

GOVERNMENT OF BRUNEI DARUSSALAM

REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM JASTRE/BKP/RFP/01/2025

TENDER DOCUMENT (PACKAGE 1)

EMPLOYER**DEPARTMENT OF ENVIRONMENT, PARKS AND RECREATION**

Tumasek Plaza Building,
Jalan Raja Isteri Pengiran Anak Saleha,
BA2111, Bandar Seri Begawan
Negara Brunei Darussalam

LEAD CONSULTANT / PROJECT MANAGER / QUANTITY SURVEYOR**UTAMACON (B) SDN BHD**

Unit 25, BT Complex
Jalan Komersial Jaya Setia, Kg Jaya Setia Mukim Berakas 'A',
BB2713, Bandar Seri Begawan
Negara Brunei Darussalam

TECHNICAL PARTNER / INTERNATIONAL SPECIALIST**FICHTNER****FICHTNER GMBH & CO. KG**

Jalan Stesen Sentral 5 Suite 2A-13-02, Block 2A,
Level 13 Plaza Sentral
50470 Kuala Lumpur
Malaysia

LEGAL SPECIALIST / LEGAL ADVISOR**Ashurst****ASHURST LLP (IN COLLABORATION WITH AIP LAW, BRUNEI DARUSSALAM)**

Level 37, Equity Tower, Sudirman Central Business District,
Jl. Jend. Sudirman Kav. 52-53,
Jakarta Selatan, 12190,
Indonesia

ARCHITECT**ARKITEK AZIZ**

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Bandar Seri Begawan,
Negara Brunei Darussalam

CIVIL & STRUCTURAL ENGINEER

JURUTERA TEMPATAN

JURUTERA TEMPATAN

P.O. Box 681 MPC Post Office,
Berakas BB3577
Negara Brunei Darussalam

MECHANICAL & ELECTRICAL ENGINEER**ZRJ ZAKARIA & ASSOCIATES SDN BHD**

Unit A2 No.11 Spg.11, Jalan Gadong, Kampong Menglait
BE4119, Bandar Seri Begawan
Negara Brunei Darussalam

ENVIRONMENTAL SPECIALIST**KEJURUTERAAN DAN PERSEKITARAN INTEGRASI SDN BHD**

Unit 10, Block A, 2nd Floor, Kiarong Complex,
Jalan Lebuhraya Sultan Haji Hassanal Bolkiah,
Bandar Seri Begawan BE1318
Negara Brunei Darussalam

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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SECTION 1
TENDER INSTRUCTIONS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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SECTION 1
PART 1 – INVITATION TO TENDER

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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SECTION 1

PART 1 – INVITATION TO TENDER

1. Department of Environment, Parks and Recreation (hereinafter referred as ‘JASTRe’), Ministry of Development, Negara Brunei Darussalam has been directed to implement Waste to Energy (WtE) Plant project and in this regard JASTRe has issued a “Request for Proposal to Invest, Design, Build, Own, Operate and Transfer Waste to Energy Plant at Lot 17394, Kg Sungai Paku, Tutong District, Negara Brunei Darussalam (hereinafter referred to as “the Project”).
 2. JASTRe invites tender submissions from applicants (hereinafter referred as ‘Tenderers’) via an Open Invitation published in media such as Pelita Brunei and Borneo Bulletin.
 3. The Tenderer must have a previous relevant experience (within the last ten (10) years) in similar industry projects as a prerequisite.
 4. Interested companies must be experienced in developing and operating Waste to Energy plant.
 5. Local companies, including Contractors registered with the Ministry of Development may form a Joint Venture/ Consortium with other reputable and experienced international companies as necessary to meet the qualification criteria and to execute the scope of works required for the timely completion of the Project.
6. **Qualification requirements:**
- i. Tenderers must have previous relevant experience in designing, building and operating waste to energy projects (within the last ten (10) years).
 - ii. Local companies / Contractors registered with the Ministry of Development who does not have such experience may form a Joint Venture (incorporated) with other international companies who have such experience. For the purposes of this requirement, the term Joint Venture Company refers to: -
 - a. Joint equity participation between local company(s) or local company(s) and international partner(s);
 - b. Actively managed by both parties;
 - c. Registered under the Companies Act (Cap 39) in Brunei Darussalam;
 - iii. In such scenario the Tenderer must furnish following additional details: -
 - a. Details of Joint Venture whether it is an existing or a proposed formation;
 - b. In the event of a future formation anticipated timeline to form a Joint Venture Company from the date of Award Notification after Tender;
 - c. Memorandum of Understanding to form Joint Venture;
Draft Joint Venture Agreement with terms including but not limited to equity share, management responsibilities, nominated lead for the Joint Venture, roles and responsibilities of the Joint Venture partners, confirmation to be jointly and severally bound for liabilities etc.
 - iv. For the purposes of the design deliverables, the Tenderer shall propose following minimum consultants as domestic sub-contractors: -
 - a. Engineering design house that has multi-discipline and integration capabilities of various discipline including, but not limited to, such as civil, structural, electrical, mechanical,

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- process, automation, control, optimisation and technical safety,
- b. Architectural consultancy with BAPEQS Practicing Certificate,
 - c. All above engineering deliverables shall comply with the Architects, Professional Engineers and Quantity Surveyors Order 2011,
 - d. Independent Accredited Checker in accordance with local regulations,
 - e. Environmental consultant registered with JASTRe for EIA and EMMP for both construction and operation phases.
- v. For the purposes of the construction, the Tenderer shall propose following minimum contractors as domestic sub-contractors (or otherwise as member of Joint Venture / Consortium): -
- a. Building and Civil Works Contractor - must have a valid registration with the Ministry of Development with a minimum of Class VI Contractor with minimum categories of KA01 and B01 and have relevant past experience; and
 - b. Mechanical & Electrical Works Contractor - must have a valid registration with the Ministry of Development with a minimum of Class V and/or above with minimum categories E01, E02, E03, E05, M01, M03 and KPME05 and have relevant past experience.
- vi. The Tenderer who in the case of a joint venture / consortium, shall be the lead member of the joint venture / consortium, shall have an average annual turnover of B\$ 25,000,000.00 (Brunei Dollars: Twenty Five Million) for the past five (5) years of which two consecutive years shall have a minimum of B\$ 40,000,000.00 (Brunei Dollars: Forty Million) annual turnover.
- vii. Joint Venture shall have a lead member. The lead member shall be capable of carrying out works of this nature. All members of the Joint Venture shall be bound jointly and severally if selected.
- viii. Tenderer are required to submit a Tender Security in the form of a Bank Guarantee for an amount of B\$ 4,000,000.00 (Brunei Dollars: Four Million) accompanied with their Tender in the format prescribed in the Tender documents.

7. Summary of Scope of Works

Following is the summary of scope of works:

- a. Invest for the entire project from Design-Build Period to Operations Service Period
- b. Design, Build, Operate and Maintain the following:-
 - i. Waste to Energy Plant and associated infrastructure and ancillary facilities capable of processing all Municipal Solid Waste delivered to the facility,
 - ii. Potable and fire-water supply reticulation,
 - iii. Raw water supply, reticulation and storage and
 - iv. 11kV or 66kV network power export infrastructure (depending on the power generation capacity proposed).
- c. Transfer the facilities to JASTRe at the end of the Operation Service Period;
- d. Generated power shall be exported to the Department of Electrical Services Grid at Jalan Telisai in accordance with the Power Purchase Agreement with Department of Electrical Services as stipulated in the Tender documents;
- e. Optional scope for Decommissioning at the end of the Operation Service Period;

8. Project Timeline

- (a) Design-Build Period including financial closure, authorities' approval, testing and commissioning not more than forty eight (48) months from the signing of the Contract

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- (b) Operation Service Period of twenty five (25) years with an optional extension for further five (5) years.
9. Interested parties shall register with JASTRe by sending an email with subject “**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**” to jastre.wte.rfp@env.gov.bn with a copy of their Company Registration / Incorporation in their country of operations. Local companies / contractors may send the above email with Company Registration, Form ‘x’ and/or Valid Contractor’s registration with the Ministry of Development (ABCi). Interested parties will be issued via email with a Confidentiality Agreement for signing and the relevant details of payment to be made.
10. To obtain the Tender Documents, a non-refundable tender fee of **B\$5,000.00 (Five Thousand Brunei Dollars) nett** and **e-document fee of B\$5.00 nett** are required in the form of cash or online payment made payable to “**GOVERNMENT OF BRUNEI DARUSSALAM**” as detailed in the response email. Once payment is received, the Tender documents will be issued.
11. Please be advised that any bank charges or transaction fees incurred in the process of online payment or transferring fund shall be borne solely by the interested parties. The amount received by the beneficiary must be the full amount above, free from any deductions or charges applied by intermediary or receiving banks.
12. The deadline for the payment of non-refundable tender and e-document fees shall be no later than **3:00 p.m. on Thursday, 4th September 2025**.
13. Tender document consists of five (5) main sections, and it will be released in two (2) packages i.e., Package 1 and Package 2. Please refer to Appendix 3 to this Invitation to Tender for segregation of Tender Packages for Tender Issuance (Package 1 and Package 2) for ease of reference.
14. Unless or otherwise marked in sub-sections in Appendix 3 – Segregation of Tender Packages for Tender Issuance (Package 1 and Package 2), Package 1 includes the following sections and will be released immediately upon confirmation of receipt of tender and e-documents fees and duly signed confidentiality agreement from the applicant:
- Section 1 – Tender Instructions and associated appendices,
 - Section 3 – Employer’s Requirement and associated appendices, and
 - Section 4 – Letter of Tender and associated appendices.
15. Package 2 shall include **ALL** the remaining sections as follows and will be released latest by 4th September 2025:
- Section 2 – Agreement, Contract Conditions (General and Particular) and associated appendices,
 - Section 5 – Commercial, and
 - Any other sub-sections of Sections 1, 3 and 4 not released in Package 1
16. The Tenderers are required to submit Appendix 1 – Tender Acknowledgement Form no later than twenty one (21) calendar days of receipt of the respective tender packages.
17. The deadline for submission of completed Tenders is **no later than 2:00 p.m. on Tuesday, 28th October 2025**. Late submissions will not be entertained.
18. Tenderers shall submit their completed bona fide Tender Proposal Submission incorporating duly completed, stamped and signed both Letters of Tender (Tender ‘A’ – Base Tender and Tender ‘B’ – Alternative Tender) and all other required documentations stipulated in the Tender documents in accordance to the details below: -

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- a) One (1) original and Two (2) duplicate copies of loose bound set of the Tender Submission including one (1) electronic copy saved as a single "PDF" file in the form of a USB Flash Drive in a sealed envelope marked: -

"PRIVATE AND CONFIDENTIAL"

TENDER PROPOSAL FOR:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND
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NEGARA BRUNEI DARUSSALAM**

JASTRE/BKP/RFP/01/2025

TO:

**MINI TENDER BOARD, MINISTRY OF DEVELOPMENT,
GROUND FLOOR, MINISTRY OF DEVELOPMENT BUILDING,
OLD AIRPORT, BERAKAS,
BANDAR SERI BEGAWAN, BS3510,
NEGARA BRUNEI DARUSSALAM**

NO LATER THAN 2:00 P.M. ON TUESDAY, 28TH OCTOBER 2025.

and

- b) The tender submission shall clearly segregate the sets in separate envelopes by marking them as 'Original', 'Duplicate Copy No.1' and 'Duplicate Copy No.2' and 'Electronic Copy'. All the four (4) envelopes shall be enclosed in an outer envelope (or) a box as appropriate, must be addressed as above and must be clearly marked as shown below.

"PRIVATE AND CONFIDENTIAL"

TENDER PROPOSAL FOR:

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JASTRE/BKP/RFP/01/2025

NO LATER THAN 2:00 P.M. ON TUESDAY, 28TH OCTOBER 2025.

19. Any correspondences, tender queries and clarification(s) shall be sent to jastre.wte.rfp@env.gov.bn

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SECTION 1

PART 1 – INVITATION TO TENDER

APPENDIX 1 – TENDER ACKNOWLEDGEMENT

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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SECTION 1
PART 1 – INVITATION TO TENDER
APPENDIX 1 – TENDER ACKNOWLEDGEMENT

TO:

Tender Board Secretary

Mini Tender Board, Ministry of Development,
Ground Floor, Ministry of Development Building,
Old Airport, Berakas,
Bandar Seri Begawan, BS3510,
Negara Brunei Darussalam.

Dear Sir / Madam,

TENDER TITLE & REF: REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM
JASTRE/BKP/RFP/01/2025

We acknowledge receipt of Tender Documents for the above-mentioned project.

We confirm that

1. we have received all of the Tender Documents listed;
2. the documents received are all in usable condition;
3. we intend to submit a bona-fide Tender by the date and time stated in the tender document;
4. if we do not submit a Tender by the due date, we shall return all Tender Documents including associated appendices;

Name of the Tenderer : _____

Signature : _____

Position : _____

Date : _____

Note:

Tenderer shall submit this duly filled form no later than Twenty-one (21) calendar days of receipt of the Tender Documents of both packages i.e., Package 1 and Package 2

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SECTION 1

PART 1 – INVITATION TO TENDER

APPENDIX 2 – CONFIDENTIALITY AGREEMENT

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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CONFIDENTIALITY AGREEMENT

THIS CONFIDENTIALITY AGREEMENT (hereinafter referred to as the "Agreement") is entered into on this _____ 2025,

between

DEPARTMENT OF ENVIRONMENT, PARKS AND RECREATION (JASTRE), the Department under the Ministry of Development, Brunei Darussalam and having its registered office at Tumasek Plaza Building, BA2111, Jalan Raja Isteri Pengiran Anak Saleha, Bandar Seri Begawan, Negara Brunei Darussalam (hereinafter referred to as the "Employer");

_____, a company incorporated under the laws of Brunei Darussalam and having its registered office at _____

(hereinafter referred to as the "**Tenderer**");

each a "Party" and collectively, the "Parties".

WHEREAS:

- A. The Employer has invited the interested firms registered in Brunei Darussalam or overseas (hereinafter referred to as the '**Tenderer**'), to participate in the Tendering exercise for the Request for Proposal to Invest, Design, Build, Own, Operate and Transfer Waste to Energy Plant at Lot 17394, Kg Sungai Paku, Tutong, Negara Brunei Darussalam [Tender Ref. No. JASTRE/BKP/RFP/01/2025] (hereinafter referred to as the '**Tender**').
- B. In connection with the Tender, the Employer has and will have access to certain proprietary and confidential information held by the Tenderer; and the Tenderer has and will access to certain proprietary and confidential information held by the EMPLOYER.
- C. The Parties wish to ensure that Confidential Information (as defined hereinafter) disclosed by the Parties remains confidential and is not used by either Party for any purpose other than the Tender.

NOW THEREFORE, the Parties agree as follows:

1. "**Confidential Information**" shall mean all information, know-how or data, of any nature whatsoever, in any form, patented or not patented, concerning or relating to the Tender, that has been or will be disclosed directly or indirectly by either Party (each a "**Disclosing Party**") to the other Party (hereinafter referred to as the "**Receiving Party**"). Such Confidential Information shall include, but not necessarily be limited to, geological and geophysical data, maps, models and interpretations, as well as technical, commercial, contractual and financial information, whether owned by the Disclosing Party or a third party, and may be oral or written, in electronic or magnetic or visual form, including the inspection of any facilities in relation to or in connection with the Tender. The Disclosing Party reserves the right to not disclose any information which in their sole discretion they deem not connected with the Tender or that such disclosure may harm or jeopardize the interests of the Disclosing Party.
2. In consideration of the disclosure of Confidential Information referred to in Paragraph 1 hereof, the Receiving Party undertakes and agrees that the Confidential Information shall be kept strictly confidential and shall not be sold, traded, published or otherwise disclosed to anyone in any

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manner whatsoever, including by means of photocopy, reproduction or electronic media, without the Disclosing Party's prior written consent, except as provided in this Agreement. To the extent that the Disclosing Party has disclosed Confidential Information to the Receiving Party prior to the effective date of this Agreement, and the Receiving Party has been advised that it is confidential at the time of disclosure or prior to the disclosure, such disclosure shall be covered by this Agreement. The Receiving Party shall only use or permit the use of the Confidential Information disclosed under this Agreement solely in connection with the Tender and shall not use the Confidential Information for any other purpose.

3. The Parties shall keep all Confidential Information strictly secret and confidential and shall not use such information for any other purposes. The Parties shall ensure that its officers, employees, subcontractors and agents do not make any disclosure to any third party of any Confidential Information, save that in the case of the Department of Environment, Parks and Recreation, disclosure may be made to Department of Environment, Parks and Recreation's financiers.
4. The Receiving Party may disclose and/or use the Confidential Information without the Disclosing Party's prior written consent only to the extent that such information is:
 - a. in the lawful possession of the Receiving Party, it having established to the reasonable satisfaction of the Disclosing Party, that the information was previously known to the Receiving Party when it was not under any obligation of confidence in respect of that information;
 - b. already in the public domain to or becomes a part of the public domain subsequent to, the execution of this Agreement, other than through the act or omission of the Receiving Party;
 - c. required to be disclosed under applicable law, rule or regulation, provided that the Disclosing Party is given Ten (10) days written notice prior to such disclosure; or
 - d. acquired independently from a third party who is under no legal duty to the Disclosing Party to keep the information confidential.

For the avoidance of doubt, the Confidential Information disclosed under this Agreement shall not be deemed to be within the foregoing exceptions merely because such information is embraced by more general information in the public domain or in the Receiving Party's possession. In addition, no combination of information shall be deemed to be within the foregoing exceptions merely because individual items of information are in the public domain or in the Receiving possession, but only if the combination itself is in the public domain or in the Receiving Party's possession.

5. The Receiving Party shall be entitled to disclose the Confidential Information to its employees, officers, directors, consultants, advisers, contractors, financiers, relevant government agencies to the extent that they have a clear need to know for the purposes of the Tender.
6. The Receiving Party shall be responsible for ensuring that all persons to whom the Confidential Information is disclosed under this Agreement shall keep such information confidential in the same manner and to the same extent as the Receiving Party is required to under this Agreement and shall not disclose or divulge the same to any unauthorized person or use it other than for the purposes of the Tender.

In the event of breach of this Agreement by the Receiving Party, the Receiving Party hereby covenants to fully indemnify the Disclosing Party for all direct losses, costs, expenses and damages sustained as a result of such disclosure.

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7. The Receiving Party shall acquire no proprietary interest in or right to the Confidential Information and the Disclosing Party may demand the return thereof at any time upon giving written notice the Receiving Party. Within Thirty (30) days of receipt of such notice, the Receiving Party shall return all of the original Confidential Information and shall destroy or cause to be destroyed all copies and reproductions (in whatever form, including but not limited to photocopies, electronic media, reproductions, documents, notes, extracts, analyses, studies, plans, compilations or any other way of representing or recording and recalling information which contains, reflects or is derived or generated from Confidential Information) in its possession and in the possession of persons to whom it was disclosed pursuant to this Agreement.
8. The confidentiality obligations and limitation on use set forth in this Agreement shall be terminated Ten (10) years after the date of this Agreement unless otherwise agreed or terminated earlier by the Parties.
9. This Agreement shall be construed and determined according to the laws of Brunei Darussalam. Any disputes arising out of this Agreement shall be settled by the Courts of Brunei Darussalam.
10. No amendments, changes or modifications to this Agreement shall be valid except if the same are in writing and signed by a duly authorized representative of each of the Parties hereto.
11. This Agreement may be executed in Two (2) counterparts and each counterpart shall be deemed to be an original Agreement for all purposes. The Parties may sign a counterpart copy of this Agreement by photocopying a facsimile of this Agreement and signing that photocopy. The transmission by facsimile by a Party to the other of a counterpart copy of this Agreement signed by that Party will be deemed proof of signature of the original and the signed facsimile so transmitted will be deemed an original.
12. The Receiving Party shall not permit or procure to be made, or solicit or assist any third party to make, any statement to a third party, the public or the media regarding the occurrence or the substance of any communications, discussions or negotiations between the Parties with respect to the Tender and/or this Agreement without the prior agreement in writing of the Disclosing Party.
13. This Agreement shall not be assigned by either of the Parties to a third party, except with the prior written consent of the other Party.
14. This Agreement comprises the full and complete agreement between the Parties with respect to the disclosure of the Confidential Information.

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IN WITNESS WHEREOF, the Parties have duly executed this Agreement on the date first above written.

DEPARTMENT OF ENVIRONMENT, PARKS AND RECREATION

Signature : _____

Name : _____

Title : _____

Name of Tenderer : _____

Signature : _____

Name : _____

Title : _____

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SECTION 1

PART 1 – INVITATION TO TENDER

APPENDIX 3 – SEGREGATION OF TENDER PACKAGES FOR TENDER ISSUANCE
(PACAKGE 1 AND PACKAGE 2)

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SECTION 1

PART 1 – INVITATION TO TENDER

**APPENDIX 3 – SEGREGATION OF TENDER PACKAGES FOR TENDER ISSUANCE
(PACAKGE 1 AND PACKAGE 2)**

Tender document consists of Sections 1 to 5. Below listed information states the release of the tender documents in packages, i.e., Package 1 and Package 2 respectively.

The Tenderer to check, verify and confirm that, the listed documents are received accordingly and submit Appendix 1 – Tender Acknowledgement form **no later than twenty-one (21) calendar days of receipt of the Tender Documents of both packages i.e., Package 1 and Package 2.**

Tender Documents Sections	Package	
	Package 1	Package 2
Section 1	Part 1 – Invitation to Tender	✓
	Appendix 1 – Tender Acknowledgement	✓
	Appendix 2 – Confidentiality Agreement	✓
	Appendix 3 – Segregation of Tender Packages for Tender issuance (Package 1 and Package 2)	✓
	Part 2 – Instructions to Tenderers	✓
	Part 3 – Appendices to Instructions to Tenderers	✓
	Appendix 1 – Submission Checklist	✓
	Appendix 2 – Confirmation of Tender Briefing Attendance	✓
	Appendix 3 – Specimen of Tender Security	✓
	Appendix 4 – Tender Clarification Form	✓
	Appendix 5 – Signed Declaration on Information Provided by the Employer during Tender	✓
Section 2	Part 1 – Contract Agreement	✓
	Part 2 – General Conditions (FIDIC Gold Book 1 st Edition 2008) – By reference to FIDIC publication	✓
	Part 2 – Particular Conditions Part A – Contract Data	✓
	Part 3 – Particular Conditions Part B – Special Provisions	✓
	Part 4 – Appendices to Contract Agreement & Conditions	✓
	Appendix 1 – Power Purchase Agreement to be executed with the Off-Taker	✓
	Appendix 2 – Specimen of Parent Company Guarantee	✓
	Appendix 3 – Specimen of Performance Security	✓
	Appendix 4 – Specimen of Designer's Warranty	✓
	Appendix 5 – Specimen of Indemnity for Materials / Workmanship	✓
	Appendix 6 – Maintenance Retention Guarantee	✓
Section 3	Part 1 – Employer's Requirements – Scope of Works & Specification	✓
	Part 2 – Appendices to Employer's Requirements	✓

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WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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Tender Documents Sections	Package	
	Package 1	Package 2
Appendix 1 – Drawings		
Appendix 1A – JASTRe's Gazette Site Boundary Indicating WTE Plant and Associated Proposed Infrastructure Locations	✓	
Appendix 1B – Proposed External Water Supply Corridor	✓	
Appendix 1C – Location of Drainage Discharge Points	✓	
Appendix 1D – Scope Demarcation Between the Contractor and The Department of Electrical Services for The Power Export (11kV / 66kV)	✓	
Appendix 1E – Proposed 11kV Network	✓	
Appendix 1F – Proposed 66kV Network	✓	
Appendix 2 – Site Data		
Appendix 2A – Topographical	✓	
Appendix 2B – Soil Investigation Reports		✓
Appendix 3 – Municipal Solid Waste Data		
Appendix 3A – Overall Waste Statistics	✓	
Appendix 3B – Existing Waste Management Eco System for Brunei Darussalam	✓	
Appendix 3C – Previous Solid Waste Studies for the Sg. Paku Land fill Site & Brunei Darussalam and MSW Sampling Data	✓	
Appendix 4 – Other Relevant Information from Stakeholders & Authorities		
Appendix 4A – Brunei Grid Code (2 nd Revision) published by The Autoriti Elektrik Negara Brunei Darussalam	✓	
Appendix 4B – Licensing Process for Electricity Generation Activity by The Autoriti Elektrik Negara Brunei Darussalam	✓	
Appendix 4C – Proposed Raw Water Intake Location	✓	
Appendix 4D – Confidential Draft of Environmental Protection and Management Act (Amendment) Order, 2025	✓	
Appendix 4E – Confidential Draft of Code of Practice for Pollution Control 2025	✓	
Appendix 5A – Schedule of current approvals and permissions obtained by the Employer	✓	
Section 4	Part 1A – Letter of Tender (Tender 'A' – Base Tender)	✓
	Part 1B – Letter of Tender (Tender 'B' – Alternative Tender)	✓
	Part 2 – Appendices to Letter of Tender	✓

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Tender Documents Sections	Package	
	Package 1	Package 2
Appendix 1 – Details of Tenderer	✓	
Appendix 2 – Details of Sub-Contractors	✓	
Appendix 3 – Details of Design Consultants (Design Sub-Contractors)	✓	
Appendix 4 – Details of Suppliers (Sub-Contractors undertaking supply works)	✓	
Appendix 5 – Details of Financing Institution	✓	
Appendix 6 – Human Resources	✓	
Appendix 7 – Execution Methodology	✓	
Appendix 8 – Plant, Tools and Equipment	✓	
Appendix 9 – Workshops and Tool Stores	✓	
Appendix 10 – Past Experiences	✓	
Appendix 11 – Current Project Commitments	✓	
Appendix 12 – Financial Capabilities	✓	
Appendix 13 – Quality Management System	✓	
Appendix 14 – Health, Safety, Security and Environment (HSSE)	✓	
Appendix 15 – Environmental Performance	✓	
Appendix 16 – Tenderer's Declaration	✓	
Appendix 17 – Details of Insurance Underwriter	✓	
Appendix 18 – Schedule of Warranties	✓	
Appendix 19 – Tenderer's Proposed Brands & Source of Materials & Their Availability	✓	
Appendix 20 – Tenderer's Proposed List of Training before Handover	✓	
Appendix 21 – Schedule of Deviations from Tender Requirements	✓	
Appendix 22 – Dispute History	✓	
Appendix 23 – Form GV1: Tenderer's Guarantees on Net Power Output	✓	
Part 3 – Technical Proposal	✓	
Section 5	Part 1 – Commercial Proposal	✓
	Part 2 – Pricing Preambles	✓
	Part 3A – Design & Build Phase	✓
	Bill No. 1A – General & Particular Conditions and Preliminaries	✓
	Bill No. 2A – Occupational Safety & Health (OSH)	✓
	Bill No. 3A – Professional Services for Design, Supervision, Studies and Authority Approvals	✓
	Bill No. 4A – Building and Infrastructure Works Outside the WTE Plant Site Boundary	✓
	Bill No. 5A – Infrastructure Works Inside the WTE Plant Site Boundary	✓
	Bill No. 6A – Buildings Works Inside the WTE Plant	✓

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WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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Tender Documents Sections	Package	
	Package 1	Package 2
Site Boundary		
Bill No. 7A – Mechanical & Electrical Works Associated with Buildings Inside the WTE Plant Site Boundary		✓
Bill No. 8A – Waste to Energy Plant Components and Associated Works (except for the Building and associated M&E Works as in Bill No. 6A and 7A)		✓
Bill No. 9A – Integrated Testing, Commissioning & Start-up (including all licensing)		✓
Bill No. 10A – Miscellaneous		✓
Part 3B – Operation Service Period (including Transfer)		✓
Bill No. 1B – General Conditions and Preliminaries		✓
Bill No. 2B – Cost for asset replacement requirements		✓
Bill No. 3B – Overall Operations (including Environmental Performance Monitoring / Reporting)		✓
Bill No. 4B – Overall Maintenance		✓
Bill No. 5B – Independent Surveyor		✓
Bill No. 6B – Transfer preparation, inspection, testing and handover		✓
Bill No. 7B – Miscellaneous		✓
Part 3C-1 – Final Summary (Design-Build Period)		✓
Part 3C-2 – Final Summary (Operation Service Period (including Transfer))		✓
TENDER 'A' – BASE TENDER		
Part 4A – Schedule of Power Export, Other Revenue Streams and Associated Revenue Projection		✓
Part 5A – Schedule of Return of Investment and Demonstration of Tipping Fees		✓
Part 6A – Schedule of Tipping Fees		✓
Part 7A – Schedule for Optional Decommissioning		✓
TENDER 'B' – ALTERNATIVE TENDER		
Part 4B – Schedule of Power Export, Other Revenue Streams and Associated Revenue Projection		✓
Part 5B – Schedule of Return of Investment and Demonstration of Tipping Fees		✓
Part 6B – Schedule of Tipping Fees		✓
Part 7B – Schedule for Optional Decommissioning		✓

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SECTION 1

PART 2 – INSTRUCTIONS TO TENDERERS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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SECTION 1

PART 2 – INSTRUCTION TO TENDERERS

1.0 OBJECTIVE

- 1.1 These Instructions to Tenderers are part of and are to be read in conjunction with all other Sections of this tender document.
- 1.2 For the purpose of these Instructions to Tenderers any reference to 'Client' and / or 'Employer' means 'Department of Environment, Parks and Recreation' (hereinafter referred as 'JASTRe').
- 1.3 The objective of this Part 2 of Section 1 of the Tender Document is to inform Tenderers of the proper procedures which must be complied with and practices adopted to satisfy the requirements of the Employer for the submission of the Tenders and Award of Contract. Any non-compliance to or deviations from these instructions may result in the offered Tender being rejected.

2.0 PURPOSES OF THE TENDER

- 2.1 The sole purpose of this Tender is for the Tenderer to prepare and submit their tender submission, both commercial and technical, to the Employer in relation to the Invest, Design, Build, Own, Operate and Transfer Waste to Energy Plant at part of Lot 17394, Kampong Sungai Paku, Tutong, Negara Brunei Darussalam.
- 2.2 Any clarification, in relation to this Tender, shall be submitted to jastre.wte.rfp@env.gov.bn not later than **fourteen (14) working days** prior to closing of the Tender.

3.0 CONFIDENTIALITY AGREEMENT

- 3.1 Each Tenderer is required to sign a Confidentiality Agreement (as enclosed herewith in Appendix 2 – Confidentiality Agreement of the Section 1 – Invitation to Tender) regarding the confidentiality of all information received from the Employer in connection with this tender, prior to the receipt of the full Tender Document. This document obliges the Tenderer not to divulge confidential information and holds the Tenderer responsible for the confidentiality of all information received from the Employer in connection with this tender document. If, for the purposes of this Tender, the Tenderer requires any of the Tender documents to be issued to their partners, suppliers, vendors etc. then accordingly the Tenderer shall seek those receiving the document to pre-sign this Confidentiality Agreement prior to issuance of such parts of the Tender documents concerned.

4.0 POTENTIAL CONFLICT OF INTEREST

- 4.1 The Tenderer is required to sign a declaration of potential conflict of interest in existing or proposed transactions or arrangements with JASTRe as per Appendix 16 – Tenderer's Declaration under the Section 4 – Tenderer's Technical Proposal.

5.0 TENDER ACKNOWLEDGEMENT

- 5.1 Tenderers are required to complete the Tender Acknowledgement form included under Section 1 of the Tender Documents and forward the same to be addressed to 'Mini Tender Board, Ministry of Development, Ground floor, Ministry of Development Building, Old Airport Road, Berakas, Bandar Seri Begawan BS3510, Negara Brunei Darussalam and submitted via email at jastre.wte.rfp@env.gov.bn no later than twenty-one (21) calendar days upon receipt of the Tender Documents i.e. both Package 1 and Package 2.

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6.0 TENDER BRIEFING AND SITE VISIT

- 6.1 Tender briefing followed by a site visit is currently being arranged and it is tentatively scheduled during Week starting 8th September 2025 at Dewan Betabur, at Tingkat Satu (Level 1), Kementerian Pembangunan (Ministry of Development), Jalan Airport Lama (Old Airport Road), Bandar Seri Begawan, Negara Brunei Darussalam. The exact date and time for the above Tender briefing will be notified to each tenderer by the Tender Secretariat.
- 6.2 Tender Briefing will be conducted in hybrid format (online / face-to-face) and detailed information regarding tender briefing will be notified to each tenderers by the Tender Secretariat.
- 6.3 The attendance at the Tender briefing is mandatory for all Tenderers. Tenderers are required to complete the Appendix 2 – Tender Briefing and Site Visit Attendance Form included in Section 1 of the Tender Documents and forward the same to the address in clause 6.1 of these Instructions within five (5) working days of receiving such instructions / details on the Tender Briefing and Site Visit.

7.0 REQUEST FOR FURTHER INFORMATION

- 7.1 Any request for further information/clarifications which may be required in order to complete the tender must be submitted in writing via email to the following address: jastre.wte.rfp@env.gov.bn stating clearly the tender number and title.
- 7.2 Any such request must be made no later than fourteen (14) working days prior to the Tender Closing Date.
- 7.3 The Tenderer shall utilise the template provided in Section 1 – Part 3 – Appendix 4 – Tender Clarification Form for any request for further information / clarification which may be required in order to complete the Tender Proposal.
- 7.4 Any further information, interpretation, advice or modifications given by or agreed upon by the Employer pursuant to clause 7.1 above will be distributed to all Tenderers.
- 7.5 Should the Tenderer find any discrepancy, error or omission in the Tender Documents supplied to the Tenderer or between any documents therein, it shall be the sole responsibility of the Tenderer to notify the Employer in writing using the form in Section 1 – Part 3 – Appendix 4 – Tender Clarification Form and submitted via email at jastre.wte.rfp@env.gov.bn not later than fourteen (14) working days before the Closing Date to have the discrepancy, error or omission rectified.
- 7.6 The Tenderer is not permitted to contact or communicate with any the Employer / JASTRe personnel or any of JASTRe's engaged consultants at any time during the preparation and submission of the Tender Documents. The communication channel in this instance for any clarifications or queries shall remain as stipulated in 7.1 above.

8.0 CONTENT OF THE TENDER DOCUMENT

- 8.1 The Tender document include the following sections:-
- Section 1 – Part 1 – Invitation to Tender
- Appendix 1 – Tender Acknowledgement
- Appendix 2 – Confidentiality Agreement
- Appendix 3 – Segregation of Tender Packages for Tender issuance (Package 1 and Package 2)

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Part 2 – Instruction to Tenderers
Part 3 – Appendices to Instructions to Tenderers
 Appendix 1 – Submission Checklist
 Appendix 2 – Confirmation of Tender Briefing Attendance
 Appendix 3 – Specimen of Tender Security
 Appendix 4 – Tender Clarification Form
 Appendix 5 – Signed Declaration on Information Provided by the Employer during Tender

Section 2 – Part 1 – Contract Agreement

 Part 2 – General Conditions (FIDIC Gold 1st Edition 2008) – By reference to FIDIC Publication
 Part 3 – Particular Conditions Part A – Contract Data
 Part 3 – Particular Conditions Part B – Special Provisions
 Part 4 – Appendices to Contract Agreement & Conditions
 Appendix 1 – Power Purchase Agreement to be executed with the Off-Taker
 Appendix 2 – Specimen of Parent Company Guarantee
 Appendix 3 – Specimen of Performance Security
 Appendix 4 – Specimen of Designer's Warranty
 Appendix 5 – Specimen of Indemnity for Materials / Workmanship
 Appendix 6 – Specimen of Plant Performance Guarantee
 Appendix 7 – Maintenance Retention Guarantee
 Appendix 8 – Specimen of Land Lease Agreement

Section 3 – Part 1 – Employer's Requirement – Scope of Works & Specification

 Part 2 – Appendices to Employer's Requirements
 Appendix 1 – Drawings
 Appendix 2 – Site Data
 Appendix 3 – Municipal Solid Waste Data
 Appendix 4 – Other Relevant Information from Stakeholders & Authorities
 Appendix 5 – Schedule of current approvals and permissions obtained by the Employer

Section 4 – Part 1A – Letter of Tender (Tender 'A' – Base Tender)

 Part 1B – Letter of Tender (Tender 'B' – Alternative Tender)
 Part 2 – Appendices to Letter of Tender
 Appendix 1 – Details of Tenderer
 Appendix 2 – Details of Sub-Contractors
 Appendix 3 – Details of Design Consultants (Design Sub-Contractors)
 Appendix 4 – Details of Suppliers (Sub-Contractors undertaking supply works)
 Appendix 5 – Details of Financing Institutions
 Appendix 6 – Human Resources
 Appendix 7 – Execution Methodology
 Appendix 8 – Plant, Tools and Equipment
 Appendix 9 – Workshops, Warehouse and Tool Stores
 Appendix 10 – List of Past Experiences
 Appendix 11 – Current Project Commitments
 Appendix 12 – Financial Information
 Appendix 13 – Quality Management System

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- Appendix 14 – Health, Safety, Security and Environmental System
- Appendix 15 – Environmental Performance
- Appendix 16 – Tenderer's Declaration
- Appendix 17 – Details of Insurance Underwriter
- Appendix 18 – Schedule of Warranties
- Appendix 19 – Tenderer's Proposed Brands & Major Materials & Their Availability
- Appendix 20 – Tenderer's Proposed List of Training before Handover
- Appendix 21 – Schedule of Deviations from Tender Requirements
- Appendix 22 – Dispute History
- Appendix 23 – Form GV1: Tenderer's Guarantee on Nett Power Output
- Part 3 – Technical Proposal

- Section 5 – Part 1 – Commercial Proposal
 - Part 2 – Pricing Preambles
 - Part 3A – Design-Build Period
 - Bill No. 1A – General & Particular Conditions and Preliminaries
 - Bill No. 2A – Occupational Safety & Health (OSH)
 - Bill No. 3A – Professional Services for Design, Supervision, Studies and Authority Approvals
 - Bill No. 4A – Building and Infrastructure Works Outside the WTE Plant Site Boundary
 - Bill No. 5B – Infrastructure Works Inside the WTE Plant Site Boundary
 - Bill No. 6A – Building Works Inside the WTE Plant Site Boundary
 - Bill No. 7A – Mechanical & Electrical Works Associated with the Buildings Inside the WTE Plant Site Boundary
 - Bill No. 8A – Waste to Energy Plant Components and Associated Works (except for the Building & its associated M&E works as in Bills 6A & 7A)
 - Bill No. 9A – Integrated Testing, Commissioning & Start-up (including all licensing)
 - Bill No. 10A – Miscellaneous
 - Part 3B – Operation Service Period (including Transfer)
 - Bill No. 1B – General Conditions and Preliminaries
 - Bill No. 2B – Cost for asset replacement requirements
 - Bill No. 3B – Overall Operations (including Environmental Performance Monitoring / Reporting)
 - Bill No. 4B – Overall Maintenance
 - Bill No. 5B – Independent Surveyor
 - Bill No. 6B – Transfer Preparation, Inspection, Testing and Handover
 - Bill No. 7B – Miscellaneous
 - Part 3C – Final Summary
 - Final Summary – Design-Build Period
 - Final Summary – Operations Service Period (including Transfer)

Tender 'A' – Base Tender

- Part 4A – Schedule of Power Export, Other Revenue Streams and Associated Revenue Projection
- Part 5A – Schedule of Return of Investment and Demonstration of Tipping Fees
- Part 6A – Schedule of Tipping Fees
- Part 7A – Schedule for Optional Decommissioning

Tender 'B' – Alternative Tender

- Part 4B – Schedule of Power Export, Other Revenue Streams and Associated

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Revenue Projection

Part 5B – Schedule of Return of Investment and Demonstration of Tipping Fees

Part 6B – Schedule of Tipping Fees

Part 7B – Schedule for Optional Decommissioning

9.0 PREPARATION OF TENDER

- 9.1 The Tenderer will be responsible for their own costs and expenses incurred in connection with their proposal including, but not limited to, site visits, attendance during Tender Briefing, preparation of the commercial and technical proposals any other subsequent clarification / confirmations, interviews and presentations that may be required by the Employer in conjunction with this Tender whether successfully awarded or otherwise. The Employer / JASTRe will not reimburse Tenderer's costs or expenses incurred in the preparation and submission of their proposal. The Employer / JASTRe expressly reserves its unconditional right to reject any proposal and/or accept any proposal in part or in whole.
- 9.2 Prospective Tenderers who are in receipt of Tender Documents from the Employer and who subsequently decide not to submit a Tender shall return all Tender Documents together with a covering letter prior to the Closing Date of Tender and shall delete all electronic versions stored in their system. The same shall be notified to all the Prospective Tenderer's prospective sub-contractors and prospective suppliers involved during the Tender exercise.
- 9.3 Site visit to the proposed Worksite by the Tenderer is **MANDATORY**. The Tenderer shall fully acquaint themselves as to the nature, extent and practicability of the Works during such site visit.
- 9.4 The Tenderer shall carefully examine the tender document and especially on Employer's Requirement mentioned in Section 3 – Employer's Requirements, Scope of Works and Specifications.
- 9.5 The Tenderer is NOT PERMITTED to make any alterations, additions to or deletions to the original tender documents issued by the Employer, whether in hardcopy or electronic file format, unless instructed to do so in writing by the Employer.
- 9.6 Any proposal submitted to the Employer containing unauthorized alterations, additions or deletions to the original tender documents issued by the Employer that are not expressly instructed by the Employer shall be **disqualified** from the tender process.
- 9.7 The Employer would hereby like to state that ownership of all documentation or items, materials or things created or arising out of or in relation to activities pertaining to such invitation, including but not limited to photographs, pictures, images, drawings or sketches, shall vest in the Employer immediately upon its creation and shall remain the property of the Employer thereafter unless agreed otherwise in writing. Therefore, the Tenderer is strongly advised not to make any publicity releases or announcements, including sharing, posting, disseminating, or reproducing any documentation, items or visual materials as aforementioned, in any and all media including the internet and social media. Failure to comply with the above may result in automatic disqualification of Tenderer's tender submission, if any, or otherwise, legal action by the Employer.
- 9.8 Tenderer must submit with its Tender a letter of undertaking from all the domestic / specialist sub-consultants (design consultants), sub-contractors, suppliers stating that in the event the Tenderer's tender submission is successful, the said domestic / specialist sub-consultants (design

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consultants), sub-contractors, suppliers will perform their respective scope of works required under this contract.

- 9.9 Tenderers are required to complete and return all Sections of the Tender Documents in English Language, which along with any annotations on accompanying material must be in English Language.
- 9.10 No Tender will be considered in which the particulars required are not completed in full. Tenderers should be completed with ink or typed and not with pencil.
- 9.11 Qualified Tenders and Tender submissions with alterations to the Tender Documents may not be considered for evaluation and may be liable for rejection. Such decisions shall be entirely at the discretion of the Employer.
- 9.12 Alterations or erasures in the details submitted by the Tenderer should be initialled in the margin by such Tenderer. Tender may not be accepted unless such procedure is carried out. White correction fluid should not be used.
- 9.13 Attestation of the Letter of Tender, together with all submission documents shall only be by the signature of the Chairman, Managing Director, Director or whoever is the most senior within the company or an authorised person who has written consent of the owner. Such signature shall acknowledge that all details, prices and other particulars submitted with this Tender have been checked, discussed, verified and agreed with him. In the event of a submission made by Tenderer who has formed a Joint Venture, then such attestation shall be only by the authorized person on behalf of the Joint Venture. **The letter of authorisation should be submitted together with the Tender.** Any Tender signed by unauthorised persons or failure to submit letter of authorisation will result in its Tender being liable for rejection.
- 9.14 Should the Tenderer consider that any of the items contained in these Tender Documents for which it is not given specific opportunity to individually price, have a cash value it will include the same into the appropriate element of its prices and/or rates and/or percentages.
- 9.15 The Tenderers are to enter their prices against each of the items in the Section 5 – Tenderer's Commercial Proposal. The value of items which are not priced or have dashes or other suitable marks inserted in the cash columns will be deemed to be of no values or have been allowed for in the prices of other items elsewhere in the Tender. No claim for payment in respect of unpriced items will be admitted.
- 9.16 Tenders will be checked by the Employer for any arithmetic errors. Arithmetic errors will be rectified such that, the total Tender amount as stated in the Letter of Tender shall prevail. If the Tenderer does not accept the correction to the arithmetical errors to maintain the amount of Tender as Tendered, then the Tenderer will be disqualified, and the tender security may be forfeited. Any arithmetical error made by the Tenderer should not be corrected using correction fluid such as 'liquid paper / blanco' etc. but should be crossed out and the correct figure should be written above together with the Tenderer's signature and company stamp. Any correction done otherwise may lead to the rejection of the Tender.
- 9.17 Tenderers are required to submit both Tender 'A' – Base Tender and Tender 'B' – Alternative Tender. The ONLY difference between these two Tender requirements are that Tender 'A' has a

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fixed Monthly Energy Base Price for Energy Payment (Feed-in Tariff Rate) of B\$0.05 per kWh under the Power Purchase Agreement (PPA) whereby in the case of Tender 'B' the Tenderers are allowed to propose their own Monthly Energy Base Price for Energy Payment (Feed-in Tariff Rate) per kWh under the Power Purchase Agreement (PPA) and consequently a different cumulative tipping fee amount in Tender 'B' in comparison to Tender 'A'.

- 9.18 If a Tenderer wish to submit an alternative Tender or a qualified Tender, in addition to Tender 'A' and Tender 'B', it may do so provided this is done under a separate document in addition to Tenders Tender 'A' and Tender 'B' calculated on the basis set out in the Tender Documents. Any consideration of such alternative Tender shall be entirely at the discretion of the Employer.
- 9.19 Tenderers are to submit with their Tender a specific and irrevocable letter of undertaking from a Bank licensed under section 4 of the Banking Order 2006 and/or under section 4 of the Islamic Banking Order 2008 and regulated by Brunei Darussalam Central Bank ("Preferred Performance Security Provider") to provide the approved Performance Security stating that in the event of the Tender being successful the same bank will provide a Performance Security in the amount of five percent (5%) of the accepted Tender amount. Non-compliance with this condition shall render the Tender liable to rejection.

10.0 TENDER SECURITY

- 10.1 Tenderers shall furnish as part of their Tender submission, in favour of the Employer, a Tender Security issued in original form for a minimum amount of B\$4,000,000.00 (Brunei Dollars: Four Million) as tendered in Section 4 – Part 1 – Letter of Tender from a Bank in Brunei Darussalam Licensed by Brunei Darussalam Central Bank (BDCB) in accordance with the specimen provided in Appendix 3 to Part 2 – Instructions to Tenderers of Section 1 – Tender Instructions.
- 10.2 The Tender Security shall:-
- be in the form of an irrevocable Bank Guarantee issued by a Bank licensed under section 4 of the Banking Order 2006 and/or under section 4 of the Islamic Banking Order 2008 and regulated by Brunei Darussalam Central Bank ("Preferred Tender Security Provider") as per the specimen provided herewith in Appendix '3' to Part 3 – Appendices to Instructions to Tenderers.
 - In the event that the Tenderer is unable to deliver a Tender Security issued by the Preferred Tender Security Provider, upon seeking confirmation from the Tender Secretary, the Tenderer shall obtain and deliver a Tender Security issued by a financial institution with a credit rating of "A" or higher from Standard & Poor's (or its equivalent rating from Moody's or Fitch) who shall be approved in advance by the Employer and from within a country approved in advance by the Employer ("Alternate Tender Security Provider"). When making such requests, the Tenderer is required to submit to the Tender Secretary, via email, the details of the bank such as the bank name, address, contact person name, phone and email address, evidence of the credit rating and its current validity.
 - be payable promptly upon written demand by the Employer in the case of the conditions in 10.10 of these Instructions to Tenderers is being invoked; and
 - remain valid for at least fifty-six (56) days beyond the expiry date of the Tender validity in order to make a claim in due course against a Tenderer in the circumstances as stated in conditions 10.10 of these Instructions to Tenderer. If the Tenderer is successful in this Tender, then the Employer reserve the right to seek the Tenderer to extend the validity of the Tender Security until upon Employer's receipt of a copy of the Contract Agreement signed by the Tenderer or a copy of the Performance Security received by the Employer

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in accordance with the Contract Agreement.

- 10.3 The authenticity of the Tender Security submitted by the Tenderer shall be examined and verified by the Employer in writing from the Bank issuing the security, prior to finalisation of the Tender evaluation report.
- 10.4 If a Tender Security is found to be not authentic, the Tender which it covers shall not be considered for subsequent evaluation and in such case, the Employer shall proceed to take such measures against the Tenderer at its sole discretion including but not limited to barring the Tenderer from any future Tenders of the Employer.
- 10.5 A Tender not accompanied by a valid Tender Security in accordance to 10.1, 10.2 and 10.3 above will be considered as non-responsive by the Employer.
- 10.6 No Tender Securities shall be returned by the Employer during and after the opening of the Tenders.
- 10.7 No Tender Securities shall be returned to the Tenderers before contract signing, except to those who are considered as non-responsive.
- 10.8 Tender Securities of the responsive Tenderers shall be returned only after the evaluated and selected Tenderer has submitted the Performance Security and signed the Contract with the Employer.
- 10.9 Tender Securities of the Tenderers not consenting within the specified date in writing to the request made by the Employer for any extension to Tender Validity shall be discharged and returned forthwith.
- 10.10 Tender Security may be forfeited, if a Tenderer;
 - a) withdraws its Tender after opening of Tenders but within the validity of the Tender; or
 - b) refuses to accept a Letter of Acceptance of Tender (LOA); or
 - c) fails to furnish Performance Security within the stipulated period in the LOA; or
 - d) refuses to sign the Contract Agreement within the time specified in the LOA; or
 - e) does not accept the correction to the arithmetical errors to maintain the amount of Tender as Tendered.

11.0 RETURNS OF TENDER

- 11.1 The Tenderer shall prepare and submit their completed bona fide Tender Submission incorporating duly completed, stamped and signed Forms of Tender (Tender 'A' – Base Tender and Tender 'B' – Alternative Tender) and all associated requested information in the Tender documents in accordance to the details below:-

One (1) Original and Two (2) Duplicate copies of loose bound set of the Tender Submission. This shall be accompanied by One (1) electronic copy of the tender in **USB Flash Drive** containing a single compiled .pdf file or word, excel file as appropriate. The Tender shall clearly segregate the sets in separate envelopes by marking them as '**ORIGINAL**', '**DUPLICATE COPY NO.1**', '**DUPLICATE COPY NO.2**' and '**ELECTRONIC COPY**' respectively. All the above **FOUR (4)** sets of Tender submissions shall be included in a sealed outer envelope or in a box as appropriate, must be clearly marked and addressed as follows:-

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"PRIVATE AND CONFIDENTIAL"

TENDER FOR

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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JASTRE/BKP/RFP/01/2025

Attention to: Tender Board Secretary

Mini Tender Board, Ministry Of Development,
Ground Floor, Ministry of Development Building,
Old Airport, Berakas,
Bandar Seri Begawan, BS3510,
Negara Brunei Darussalam.

NOT TO BE OPENED BEFORE 2:00 P.M. ON TUESDAY, 28TH OCTOBER 2025.

The name and mailing address of the Tenderer must be clearly marked on both the inner and outer envelopes to enable the Tender to be returned unopened in case it is declared late pursuant to clause 12.1.

- 11.2 Tenders may be forwarded by Government post, courier service or delivered by hand to the address in Clause 11.1 above of these Instructions not later than the Closing Date and Time for receipt of Tenders.
- 11.3 The Closing Date and Time for receipt of Tenders is **not later than the 2:00 P.M. on Tuesday, 28th October 2025**.
- 11.4 Tenders received later than the Closing Date and Time stated shall be rejected, notwithstanding the means of delivery to the Employer.
- 11.5 Failure on the part of the Tenderer in submitting the original, all duplicate and electronic copies of the Tender Submissions may result in the disqualification of the Tenderer.
- 11.6 In the event of discrepancy between the Original and Duplicate Copies and Electronic Copies of the submissions, the contents of the Original shall take precedence.
- 11.7 Except under exceptional circumstances no extension of the time and date by which the Tenders must be submitted will be granted.
- 11.8 Under no circumstances shall a receipt be given by the Employer to acknowledge delivery of a Tender except for Tender packages too large to be deposited in the Tender Box. These packages should be handed directly to the office of **The Secretary to the Mini Tender Board, Ministry of Development, Ground Floor, Ministry of Development Building, Old Airport Road, Berakas, Bandar Seri Begawan, BS3510, Negara Brunei Darussalam**.
- 11.9 Tenders may be withdrawn by written or faxed requests only, which must be received by the Employer at the address indicated in Clause 11.1 of these instructions and prior to the Closing

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Date for receipt of Tenders. Tenderers must return all the sections/documents and enclosure which was provided during the tender along with clarification and confirmation.

- 11.10 All Tenders submitted shall be deemed to remain valid for **Three Hundred Sixty Five (365) days** from the final date for submission of Tenders and no Tenderer may withdraw its Tender within that period. If in the event no decision for an award was made within the Tender validity period and deemed necessary by the Employer to extend the validity of the Tender, the Employer may request to extend the validity of the Tender. Any such extension is subject to the agreement of the Tenderer.

12.0 LATE TENDER

- 12.1 Any Tenders received by the Employer after the deadline for submission of Tenders described in clause 11 in the Part 2 – Instruction to Tenderers or any extension granted by the Employer by means of an Addendum thereafter may be rejected and returned unopened to the Tenderer. In such case the Tenderer will be notified accordingly for their collection. All costs and associated responsibility to collect the late tender submitted, when notified by the Employer, shall rest with the Tenderer. Any such late tenders not collected beyond one (1) month after such notification from the Employer will be destroyed by the Employer.

13.0 CONSIDERATION OF TENDER

- 13.1 The Employer hereby reserves the right to request any further information it may deem necessary to evaluate the Tender, which may include but not be limited to a breakdown of, or supplement to, any lump sum prices, rates or percentages tendered.
- 13.2 The Employer may require, prior to the award of any subsequent Contract, satisfactory evidence of the successful Tenderer's credit worthiness and financial soundness and capacity to handle the Contract and in this connection the Tenderer may be required to furnish a certified copy of its latest published accounts, details of similar Contracts successfully completed, a banker's reference, details of existing third party loans or guarantees (if any) and similar relevant information.

14.0 ACCEPTANCE OF TENDER

- 14.1 The Employer shall not be deemed to have accepted any offer unless and until a Letter of Acceptance of Tender (LOA) is issued by the Employer.
- 14.2 The Employer is neither bound to accept the lowest bid nor to accept any proposal in part or in whole at its discretion.
- 14.3 The Employer may award the Contract to the Tenderer whose tender has been determined to be substantially responsive to the tender documents and who has been judged to have offered the Employer the most commercially advantageous combination of price and technical quality.
- 14.4 The successful Tenderer will be required to sign a written Agreement, a draft copy of which is included in this Tender Document, which shall be subject to any mutually agreed amendments which both parties may deem necessary, including that arising from the further information requested and provided in accordance with clause 8 and clause 14 hereof. Such formal Contract shall be made in accordance with the Contract Agreement included in this tender document.

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15.0 MODIFICATION AND WITHDRAWAL OF TENDERS

- 15.1 Tenderer may modify or withdraw its Tender prior to the Tender submission, provided that written notice of the modification or withdrawal is received by the Employer **prior to the deadline for submission of Tenders.**
- 15.2 Tenderer's modification or withdrawal notice shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause 11, marked "MODIFICATION" or "WITHDRAWAL" as appropriate. A withdrawal notice may also be sent by e-mail, but must be followed by a signed confirmation copy.
- 15.3 No Tender may be modified by the Tenderer after the deadline for submission of Tenders.

16.0 PROCESS TO BE CONFIDENTIAL

- 16.1 Information relating to the examination, clarification, evaluation and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other person not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the Tenderer's disqualification.

17.0 CLARIFICATION OF TENDERS AND CONTACTING THE EMPLOYER

- 17.1 To assist in the examination, evaluation and comparison of Tenders, the Employer may, at its discretion, ask any Tenderer for clarification of its Tenders, including breakdowns of prices. The request for clarification and the response shall be in writing, or by e-mail, but no change in the price or substance of the Tender shall be sought, offered or permitted.
- 17.2 No Tenderer shall contact the Employer, any of its employees or Employer's Consultants, whether in writing (other than as provided for below) or by any other means on any matter relating to its Tender from the time of the Tender opening to the time the Contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing. Any attempt to influence the Tender evaluation should be considered to be detrimental to the Tenderer and may result in disqualification.
- 17.3 Tender clarification meetings may be requested by the Employer to facilitate better understanding of the Tender submissions. All cost incurred by the Tenderer in attending such Tender clarification meetings shall be borne by the Tenderer.

18.0 PRELIMINARY EXAMINATION OF TENDER AND DETERMINATION OF RESPONSIVENESS

- 18.1 Information relating to the examination, clarification, evaluation and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other person not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the Tenderer's disqualification.
- 18.2 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender:
- Has been properly signed;
 - Provides any clarification and/or substantiation that the Employer may require pursuant to Clause 17.

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- 18.3 A substantially responsive Tender is one, which conforms to all the terms, conditions and specifications of the Tender Documents, without material deviation or reservation. A material deviation or reservation is one:
- a) Which affects in any substantial way the scope, quality or performance of the Works;
 - b) Which limits in any substantial way, inconsistent with the Tender Documents, the Employer's rights or the Tenderer's obligations; or
 - c) Whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.
- 18.4 If a Tender is not substantially responsive, the Tenderer may be disqualified by the Employer.
- 18.5 Any tender without the accompanying fully priced Bills / Commercial Schedules is liable to disqualification. Tenderers are to enter their prices against each of the items in the Bills / Schedules. The value of items which are not priced or have dashes or other suitable marks inserted in the cash columns will be deemed to be of no values or have been allowed for in the prices of other items elsewhere in the tender. No claim for payment in respect of non-priced items will be admitted.
- 18.6 Tenderers are advised that rates inserted in the Tender must correctly reflect the cost of the Works. If during evaluation of tenders, rates are found, which in the Employer's opinion, do not correctly reflect the cost of the particular item, the Tender may be rejected or considered for acceptance subject to adjustment of rates without prior agreement from the Contractor to provide a more equitable distribution of cost.

19.0 BID RIGGING

- 19.1 The Employer prohibits bid rigging and this is subject to Competition Order 2015.

20.0 DISCLAIMER

- 20.1 The Employer shall not be held responsible for any loss, injury or damages suffered by the Tenderer or their employees or their agents in preparing the Tender or for any action whatsoever taken by a third party for any costs, loss, injury or damages suffered as a direct result of, or consequential to, the preparation of the Tender proposal.
- 20.2 All information and data given in this document, and/or subsequently forwarded by the Employer shall be regarded as for "Information Only". The Employer does not warrant or guarantee the accuracy or sufficiency of the information provided. The tenderer shall be responsible to verify and satisfy itself as to the accuracy and sufficiency of any information provided by the Employer. The Tenderers are deemed to have visited the sites, consulted with all relevant authorities and stakeholders, ascertained actual conditions of buildings and facilities etc, to ensure and verified for themselves the content of such information and data, as correct and current.

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SECTION 1

PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS

APPENDIX 1 – SUBMISSION CHECKLIST

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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SECTION 1
PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS
APPENDIX 1 – SUBMISSION CHECKLIST

The Tenderer must strictly adhere to the following submission requirements and ensure all the requisite documents are duly filled in, signed, stamped and submitted accordingly. Failure to do so may render the tender being rejected by the Employer. All supporting document, attachments, explanatory write-up, program of works, CVs, certifications etc as required to be submitted within each of the sub-sections below shall be accordingly included in the relevant sections.

The following checklist must be duly filled in and included in all the Original and Duplicate Copies of the envelopes respectively.

Submission Documents		Submission	
		Yes	No
Section 1	Part 1 – Invitation to Tender		
	Appendix 1 – Tender Acknowledgement		
	Appendix 2 – Confidentiality Agreement		
	Appendix 3 – Segregation of Tender Packages for Tender issuance (Package 1 and Package 2)		
	Part 2 – Instructions to Tenderers		
	Part 3 – Appendices to Instructions to Tenderers		
	Appendix 1 – Submission Checklist		
	Appendix 2 – Confirmation of Tender Briefing Attendance		
	Appendix 3 – Specimen of Tender Security		
	Appendix 4 – Tender Clarification Form		
	Appendix 5 – Signed Declaration on Information Provided by the Employer during Tender		
Section 2	Part 2 – Particular Conditions Part A – Contract Data		
Section 4	Part 1A – Letter of Tender (Tender 'A' – Base Tender)		
	Part 1B – Letter of Tender (Tender 'B' – Alternative Tender)		
	Part 2 – Appendices to Letter of Tender		
	Appendix 1 – Details of Tenderer		
	Appendix 2 – Details of Sub-Contractors		
	Appendix 3 – Details of Design Consultants (Design Sub-Contractors)		
	Appendix 4 – Details of Suppliers (Sub-Contractors undertaking supply works)		
	Appendix 5 – Details of Financing Institution		
	Appendix 6 – Human Resources		
	Appendix 7 – Execution Methodology		

.....
Signature of Tenderer

Date:

.....
Signature of Witness

Date:

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Submission Documents	Submission	
	Yes	No
Appendix 8 – Plant, Tools and Equipment		
Appendix 9 – Workshops and Tool Stores		
Appendix 10 – Past Experiences		
Appendix 11 – Current Project Commitments		
Appendix 12 – Financial Capabilities		
Appendix 13 – Quality Management System		
Appendix 14 – Health, Safety, Security and Environment (HSSE)		
Appendix 15 – Environmental Performance		
Appendix 16 – Tenderer's Declaration		
Appendix 17 – Details of Insurance Underwriter		
Appendix 18 – Schedule of Warranties		
Appendix 19 – Tenderer's Proposed Brands & Source of Materials & Their Availability		
Appendix 20 – Tenderer's Proposed List of Training before Handover		
Appendix 21 – Schedule of Deviations from Tender Requirements		
Appendix 22 – Dispute History		
Appendix 23 – Form GV1: Tenderer's Guarantees On Net Power Output		
Part 3 – Technical Proposal (complete with all the necessary write-ups, layout plants and associated supporting documents stated in this section of the Tender document)		
Section 5	Part 1 – Commercial Proposal	
	Part 2 – Pricing Preambles	
	<u>Part 3A – Design-Build Period</u>	
	Bill No. 1A – General & Particular Conditions and Preliminaries	
	Bill No. 2A – Occupational Safety & Health (OSH)	
	Bill No. 3A – Professional Services for Design, Supervision, Studies and Authority Approvals	
	Bill No. 4A – Building and Infrastructure Works Outside the WTE Plant Site Boundary	
	Bill No. 5A – Infrastructure Works Inside the WTE Plant Site Boundary	
	Bill No. 6A – Buildings Works Inside the WTE Plant Site Boundary	

.....
Signature of Tenderer

Date:

.....
Signature of Witness

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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Submission Documents	Submission	
	Yes	No
Bill No. 7A – Mechanical & Electrical Works Associated with Buildings Inside the WTE Plant Site Boundary		
Bill No. 8A – Waste to Energy Plant Components and Associated Works (except for the building and associated M&E works as in Bill No. 6A and 7A)		
Bill No. 9A – Integrated Testing, Commissioning & Start-up (including all licensing)		
Bill No. 10A – Miscellaneous		
<u>Part 3B – Operation Service Period (including Transfer)</u>		
Bill No. 1B – General Conditions and Preliminaries		
Bill No. 2B – Cost for asset replacement requirements		
Bill No. 3B – Overall Operations (including Environmental Performance Monitoring / Reporting)		
Bill No. 4B – Overall Maintenance		
Bill No. 5B – Independent Surveyor		
Bill No. 6B – Transfer preparation, inspection, testing and handover		
Bill No. 7B – Miscellaneous		
Part 3C-1 – Final Summary (Design-Build Period)		
Part 3C-2 – Final Summary (Operation Service Period (including Transfer))		
<u>Tender ‘A’ – Base Tender</u>		
Part 4A – Schedule of Power Export, Other Revenue Streams and Associated Revenue Projection		
Part 5A – Schedule of Return of Investment and Demonstration of Tipping Fees		
Part 6A – Schedule of Tipping Fees		
Part 7A – Schedule for Optional Decommissioning		
<u>Tender ‘B’ – Alternative Tender</u>		
Part 4B – Schedule of Power Export, Other Revenue Streams and Associated Revenue Projection		
Part 5B – Schedule of Return of Investment and Demonstration of Tipping Fees		
Part 6B – Schedule of Tipping Fees		
Part 7B – Schedule for Optional Decommissioning		

.....
Signature of Tenderer

Date:

.....
Signature of Witness

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 1

PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS

APPENDIX 2 – CONFIRMATION OF TENDER BRIEFING AND SITE VISIT

ATTENDANCE

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 1

PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS

APPENDIX 2 – CONFIRMATION OF TENDER BRIEFING AND SITE VISIT ATTENDANCE

TO:

Tender Board Secretary
Mini Tender Board,
Ministry of Development,
Ground Floor, Ministry of Development Building,
Old Airport Road, Berakas,
Bandar Seri Begawan, BS3510,
Negara Brunei Darussalam.

Dear Sir / Madam,

TENDER TITLE: **REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE
AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU,
TUTONG, NEGARA BRUNEI DARUSSALAM**
JASTRE/BKP/RFP/01/2025

SUBJECT: **TENDER BRIEFING AND SITE VISIT ATTENDANCE**

We are pleased to confirm our attendance to the above Tender Briefing scheduled at Dewan Betabur, at Tingkat Satu (Level 1), Kementerian Pembangunan (Ministry of Development), Jalan Airport Lama (Old Airport Road), Bandar Seri Begawan, Negara Brunei Darussalam.

Please find below list of attendees from our Company for your perusal: -

Name	Position	I.C. No. / Passport No.
1.		
2.		
3.		
4.		
5.		

Note:

The schedule for tender briefing and site visit will be notified to the respective tenderer via email from jastre.wte.rfp@env.gov.bn. Currently this is tentatively planned in the week commencing 8th September 2025.

Name of the Tenderer : _____

Signature : _____

Position : _____

Date : _____

SECTION 1

PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS

APPENDIX 3 – SPECIMEN OF TENDER SECURITY

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 1
PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS
APPENDIX 3 – SPECIMEN OF TENDER SECURITY

[Sample below to be written and submitted in Bank's Letterhead]

BANK'S LETTERHEAD

[Must be from a Bank in Brunei Darussalam Licensed by Brunei Darussalam Central Bank (i.e. Preferred Tender Security Provider) or by an Alternative Tender Security Provider to be pre-approved by JASTRe via Tender Clarifications as stipulated in the Instructions to Tenderers]

Date

The Chairman of Tender / Quotation Committee

Mini Tender Board,
Ministry of Development,
Ground Floor, Ministry of Development Building,
Old Airport Road, Berakas,
Bandar Seri Begawan, BS3510,
Negara Brunei Darussalam

Dear Sir/Madam,

TENDER REF. NO. JASTRE/BKP/RFP/01/2025

PROJECT TITLE: REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM

(GUARANTEE REFERENCE NUMBERS)

We have been informed that *[name of Tenderer]* (hereinafter called “the Tenderer”) intends to submit to you its Tender dated *[date of Tender]* (hereinafter called “the Tender”) in response to Request for Proposal to Invest, Design, Build, Own, Operate and Transfer Waste To Energy Plant at Lot 17394, Kg. Sg. Paku, Tutong, Negara Brunei Darussalam at Sungai Paku Engineered Landfill area at Kg Sg. Paku, Tutong District, Negara Brunei Darussalam under the above Invitation for Tenders.

Furthermore, we understand that, according to your conditions, the Tender must be supported by a Bank Guarantee for Tender Security.

At the request of the Tenderer, we *[name of bank]* hereby irrevocably undertake to pay you, without civil or argument, any sum or sums not exceeding in total an amount of Brunei Dollars: Four Million (B\$4,000,000.00) upon receipt by us of your first written demand accompanied by a written statement that the Tenderer is in breach of its obligation(s) under the Tender conditions, because the Tenderer:

- a. has withdrawn its Tender after opening of Tenders by the Mini Tender Board, Ministry of Development but within the validity of the Tender Security; or
- b. refused to accept the Letter of Acceptance (LOA); or
- c. failed to furnish Performance Security within the period stipulated in the LOA; or
- d. refused to sign the Contract Agreement by the time specified in the LOA; or
- e. refused to accept the correction to the arithmetical errors to maintain the amount of Tender as Tendered.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

This guarantee will expire:-

- (a) if the Tenderer is the successful Tenderer, upon our receipt of a copy of the Contract Agreement signed by the Tenderer or a copy of the Performance Security issued to you in accordance with the Contract Agreement;
(or)
- (b) if the Tenderer is not the successful Tenderer, fifty-six (56) days after the expiration of the Tenderer's Tender validity period, being *[date of expiration of the Tender validity plus fifty-six (56) days]*.

Consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

Yours faithfully,

.....
Name & Designate of Authorised Signatory

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 1

PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS

APPENDIX 4 – TENDER CLARIFICATION FORMS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**

**SECTION 1
PART 3 – APPRNDICES TO INSTRUCTIONS TO TENDERERS
APPENDIX 4 – TENDER CLARIFICATION FORM**

REQUEST FOR TENDER CLARIFICATION NO. []*

Tender Title:	REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM JASTRE/BKP/RFP/01/2025
Name of the Tenderer:	
Date:	

No.	Tenderer's Queries	JASTRe's Responses
Q1.		
Q2.		
Q3.		
Q4.		
Q5.		

Note: All clarification requests shall be emailed to jastre.wte.rfp@env.gov.bn no later than Fourteen (14) working days prior to the closing date of the Tender.

* Tenderer to fill in their own running number of tender clarifications issued for this project during the tender stage

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 1

PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS

**APPENDIX 5 – SIGNED DECLARATION ON INFORMATION PROVIDED BY THE
EMPLOYER DURING THE TENDER**

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 1

PART 3 – APPENDICES TO INSTRUCTIONS TO TENDERERS

**APPENDIX 5 – SIGNED DECLARATION ON INFORMATION PROVIDED BY THE EMPLOYER
DURING TENDER**

We (Tenderer) declare that all the information furnished, including but not limited to Site Data, Municipal Solid Waste (MSW) Data, Soil Investigation Report, Topographical Survey Drawings, etc. issued by the Employer (JASTRe) are for information only.

We (Tenderer) hereby confirm our full understanding that the Employer does not warrant (or) guarantee the accuracy (or) sufficiency of the information provided by the Employer.

We (Tenderer) shall be fully responsible to verify and satisfy ourselves as to the accuracy and sufficiency of any information provided by the Employer.

We also confirm our understanding that we are required to visit the sites, consult with all relevant authorities and stakeholders, ascertain actual conditions of site, sub-soil conditions, existing services, buildings and facilities etc., to ensure and verify for ourselves the content of such information and data, as correct and current prior to the submission of our Tender for this project.

TENDERER : _____

SIGNATURE : _____

NAME : _____

DESIGNATION : _____

DATE : _____

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3
EMPLOYER'S REQUIREMENTS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3
PART 1 – EMPLOYER’S REQUIREMENTS



FIS0000635-580-001

Employer's Requirements

FIS0000635

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG.
SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**

**Department of Environment, Parks and Recreation,
Brunei Darussalam**

Contact



Fichtner GmbH & Co. KG
Sarweystrasse 3
70191 Stuttgart
Germany

www.fichtner.de

Disclaimer

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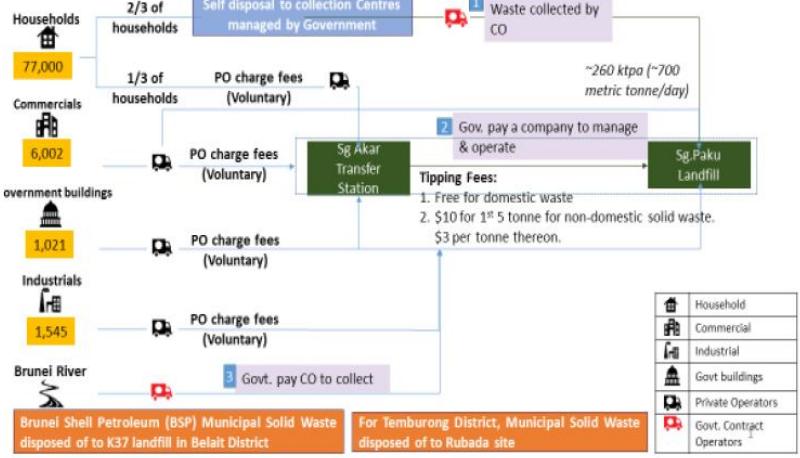
List of abbreviations and acronyms

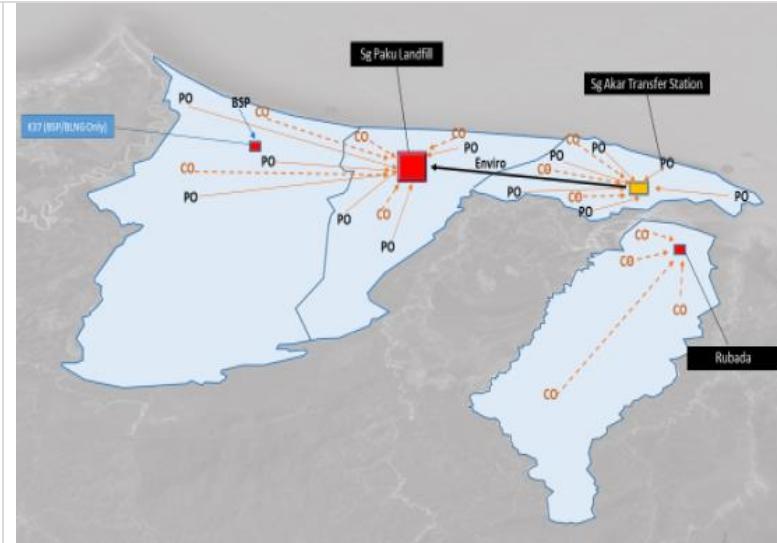
Abbreviation / Acronym	Expansion
AASHTO	American Association of State Highway and Transportation Officials
ABCi	Authority on Building Control and Construction Industry, Brunei Darussalam
ACMV	Air Conditioning and Mechanical Ventilation
AENBD	Autoriti Elektrik Negara Brunei Darussalam
APC	Air Pollution Control
APCR	Air Pollution Control Residues
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AVRS	Automatic Vehicle Recognition System
BAGUS	Brunei Accredited Green Unified Seal
BCAI	BCA International Pte Ltd, Singapore rating for overseas BCA Green Mark green building rating system
BFRD	Brunei Fire and Rescue Department or commonly known as BOMBA
BREEAM	Building Research Establishment Environmental Assessment Method
BSP	Brunei Shell Petroleum
CCTV	Closed Circuit TV
CEMP	Contractor's Environmental Management Plan which shall include Environmental Impact Assessment EIA and Environmental Management and Monitoring Plan (EMMP) in relation to the relevant phases of the project including Design-Build Period and Operation Service Period.
CEMS	Continuous Emission Monitoring System
C&I	Control and Instrumentation
CIBSE	Chartered Institution of Building Services Engineers
CIT	Computer, Information Technology
CO	Government Contracted Operators
COC	Conditions of Contract as per FIDIC Gold Book 2008 Edition as amended and/or supplemented by the Particular Conditions (PCCs which consists of the Contract Data and Special Provisions)
DBO	Design-Build and Operate
DCS	Distributed Control System

Abbreviation / Acronym	Expansion
DDS	Department of Drainage and Sewerage, Public Works Department, Brunei Darussalam
DES	Department of Electrical Services, Brunei Darussalam
DWS	Department of Water Services, Public Works Department, Brunei Darussalam
EIA	Environmental Impact Assessment
FIDIC	Fédération Internationale des Ingénieurs-Conseils
GCC	Any reference of GCC is deemed to refer to COC
HSE	Health Safety and Environment
HSSE	Health, Safety and Security Environment
HVAC	Heating, Ventilation and Air Conditioning
ID	Induced Draft
IFC	International Finance Corporation
ISO	International Organisation for Standardisation
JASTRe	Department of Environment, Parks and Recreation (the "Employer"), Brunei Darussalam
LEED	Leadership in Energy and Environmental Design
LD	Land Department, Brunei Darussalam
LTP	Leachate Treatment Plant
MCR	Maximum Continuous Rating
MSW	Municipal solid waste
MW	Megawatt
NCV	Net Calorific Value
NFPA	National Fire Protection Association (United States of America)
OS	Original Substance (wet waste)
OSP	Operation Service Period
PBD	Piawai Brunei Darussalam (National Standard, Brunei Darussalam)
PC	Particular Conditions (Amendments / supplements to FIDIC Gold Book 2008 Edition and consists of the Contract Data and Special Provisions)
PD	Performance Damages

Abbreviation / Acronym	Expansion
PG	Performance Guarantees
P&IDs	Process and Instrumentation Diagrams
PIMS	Plant Information Management System
PO	Private Operators
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
QA	Quality Assurance
QMP	Quality Management Plan
RO	Reverse Osmosis
SCADA	Supervisory Control and Data Acquisition
SD	Survey Department, Brunei Darussalam
SNCR	Selective Non-catalytic Reduction
SHENA	Safety, Health, and Environment National Authority, Brunei Darussalam
TCP	Town and Country Planning Department, Brunei Darussalam
TOC	Total Organic Carbon
tpd	tonnes per day
UNN	Unified National Networks, Brunei Darussalam
WTE	Waste to Energy

1 Introduction and Background

1. Introduction	<p>The Government of Brunei through the Department of Environment, Parks and Recreation, under the Ministry of Development (JASTRe, or the Employer) is committed to improve the environmental conditions and strengthen the solid waste management system in Brunei. The Employer is inviting interested proponents (the Contractor) to participate and submit a proposal for a Request for Proposal (RFP) to Invest, Design, Develop, Own, Operate and Transfer a Waste to Energy (WTE) Facility in Brunei Darussalam.</p>
2. Background	<p>Brunei Darussalam's waste management, for both hazardous and non-hazardous waste, is under the purview of JASTRe. Both wastes are managed in separate manner. Hazardous waste is managed by registered companies regulated under JASTRe whereas non-hazardous waste, comprising mostly of municipal solid waste (MSW) is managed via an existing waste management ecosystem as follows.</p>  <p>The flowchart illustrates the waste management process:</p> <ul style="list-style-type: none"> Sources: Households (77,000), Commercials (6,002), Government buildings (1,021), Industries (1,545), and Brunei River. Collection: <ul style="list-style-type: none"> Households (2/3) contribute to "Self disposal to collection Centres managed by Government". Households (1/3), Commercials, Government buildings, Industries, and the Brunei River all contribute to "PO charge fees (Voluntary)" which goes to the "Sg Akar Transfer Station". Brunei River waste is collected by CO. Disposal: <ul style="list-style-type: none"> "Self disposal to collection Centres managed by Government" leads to "Waste collected by CO" (labeled 1). "Sg Akar Transfer Station" leads to "Govt. pay a company to manage & operate" (labeled 2). "Waste collected by CO" and "Govt. pay a company to manage & operate" both lead to "Sg.Paku Landfill". "Govt. pay CO to collect" (labeled 3) leads to "For Temburong District, Municipal Solid Waste disposed of to Rubada site". "Govt. pay CO to collect" also leads to "Brunei Shell Petroleum (BSP) Municipal Solid Waste disposed of to K37 landfill in Belait District". Tipping Fees: <ul style="list-style-type: none"> 1. Free for domestic waste 2. \$10 for 1st 5 tonne for non-domestic solid waste \$3 per tonne thereon. <p>Legend:</p> <ul style="list-style-type: none"> Household Commercial Industrial Govt buildings Private Operators Govt. Contract Operators



As subscription for waste collection is not a mandatory requirement, only one third of the 77,000 households are subscribed to Private Operators (PO) to collect waste from their homes whereas two thirds self-dispose their waste to 45 collection centres nationwide that are provided and managed by the Government Contracted Operators (CO) which are then transported to Sungai Paku landfill via Sg Akar Transfer Station located in Brunei-Muara District. For BSP in Belait District, all their MSW are disposed of at the designated K37 landfill which is fully funded by BSP, whereas waste in Temburong District is disposed of at Rubada disposal site.

Not all commercial and industrial buildings engage POs to collect waste from their premises. Waste floating on the Brunei River are collected by CO and disposed of at Sg Paku Landfill.

Currently, subscription to waste collection services is not a mandatory requirement yet. However, in future JASTRe aims to make subscription to waste collection services mandatory for households, commercial and industrial sectors. This is currently in implementation as a pilot project at specific selected areas.

In 2024, the total waste disposed of in Brunei Darussalam was about 235,774 metric tonnes, which is equivalent to 646 tonnes per day. Of this total volume, 200,034 metric tonnes was disposed of at the Sungai Paku Engineered Landfill at an average rate of 548 tonnes per day. However, the highest number ever recorded since the landfill came into operation in 2011 is in the year 2019 with an average rate of 685 tonnes per day disposed at the Sungai Paku Engineering Landfill. At this rate, the Sungai Paku Engineered Landfill is expected to reach its full capacity by 2030 or even earlier. Please see in Appendix 3A – Overall waste Statistics of Section 3 – Employer's Requirements – Part 2 – Appendices to Employer's Requirements for the recent statistics as of December 2024.

Based on the population growth of 1.1% per year, the total volume of waste (MSW) to be disposed of in Brunei Darussalam is expected to increase to about 780 metric tonnes per day by 2052. Please see in

Appendix 3D – Projected total waste growth of Section 3 – Employer’s Requirements – Part 2 – Appendices to Employer’s Requirements. The waste projections provided are indicative and for information purposes only. The Employer makes no representation, warranty, or guarantee as to the accuracy, completeness, or achievability of the projected waste volumes and shall bear no liability whatsoever in the event that actual waste volumes differ from the projections. The Contractor shall have no right to claim for compensation, or any other relief on the basis that the actual waste volumes do not meet the projected figures.

As of 2023, the bulk of Brunei Darussalam’s waste (~235 kTpa) are largely disposed of via landfilling and open dumping. Approximately 66 kTpa is aggregated by recyclers and exported out of the country. Brunei Darussalam needs a better waste management policy to remediate the landfilling situation and better handle its waste streams.

2 Purpose of the Works

1. General	<p>The main purpose of the Works is to ensure safe and environmentally friendly solid waste treatment and disposal in Brunei, by applying state of the art incineration and heat recovery technology. The aim is to reduce the overall environmental impact of the solid waste treatment within Brunei throughout the Operation Service Period that shall be twenty-five (25) years.</p> <p>The Contractor shall operate and maintain the Works during the Operation Service Period and shall be responsible for meeting the Performance Guarantees stipulated in this Contract and ensuring that the facility is fit for purpose. Two (2) years prior to the completion of the Operation Service Period, it shall be decided by mutual agreement by the Employer and the Contractor to continue the Operation Service Period by a further extension or handed back at the end of the Operation Service Period.</p>
2. Waste Treatment	<p>The current waste delivery records to Sungai Paku Landfill is detailed in Please see in Appendix 3A – Overall waste Statistics of Section 3 – Employer's Requirements – Part 2 – Appendices to Employer's Requirements for the recent statistics as of December 2024.</p> <p>Waste will be delivered to the Site by the Employer. The Contractor shall be responsible to treat all the waste delivered by the Employer at the WTE throughout the Operation Service Period.</p> <p>The Contractor shall propose a WTE with a minimum daily processing capacity of 900 tonnes per day, while the Employer guarantees at least 650 tonnes per day of waste for delivery at the WTE (based on a seven-day rolling average).</p> <p>The Contractor shall receive compensation by the Employer through a Tipping Fee to be proposed by the Contractor.</p>
3. Power Export	<p>The export of electricity into the DES grid will be governed by a PPA agreement between the Contractor and DES which will be agreed.</p> <p>The Contractor shall use a turbine offering a versatile use of the thermal heat while the generator shall allow island mode operation to satisfy the WTE plant's self-consumption without any time limitation.</p>
4. Maximizing the Sungai Paku Landfill's Lifetime	<p>Bottom ash and APC residues from the WTE facility shall be disposed to the Sungai Paku landfill by the Contractor with an applicable fee set by the landfill contractor agreement with the Department of Environment, Parks and Recreation, and shall be compliant to the standards set forth in the European Landfill Directive 2018/850/EC. Only non-hazardous waste may be disposed at the Sungai Paku Landfill. The Contractor shall be responsible to dispose hazardous waste in accordance with the requirements of the Department of Environment, Parks and Recreation.</p>

3 Scope of the Design, Build, Own, Operate and Transfer Contract

1. Scope of the DBOOT Contract	<p>The Contract includes the design, procurement, construction, installation, own, operation and transfer of a Waste to Energy facility (WTE) incorporating incineration and heat recovery technology, its ancillary equipment, including leachate treatment plant and all associated permanent and temporary Works to provide a fully functional, environmentally compliant and a highly durable and reliable solution that remains fit for purpose over the entire Operation Service Period and thereafter.</p> <p>The WTE shall have a minimum daily waste processing capacity of 900 tonnes per day (900 tpd) (based on a seven-day rolling average). The actual daily processing capacity, and number of process lines shall be proposed by the Contractor. The Employer shall guarantee a daily waste delivery of 650 tonnes to the WTE (based on a seven-day rolling average).</p> <p>The Contractor shall be responsible to treat the Contract Waste which is defined as all the waste delivered by the Employer at the WTE throughout the Operation Service Period.</p> <p>The WTE shall be designed to operate 24 hours per day with continuous waste feed, with an annual Availability of 89% (rolling average of 5-years). The WTE shall be capable of handling the entire range of the waste composition as per the Appendix 3C - Previous solid waste studies for the Sg. Paku land fill site & Brunei Darussalam and municipal solid waste sampling data of these Employer's Requirements – Part 2 – Appendices to Employer's Requirements.</p> <p>The WTE facility shall be engineered and constructed as a conventional, state-of-the-art grate-type incinerator with heat recovery. The power demand of the WTE facility and all ancillaries shall be satisfied by the power generated with the facility's turbo-generator system,</p> <p>The WTE facility shall incorporate the following key components:</p> <ul style="list-style-type: none">a) Tipping hall and bunker including bunker cranes;b) Combustion system including feeding hopper, pusher, grate and deasher;c) Boiler including superheaters and economizer;d) Boiler make up water demineralization unit;e) Air pollution control (APC) system including all necessary handling, dosing and storage units;f) Extraction condensing type turbine and air cooled condenser;g) Generator;h) Balance of plant including auxiliary cooling systems and all ancillary systems;
--------------------------------	---

	<p>i) Building structure and building services;</p> <p>Additionally, the Contractor shall design, build and operate:</p> <ul style="list-style-type: none"> a) Required infrastructure for connection to Interfaces (water, sewerage, power, roads, telecommunication etc.); b) Necessary waste pre-treatment facilities for leachate extraction; c) A weighbridge station; d) A bottom ash treatment system; e) A fly ash and APC system residue treatment and stabilization system ; f) A plant to treat leachate and wastewater; g) All ancillary infrastructures within the Site and up to the interconnection point of Interfaces to facilitate the Works (water supply, wastewater treatment and discharge, power supply, firefighting system, drainage system, internal and access roads, carriageways and parking lots, landscaping, etc.). Please see the relevant infrastructure below for the extent of the scope to be covered by the Contractor within and beyond the Site. <p>The Contractor shall also supply, install and operate the necessary electrical and control equipment to allow an island mode without any time limitation as well as a grid backed operation of the facilities.</p>
2. Contract Management	<p>The project execution shall be supported by a Contract management approach that ensures timely delivery of the scope of the Works. The contract management system throughout the Contract term shall, without limitation, cover the following:</p> <ul style="list-style-type: none"> a) Project and contract management including programme and arrangement for timely delivery of design, procurement, manufacturing, construction and assembly, commissioning and operation, reporting and resource management; b) Quality assurance and management plan; c) Contractor's Environmental Impact Assessment (EIA) and Environmental Management Plan (CEMP); d) Health & Safety Management Plan; e) Communication management towards the public.
3. Design, Procurement, Manufacturing and Shipment	<p>These activities shall encompass, but are not limited to the following:</p> <ul style="list-style-type: none"> a) Elaborate the arrangement for the timely design, procurement, manufacturing including factory testing and shipment of the scope of the Design-Build; b) Prepare all engineering studies needed to complete the project design, including additional investigations and surveys (if necessary) such as bathymetric (as applicable), geotechnical,

	<p>topographic survey or any other relevant studies including but not limited to EIA/EMMP, Raw-water intake study. The site is located in the district of Tutong, Brunei Darussalam, with the coordinates of 4°42'8.79"N, 114°32'27.68"E. The site is situated adjacent to the Engineered Landfill at Sungai Paku, Tutong and occupied by sand quarries;</p> <ul style="list-style-type: none"> c) Elaborate the concept and detailed design as per Chapter 5.6 to achieve design progress in accordance with Chapter 5.5; d) Prepare the permitting design documentation and obtain all necessary approvals from relevant authorities, including but not limited to, environmental and building permits and clearances (Please refer to Appendix 5A - Schedule of current approvals and permissions obtained by the Employer appended herewith these Employer's Requirements); e) Ensure the timely procurement, manufacturing and shipment of all Materials and Goods, equipment and components that are needed for the subsequent assembly and construction. <p>The Contractor's responsibilities with respect to design, procurement, manufacturing and shipment shall be embedded in its quality management plan which shall indicate clear responsibilities of all involved parties and assure hold points for relevant design and construction activities.</p>
4. Construction Activities	<p>The Contractor's responsibilities during the construction stage shall include but are not limited to the following:</p> <ul style="list-style-type: none"> a) Mobilize all Contractor's Personnel and sub-contractors and erect temporary facilities at the Site; b) Prepare the Site for construction and manage all construction works on the Site; c) Ensure timely delivery of all Materials and Goods to the Site, as well as unloading, unpacking, inspection, installation and testing of equipment; d) Integrate Works to ensure safety of personnel, assets and environment; e) Connect Site infrastructure to utilities (water, sewerage, power, drainage, telecom etc.); f) Ensure timely construction, assembly and erection of the Works to fulfil the scope of the Contract and these Employer's Requirements; g) Facilitate all inspections required by the relevant authorities, Employer's Representative or any third party engaged by the Employer.
5. Commissioning Activities	<p>The Contractor's commissioning activities shall, without limitation, consist of:</p> <ul style="list-style-type: none"> a) Prepare and submit relevant Contractor's Documents including commissioning plan, operation and maintenance manuals,

	<p>and as-built drawings;</p> <ul style="list-style-type: none"> b) Prepare and submit to relevant authorities and obtain the required permits before any commissioning is undertaken; c) Carry out pre-commissioning and commissioning including tests of individual equipment, items of the Plant and entire systems; d) Perform trial operations and Performance Guarantee testing of the Works until the achievement of the Performance Guarantees has been demonstrated and agreed by the Employer's Representative; e) Submit reports on Tests on Completion of Design-Build.
6. Operation Services	<p>The Contractor shall operate and maintain the Works continuously, taking on the responsibility to achieve the Performance Guarantees as defined in Chapter 4 of these Employer's Requirements and carrying out, without limitation, the following tasks throughout the Operation Service Period:</p> <ul style="list-style-type: none"> a) Operate, maintain and calibrate all necessary equipment to demonstrate the Works performance; b) Plan and effect the operational regime of the Works in close collaboration with the Employer's Representative; c) Maintain, inspect, repair and overhaul all assets included in this Contract and organize the required downtime in due consultation with the Employer's Representative; d) Replace assets as per Contractor's proposal under Section 5 – Part 3B – Bill No. 2B - Asset Replacement Requirements and the associated Asset Replacement listed therein or as needed; e) Report regularly on the operational performance of the Works; f) Process incinerator bottom ash and minimize landfilling of residues from the WTE; g) Conduct tests during the Operation Service Period as per these Employer's Requirements or upon request by the Employer; h) Conduct Tests Prior to Contract Completion as defined by these Employer's Requirements; i) Comply with all prevailing regulations at the time of operations, including regular renewal of permits and licences, to ensure the Operation Services are performed in compliance to all laws and regulations of Brunei Darussalam; j) Facilitate any inspection requested by the relevant authorities or Employer's Representatives or any third party engaged by the Employer. <p>Provide for a seamless handback or handover of all assets to the Employer or to another third party as per the handback requirements</p>

	and, as needed, arrange for the necessary training of the personnel of the follow-on operator.
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4 Performance Requirements

1. General	<p>The Contractor shall design, build and operate the Works so that they shall at all times comply with the limit values specified in the Schedule of Performance Guarantees below. Where indicated, failure to reach any limit value shall make the Contractor liable to make good the failure and to remedy it within the time specified in the said Notice to Correct under GCC Sub-Clause 11.4 [Failure to Pass Tests on Completion of Design-Build, or pay damages to the Employer in accordance with the provisions in the Contract Section 2 – Part 2 – Particular Conditions Part A – Contract Data, GCC Sub-Clause 10.7 [Failure to Reach Production Outputs], GCC Sub-Clause 11.4 [Failure to Pass Tests on Completion of Design-Build, and GCC Sub-Clause 11.11 [Failure to Pass Tests Prior to Contract Completion].</p> <p>The requirements for monitoring and testing of the Works to demonstrate compliance with the Performance Guarantees (PG) are included in Chapter 5.16 [Tests on Completion of Design Build] and Chapter 6.4.9 [Compliance Monitoring and Testing]. see chapter below</p>
2. PG1: Waste Processing Capacity	<p>The Works shall, at all times, have sufficient capacity to process a minimum of 900 t/day. However, the actual Waste Processing Capacity of the WTE shall be defined by the Contractor and shall be complied under PG1.</p> <p>The PG1 performance of the incineration train(s) shall be assessed:</p> <ul style="list-style-type: none"> • during the Tests on Completion of Design-Build and, • subject to the performance of the Works, upon request by the Employer, annually on each anniversary of the commencement of the Operation Service Period, and • during the Tests Prior to Contract Completion and handover. <p>Minimum Performance Guarantee of at least 95% of the defined Waste Processing Capacity, with Performance Damages applicable from 95% up to the defined Waste Processing Capacity shall apply during the Tests on Completion of Design-Build and during the Tests Prior to Contract Completion and handover.</p>
3. PG2: Minimum Annual Waste Throughput	<p>The Contractor shall process not less than the minimum amount of 237,250 tonnes per annum (based on 650 t/day waste).</p> <p>The Contractor's performance shall be assessed annually on each anniversary of the commencement of the Operating Service Period.</p>
4. PG3: Delivered Annual Waste Throughput Above Minimum Annual Waste Throughput	<p>The Contractor shall process all waste delivered to the WTE above the amount specified in PG2.</p> <p>The Contractor's performance shall be assessed annually on each anniversary of the commencement of the Operating Service Period.</p>

5. PG4: Net Power Output	<p>The Net Power Output (PG4) is determined from the Contractor's Bid Form [Bid form GV1] submitted with the Contractor's Bid.</p> <p>The net power output values in form [Bid form GV1 in Appendix 23 to Letter of Tender] shall be used as a proxy to demonstrate that the facility can meet the net power output (PG4) during the Tests on Completion of Design-Build.</p> <p>For the sake of clarity, the net power output (in MW) shall be measured at the following metering location:-</p> <ul style="list-style-type: none"> a) at Main Intake Substation (MIS) to be built by the Contractor at the Waste to Energy Plant in the case of 11kV network for power export less than 10MW; b) at the switchyard to be built by the Contractor at the Waste to Energy Plant in the case of 66kV network for power export of 10MW and above. <p>The net power output shall be tested during the Tests on Completion of Design-Build after the boiler has reached nominal fouling (1,000 hours of continuous operation), and prior to Contract Completion or Handback.</p> <p>The Minimum Performance Guarantee of 95% of the defined Net Power Output must be achieved by the Contractor.</p>
6. PG5: Total Organic Carbon Content Bottom Ash (TOC)	<p>The Contractor shall ensure that the annual averaged TOC content of bottom ash does not exceed the value in Table 4-1.</p> <p>The average TOC content shall be determined by analysing two representative samples monthly (i.e. approximately one sample every 15 days). None of the measured TOC contents shall exceed the value as defined in Table 4-1.</p> <p>The Contractor's performance shall be assessed annually on each anniversary of the commencement of the Operating Service Period and during the Tests on Completion of Design-Build.</p>
7. PG6: Air Emission Standards	<p>The Contractor shall operate the plant so that none of the half hourly and none of the daily aggregated pollutants' measurements and none of the discontinuously measured pollutants' concentrations exceed the limits stipulated in Table 4-2 any time.</p> <p>The Environmental Authority may request the Contractor to shut down the plant any time if the air emission standards are not met.</p> <p>The Minimum Performance Guarantee of compliance with all limits stipulated in Table 4-2 must be achieved by the Contractor.</p> <p>PG6 shall be assessed:</p> <ul style="list-style-type: none"> • during the Tests on Completion of Design-Build and, • subject to the performance of the Works, upon request by the Employer, annually on each anniversary of the commencement of the Operation Service Period, and • during the Tests Prior to Contract Completion and handover

8. PG7: Combustion conditions	The Contractor shall ensure that the limit values in Table 4-1 for temperature and residence time are always maintained. The requirements as per Chapter 5.16 shall be considered.
9. PG8: LTP Discharge Standards	The maximum permissible concentrations of pollutants discharged from the LTP are specified in Table 4-3. The Environmental Authority may prohibit the discharge of effluent from the LTP any time if the LTP discharge emission standards are not met.
10. PG9: Wastewater Treatment Discharge Standards	The maximum permissible concentrations of pollutants discharged from the wastewater treatment plant are specified in Table 4-4
11. PG 12: Sound Pressure Level	<p>Sound pressure levels of the fully operating plant shall not exceed the values as defined below:</p> <p>Within the facility: 80 dB(A) at a distance of 1m from the emitting equipment subject to control measures e.g. hearing protection</p> <p>At the Site's boundaries:</p> <ul style="list-style-type: none"> ▪ 75 dB(A) (7 am to 7 pm), ▪ 70 dBA (7pm – 11pm), ▪ 65dB(A) (11 pm to 7 am) <p>Within the office and control room areas, the Contractor shall take into account the noise rating curves of CIBSE and shall meet the noise ratings curves as follows:</p> <p>Admin block (office rooms): 35 dB(A)</p> <p>Control room: 35 dB(A)</p> <p>Multipurpose rooms (reception, visitor's centre): 40 dB(A)</p> <p>Other technical rooms that are used for working: 45 dB(A)</p> <p>Corrections of the readings that may be due to atmospheric or meteorological conditions shall be considered using appropriate noise prediction modelling software.</p>

Table 4-1: Schedule of Performance Guarantees: Operational Performance Guarantees

Ref	Description	Limit values	Permitted exceptions	Measurement (method and point) (refer Ch 6.4.10)	External validation requirement
PG1	Waste Processing Capacity of WTE	To be defined by Contractor, with minimum of 900 tpd	none	<p>Waste weighed using calibrated weighbridge in accordance with authority regulations, with Throughput Capacity Test. Requirements as per chapter 5.16 for Throughput Capacity Test to be taken into account.</p> <p>Assessed at commissioning and thereafter upon request of the Employer's Representative (ER).</p>	Witnessed by ER, weighbridge to be calibrated prior to Tests on Completion of Design Build and every three years thereafter
PG2	Minimum Annual Waste Throughput	As defined in the table in Chapter [4.3]	The Employer is unable to supply sufficient waste.	Annual waste input logs, verified at reception	External calibration of weigh bridge every third year if not otherwise instructed by the ER
PG3	Delivered Annual Waste Throughput Above Minimum Annual Waste Throughput	As defined in the table in Chapter [4.4]	The Employer is unable to supply sufficient waste.	Annual waste input logs, verified at reception	External calibration of weigh bridge every third year if not otherwise instructed by the ER
PG4	Net Power Output	To be proposed by Contractor	Temporary grid outages or maintenance (max 10% downtime)	<p>Electricity meter at grid connection point</p> <p>As per the PPA</p>	Inspection of electricity meter by DES by ER.
PG5	TOC Content in Bottom Ash	Annual average less than 3% by weight, dry matter, and none of the fortnightly representative samples greater than 3.5% by weight, dry matter	None, unless waste composition is unusually non-combustible	<p>Taken representatively fortnightly at conveyor belt or at conveyor belt discharge to bottom ash treatment plant.</p> <p>Measurement of TOC according to BS EN 13137, as further described in EMPLOYER'S REQUIREMENTS 6.4.10.</p>	Subject to decision by Contractor (see 6.4.10.8), 6 samples per year tested by external accredited lab

Ref	Description	Limit values	Permitted exceptions	Measurement (method and point) (refer Ch 6.4.10)	External validation requirement
PG6	Air Emission Standards	According to Table 4.2	None	Continuous: CEMS Discontinuous: external accredited lab.	CEMS to be calibrated every third year at least by an accredited lab pursuant to Chapter 6.4 [10] if not otherwise instructed by the Environmental Authority.
PG7	Combustion Conditions	At least 2 seconds at a temperature of at least 850 °C	None	As per methodology developed by the Contractor	Prior to the Test on Completion validation by external third party competent to carry out such validations
PG8	LTP Discharge Standards	According to Table 4-3	Conductivity shall be exempted from PG8 but shall be used to monitor performance of the LTP	Monthly samples tested by accredited external laboratory.	4 samples per year tested by an accredited / licensed third party laboratory.
PG9	Wastewater Treatment Discharge	According to Table 4-4	None	Annual sampling as per Chapter [6.4.10]	Tested by an accredited / licensed third party laboratory. Tests verified by ER.
PG10	Pressure Level	As defined in Chapter [4.13]	None	In situ measurement with decibel meter. Assessed at commissioning and thereafter upon request of the Employer's Representative (ER).	Tested by an accredited / licensed third party. Tests verified by ER.

Table 4-2: Performance Guarantees: minimum air emission standards¹ for both the WTE and the bottom ash processing plant

	Emission parameter per line	Unit ²	Guaranteed values ³		SOURCE
			Half-hourly average	Daily average	
Contiguous Measurements	Total Dust	mg/Nm ³	30	10	EU IED (2010/75/EU), Chapter IV; EU BREF Waste Incineration (2006), Section 5.2
	Organic Substances as Organic Carbon (TOC)	mg/Nm ³	20	10	EU IED (2010/75/EU); EU BREF (2006), Section 5.2.2
	Carbon Monoxide (CO)	mg/Nm ³	100	50	EU IED (2010/75/EU), Annex VI; World Bank (1999), MSW Incineration Technical Guidance
	Hydrogen Chloride as HCl	mg/Nm ³	60	10	EU IED (2010/75/EU); EU BREF (2006), Section 5.2.3
	Hydrogen Fluoride as HF	mg/Nm ³	4	1	EU IED (2010/75/EU), Annex VI; EU BREF (2006), Section 5.2.4
	Sulphur Dioxide/Trioxide as SO ₂	mg/Nm ³	200	50	EU IED (2010/75/EU); World Bank (1999); Brunei Air Quality Guidelines

¹ Unless otherwise defined in Table 4-2, IED 2010/75, Annex 6 shall apply

² Nm³ refers to 273.15 K and 101.3 kPa

³ All values are related to 11 Vol% O₂, dry flue gas and the conditions of the flue gas as indicated in footnote 3

	Emission parameter per line	Unit ²	Guaranteed values ³		SOURCE
			Half-hourly average	Daily average	
					(assumed alignment)
	Nitrogen Oxide/Dioxide as NO ₂ (expressed as NO ₂)	mg/Nm ³	400	200	EU IED (2010/75/EU); EU BREF (2006), Section 5.2.5; Brunei Environmental Policy (assumed)
	Mercury and its compounds as Hg	mg/Nm ³	0.05	0.03	EU IED (2010/75/EU), Annex VI; Minamata Convention (2013), adopted by Brunei
	Ammonia (NH ₃)	mg/Nm ³	15	10	EU BREF (2006), Section 5.2.6; Typical for Selective Catalytic Reduction (SCR) systems
			Value over the sampling period⁴		
Disc on tin uo us Me as ur e m	Sum of heavy metals and their compounds as Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel, Vanadium, Tin, Zinc	mg/Nm ³	0.5		EU IED (2010/75/EU), Annex VI, Part 6; EU BREF WasteIncineration (2006), Section 5.2.7; EN 13211
	Cadmium/Thallium and compounds expressed as Thallium/Cadmium	mg/Nm ³	0.05		EU IED (2010/75/EU), Annex VI; EU BREF (2006),

⁴ Sampling period for heavy metals between 30 and 120 min, for dioxins, furans and Benz(a)pyrene 6 to 8 hrs
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	Emission parameter per line	Unit ²	Guaranteed values ³		SOURCE
			Half-hourly average	Daily average	
emissions					Section 5.2.7; EN 14385
	Arsenic/Cadmium and their compounds (as As and Cd), Benz(a)pyrene, water soluble Cobalt compound (as Co), Cr(Vi) compounds as Cr	mg/Nm ³	0.05		EU IED (2010/75/EU); EU BREF (2006), Section 5.2.7; EN 14385, EN 1911
	Dioxins and Furans (according to WHO TEF 2005, see below)	ng/Nm ³	0.1		EU IED (2010/75/EU), Annex VI, Part 6; EU BREF (2006), Section 5.2.8; EN 1948-1/2/3
	Emission parameter bottom ash processing plant				
	Total Dust ⁵	mg/Nm ³	10		EU BREF Large Volume Inorganic Chemicals (2007), Section 4.2; EU IED (2010/75/EU); OSHA Dust Standards; Brunei Air Quality Assumptions

⁵ Dust emissions are referenced to 273.15 K and 101.3 kPa at the ambient oxygen concentration, sampling period for dust emissions from the bottom ash plant between 30 and 120 min

Table 4-3: Performance Guarantees: minimum discharge standards for leachate treatment plant

Parameters		unit	Limit
Chemical Oxygen demand	COD	mg/l	200
Biological Oxygen demand	BOD ₅	mg/l	20
Total Nitrogen	N	mg/l	50
Nitrite	NO ₂ -N	mg/l	2
Sulphide	S	mg/l	1
Total Phosphorus	P	mg/l	30
Lead	Pb	mg/l	0.5
Cadmium	Cd	mg/l	0.1
Total Chromium	Cr	mg/l	Nil
Chromium (VI)	Cr VI	mg/l	0.2
Mercury (total)	Hg	mg/l	0.005
Nickel	Ni	mg/l	1
Zinc	Zn	mg/l	2
Copper	Cu	mg/l	0.5
Arsenic	As	mg/l	0.5
Chloride	Cl	mg/l	2,000

*Used to monitor the performance of the LTP only

Table 4-4: Performance Guarantees: minimum discharge standards for wastewater treatment plant

Parameters		unit	Threshold Value
Potential of Hydrogen	pH	range	6.9 – 9.0
Temperature	°C		40
Chemical Oxygen demand	COD	mg/l	150
Biological Oxygen demand	BOD ₅	mg/l	50
Total Dissolved Solids	TSS	mg/l	2500
Suspended Solids	SS	mg/l	30
Ammonia-N	NH4	mg/l	50

Parameters		unit	Threshold Value
Total N	N	mg/l	50
Phenols		mg/l	0.5
N-hexane extract (mineral oils, grease)		mg/l	5
Synthetic detergents		mg/l	1

5 Basic Design Criteria and Technical Specification

The following general principles shall be considered and applied by the Contractor during the Design-Build Period and the Operation Service Period.

Individual standards and codes given subsections of these Employer's Requirements are not exhaustive and the obligation to comply with all prevailing laws and regulations shall rest with the Contractor. In the event of any contradiction and/or ambiguity amongst the local laws, regulations & codes and international codes listed elsewhere in the most stringent amongst them shall apply unless or otherwise overridden by the relevant authorities to apply the contrary.

Any lists of codes and standards provided under these Employer's Requirements are for reference only and shall not be considered as exhaustive.

5.1 Laws, Regulations, Codes and Standards

1. General	<p>The Contractor shall Design and Build the Works in accordance with the Contract Documents, ALL relevant statutory and regulatory requirements, all applicable permits and consents, and Good International Industry Practice. The individual standards and codes given in the sub-sections under 5.1 is not exhaustive and the obligation to comply with all prevailing laws and regulations shall rest with the Contractor. In the event of any contradiction and/or ambiguity amongst the local laws, regulations & codes and international codes listed elsewhere in these sub-sections under 5.1 the most stringent amongst them shall apply unless or otherwise overridden by the relevant Brunei authorities to apply the contrary.</p> <p>During the Design-Build Period, the Contractor shall apply codes and standards applicable to the Design and Build of waste to energy plants of Brunei. If no standard or code is specified in these Employer's Requirements, the Contractor shall apply the following standards (in order of priority):</p> <ul style="list-style-type: none">▪ Relevant codes and standards of practices of Brunei;▪ European standards (EN) or similar international standards (e.g. American ASME/ASTM/AASHTO, API standards);▪ British standards;▪ Other international codes of practice (ISO, DIN, etc.). <p>All codes and standards referred in this specification shall be understood to be the latest version.</p> <p>Although all applicable codes and standards may not be specified herein, the Contractor shall be responsible for determining the applicable codes, acquiring copies at its sole expense, and complying with the requirements of such codes and standards</p> <p>Where the requirements of these Employer's Requirements differ from the requirements of the relevant codes and standards, then the more stringent requirements shall apply.</p>
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2. General Design Guidelines	<p>For general Design-Build activities the following guidelines shall be applied (latest version):</p> <ul style="list-style-type: none"> ▪ IFC Performance Standards and guidance notes; ▪ IFC EHS general guidelines; ▪ IFC EHS sector guidelines: Waste management facilities, thermal power and electric power transmission and distribution; ▪ Applicable planning control guidelines from Department of Town and Country Planning; ▪ Brunei Building Guidelines and Requirements 5th Edition 2022.
3. Process basis design of the Waste to Energy plant and mechanical parts	<p>For process basis design of the WTE plant and mechanical parts the following general and specific codes and standards shall be applied unless otherwise mentioned:</p> <ul style="list-style-type: none"> ▪ European Industrial Emissions Directive Standards (IED 2010/75) along with the BAT conclusions as per Commission Implementing Decision EU 2019/2010 and the latest European BAT Reference Document for Waste Incineration (BREF WTE); ▪ EN 12952: Water-tube boilers standards (any applicable part of it); ▪ Any applicable British Standards ▪ The American Society of Mechanical Engineers (ASME); ▪ International Electrochemical Commission (IEC); ▪ VDI Guideline 3460, Emission control – Thermal waste treatments ▪ Other International Codes of practice (ISO, DIN, etc.).
4. Mechanical and Electrical parts	<p>For Mechanical and Electrical parts the following codes and standards shall be applied:</p> <ul style="list-style-type: none"> ▪ The guidelines of the Brunei Energy Authority, Autoriti Elektrik Negara Brunei Darussalam (AENBD); ▪ The guidelines of the Department of Electrical Services (DES – HV Specifications); ▪ The guidelines of the Department of Electrical Services (EIR); ▪ Brunei Darussalam Building Guidelines & Requirements (5th Edition BGR 2022); ▪ Brunei Authority for Info-communications Technology Industry AITI; ▪ BS EN 50341-2-9:2017+A1:2018 the design and construction of overhead electrical lines; ▪ Department of Electrical Services – Latest General List of Approved Products / Manufacturer; ▪ International Electrochemical Commission (IEC);

- The Institute of Electrical and Electronic Engineering (IEEE);
- Instrumentation Systems and Automation Society (ISA);
- American National Standards Institute (ANSI);
- The American Society of Mechanical Engineers (ASME);
- Deutsche Industrie Norm (DIN);
- Verband der Elektrotechnik, Elektronik und Informationstechnik (VDE)/Germany;
- NFPA 10, Standard for Portable Fire Extinguishers, 2018 edition;
- NFPA 13, Standard for the Installation of Sprinkler Systems, 2022 edition;
- NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, 2022 edition;
- NFPA 30, Flammable and Combustible Liquids Code, 2018 edition;
- NFPA 30A, Code for Motor Fuel Dispensing Facilities and Repair Garages, 2018 edition;
- NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, 2019 edition;
- NFPA 54, National Fuel Gas Code, 2018 edition;
- NFPA 55, Compressed Gases and Cryogenic Fluids Code, 2020 edition;
- NFPA 58, Liquefied Petroleum Gas Code, 2020 edition;
- NFPA 59, Utility LP-Gas Plant Code, 2018 edition;
- NFPA 70, National Electrical Code, 2020 edition;
- NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, 2021 edition;
- NFPA 101, Life Safety Code, 2021 edition;
- 2023 ASHRAE Handbook—HVAC Applications, Air Cleaners for Gaseous Contaminants;
- Standard 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size;
- ASHRAE Standard 55-2023, Thermal Environmental Conditions for Human Occupancy (ANSI Approved);
- ASHRAE Standard 62.1-2022, Ventilation and Acceptable Indoor Air Quality;
- Design Manual for Water Supply Distribution Networks 2017, Jabatan Kerja Raya;
- Standard AITI 151121;
- Lift Standard 81-20.

5. Civil works	<p>For civil works, the following codes and standards shall be applied in order of priority:</p> <ul style="list-style-type: none"> ▪ Brunei's Building Control Order and Building Regulations 2014; ▪ Urban Drainage Design Manual published by Department of Drainage and Sewerage, Public Works Department, Brunei Darussalam; ▪ Design Manual and Guidelines for Sewerage from Department of Drainage and Sewerage, Public Works Department, Ministry of Development, Brunei Darussalam; ▪ Ministry of Development Negara Brunei Darussalam General Specifications; ▪ Design Manual for Water Supply Distribution Networks published by Ministry of Development, Brunei Darussalam; ▪ British and International Standards, Codes of Practice, or equivalent European industry recognized standards and guidance), American AASHTO Standards, Guide to Fire Protection (Malaysia); ▪ CIBSE guidelines; ▪ BRE Guidance Note; ▪ Green Protocol Guidelines V1 (2021) published by the Brunei Darussalam National Council on Climate Change; ▪ Energy Efficiency and Conservation Handbook published by the Department of Energy, Prime Minister's Office; ▪ Guidelines for BAGUS Certification for Green Buildings 2025 prepared by the Authority on Building Control and Construction Industry (ABCi), Ministry of Development.
6. Earthworks, dredging, dewatering	<p>For the earthworks, dredging and dewatering, codes and standards shall be applied in order of priority:</p> <ul style="list-style-type: none"> ▪ General Specifications for Earthworks – GS4:1999 published by Ministry of Development Brunei Darussalam; ▪ British standards; ▪ The laws and regulations published by the Environmental Authority in particular: Dewatering regulation, sand mining act, reclamation and dredging regulation.
7. HSE codes and standards	<p>For Health & Safety and Environment, the following codes and standards shall be applied:</p> <ul style="list-style-type: none"> ▪ Relevant Brunei Guidelines and Codes (including, but not limited to those listed below); ▪ Environmental Protection and Management Act (Amendment) Order, 2025 (Please refer to Appendix 4D appended herewith these Employer's Requirements for a confidential draft of this order); ▪ Code of Practice for Pollution Control, 2025 (Please refer to Appendix 4E appended herewith these Employer's Requirements for a confidential draft of this code of practice);

	<ul style="list-style-type: none"> ▪ Environmental Pollution Control Order; ▪ Environmental Impact Assessment Order; ▪ Hazardous Waste (Control of Export, Import, and Transit) Order, 2013; ▪ Workplace Safety and Health Order 2009 & Construction Regulations, 2014; ▪ Control of Major Accident Hazards (COMAH) Regulations, 2017; ▪ The Ministry of Development Health, Safety and Environmental Manual, September 2012 edition; ▪ Fire Safety Order 2016; ▪ The laws and regulations published by the local authorities; ▪ CDM Regulation; ▪ ISO 45001; ▪ British H&S Guidelines; ▪ IFC Environmental Health and Safety (EHS) Guidelines on Construction and Decommissioning (Environment, Occupational Health and Safety, and Community Health and Safety).
8. Quality assurance	<p>For Quality Assurance, the following code shall apply:</p> <ul style="list-style-type: none"> ▪ ISO 9001 or similar international standard.
9. Labour, employment and professional accreditation	<p>For labour and employment, the following codes and standards shall be applied:</p> <ul style="list-style-type: none"> ▪ Labour Act (Chapter 93); ▪ Brunei's Employment Order; ▪ Immigration Act (Chapter 17); ▪ Architects, Professional Engineers and Quantity Surveyors Act (Chapter 266); ▪ Licensed Land Surveyors Act (Chapter 100).
10. Air Emissions	<p>For air emissions, the following code shall apply unless otherwise specified:</p> <ul style="list-style-type: none"> ▪ Relevant ASEAN Guidelines and Codes: Singapore Standards for Air Emissions (Air Impurities) July 2015 ▪ WHO 2021 Air Quality Guidelines; ▪ European Industrial Emissions Directive Standards (IED 2010/75) along with the BAT conclusions as per Commission Implementing Decision EU 2019/2010 and the latest European BAT Reference Document for Waste Incineration (BREF WTE); ▪ IFC EHS general guidelines: Air Emissions and Ambient Air Quality; ▪ IFC EHS Guidelines for Waste Management Facilities.

11. Wastewater discharge	<p>For wastewater discharges, the following code shall apply unless otherwise specified:</p> <ul style="list-style-type: none"> ▪ Relevant Brunei Guidelines and Codes: Code of Practice for Pollution Control 2025 Annex C (Confidential Draft); ▪ Pollution Control Guidelines for Industrial Development in Brunei Darussalam June 2003; ▪ Environmental Protection and Management Act: Amendment Order 2025 (Confidential Draft); ▪ ASEAN Marine Water Quality Criteria (Ambient Water Quality Standards) 2002; ▪ Malaysian National Water Quality Standards 2016 (Riverine Water Quality); ▪ Licensing and Permits, EIA.
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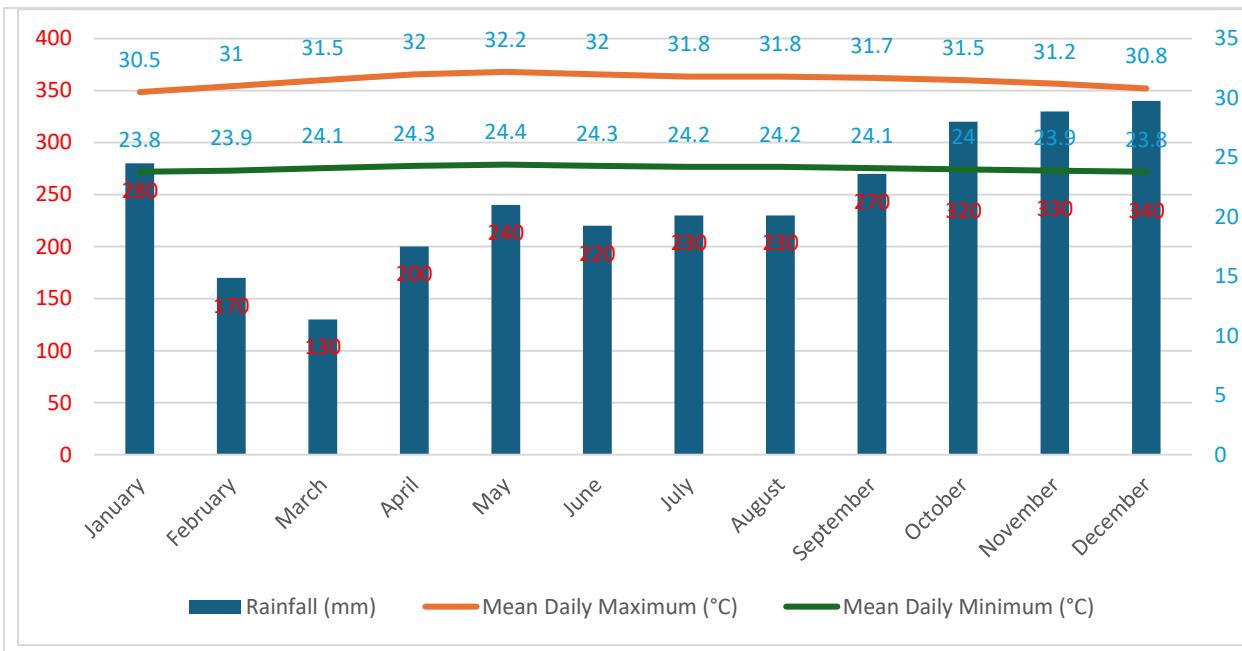
5.2 Site Data

1. General	<p>This section lists the relevant Site data to be taken into account by the Contractor when designing and building the Works. Please refer to Appendix 2 – Site Data of Section 3 – Employer's Requirements. Any Site Data and associated reference documents provided are in good faith for the guidance. The Contractor shall be responsible for interpreting the same. No warranty or representation of any kind is given as to the sufficiency, accuracy or completeness of such Site Data and associated reference documents. The Site Data and associated reference documents do not purport to be comprehensive or to have been verified by the Employer or the Employer's consultants or to have been verified by any third parties whose information has been issued by the Employer, or the Employer's consultants, on behalf of such parties.</p> <p>The Employer and the Employer's consultants;</p> <ul style="list-style-type: none">a) Shall not be liable for any errors, omissions or lack of specificity in such Site Data and associated reference documents; andb) Shall not be liable or responsible for negligence or failure to exercise any degree of skill or care in connection with the production of the Site Data and associated reference documents or for any action taken by the Contractor as a result of the Site Data and associated reference documents. <p>Any reliance on or use of any Site Data and associated reference documents is entirely at the risk of the Contractor.</p> <p>Contractor shall be responsible for carrying out its own review and checks to satisfy itself as to the sufficiency, adequacy and correctness of the Site Data and associated reference documents before relying on and using such information to produce any part of the Contractor's deliverables.</p>
2. Employer's Gazetted Land	<p>Employer has a gazetted land part of which the landfill operations are currently being carried out. The indicative site boundary based on the expansion plan of the Employer to extend the gazetted land is shown in Appendix 1A – JASTRe's gazetted site boundary indicating the Waste to Energy plant and associated proposed infrastructure locations of these Employer's Requirements – Part 2 – Appendices to Employer's Requirements. The same Appendix 1A also includes the latest approved expanded boundary of the Employer's land gazetted part of which the landfill operations are currently being carried out.</p> <p>All the allocated spaces within the Employer's gazetted land boundary are indicative only and for the Contractor to adjust the size to suit their Design and Operational needs. All the allocated spaces within the Employer's gazetted land will be provided to the Contractor free-of-cost for the entire Contract Period on condition that the usage of the land will be solely for the purposes of this Contract and any other downstream activities related to the WTE Plant approved by the Employer.</p>

	<ul style="list-style-type: none"> a) The Employer has marked indicatively a space of 200m x 400m (approximately 8 ha.) for the proposed WTE Plant to be designed, built and operated by the Contractor; b) An additional allocation, within the Employer's gazetted land, for switchyard required as part of the power export infrastructure at approximately 50m x 60m in plot size; c) The power export infrastructure corridor, within the Employer's gazetted land until the tie-in at the main Telisai Road 66kV network (for the power export scenario if the exported power is 10MW or above); d) Allocation of 30m x 40m space for the transfer tank and pumps in order to boost the water pressure for the water supply from the Department of Water Services pipeline tie-in for the domestic and fire fighting water supply. The reticulation of the above water supply from the space for the transfer tank and pumps to the WTE plant site shall be within the Employer's gazetted land. <p>Contractor shall allow suitable space within the Employer's gazetted land for its design, construction, operation and maintenance of at least One (1) MLD capacity raw water storage for feed to the WTE plant.</p> <p>The service corridors for the following is anticipated to be at the road reserve for which the Contractor shall apply for the necessary permits and wayleaves for the entire Contract Period:-</p> <ul style="list-style-type: none"> a) Cable routing for the ring main from the end of the Employer' gazetted land till the Telisai 66kV Main Intake Substation and Yard and vice versa; b) Raw water reticulation from the Sg, Danau / Sg. Pepakan river intake point till the raw water storage tank at the WTE.
3. Meteorological records	<p>The climate of the Sungai Paku Landfill region in Brunei Darussalam is characterized by an equatorial tropical rainforest climate, heavily influenced by the Southeast Asian monsoon system. This system manifests in two distinct monsoon seasons: the northeast monsoon (December to March) and the southwest monsoon (June to September), separated by two transitional inter-monsoon periods (April to May and October to November). Unlike regions with pronounced wet and dry seasons, Brunei experiences consistently high humidity and rainfall throughout the year, though seasonal variations do occur due to monsoon influences.</p> <p>The northeast monsoon, arriving from the South China Sea between December and March, brings wetter conditions to the region, with December often being the wettest month. During this period, the Inter-Tropical Convergence Zone (ITCZ) shifts southwards across Borneo, contributing to increased rainfall. The southwest monsoon, spanning June to September, introduces a slightly drier phase, though rainfall remains significant due to the equatorial location and localized land-sea interactions. The inter-monsoon periods serve as transitional phases, with April and May often experiencing peak</p>

	<p>thunderstorm activity, while October and November mark the onset of the heavier northeast monsoon rains.</p> <p>Meteorological data for Brunei, including the Sungai Paku area, indicate an average annual rainfall of approximately 3,000 millimetres, with some variation depending on proximity to coastal or inland zones. The area is influenced by both regional monsoon patterns and local topographic effects. Rainfall peaks occur from October to January (northeast monsoon) and, to a lesser extent, from May to July (southwest monsoon), while the driest months are typically February and March. Temperature remains consistently warm, with a mean daily average of around 28°C, fluctuating between a minimum of approximately 23.7°C and a maximum of 32.4°C. High humidity levels, often exceeding 80%, persist year-round, amplifying the tropical conditions.</p> <p>Surface winds and currents in the region are dictated by the monsoon dynamics. During the northeast monsoon, prevailing winds blow from the northeast, bringing moisture-laden air from the South China Sea. In contrast, the southwest monsoon features south-westerly winds, which are influenced by the recurring of southeast trade winds across the equator. These wind patterns affect not only rainfall distribution but also temperature and humidity at the landfill site. Salinity levels in nearby water bodies, such as the Brunei River, may experience minor fluctuations due to increased freshwater runoff during peak rainfall periods, though specific data for the landfill's immediate vicinity is limited.</p>
4. Temperature and rainfall	<p>Temperature remains consistently warm, with a mean daily average of around 28°C, fluctuating between a minimum of approximately 23.7°C and a maximum of 32.4°C. High humidity levels, often exceeding 80%, persist year-round, amplifying the tropical conditions.</p>

Figure 5-1: Annual rainfall and Temperature pattern in the site area



5. Maximum rainfall and return period	Maximum Rainfall: Brunei experiences an average annual rainfall of approximately 2,872 mm (1991-2020), with peaks during the Northeast Monsoon (December-January). December is the wettest month, recording up to 400-500 mm in Bandar Seri Begawan (BDMD data). A notable extreme event occurred on January 20-21, 2009, with heavy rainfall causing flash floods (exact mm not publicly recorded). Return Period: For extreme rainfall exceeding 200 mm/day, a 10–25-year return period is estimated based on regional monsoon patterns (Climateknowledgeportal.worldbank.org). Specific return periods are not publicly detailed by BDMD but align with Southeast Asian norms.
6. Wind	Average Wind Speed: Ranges from 1-2 m/s annually, with higher speeds of up to 3-4 m/s during the Northeast Monsoon (December-March) due to stronger trade winds from the South China Sea (weather-and-climate.com). Extreme Winds: Brunei is outside the typhoon belt, so wind speeds rarely exceed 15-20 m/s. Gusts during thunderstorms may reach 10-15 m/s briefly (BDMD). El Niño years (e.g., 1997-1998) show minimal wind impact compared to rainfall/haze
7. Climate change and disaster risks.	Climate Change: Mean temperature rises 0.25°C per decade (BDMD); anticipated annual rainfall increased by approximately 100 mm per decade (BDMD). Sea level rise and heatwaves (51 deaths/100,000 by 2080 under high emissions, Wikipedia) are key risks. Disaster Risks: Flash floods (e.g., 2009, 2010), landslides (urban areas), forest fires/haze (El Niño 1997-1998, 2015-2016). Low typhoon risk due to location outside the belt (climatechange.gov.bn). Vulnerability is medium-high (Climate Technology Centre).
8. Hydrological conditions	Rainfall Distribution: Two maxima (October-January, May-July) and minima (February-March, June-August) due to monsoon and ITCZ

	shifts (BDMD). Annual runoff is high due to 3,000 mm rainfall and tropical soils. Rivers: Brunei River's flow increases during monsoons; dry days decrease by 1.79 days/year (Ratnayake, 2014, ResearchGate). Groundwater levels in Brunei-Muara are shallow (0-18 m, mean 2.9 m, ResearchGate), prone to flooding
9. Topographical levels, benchmarks of reference	Topography: Flat coastal plains (0-10 m above sea level), hilly west (50-200 m), mountainous east (up to 1,850 m at Bukit Pagon) (Wikipe-dia). Benchmarks: Sea level (0 m) at South China Sea coast; Bandar Seri Begawan (approximately 5-10 m ASL); Tutong plains (ap-proximately 10-20 m). Urban areas are low-lying, increasing flood risk (JICA 2015, Springer). No official benchmark datum publicly specified beyond sea level.
10. Environmental conditions	Climate: Tropical rainforest (Köppen Af), hot (26-32°C), humid (80-90%), wet year-round (BDMD, weatherspark.com). Issues: Seasonal haze from Indonesian fires (e.g., 1997-1998), deforestation in urban zones (Springer), biodiversity loss, and air pollution in cities (Wikipe-dia). Forest cover (including secondary forest and plantations) ap-proximately 81% (2019) as per 4 th National Report on Biodiversity 2019. Functional forest classification is 55.9% of total land area as per the above report. Brunei's CO ₂ emissions approximately 17M tonnes (2021, 0.025% global).

5.3 Waste Characterization

1. General	<p>The waste stream shall be processed in the WTE is provided in Please see in Appendix 3A – Overall waste Statistics of Section 3 – Employer's Requirements – Part 2 – Appendices to Employer's Requirements for the recent statistics as of 2024.</p> <p>The guaranteed amount of waste delivered by the Employer at the start of the WTE Operation Service Period is 650 t/day (based on a seven day rolling average).</p> <p>The waste is a mixture of household and household like commercial waste.</p> <p>A waste composition assessment is provided in Appendix 3C - Previous solid waste studies for the Sg. Paku land fill site & Brunei Darussalam and municipal solid waste sampling data of these Employer's Requirements – Part 2 – Appendices to Employer's Requirements.</p> <p>The Contractor shall provide the mass balance and the design NCV range.</p>
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Table 5-4: not used

Table 5-5: not used

2.	<p>When designing the system, both thermal and mechanical short-term overloads of 10% shall be provisioned.</p> <p>The Contractor shall demonstrate the design range. The air pollution control system shall be designed according to the Contractor's considerations and calculations taking into account the maximum flue gas flow rates, the maximum pollutants concentrations and the design margins as per Chapter 5.4.3.4. The design parameters shall be submitted during the design review.</p> <p>The Contractor shall take account of a higher water content (i.e. greater than the value indicated in Table 5-5) in the rainy season by an appropriate design of the relevant components.</p>
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Table 5-6: [Not used]

Figure 5-6: [Not used]

5.4 Basic Design Criteria and Technical Specification

5.4.1 Process Units, Equipment and Lay-out Arrangements

1. General	<p>The Contractor shall set up the infrastructure, buildings, process units and balance of plant components to a fully functional system that is fit for purpose and meets the objectives the Contract.</p>
2. Process Units	<p>The Contractor's design shall include the following:</p> <ul style="list-style-type: none">a) Waste reception, storage and feeding consisting of a weigh bridge including guard house, tipping hall and waste bunker, a shredder and waste cranes;b) Waste pre-treatment consisting of measures for leachate extraction;c) Thermal treatment consisting of combustion system including feeder unit; boiler and heat recovery system and boiler feed water and make-up water system;d) Air pollution control system and ID fan and stack and continuous emission monitoring system (CEMS)e) Turbine with generator and air-cooled condenserf) Other balance of plant components including fuel and chemicals supply and storage; fire-fighting water supply system, a wastewater treatment plant for sewerage, water supply system;g) Bottom ash treatment plant including bottom ash bunker and conveying system;h) Fly ash treatment plant including fly ash treatment and stabilization;i) Leachate collection, management and treatment system;j) Electric system including connection to public network <p>All process units and the balance of plant components shall be equipped with the necessary electrical and control components, with valves, fittings, piping, utility mains etc. and shall be combined to a fully functional system that is fit for purposes and that is operated and controlled by a DCS which shall facilitate monitoring and recording of operational data.</p>
3. Buildings and Housing	<p>To accommodate the process units and balance of plant components the Contractor shall design and build the following buildings and housings:</p> <ul style="list-style-type: none">a) Waste reception/guard house;b) Tipping hall;c) Waste bunker and operator island control room;d) Machinery hall and steam turbine housing;

	<ul style="list-style-type: none"> e) Housing for the bottom ash processing plant; f) Housing for the fly ash processing plant; g) Administration block including the following: <ul style="list-style-type: none"> (i) Control room; (ii) Visitors' centre with viewing gallery and educational space; (iii) Administrative offices including an enclosed / secured office space for at least three (3) pax from the Employer to be stationed; (iv) Periodic training rooms for management, plant operators, maintenance and services personnel; (v) Surau / prayer room with male and female segregation complete with ablution facilities; (vi) Worker welfare facilities; (vii) Mechanical & electrical utility rooms; (viii) Rest rooms and toilets for male and female complete with accessible toilet facilities; (ix) Canteen / pantry; and (x) Medical / First Aid-room. h) Spare parts storage; i) Chemical storage and dosing rooms; j) Workshop; k) Security monitoring room (separate from guard house) including CCTV, alarms and access control systems); l) Housing of the leachate treatment plant. <p>The Contractor shall arrange the buildings to a functional yet aesthetically pleasing and harmonic ensemble.</p>
4. Mobile Equipment	The Contractor shall provide sufficient mobile equipment to fulfil the contractual obligations resulting from these Employer's Requirements.
5. Infrastructure	<p>To operate the Works, the Contractor shall design and construct the necessary infrastructure:</p> <ul style="list-style-type: none"> a) Roads, carriageways and sidewalks; b) Open and covered carparks; c) Required infrastructure for connection to the Interfaces; d) Drainage system, external domestic sewerage works, external domestic water supply and external fire fighting including pump houses and storage tanks; e) Wastewater treatment system; f) Dedicated washdown for applicable equipment and areas, directed to on-site wastewater/leachate treatment;

	<p>g) Landscaping;</p> <p>h) Fencing;</p> <p>i) External Telephone Manholes;</p> <p>j) Compound Lightings; and</p> <p>k) LV Cabling and road crossing pipe sleeves.</p> <p>All infrastructural elements shall be incorporated into the buildings and process units to allow for easy operation and maintenance of all facilities.</p> <p>Accordingly, the Contractor shall perform the EIA and EMMP for both construction stage and operations stage and submit written notification to the relevant authority and obtain approvals prior to implementation of any of the associated phases to comply with the prevailing laws and regulations.</p>
6. Minimum Number Requirements	<p>For the sake of clarity, the Contractor shall consider the minimum number of components and mobile equipment as listed in Table 5-7 which shall not relieve the Contractor from supplying a fully functional system including the buildings, roads, carriageways, sidewalks, fences, utility mains etc. If the Contractor deems the minimum requirements not sufficient due to its design considerations it shall suggest an alternative number or capacity.</p> <p>Any percentage given below shall be understood as related to the maximum design criteria to be applied.</p>

Table 5-7: Requirements for the number of components, equipment, building and infrastructure

Process Unit	Component / Equipment	Minimum Number Total
a) Waste reception, storage and feeding	Weigh bridge	3 x100% (2 incoming, 1 outgoing)
	Shredder	1
	Tipping bay	6
	Bunker	1
	Bunker crane	2x100%
	Infrared fire detection system	1
b) Thermal Treatment System	Fire-fighting monitors within the bunker	4
	Combustion System	1
	Hydraulic station	1
	Boiler and heat recovery system	1
	Primary air fan, secondary air fan (each)	1x100% or 2x50%
	Auxiliary burners	2x50%
	Boiler feed water pumps	2x100% or 3x50%
c) APC system and ancillaries	All other pumps	2x100% or 3x50%
	Boiler feed water and make-up water system	1
	Air pollution control components	1
	Dosing systems for supplies	2
	Reagent injection and conveying	2x100%
	All other pumps	2x100% or 3x50%
	ID fan	1x100%
d) Turbine and ancillaries	CEMS	1
	Stack	1
	Turbine	1
	Condensers	1
	Gland steam condenser exhaust fan	2x100%

Process Unit	Component / Equipment	Minimum Number Total
	Steam turbine enclosure ventilation fans	2x100%
	Holding ejectors or vacuum pumps for maintaining condenser vacuum	2x100%
	All other pumps	2x100% or 3x50%
e) Balance of plant components	Fuel storage tank including supply pumps	1
	Chemical storage per chemical including conveying system to supply tank	1
	Fire-fighting water supply system including reservoir ⁶	1
	Wastewater treatment system process lines	2x100%
	Water treatment system process lines	2x100% with 3 days storage
	All other pumps	2x100% or 3x50%
	Electrical room cooling systems	2x100%
	Compressed air supply plant	2x100% or 3x50%
	Instrument air supply system	2x100% or 3x50%
f) Ash treatment plant	Conveying system	1
	Magnet separator	2
	Eddy current separator	2
	Screen / coarse	1
	Screen grading	1
	Crusher	1
	Bottom ash stabilization plant	1
	APCR stabilization plant	1
g) Leachate collection, management and treatment	Leachate treatment plants	1
	Leachate collection tank	1
	All other pumps	2x100% or 3x50%
	Concentrate collection tank	2

⁶ As per NFPA

7. Lay-out Arrangement	<p>In due consideration of the Site, the Contractor shall seek to minimize the land take of facilities in order to maximize the land available.</p> <p>The Contractor shall propose a layout arrangement:</p> <p>All other components which shall be delivered for the functionality of the facilities according to these Employer's Requirements shall be arranged based on the design considerations of the Contractor.</p>
8. Plant Coding System	<p>The Contractor shall apply an internationally recognized and commonly used consistent coding system for all components that need to be included which shall be the basis for its own process structure and the hereto relating arrangements of P&IDs, control and instrumentation, alarm systems, supply and disposal schemes, procurement of wear and spare parts etc.</p>

Table 5-7: Requirements for the number of components, equipment, building and infrastructure

5.4.2 Basis of the Design-Build

1. General	<p>While carrying out the Design-Build, the Contractor shall for all Works,</p> <ul style="list-style-type: none"> ▪ Meet the objectives of the Contract with respect to content, time and costs; ▪ Protect health and safety of the public, third parties, the Employer's Personnel, and the Contractor's Personnel during the Design-Build Period as well as throughout the Operation Service Period and the entire Design-Build-Operate-Own-Transfer (DBOOT) lifecycle; ▪ Maximize the protection of the environment and minimize any adverse environmental impacts caused by the Works to the Site, its surroundings and to air, water and soil by employing green and sustainable concepts (as outline below); ▪ Meet all quality management and assurance requirements; ▪ Meet all the regulatory and authority requirements and demonstrate compliance to ensure timely approvals are obtained; ▪ Provide a design that reflects the land area constraints of the Site; ▪ Assure the Employer of meeting the applicable standards, norms and guidelines for the Works irrespective whether they were explicitly requested by these Employer's Requirements; ▪ Apply methods and technical solutions as described in
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	<p>the latest version of the European Best Available Techniques Reference Document (BREF) on Waste Incineration and according to the European Industrial Emission Directive (IED) in its latest version and the BAT conclusions of the European Commission and by applying the Best Available Technology (BAT);</p> <ul style="list-style-type: none"> ▪ Ensure that the Works are fit for purpose and meet the requirements of a fully functional, durable and easy and safe to maintain waste treatment solution complying with or exceeding these Employer's Requirements; ▪ Provide evidence of meeting or exceeding the requirements as per the Schedule of Performance Guarantees by carrying out the Tests on Completion of Design-Build in due course as per agreed scheduling and phasing requirements; ▪ Ensure that all components and equipment are easily accessible and can be maintained without larger interventions or dismantling. Wherever necessary, the Contractor shall provide lifting gear or shall allow to mount such temporarily. <p>Take account of the implications as per EIA and the herein included EMP for the entire project covering for both design and build as well as for operations and maintenance phases. Besides, the Tests on Completion of Design-Build, the Employer's Representative shall be entitled to carry out inspections and to request the Contractor to conduct tests during the Design-Build.</p>
2. Ambient Climatic Conditions	<p>The design of the Works shall conform to local climatic conditions taking into account the maximum and minimum temperature, rainfall, pressure and humidity and their annual pattern. Any equipment or system shall be designed to operate, to idle, to remain in stand-by without operating for extended periods, and to resume operating without being damaged at maximum and minimum ambient conditions.</p> <p>Designing the Works, the Contractor shall consider the corrosive marine environment and shall use corrosion resistant Materials for steelworks/metal works, concrete etc. and Plant and their components or shall apply appropriate corrosion protection measures wherever applicable.</p> <p>The Contractor's concept design report described in Chapter 5.6 shall include a durability plan which describes in detail the corrosion protection measures that will be applied, along with the Contractor's justification of their use. The Contractor shall be required to demonstrate that the protection measures provided will ensure that the assets are able to achieve the asset lives specified in Table 5-9 of these Employer's Requirements.</p>
3. Disaster and Climate Change Resilience	<p>Brunei Darussalam is exposed to a range of hydro-meteorological and climate-related hazards, including floods, landslides, forest fires, and droughts. These risks are heightened by climate change</p>

	<p>effects, such as, but not limited to, increasing rainfall intensity, and rising temperatures.</p> <p>The Contractor shall therefore provide a design of the Works that accounts for the consequences of these impacts, including but not limited to:</p> <p>All critical and safety equipment (such as, but not limited to, transformers, switch yards, emergency gensets, boiler feed water pumps, etc.) that could be affected by flooding shall either be designed and installed to be waterproof or positioned at heights to prevent incidents caused by these hazards. This requirement also applies to the tipping hall and tipping bays, which must remain unaffected by flooding, ensuring that stormwater does not enter the bunker.</p> <p>Elevated building structures, their supports, and building envelopes shall be designed to withstand strong monsoon winds, equivalent to sustained speeds that may occur during intense weather events in the region.</p> <p>The Site's storm and rainwater drainage system shall minimize flooding incidents through practical measures such as, but not limited to, appropriate site inclination, backflow prevention devices, retention ponds, stormwater pumps, etc.</p>
4. Process, Mechanical, Electric and Control Works of the WTE	<p>The Contractor shall be responsible for the Design-Build of the process, mechanical, electric and control components of the WTE facility as specified in these Employer's Requirements.</p> <p>For the Design-Build of the process units as per Chapter 5.4.1, the Contractor shall design, procure, manufacture, supply to the Site and assemble and install all necessary process, mechanical, electric and control equipment and install a DCS to control the operation of all facilities. The scope includes all ancillary items such as piping and valves, wiring, steelwork for erecting and assembling the process components, lifting gear, appliances to facilitate easy maintenance and operations of all components, thermal insulation to meet maximum surface temperatures requirements, and noise dust and odour control and suppression equipment, all as necessary to deliver a facility that is fully functional and fit for purpose.</p> <p>The Contractor shall ensure that all components are designed using state-of-the-art design software, tools, calculations and process simulations necessary for the timely delivery of high-quality design submissions. The Contractor shall provide for manufacturing of the components using robust and proven techniques and with high-quality workmanship. All processes covering design, procurement, manufacturing, packaging, shipment and transport to the Site, the construction and assembly on-site and the tests during and prior to completion of the Design-Build shall be performed applying the Contractor's quality management and assurance procedures.</p>
5. Architectural and Landscaping Works	The Contractor shall design and build all architectural and landscaping elements of the Site in accordance with the Brunei local

	<p>authority's planning and building Control requirements and in line with British Standards and best practices, unless otherwise mentioned. In particular, the Contractor shall consider the requirements towards the land area constraints of the Site, the energy sustainability of the buildings, access to and maintenance of all components, health and safety of the Contractor's and the Employer's personnel and any third party entering the Site.</p> <p>The architectural and landscaping design shall be aesthetically pleasing and demonstrate sensitivity to the local setting. The design shall be up-to-date, shall maintain clean and simple lines, and shall be in accordance with current international best practice for WTE design.</p> <p>The design approach for buildings and structures shall be to achieve a safe, functional, durable and fit for purpose facility. Materials and their colours for external surfaces shall be selected for their visual qualities and proven durability to withstand all the local climatic conditions likely to be experienced, ease of maintenance and reasonable cost.</p>
6. Civil Works	<p>All civil and structural works shall be designed and built in accordance with Brunei local norms and pursuant to applicable British Standards, European Standards, American Standards and Malaysian Standards.</p> <p>As basis for the design of the civil works, the Contractor shall consider the following which shall not be understood as exhaustive:</p> <ul style="list-style-type: none"> a) The Employer's geo-technical survey as per Appendix 2B – Soil Investigation Reports of these Employer's Requirements – Part 2 – Appendices to Employer's Requirements; b) The aggressive and corrosive marine environment for all structures above and below ground; c) Maximum loads for all traffic areas and building structures based on the design considerations of the Contractor; d) Specification of the civil works as per chapter 5.4.5; and e) All necessary materials and equipment to deliver the civil works, such as, but not limited to, fill and embankment materials, construction tools and equipment, cranes and lifting gear, scaffolding, concrete, reinforcing steel, formwork material, fuel, utilities etc. <p>Notwithstanding the aforementioned, the Contractor shall be responsible for the design and the delivery of all Temporary Works, such as, but not limited to, surveying, levelling, setting-out, collection of geo-technical data besides the geo-technical survey data presented in Appendix 2B – Soil Investigation Reports and Appendix 2A – Topographical Survey of these Employer's Requirements – Part 2 – Appendices to Employer's Requirements, provision of utilities, provision of the Contractor's and the Employer's facilities, fencing and securing the Site etc. and to decommission and to dismantle all Temporary Works.</p>

<p>7. Construction Dewatering, Sewerage and Drainage System Works</p>	<p>The Design-Build of the construction dewatering, the sewerage and the drainage system as defined in Chapter 5.4.6 shall conform to the ambient and climate conditions (see provisions 2 and 3 of this chapter) and shall consider the following:</p> <ul style="list-style-type: none"> ▪ Any discharge of construction dewatering shall not be forwarded to any adjacent site; ▪ Construction dewatering shall be kept operational any time unless otherwise instructed by the Employer's Representative; ▪ Temporary drainage or sewerage works shall be decommissioned and dismantled unless needed for further use; ▪ The Site's drainage system for surface runoff and its sewerage system shall be kept strictly separated; ▪ In the event of storm surges, flooding etc. both the sewerage and the drainage system and their equipment shall be kept operational any time; <p>Fire-fighting water that may be contaminated shall be kept in sufficiently sized retention tanks, containers or storage compartments.</p>
<p>8. Expandability</p>	<p>The Contractor at its own discretion, may elect to design and build certain parts of the Works to accommodate an extended capacity of the facility.</p> <p>If the Contractor chooses to extend the facility, the Contractor shall ensure that the extra capacity can be added at minimum additional cost and with minimum disruption to on-going WTE operations.</p> <p>Where appropriate, common foundations or structural elements between installed and envisaged components or buildings shall be designed to allow such extension. For the design of the utilities, the transformer and the cooling system, the Contractor shall apply 110% MCR at the extended capacity plus a variance margin of +20% to cope with potential future changes in the NCV of processed waste and shall consider the applicable design criteria.</p>

9. Design Life Requirements	<p>All Works shall be new, designed, manufactured and constructed applying robust and state-of-the-art workmanship and shall be suitable to meet or to exceed the design-life requirements as defined in Table 5-9. Design life shall be understood as the period during which the Works or components thereof fulfil their functions and are able to meet the Performance Guarantees either as a whole or individually, provided they are operated, inspected and maintained according to good engineering and operational practices.</p> <p>The Contractor shall be responsible for refurbishment works to ensure Works or components thereof fulfil their functions and are able to meet the Performance Guarantees either as a whole or individually throughout the Operation Service Period and as per Handback Requirements listed in Section 6.9.</p> <p>Notwithstanding that the lifetime of the landfill is not listed below, the Contractor shall minimize the land take of the landfill and shall use its best endeavours to maximize the lifetime. As per current estimations, the landfill's lifetime is expected to be for a further period 5 years from now.</p>
10. Green and sustainable design considerations	<p>The Employer places high importance on environmental stewardship and long-term sustainability in the development and operation of the WTE Plant. The Contractor shall integrate green and sustainable design concepts throughout the lifecycle of the WTE Plant, with the aim of minimizing environmental impact while ensuring operational efficiency and regulatory compliance.</p> <p>Opportunities for on-site renewable energy integration, green landscaping, and the establishment of educational or community engagement facilities shall be considered, where relevant.</p> <p>The design and operation shall prioritise the use of energy-efficient technologies, advanced air pollution control systems, water reuse and conservation measures, and recovery of resources such as metals and bottom ash, where technically and economically viable. While a zero-landfill outcome is desirable, it is acknowledged that achieving complete landfill diversion may not always be feasible. Nonetheless, the Contractor shall aim to minimise the volume of residual waste sent to landfill through effective waste processing, segregation, and recovery strategies, in line with circular economy principles.</p> <p>The Employer encourages the Contractor to align with recognised green building or sustainability frameworks (e.g., LEED, BREEAM, ISO 14001, BCAI-Green Mark, BAGUS (Brunei Darussalam)) where applicable, and to propose innovative solutions that enhance the overall environmental performance of the WTE Plant over its entire Design-Build-Operate-Own-Transfer (DBOOT) lifecycle.</p>

Table 5-9: Minimum design life requirements of Works components

Component	Minimum Lifetime Expectancy
Civil works (structures, buildings, bunker, ramps)	40 years
Roads and carriageways	30 years
External Drainage Works	Initial Storm of 5 years & Major Storm of 50 years flood
External Water Supply and External Sewerage Reticulation System	30 years
Building services except A/C	35 years
Facades and roof	35 years
Moving grate	15 years
Crane, hoists	25 years
Turbine	40 years
Fans	15 years
Pumps	15 years
Electrical components	30 years
DCS	15 years
C&I System	15 years
A/C	10 years
Mobile equipment (vehicles etc.)	7 years

5.4.3 WTE Process and Mechanical Works

<p>1. Waste Reception, Storage and Feeding</p>	<p>The Contractor shall consider for the Design-Build of the process unit 'Waste Reception, Storage and Feeding' process and mechanical equipment for the following process components:</p> <ul style="list-style-type: none"> a) weighing system; b) waste pre-treatment; c) waste reception hall (tipping hall) with shredder; d) waste bunker; e) waste cranes; f) supply of waste oil; <p>The mechanical equipment shall be complemented by electrical, control and safety components which, jointly with the civil works relating to this process unit, shall be arranged to a fully functional process unit that allows for weighing of incoming and exiting materials, for unloading of waste delivery vehicles, for storage of waste and for feeding of waste to the subsequent process unit. Further to this, the Contractor shall design and install the necessary odour and fire control system and any other related safety feature to facilitate a constantly safe operation of the process unit.</p> <p>The waste delivery concept and the hereto applied equipment is described in Chapter 6.3 [Interfaces].</p> <p>Besides the minimum quantitative design parameters listed in chapter 5.4.1, the Contractor shall consider the criteria as listed in Table 5-10.</p>
<p>a) Weighing system</p>	<p>The weighing system consisting of weighbridges and weighing software shall be used to</p> <ul style="list-style-type: none"> a) Weigh and monitor incoming waste, b) control the supply of fuels and chemicals, c) weigh any kind of residue which leaves the facility either directly (APC residues) or after processing (bottom ash, metals), d) weigh any other material whose mass shall be controlled, and e) enable a mass balance of the WTE facility. <p>The design of the weighbridge and its computerized recording of incoming and exiting vehicles shall facilitate the operations without any manual intervention during weight recording. It shall be at the discretion of the Contractor to decide whether to install an Automatic Vehicle Recognition System (AVRS) or whether to determine the weights via manually triggered weighing or by scanning bar codes, tokens or the like.</p> <p>Load (or weighing) cells shall be calibrated by a third party or by the supplier certifying the correctness of their functions prior to the Tests on Completion of Design-Build.</p>

	<p>The weighing system shall allow for each weighing event to be logged and allocated to a delivery vehicle jointly with a time stamp for entering and exiting. Weighing records shall be archived without any option to modify or manipulate data unless mutually agreed by the Employer's Representative and the Contractor.</p> <p>The weighing software shall enable the exchange of data with the Plant Management Information System (PIMS).</p> <p>All components of the weighing system which are prone to corrosion shall be manufactured using corrosion protected steel. The entire system shall not be affected by electromagnetic fields, e.g. radio frequencies, industrial frequencies. Appropriate storm surge, earthing and lightning protection shall be provided and installed.</p> <p>The weighbridge area shall be surveyed by a pan-tilt CCTV camera which shall be monitored from the central control room.</p> <p>The weighing system shall comply to all the prevailing regulations of Brunei Darussalam including compliance with the requirements of licensing and permitting of Ministry of Finance and any other relevant authorities including subsequent compliance with the calibration, reporting and inspection requirements of Ministry of Finance and any other relevant authorities.</p>
b) Waste Pre-treatment	<p>The Contractor shall consider and design appropriately adequate waste pre-treatment measures such as a Waste Separation Facility prior to the waste bunker, to allow for leachate extraction considering the high leachate content of the incoming waste.</p>
c) Waste Reception	<p>The Contractor shall design and construct the waste reception hall of the WTE plant that shall comply with environmental, health & safety and operational requirements for all personnel entering the tipping hall, including all necessary electrical and control components to allow for a 24/7 operations. Whenever required due to emergency operations requirements, all shutters shall be controlled according to applicable emergency procedures.</p> <p>The waste reception hall shall be an enclosed area equipped with adjustable louvers that allow ventilation of the hall. Odour emissions shall be prevented by a draft induced by the primary air supply fan.</p> <p>Any ingress of water due to storm surges shall be prevented by an appropriate height of the tipping area.</p> <p>Entry and exit gates shall be closed by an electrically driven fast acting shutter with an air-tight design. The dimension of the reception hall shall allow for safe movement of incoming and exiting vehicles. Access to the waste reception hall for all waste delivery vehicles shall be restricted by automatic traffic lights in the event all tipping bays are occupied. The traffic lights shall be positioned to avoid vehicles entering the access ramp when access is denied.</p> <p>Wherever reasonable and applicable, the supporting structures of the building and the access gate shall be equipped with impact protectors while elevated curbs shall be protected with edge</p>

	<p>angles or embedded steel plates to prevent damages from wheel loader buckets.</p> <p>The Contractor shall design and build the number of tipping bays as indicated in Table 5-10 which shall be closed by electrically or hydraulically driven flap door or roller gate when not in use. The doors or gates shall be made for heavy duty and continuous operations and shall withstand the dust laden atmosphere of the bunker. For all tipping bays the Contractor shall provide safety curbs to prevent reversing vehicles from falling into the bunker. Tipping bays shall be made of wear resistant concrete or shall be covered by wear resistant steel sheets.</p> <p>The waste reception hall and the tipping bays shall be surveyed by tilting CCTV cameras (minimum 2) which shall be monitored in the central control room.</p> <p>For cleaning purposes, the reception hall shall be provided with a sufficient number of power sockets and water supplies to allow a high-pressure steam cleaner to operate. Water shall be collected by the drainage system and directed to the wastewater treatment plant.</p> <p>The Contractor shall provide for a leachate collection sump which shall be used to collect leachate. All necessary equipment including but not limited to, pumps, pipes, valves, reservoirs for intermediate storage shall be supplied by the Contractor. Any accumulated leachate shall be disposed of to the Leachate Treatment Plant or via the combustion system.</p> <p>Subject to the design considerations of the Contractor, a waste inspection area shall be provided either inside or outside of the reception hall which shall enable inspection of suspicious wastes.</p> <p>The shredder to shred bulky waste, tree trunks, mattresses and other larger objects to be incinerated shall be a slowly rotating machine to prevent any sparking. If the shredder is positioned directly before or inside the bunker it shall be equipped with a spark detection and fire suppression system.</p> <p>The shredder shall be of a robust design which facilitates high endurance with limited wear and tear. The shredder shall be electrically driven and shall be equipped with a local control.</p>
d) Waste Bunker	<p>The waste bunker shall be designed to accommodate waste to allow continuous (i.e. 24/7) operation of the WTE facility as defined in Table 5-10. Designing the bunker, the Contractor shall take into account the waste density as defined in Table 5-10.</p> <p>The Contractor shall design the bunker to meet all safety and environmental requirements including, but not limited to,</p> <ul style="list-style-type: none"> a) General work safety, by, e.g., assuring sufficient signalling and warning notices; b) Prevention of falling into the bunker (through, e.g., handrails, providing secured maintenance or service platforms etc.);

	<p>c) Prevention of fire incidents by a constant fire detection via an infrared fire detection system (see chapter 5.4.5.12);</p> <p>d) Installation of an automatically controlled and monitored (with manual override from the crane control room) fire detection and suppression system with at least four externally controllable fire monitors (see chapter 5.4.5.12);</p> <p>e) Heat and smoke extraction system meeting the requirements of both the local fire department and the Contractor's insurance company;</p> <p>f) Avoidance of odour emissions by extracting primary combustion air from the bunker.</p> <p>The bunker design shall consider a parking position for the redundant crane and an aperture that, under normal operations, is kept closed to facilitate the grapple's maintenance outside the bunker.</p> <p>Access to the bunker from the roof shall be provided to access the crane bridges and rails for maintenance or replacement.</p> <p>The Contractor shall install a CCTV system that shall allow the crane operators to survey bunker areas out of their sight and the control room personnel to monitor the crane operations and the waste feeding into the feeding hoppers of the subsequent process unit.</p> <p>The Contractor shall provide for a leachate collection sump which shall be used to collect leachate. All necessary equipment including but not limited to, pumps, pipes, valves, reservoirs for intermediate storage shall be supplied by the Contractor. Any accumulated leachate shall be disposed of to the Leachate Treatment Plant or via the combustion system.</p>
e) Waste Cranes	<p>The waste supply to the feeding hoppers shall be secured by two identical waste cranes. In order to provide redundancy, each crane shall be sufficient to supply waste equivalent to the amount at 110% MCR of the entire WTE facility taking into account the typical crane operations stacking/mixing/removing and idling. The Contractor shall provide a spare grapple.</p> <p>The cranes shall allow operations in an automatic, semi-automatic and a manual (override) control mode. Manual operations shall facilitate the operations of the cranes from the crane control room which shall provide the necessary control devices. The control room's window shall have a fire rating of EW120 and shall be impact resistant (Class A, according to BS 6206). The crane control room shall be equipped with air conditioning.</p> <p>The cranes shall be equipped with automatic load cells to weigh the waste quantity and log the feeding data (time, quantity) within the DCS. Load cells shall be calibrated by an accredited third party or by the supplier who shall certify the accuracy prior to the Tests on Completion of Design-Build. The Contractor shall demonstrate via its Programme of Tests on Completion of Design-Build how it</p>

	<p>intends to assure the accuracy of the crane scales during the tests.</p> <p>Waste cranes and their rails shall be designed for high durability (24/7 operations in a dust laden environment at high temperatures), easy maintenance (e.g. double-sided maintenance walkway along the bridge) and safe operations (e.g. anti-collision system, IP65 protection class).</p> <p>The design of the waste cranes shall consider, amongst others, the standards of crane safety BS 7121, BS EN 13000 and BS EN 12077-2, and with BS EN 13001-3-1 dealing with design and material aspects. The crane shall meet FEM 1.001 standard A8 with mechanism groups for hoist (M8), travelling drive (M7) and trolley traversing drive (M7).</p> <p>The Contractor shall provide with its design documentation as per Chapter 5.6 a crane cycle scenario.</p> <p>The Contractor shall obtain third party inspection certifications for the waste cranes and maintain the validity of the certification throughout the Contract Period.</p>
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Table 5-10: Minimum quantitative design requirements of the waste reception, storage and feeding system

Item	Unit	Minimum Requirement
Weighbridge		
Dimensions	m	12.00 x 3.00 or as defined by Employer.
Capacity	t	40
Accuracy	kg	+/- 0.2%
Protection	-	IP68
Waste reception hall		
Number of tipping bays	pcs	As per Table 5-7
Number of CCTV cameras	pcs	2
Shredder	pcs	1
Rotating speed shredder	rpm	< 20
Shredder capacity at waste density	Mg/h / kg/m ³	30 / 200
Waste bunker		
Storage capacity waste bunker at extended capacity of the WTE plant	days	5
Design waste density	kg/m ³	350
CCTV cameras	pcs	4
Waste cranes		
Number	pcs	2
Spare grapple	pcs	1
Crane performance / per crane	per hour at maximum waste	20 min feeding time

	supply per hour at extended capacity	30 min stacking/mixing/removing incoming waste 10 min idling
Crane scale accuracy	%	+/- 1
Protection	-	IP65
FEM 1.001 Class / utilization / group	-	A8 / U8 / Q4

2. Thermal System	<p>For each of the thermal systems to be delivered, the Contractor shall provide an identical set of components from the waste feeding hopper, to the combustion chamber including air supply systems and wet deasher, up to the boiler including economizer. Each of the thermal trains shall be capable being operated independently from the other.</p> <p>Each thermal system shall be designed to burn waste within the range of net calorific values and composition without any auxiliary fuel, and shall achieve the bottom ash characteristics as defined in Table 4.1</p> <p>At maximum thermal overload conditions (110% MCR per line), each thermal train shall allow operations for at least 2 hours every 4 hours.</p> <p>Intake of any air other than via the primary or secondary air supply system or discharge of any gaseous combustion products either via the feeding system or the bottom ash discharge shall be prevented under all operational conditions.</p> <p>Appropriate fail-safe systems shall prevent access to or operation of the combustion system whenever necessary or as per authority requirements. Access doors to the furnace, which shall be sufficient in number and size, shall be locked automatically while the system is operating.</p> <p>Via an automated and fail-safe control, the Contractor shall secure that, whenever the temperature in the combustion chamber tends to be below 850 °C, auxiliary fuel burners will be used to raise the temperature. Feeding waste shall be allowed only if the temperature has reached 850 °C. The waste supply to the furnace shall be interrupted if an exceedance of any of the continuously measured pollutants is to be concerned. Any of the aforementioned automated interventions shall be recorded by the DCS.</p> <p>Lubrication and grease of moving components shall be arranged centrally for ease of control and maintenance.</p> <p>Other minimum design requirements for components and equipment are listed in Table 5-11.</p>
a) Feeding hoppers, waste chute and waste feeder	Feeding hoppers shall be designed to facilitate blockage free feeding of waste towards the waste chutes. Designing the feeding hopper, the Contractor shall use wear resistant and replaceable steel

	<p>sheets and shall consider a maximum waste item size that shall be obtained using the shredder.</p> <p>Similar to the feeding hoppers, the design of the waste chute shall assure non-clogging operation characteristics via an appropriately shaped widening of the chute towards the furnace. The waste chute shall be equipped with a hydraulically driven cut-off gate and expansion joints and shall be water cooled. The cut-off gate shall have fail-safe provisions (e.g. in the event of a low waste level) to prevent back-firing from the furnace into the bunker. Materials for the cut-off gate shall be corrosion resistant. The Contractor shall provide suitably designed fire alarm, firefighting and fire suppression equipment.</p> <p>Waste shall be fed into the furnace via a hydraulically driven waste feeder which shall be controlled by the DCS to allow the desired feeding rate. The pusher walls shall be made of wear resistant steel.</p>
b) Moving Grate	<p>Design and assembly of the moving grate shall ensure a robust and durable non-clogging, easy to clean, operate and maintain system which shall limit downtime due to failure or breaking of grate bars and other driving or moving components. The Contractor shall demonstrate that the proposed design of the grate and the material used for the grate bars have a proven track record of an at least 3 years continuous operation in other facilities incinerating co-mingled MSW.</p> <p>All grate zones shall be designed to be controlled and operated individually. Cooling of the grate shall be provided via the primary air. Air flow for the grate zones shall be adjustable individually. The moving grate components shall be driven hydraulically.</p> <p>Operations and control of all grate components shall be realized automatically via the DCS.</p>
c) Bottom ash collectors and discharge system	<p>Bottom ash collectors beneath the grate and a wet deashing system shall be provided. All bottom ash collecting and conveying equipment shall be wear resistant, easy to clean, and easy to operate and maintain. Necessary flexible compensators shall be supplied. Access to the discharge system shall be provided through adequately designed apertures to remove any blocking objects or for inspection purposes. Dust emissions from the bottom ash discharge, collection and conveying system shall be prevented.</p> <p>The design of the bottom ash conveying system downstream of the wet deasher shall incorporate any needed redundancy or intermediate storage to avoid shutdown of the combustion system or the subsequent units due to failures of the conveying system.</p> <p>During continuous and steady state operations, bottom ash shall be conveyed without any intermediate manual handling to the bottom ash processing plant as specified in chapter 5.4.8.</p>

d) Combustion chamber	<p>The design of the combustion chamber above the grate after injection of secondary air shall take into account the combustion conditions pursuant to the Performance Guarantees (i.e. at least 2s residence time at a minimum temperature of 850 °C) under all operating conditions. The design shall be substantiated by CFD simulations which shall form part of the Contractor's detailed design documentation. The Contractor shall equip the combustion chamber with measuring devices to allow the Employer's Representative to verify combustion conditions. The combustion temperature shall be measured continuously. The compliance of the combustion chamber with the combustion conditions shall be certified by an impartial external third party during the Tests on Completion of Design-Build.</p> <p>Any area exposed to flames shall be covered with the materials as specified in Table 5-11. Design of the combustion chamber shall ensure a uniform flue gas distribution, an enhanced mixing efficiency of the secondary combustion air and minimizing fouling and/or slagging of the furnace walls.</p> <p>Walls of the water cooled combustion chamber shall be gas tight (membrane-type wall) and shall be covered by a back ventilated SiC lining in those areas that are prone to flame impingement or shall be cladded using an appropriate cladding material which shall be certified according to BS EN 10204 3.1/3.2.</p> <p>All equipment to measure the parameters which are necessary to control the incineration shall be supplied. Data supplied by the measurement equipment shall be used by the combustion control system within the DCS to avoid unfavourable combustion and operating conditions of the incineration train such as, but not limited to, uneven oxygen and CO concentration across the combustion chamber cross section, thermal overload, variation of steam generation rate, peak temperatures and to assure a complete combustion of the flue gases within the combustion chamber thus leading to minimum CO and organic carbon emissions.</p> <p>To allow visual inspection, each combustion chamber shall be equipped with a sufficient number of apertures to both have a direct view on the grate and to install a CCTV camera. Apart from that, the Contractor shall equip the furnace with a sufficient number of access doors to allow entering the furnace for inspection and maintenance.</p>
e) Auxiliary burners	<p>The Contractor shall provide a sufficient number of auxiliary burners to bring the combustion chamber to a temperature or to keep the combustion temperature within the combustion chamber under all operating conditions at or beyond the set-point of 850 °C whenever required by the waste input. The thermal capacity of the auxiliary burners shall be at least 60% of the thermal capacity of the boiler. Auxiliary burners shall be of a low NOx design and shall be equipped with flame monitoring, fail safe features and control devices for automatic ignition.</p>

f) Combustion air supply system	<p>The combustion air supply system shall include a primary and secondary air fan, air pre-heaters for both primary and secondary air and all the necessary measuring, control and instrumentation equipment and the required ducts, pipes and fittings. The system shall be designed to allow the operations at all loading points as per stoker capacity diagram and shall have a design margin of +20%.</p> <p>Primary air shall be extracted from the bunker area via a sufficiently designed louver or grille which shall allow easy cleaning. In the event of a bunker fire the air intake shall be swapped automatically to the boiler building. Given the dust laden primary air, all devices and equipment conveying primary air shall be designed abrasion and erosion proof. Secondary air shall be extracted from the boiler house.</p> <p>The primary air shall be supplied to at least 5 individual zones. Each zone's air supply shall allow independent control.</p> <p>Electrical drives of the combustion air supply fans shall be of the energy efficiency class as defined in chapter 5.4.4.</p> <p>Primary and secondary air pre-heaters shall be operated with extracted steam from the turbine.</p>
g) Hydraulic System	<p>A central hydraulic system for all hydraulically driven components of the combustion system shall be designed with sufficient redundancy and operating margin, either 3x50% or 2x100% of the system requirements at MCR. Non-flammable hydraulic oil shall be used while hydraulic hoses close to hot components shall be laid in shield tubes.</p>

Table 5-11: Minimum design criteria for the combustion system components

Component	Minimum requirement
Waste feeding system and furnace	
Feeding hopper / sheet thickness (replaceable)	12 mm
Waste chute / inner wall thickness (replaceable)	8 mm
Pusher chamber wear plates (replaceable)	20 mm
Combustion chamber	
Refractory	Minimum Al ₂ O ₃ -content in areas with t < 900 °C: 60%
Ceramic lining	Minimum SiC-content in areas with t ≥ 900 ° C: 90%
Cladding of membrane walls	Less than 1% iron and certified according to BS EN 10204 3.1/3.2.
Boiler wall thickness (all components)	Based on the stress analyses of the boiler components plus 3 mm for each boiler tube

3. Boiler and water steam system	<p>The Contractor shall design and deliver the number of boilers and water-steam systems as per Table 5-7 that shall allow the heat extraction including the required piping, insulation, valves and control equipment etc. All components shall be easy to inspect, to maintain and to replace (e.g. via apertures in the roof, in combustion chamber or in the boiler passes). The boilers' operations shall be controlled by the DCS system.</p> <p><u>Design parameter shall be as follows:</u></p> <ul style="list-style-type: none"> • operation pressure 42 bar (g) • steam temperature 405°C <p>Design temperature and pressure shall be kept in the thermal load range between 85 and 110% of the design thermal load.</p> <p>The selection of the boiler type shall be within the discretion of the Contractor. The Contractor shall, however, minimize the footprint of the facility. The boiler and water steam system shall consist of radiation and convection boiler passes including evaporator, super heaters and economizer, steam drum and all necessary sampling, venting, injection, blow-down and cleaning equipment etc. needed for safe operations of the boiler and the water steam system. The deashing equipment, including chutes, (pneumatic) conveying systems, compensators etc. shall be included in the scope of design and supply.</p> <p>All shut-off valves shall be fast-acting fulfilling the relevant British standard.</p> <p>All water/steam feeding pipes, safety valves, silencers and necessary pipe sections shall allow drainage. The necessary drainage shall be provided with a double shut-off fitting.</p> <p>The safety devices of the boiler shall comply with applicable British standards. A silencer shall be installed in the boiler safety valve blow-off.</p> <p>Each injection station shall include an injection control valve including a dirt trap, bypass and corresponding shut-off valves.</p> <p>The protection of the membrane walls as outlined in Table 5-11 shall be taken into account.</p> <p>The cladding shall be applied with a thickness of 2 mm in total and an overlapping of 30 - 50% of each welding line. The service life of the cladding shall be at least 3 years, calculated from the application. The type of cladding material and its application mode shall be submitted with the design documentation according to Chapter 5.6</p> <p>Extended boiler travel times shall be achieved applying, amongst others, appropriately designed:</p> <ul style="list-style-type: none"> • Gas velocities to prevent local overloads particularly in convection passes, entrainment of fly ash and its deposits;
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	<ul style="list-style-type: none"> • Transverse divisions sufficiently large and decreasing in exhaust flow directions; • Cooling of the exhaust gas before the final super heater (super heater 3) to a maximum of 650 ° C (at 100% load, end of travel time). • Evaporator bundle (protective evaporator) prior to the final super heater. • Co-flow arrangement of the final superheater; • Aligned arrangement of all pipes; • Easy access to superheater bundles; • Live steam pipes with minimum welded joints; • Cleaning devices. <p>The boiler lining in the first pass shall be optimized to meet the following requirements:</p> <ul style="list-style-type: none"> • Good ignition of the fuel on the grate (ignition cover); • Good burnout of the fuel on the grate; • Protection of the pipe walls against erosion by the fuel on the grate and in the filling area; • Insulation of the combustion chamber and the afterburner chamber to achieve the required residence times of the exhaust gas at high temperatures; • Protection of the pipe walls against hot and not completely burnt off exhaust gases (corrosion protection); • Minimize heat accumulator for varying heat dissipation due to varying fuel throughput and calorific value; • Avoiding too high surface temperatures (low heat transfer resistance of the design where possible) to avoid caking, deposits and slag flow. <p>Each boiler shall allow independent operation from the other.</p> <p>The Contractor shall ensure all approvals required from the relevant authorities are in place for such boilers for use in the Plant and subsequent initial and periodic inspection and certification shall be ensured to comply with the relevant authority requirements.</p>
4. Air Pollution Control System (APC)	Each thermal line shall be equipped with a dry or semi-dry flue gas cleaning that shall meet the emission standards as per chapter 4 of this Section 6, taking account of the stoker capacity diagram and the waste characteristics as per Chapter 5.3 and that shall minimize the amount of residues to be landfilled. The APC system shall be designed so that bypass operations are not required. The Contractor shall apply a sufficient safety margin in its

	<p>design to cope with variations in the pollutants' raw gas concentrations and in the flue gas flow rate.</p> <p>The scope of the Contractor shall consist of all necessary dosing units, reaction and storage vessels or, as the case may be, storage silos, including, but not limited to, the piping, pumps, measurement, instrumentation and control devices. All components shall be arranged to allow easy maintenance and replacement.</p> <p>Requirements regarding the working environment, the H&S and the noise and dust or any other emissions shall be considered in any case.</p> <p>Any dust emissions while discharging APC residues from the storage silos shall be prevented by dust-tight discharge stations/chutes. Appropriate safety devices shall prevent overloading of the transport containers or vessels.</p> <p>With reference to Performance Guarantee PG2 and PG3 (annual waste throughput), the Contractor shall provide a raw gas measurement for the HCl concentration at a suitable location prior to the APC system.</p> <p>APC residues shall not be mixed with bottom ash or boiler ash prior to the bottom ash treatment.</p> <p>Residues of the APC system shall be disposed in the residue landfill so that no environmental impact is to be concerned and the leachability of heavy metals is reduced. It shall be within the discretion of the Contractor to stabilize or solidify, or to trigger pozzolanic reactions of the APC residues. If deemed appropriate by the Contractor, residues after bottom ash treatment may be used to stabilize APC residues only if the grading yield as per Table 5-14 is reached.</p> <p>The design criteria applied for the APC system and the treatment prior to landfilling shall be delivered with the design documentation for review and approval by the Employer's Representative.</p>
5. Turbine, generator and condenser	<p>The Contractor shall design and install a turbine generator set including all necessary ancillaries to supply process steam and electrical energy to satisfy the Site's demand and to export electricity to the DES grid based on the PPA to be concluded between the Employer and DES.</p> <p>The turbine shall allow a steam intake equivalent to 110% MCR of boiler(s).</p> <p>The exhaust steam of the steam turbine shall be cooled down in an air-cooled condenser. The condenser and the hereto auxiliaries shall be designed to facilitate the condensation of 100% of the steam generated in the boiler if needed.</p> <p>The turbine generator set shall allow both island mode and external grid backed operations.</p> <p>a) Steam turbine with auxiliary equipment</p>

	<p>Besides the steam turbine itself, the Contractor's scope shall include all auxiliary equipment such as, but not limited to, valves, internal pipes, extraction points, gearbox, instrumentation, lubricating system including oil coolers and filters, etc. that are required for fully automated and safe operations. Crucial equipment shall be installed redundantly.</p> <p>The turbine shall be single-casing design in axial construction. Thermal stresses during load changes or temperature fluctuations shall be reduced to a minimum.</p> <p>To satisfy steam and operating conditions, the housing shall be made of alloyed cast steel.</p> <p>The fast closing valve shall be medium-actuated that shall close in the event of malfunction in milliseconds.</p> <p>The nozzle segments shall be designed for a wide load range between 35% to 110% of the MCR (thermal).</p> <p>The exhaust housing is selected from the modular system and - depending on size and type of turbine – shall be cast or welded.</p> <p>The turbine rotor shall be designed as a fully forged rotor.</p> <p>The torsion-critical calculation shall be carried out using modern computer calculation methods. In particular, the vibrations are pre-calculated and minimized, taking into account the bearing conditions as well as the influence of the plain bearings.</p> <p>The design shall minimize the start-up-time and shall allow fast load changes.</p> <p>All rotor blades material shall be a steel with not less than 13% chrome.</p> <p>The steam turbine and auxiliary components shall be mounted on a single frame and shall be packaged by one supplier.</p> <p>Insulation of the turbine and its internal piping must not contain any asbestos.</p> <p>Equipment and components that are crucial for the facility's and the turbine performance shall be provided fully redundant (2 x 100%), such as, but not limited to, oil coolers, pumps and filters.</p> <p>For failures of the steam turbine, a bypass shall be provided, which directs the live steam directly into the condenser.</p> <p>To facilitate a multiple use of the heat recovered, the steam turbine shall allow a controlled steam extraction at a pressure of 5 bar_g. The 5 bar_g steam shall supply the connected heat consumers. The steam extraction shall be designed that the maximum steam flow can be extracted for external use.</p> <p>The turbine shall be prepared for manual starting as well as for remotely controlled start-up and synchronization procedures initiated from the control room.</p>
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	<p>The Contractor shall provide all applicable standards with its design submission.</p> <p>b) Generator System</p> <p>The generator shall be a four-pole rotor (1,500 min-1).</p> <p>The generator shall be of a brushless design using rotating diodes for excitation.</p> <p>The generator shall be cooled by a closed air-cooling circuit. The heated air shall be re-cooled over cooling water. The design shall be selected in such a way that the generator does not suffer damage by water.</p> <p>The Contractor's scope shall include:</p> <ul style="list-style-type: none"> ▪ 1 Three-phase synchronous generator, 4-pole, air-cooled, with plain bearings, with the following accessories: ▪ 1 standstill heating (subject of the design consideration of the contractor); ▪ Auxiliary grinding ring for rotor earth fault protection; ▪ 1 Rotor removing device; ▪ 1 Generator air cooler, consisting of cooling elements with cooling air control housing; ▪ A brushless excitation system with power supply from a permanent-pole auxiliary excitation machine. <p>c) Condenser</p> <p>The exhaust steam from the steam turbine shall be cooled via an Air Cooled Condenser that shall be designed for bypassing the entire steam rate generated at 110% MCR of the incineration train in the event the turbine trips.</p> <p>To start the turbine, a vacuum shall be generated in the condenser using two parallel water ring pumps. In order to maintain the vacuum in the condenser during operation, a standby water ring pump shall be provided.</p> <p>Alternatively, the vacuum may also be generated via steam emitters.</p> <p>Condensate shall be collected in the hotwell and pumped by the redundant condensate pumps into the condensate collecting tank.</p>
6. ID fans and stack	<p>The ID fans shall be arranged downstream of the bag house filter. This shall be designed as a radial fan with a single-flow impeller, statically and dynamically balanced.</p> <p>The shaft shall be double-mounted. A labyrinth shaft seal shall be provided as a shaft seal. An elastic coupling shall be used between the drive motor and the shaft.</p> <p>The housing shall be designed as a steel plate construction with external stiffeners. The fan shall be installed together with the drive motor on a steel base frame and is equipped with a noise protection hood.</p>

	<p>The auxiliary driver shall be supported by emergency power.</p> <p>Each ID-fan shall be designed for 130% load at a nominal flue gas flow. In order to minimize the wear and the noise emission the maximum air fan speed shall be below 1,200 rpm.</p> <p>The drive shall be equipped with a frequency converter.</p> <p>Stack(s), either as tube-in-tube arrangement or separate ones, shall be built with the minimum height as defined in the EIA. The stack shall be accessible via an external climbing ladder.</p>
7. Continuous Emission Monitoring System (CEMS)	<p>For each stack (i.e. incineration train), the Contractor shall design and supply a CEMS including the necessary flue gas sampling points for the emission measurements. The flue gas sampling points shall allow an undisturbed flue gas flow before and after the sampling point. The sampling points shall be easily accessible.</p> <p>In addition to the continuously measured parameters listed in Table 4-2, the pressure, flue gas temperature and flow, oxygen, water and carbon dioxide concentration shall be also continuously measured.</p> <p>Only certified in-situ flue gas analysers shall be used.</p> <p>The analysers shall be installed in cabinets. In addition, a computer and the holders for the test gas cylinders (zero gases and calibration gases), sample gases and carrier gases shall be arranged in the measuring room.</p> <p>The measuring room or container, respectively, shall be air-conditioned.</p> <p>The analysers shall be equipped with a periodically self-calibrating system using the test and calibrating gas. Each analyser shall be provided with a suitable measurement range to allow the collection of emission data beyond the half hourly emission standards without compromising the accuracy in its lower measurement range.</p> <p>The measuring instruments used shall comply with EN 14181 and EN 15267 or US EPA CFR 11 Part 60 and Part 75.</p> <p>Raw emission data shall be compiled by the emission evaluation program to facilitate emissions statements according to the regulatory requirements.</p> <p>The emission computer shall be equipped with special software that fulfils the following requirements:</p> <ul style="list-style-type: none"> • Formation of overage values; • Correction calculation for O₂, temperature, pressure and flue gas humidity; • Simultaneous calculation of the concentration; and • Archiving the raw data and the classified averages values with date and time stamp for stamp minimum 5 years.

	<p>All measurement results shall be forwarded to the DCS and be displayed in the central control room. Subject to the requirements of the Environmental Authority, the emission data shall be also transmitted to the Environmental Authority.</p> <p>During the design submission, the Contractor shall seek consent of the Employer's Representative to the type and specification of the CEMS and the list of firms to certify the correct installation of the CEMS and the sampling points and probes.</p>
8. Condensate system	<p>The condensate system consists of the condensate collecting system, the condensate tank and the make-up water system.</p> <p>a) Condensate collecting system</p> <p>A hotwell shall be arranged in the condenser at the lowest point in which the condensate from the turbine exhaust is collected. With a redundant condensate pump, the condensate shall be pumped to the main condensate tank.</p> <p>All other condensate from internal heat exchangers, air-pre-heaters etc. shall be collected in a separate condensate tank and pumped into the main condensate tank.</p> <p>b) Main condensate tank</p> <p>The condensate tank shall be designed as an insulated horizontal tank. The size of the main condensate tank shall be adapted at the maximum condensate flow. The minimum storage capacity shall be not lower than 15 m³.</p> <p>c) Feedwater</p> <p>The condensate shall be pumped in the boiler feedwater tank which shall be designed as a horizontal preheater. The preheater shall be operated by LP steam.</p> <p>The volume of the boiler feedwater tank shall be not smaller than 35 m³, the degassing capacity not smaller than 70 m³/h.</p> <p>d) Boiler feedwater pumps</p> <p>Each boiler shall be equipped with electrically driven feedwater pumps.</p> <p>The boiler feed water pumps shall be connected to the emergency power system for a safe shut down of the plant.</p> <p>The design shall be according to the ISO 13709 or API-610.</p> <p>e) Make-up water system</p> <p>A water treatment plant producing the make-up water shall be able to supply a full boiler filling within 24 hours. The conductivity of the make-up water shall be lower than 0,2 µS/cm.</p> <p>f) Boiler water collection tank</p> <p>To collect boiler water (if the boiler needs to be drained), a sufficiently large collection tank shall be provided.</p>

9. Fuel and Chemical Supply and Storage	<p>Tanks and silos shall be designed to prevent the occurrence of encrustation, deposits, leakages, disintegration etc. Necessary monitoring equipment's such as, but not limited to, leakage detection (amongst others for ammonia water tank, fuel tanks), level gauges, and overfill protection shall be installed for all hazardous substances.</p> <p>This shall also apply to securing against vacuum, e.g. by suction during emptying. All containers shall be equipped with manholes and associated manoeuvring aids.</p> <p>The manholes shall be opened without the aid of hoists. Odour emissions shall be prevented. Containers for substances that are hazardous to water shall be provided with sufficient retention volume.</p>
10. Piping and valves	<p>Installation lengths and connection dimensions of fittings shall be selected according to British Standards or ASME. For fittings and piping components, at least certificates of the acceptance test in the factory and a 2.2 certificate in accordance with BS EN 10204 for mechanical-technological tests shall be submitted. For materials of stressed pipelines, e.g. thick sludge lines, approval test 3.1B according to BS EN 10204 shall be submitted.</p> <p>Fittings for insulated pipelines shall be equipped with spindle extensions, if necessary. All fittings shall be supplied with a full corrosion protection (including the hand wheels and chain wheels) in the factory, in accordance with the customer's order.</p> <p>Fittings and piping components shall be equipped with factory-specific markings.</p> <p>For fittings these are:</p> <ul style="list-style-type: none"> ▪ Nominal size, nominal pressure, permissible operating temperature and pressure ▪ Type, Year of manufacture, Material ▪ Manufacturer or manufacturer's code ▪ Flow Direction <p>The following applies to piping components:</p> <ul style="list-style-type: none"> ▪ Manufacturer's mark ▪ Material, melting number (percent), if relevant ▪ Nominal pressure for flanges <p>Dimensions (nominal width and pipe connection)</p>
11. Pumps	<p>Dry-mounted pumps shall be delivered on suitable base plates or base frames pre-assembled for installation including motor and coupling. The aligned arrangement of engine-clutch-pump shall be measured and, if necessary, adjusted. Pumps shall be designed in horizontal design and shall be able to absorb cavitation in the short term. The material of the pumps shall be capable of continuous operation under appropriate relevant conditions.</p>

	<p>Pumps shall have a stable characteristic and shall allow a quick start from the cold conditions without prior warming.</p> <p>Sliding ring seals of the pumps shall preferably be made of silicon carbide or wolfram carbide. Seals, which are exposed to sealing water are equipped for a continuous monitoring and recording of the flow or pressure or temperature.</p> <p>All pumps shall be provided with dry-running protection. Pumps with a motor power of more than 20 kW shall have a bearing temperature monitor.</p> <p>Suitable shut-off devices before and after the pumps shall be provided so that the pumps can be replaced at any time.</p> <p>Efficiency considerations for the electrical drives as per Chapter 5.4.4.6 shall be taken into account.</p>
12. Compressed and instrument air supply	<p>The Contractor shall design and install a fully redundant compressed air supply plant for the provision of dry, particle and oil-free compressed air that allows an energy optimised supply at 110% MCR of each incineration train. The compressed air supply unit shall consist of the following systems:</p> <p>a) A compressed air supply system for continuous consumption such as but not limited to, cooling air for furnace cameras, SNCR, sealing air, and temporary consumption for, amongst others, tools, cleaning purposes etc. Drying shall be achieved by refrigerant cooling (dew point 3°C, at max pressure), filtration rate with grain size 3 µm 99.99%.</p> <p>b) An instrument air supply system for all measurement and control instrumentation meeting the quality requirements of the measuring and instrumentation devices. Based on the design considerations of the Contractor, the instrument air shall be either made up from compressed air or a completely separate supply system shall be installed (with refrigerant cooling, 3°C dew point, adsorption drying, -40°C dew point, and filtration rate of 99.99% with grain size 0.01µm).</p> <p>It shall be at the Contractor's discretion to supply a compressed and instrumentation air supply system either catering for 2x100% or a 3x75% of the required capacity. In any case, the supply of the compressed and instrument air shall be secured any time without interruption.</p> <p>The compressed air system shall be soundproofed and operated fully automatically. The compressed air lines shall be made of stainless steel.</p> <p>Sufficiently sized tanks with pressure relief valves shall be provided for both compressed air and instrument air.</p> <p>Consumers shall be supplied via a redundant supply line or via a ring supply system.</p>
13. Thermal Insulation and Heat Protection	All equipment or components carrying media at elevated temperatures or at temperatures below ambient conditions or that, due

	<p>to its operations, work at such temperatures shall be provided with thermal insulation to assure high energy efficiency and to prevent condensation or shall be covered with heat protection shields to avoid accidental contact.</p> <p>The thermal insulation design shall be submitted with the design documentation according to chapter 5.6.</p>
a) Maximum surface temperature	<p>The Contractor shall provide thermal insulation so that the maximum temperature the working personnel are exposed to does not exceed 65 °C whenever feasible or shall install heat protection shields when the maximum surface temperature of any equipment which cannot be insulated exceeds 65 °C.</p>
b) Design criteria	<p>For the design of the insulation thickness, the Contractor shall consider the maximum heat flow due to operational conditions, such as, but not limited to, maximum inner temperature, by-passing the turbine etc.</p>
c) Insulation materials	<p>No asbestos shall be used for thermal insulation but only non-flammable, chemically and highly durable resistant rock wool mats. The mats shall not have any chemical impact on the base material. Materials shall comply with BS 5970 and BS 5422.</p> <p>Pipes or components working below ambient temperatures shall be insulated using flexible elastomeric foam material in accordance with BS 5422.</p>
d) Pipe and equipment supports, valves, fittings and measurement devices	<p>The Contractor shall design the insulation so that no heat losses or condensation occur via pipe and equipment supports and that valves, fittings and measurement devices are accessible yet are covered by insulation material.</p>
e) Lagging and jackets	<p>The Contractor shall supply and mount lagging and jackets that shall meet the ambient conditions of the corrosive environment, accommodate the thermal expansion of pipes and equipment and that shall allow access to base materials, valves, fittings, flanges, measuring devices and other equipment.</p>
14. Noise, Dust and Odour Control	<p>Th. The Contractor shall consider in its design to minimize all potential emissions of noise, dust and odour and the allowed levels thereof. Mitigation measures considering impacts to sensitive receptors shall be in accordance with the EIA and Industry Best Practice for mitigation of the particular pollutants to the sensitive receptors.</p>
a) Noise suppression	<p>The SPL and noise ratings shall be as stipulated in Chapter 4.13.</p> <p>For all noise emitting equipment appropriate hoods, dampers, silencers or attenuators or sound mitigating structures shall be provided to meet the SPLs or noise rating curves as defined in Table 4-1.</p> <p>The Contractor shall be responsible to instruct its personnel to wear appropriate noise protection equipment (ear plugs,</p>

	<p>headphones) in all those designated areas of the facility where due to operational conditions the SPL cannot be kept such as within the turbine hall or the bottom ash treatment plant.</p> <p>Wherever sound pressure levels (SPL) and noise rating (NR) exceeding the values as given in Chapter 4.13 within the facility are to be concerned, the Contractor shall take account of providing appropriate protection measures.</p>
b) Dust control	<p>Notwithstanding the obligation to limit the dust emissions from the stack, the Contractor shall design and build the facilities to prevent any dust emissions due to unloading, loading, landfilling or conveying and processing any dust prone materials such as bottom ash, chemicals for the APC system, APC residues etc. Any potential explosion hazard due to a dust laden environment shall be prevented.</p> <p>Subject to the considerations of the Contractor, the design shall take account of appropriate measures such as, but not limited to:</p> <ul style="list-style-type: none"> a) A central vacuum system to collect all dust laden air that can escape for example, but without limitation, during maintenance, after opening manholes, while filling APC residue silos or APC transport containers/vessels; b) Enclosing the top of the bag filter housing to prevent dust emission while pulling bag filter hoses or the like. c) Covering all conveyors to prevent materials to be blown away by wind; d) Using dust free bulk loading chutes during unloading or loading; e) Dust free filling from or discharging into jumbo bags; f) Using dust filter to remove dust from an exhaust; g) Minimizing drop height of automatic unloading or discharging systems; h) Operating dust laden atmosphere under sub-atmospheric pressure. <p>Signage to instruct the Contractor's personnel of any potentially dust laden area and to use protection equipment shall be provided.</p>
c) Odour control	<p>Odour emission from the plant may be due to handling waste, wastewater or chemicals (such as urea or ammonia). Subject to the design considerations, the Contractor shall apply appropriate measures such as but not limited to:</p> <ul style="list-style-type: none"> a) Operating odorous atmospheres under sub-atmospheric pressure and deodorizing the atmosphere by using it as primary air for the combustion system (e.g. bunker, tipping hall); b) Monitoring the continuous operation of ventilating systems (fans) and alarming in the event of failures;

	<p>c) Using gas tight connectors while unloading urea/ammonia or any other odour emitting chemical;</p> <p>d) Providing an efficient and sufficient aeration to the wastewater treatment;</p> <p>The Contractor shall determine the potential fugitive and localized emission sources and shall submit these jointly with the odour control concept during the concept design phase. The implementation of the odour control concept shall be subject to the approval of the Employer's Representative.</p>
15. Lifting Devices	<p>Notwithstanding the Contractor's obligation to provide all required lifting devices for construction, assembly and erection during the Design-Build, the Contractor shall facilitate an easy maintenance or replacement of equipment which cannot be lifted by hand (beyond 25 kg) either during Design-Build or during the Operation Service Period and shall provide either permanent or temporary (including attachments) lifting devices such as cranes, hoists etc. The surrounding steel structure of the equipment shall be designed to allow anchoring or attaching temporary lifting gear if needed via mounting additional beams, clamps, shackles etc. or directly to the steel structure.</p> <p>A permanent crane shall be installed in the turbine hall (see chapter 5.4.5.9). Also, the Contractor shall provide a permanent hoisting system to replace bag filter hoses.</p> <p>To allow lifting of larger components and Goods, the Contractor shall provide a sufficiently large lifting area within the boiler hall that is equipped with appropriate lifting devices.</p> <p>The Contractor shall provide all necessary mobile lifting gear such as pallet trucks, forklifts, mobile cranes etc. to allow manoeuvring detached or dismantled or to be replaced equipment across the Site.</p> <p>Removable openings in the roof of the machinery hall shall allow the access via mobile cranes to lift larger components that cannot be moved otherwise.</p> <p>The Contractor shall consider all necessary safety rules and applicable standards for all cranes and hoists irrespective whether they are of permanent or temporary installation.</p> <p>The Contractor shall obtain third party inspection certifications for all lifting devices and maintain the validity of the certification throughout the Contract Period.</p>
16. Steelwork	<p>The WTE facility's supporting structural material for the tipping hall, the machinery building, turbine hall, for the combustion system, the boiler, the APC system, the chemicals and fuel storage and supply system, the conveying systems for bottom ash and APC residues, for all walkways, platforms, stairs etc. shall be steel unless otherwise agreed.</p>

	<p>The detailed design documentation that the Contractor is required to deliver shall include all load assumptions (equipment, wind, seismic, live and dead load) and the necessary calculations to provide the evidence of the load bearing capacity.</p> <p>When delivered to Site, the Contractor shall provide the material certificates according to EN 10204.</p> <p>Notwithstanding the obligation to deliver the steelworks that meet the design life expectancy as per chapter 5.4.2, the Contractor shall be responsible for, but not limited to the following:</p> <ul style="list-style-type: none"> a) All structural elements shall be erected without altering the load bearing capacity; b) All pre-coated steelwork that requires welding, machining, grinding etc. shall receive a final coating meeting the requirements stipulated below; <p>The run-off of any potentially accumulating water on the steel structure shall be prevented.</p>
17. Corrosion Protection	<p>The Contractor shall consider the corrosive marine environment in which the Works is located and shall either use corrosion resistant Materials or shall apply appropriate corrosion protection measures.</p> <p>Except where stainless steel is used, steel structures, steel components and their fastenings shall be provided with corrosion protection, including as applicable, the use of galvanizing, primers and cover coatings.</p> <p>For the workmanship and control of coatings and paintings or galvanizing of steel and metal works, the applicable standards such as, but not limited to the following shall apply:</p> <ul style="list-style-type: none"> a) ISO 1461 b) ISO 2360 c) ISO 2808 d) ISO 12944 e) ISO 14713 f) ISO 24624 <p>The coatings (thickness, type, material composition, hardness etc.) which are applied to structural elements shall be included in the Contractor's detailed design submission.</p> <p>Coatings and primers shall not contain any hazardous substances such as lead and chromate compounds.</p> <p>Machinery and equipment delivered to the Site that are, due to further applications, not coated or protected against corrosion shall be protected with appropriate preservatives until final installation or commissioning.</p>

18. Welding	<p>Welding applied to the steel structure and to pressurized/vacuum vessels or pipework shall be in accordance with all applicable standards as follows, but not limited to:</p> <ul style="list-style-type: none"> a) ISO 3834 b) ISO 5817 c) ISO 14731 d) ISO 12952 e) ISO 13480 f) ISO 15607 g) ISO 15609
a) Welding personnel	<p>To obtain the consent of the Employer's Representative, the Contractor shall provide sufficient evidence (valid qualification records) for the skills and experience of the staff who provides welding either on-site or during manufacturing at the suppliers' premises for</p> <ul style="list-style-type: none"> a) crucial structural elements or pressurized or under enhanced vacuum operating components such as boiler, turbine or condenser, etc.
b) Welding personnel	<p>Prior to start welding boiler or turbine elements, the Contractor shall obtain the Employer's Representative consent to the following:</p> <ul style="list-style-type: none"> a) Quality assurance and management of the manufacturer related to welding; b) Welding procedure specification and welding procedure qualification records; c) Specifications of the materials used; d) Test methods applied to control the quality of welds; e) Specification of weld repair methods.
c) Tests on welding quality	<p>The Contractor shall conduct tests of welding of the boiler components and on pipework according to ISO 12952-6 and ISO 13480-5. Inspections and certifications of welds shall be performed by an approved third party.</p> <p>The Contractor shall apply non-destructive test methods on 5% of all welds whereas for the boiler feed water pipes and live steam pipes that run outside the boiler all welds shall be tested non-destructively.</p> <p>Whenever a weld defect is identified, the Contractor shall inform the Employer's Representative who shall be entitled to request a higher sampling rate for non-destructive testing.</p>

	The Contractor shall carry out a hydrostatic pressure test on all components that are designed to operate under conditions of pressure or vacuum that have welds.
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5.4.4 Electrical Works

1. General	<p>The electrical works of the Contractor shall comply with Brunei guidelines, norms and standards, shall take into account international standards and norms in their latest version, and shall meet the requirements of a fully functional facility that can be operated and controlled in a robust, safe and secure manner under all operational conditions at the given environmental conditions and shall be compliant to the Performance Guarantees as defined in Chapter 4 of this section.</p> <p>The Contractor's electrical works shall include the supply and installation of an overhead transmission line connected to the DES Grid at the intersection of Jalan Telisai and the landfill access road. The transmission line will follow the designated wayleave and utilize slim poles. Prior to crossing the existing transmission line tower, a transition yard shall be established to convert the overhead transmission line into underground high-voltage (HV) cables. These HV cables will extend to the new WTE switchyard.</p> <p>All necessary switchyard structures and equipments shall be provided such as:</p> <ul style="list-style-type: none"> ▪ 30MVA Transformers; ▪ Lightning Arresters; ▪ Metering Potential Transformers and Protection; ▪ Metering Current Transformer and Protection; ▪ Motorized Double Break Isolator; ▪ Circuit Breaker; ▪ Bus Post Insulator; ▪ Earthing System; ▪ Other equipments. <p>Other downstream equipment includes low-voltage (LV) switchboards, cabinets, motor control centres, and centralized variable frequency drives (VFDs), which are installed in local switchboards and control rooms. The scope also covers earthing and lightning protection systems, a DC power supply system, emergency and safety lighting, fire extinguishing pumps, fire alarm systems, and other equipment located in the main control room.</p> <p>Control Room - where operators monitor the status of gas turbine generators, including their output and system load. The entire Brunei 66kV Electrical Distribution Network, synchronized across multiple power plants, shall also be illustrated.</p> <p>HV Switchgear Switch Building - indoor 66kV Gas Insulated Switchgear (GIS) Substation and HV switchgear, along with the rectifiers, communication equipment, and protection relay systems.</p>
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Transition Yard - A fenced-off area with cable terminals where underground cables connect to overhead power lines. This yard serves as the transition point between underground and overhead power distribution.

The Contractor shall also supply an emergency power supply system as specified further below to allow operation of the facilities in the event of a failure of the turbo-generator system or the external supply.

For the connection to the DES grid, the Design-Build and the operations of the electrical works, the Contractor shall liaise with DES and the AENBD and shall take into consideration the approvals and permits granted by DES and AENBD. For the Design-Build of the electrical works, the Contractor's shall, amongst others, consider the following:

- a) List of accredited electrical engineers that are licensed to perform electrical engineering works in accordance with the prevailing regulations including but not limited to APEQS Act (Chapter 266) and any registration with DES for the authorised Engineers and Technicians to carry out the construction and tie-in works;
- b) Guideline for power systems approval;
- c) List of approved cables with valid certificates;
- d) Grid connection application/permit and other applicable services provided by DES;
- e) Approval of technical specifications by DES and any other relevant authorities concerned and having jurisdiction over these works;
- f) Brunei Darussalam National Grid Code (second edition) as appended herewith in Appendix 4A to these Employer's Requirements – Part 2 – Appendices to Employer's Requirements

The Contractor shall design the electrical system and the relevant components to achieve the following outcomes:

- a) The electrical system can be operated in parallel mode to the DES grid in compliance with DES grid operation requirements;
- b) The maximum power rating of the entire WTE facility and the landfill installations under all operating conditions can be met;
- c) The full power output of the WTE facility at 110% MCR at the extended capacity taking into account the variance margin as defined in Chapter 5.4.2 (see expandability) can be exported;
- d) The requirements can be met for constant off-grid operations of all components that are within the scope of this Contract;
- e) Low power losses and high reliability of supply and operational safety of the installations, even in the event of individual equipment failures (redundant supply, selectivity of the power system protection, and high availability);
- f) Low operating costs with the selection of maintenance-friendly and durable equipment;
- g) Sufficient transmission capacity of the equipment under normal operating conditions as well as in fault conditions;
- h) Good quality of the power supply, meaning few voltage changes due to load fluctuations with sufficient voltage symmetry and

	<p>few harmonic distortions in the voltage;</p> <p>i) Observance of valid IEC / EN / VDE regulations as well as project-related regulations for special installations.</p> <p>Electrical components shall be designed and installed so that any damage due to water intrusion, sea water attack or the corrosive marine environment is prevented, thus, resulting in either appropriate protection classes and measures, or in elevated installation of electrical components.</p> <p>Wherever appropriate, the Contractor shall provide surge arrestors to protect the electrical equipment.</p> <p>For the concept design report (see Section 5.6), the Contractor shall submit a detailed description of the electrical system including, but not limited to, arrangement of the connection to the DES grid, electrical consumer list and an analysis of the self-consumption, potential gross and net power generations at the load points as per stoker capacity diagram, cabling plan for major cables including trenches and arrangement across the Site, single line diagrams and protection philosophy for all switchboards, set-up of the emergency power supply including entitled consumers, provision of protection zones, etc. Furthermore, the Contractor shall submit detailed calculations of energy balance, load-flow (normal/fault), short circuit currents calculations taking into account all lists of power consumers, forecasts of expansions, temperatures, equipment data etc. Regarding network dimensioning and selection of equipment, transformers, cables protection and switching devices, etc. all requirements according selectivity and back-up protection shall be fulfilled.</p>
2. Connection to DES Grid	<p>The interface with the DES grid is as described in Chapter 5.8.</p> <p>All electrical components including, but not limited to, the metering system, circuit breaker(s), control and instrumentation equipment shall be provided by the Contractor.</p> <p>The Contractor shall liaise with DES to identify the best suiting transfer point and to define the exact location of the physical interface and also the redundancy requirements of the grid feeder system. The Contractor shall confer with DES and AENBD on the approval of the power supply system to work out the appropriate connection.</p> <p>All components to establish the grid connection shall be sized to allow the operation of all electrical equipment via this transfer point over the full range of import as required as per Table 5-12 and the net export of the WTE facility at the extended capacity as per Table 5-8.</p>
3. Transformers	<p>The Contractor shall supply and install transformers from the supply voltage (see Table 5-12) to the voltage level as required within the WTE facility. The design of the transformers shall be in accordance with the climatic conditions of Brunei and with a relative humidity of 100%. The transformer shall be a dry type, of low-loss and double or three phase wound enclosed design and shall be</p>

	<p>equipped with air cooling. Sizing of the transformers, the Contractor shall consider natural air ventilation while forced air ventilation shall cater for an extra rating of +25% of the nominal capacity. The transformers shall be designed to preclude any damage due to overheating from a failure of the cooling system for a duration of minimum 10 min. All control and instrumentation equipment necessary to monitor the safe and manufacturer's instruction compliant operation of the transformer shall be supplied by the Contractor. A two-mode operating temperature control system shall allow to monitor and alarm (system 1) and to shut-off power from the transformer (system 2).</p> <p>Different loads shall be accommodated using a proven type of on-load tap changer of high speed and resistor-transition type design. The on-load tap changer shall be designed to facilitate at least 50,000 tap changes without maintenance. Vacuum interrupters shall cater for 200,000 switching cycles while the entire tap changer shall withstand 800,000 operations at minimum. The transformers shall be tested at the manufacturer's premises according to IEC 60076. Test reports shall be submitted with the Contractor's documentation during the testing and inspection phase (see chapter 5.15).</p>
4. Generator	See requirements as stipulated in chapter 5.4.3.
5. HV/MV/LV Switchyards and Switchboards and Rooms	<p>The design of the HV, MV and LV power distribution systems shall consider availability, safety and redundancy requirements, and shall assure that failure or maintenance of an ancillary component does not result in the failure of a superior system, by either a dual feed, a double bus bar system or a 100% redundancy. The configuration of the HV switchyard and/or the MV/LV switchboards shall be submitted during the detailed design review. Suitable power supply system according to the type of connection to earth shall be selected carefully for the medium- or low-voltage network in acc. with IEC 60364-1.</p> <p>Design and installation of medium-voltage switchgear shall be in accordance with IEC 62271 while the low-voltage switchgear and control gear assemblies shall be in compliance with IEC 61439. Circuit breakers shall be according to IEC 60947-1 and IEC 60947-2 with selectivity (full/partial) requirement and back up protection.</p> <p>All necessary safety requirements such as, but not limited to, overriding control hierarchy (i.e. DCS against manual control and vice versa), interlock of the rack in the event of continuing power supply, locking the switching device unless all warning or alarms are acknowledged, minimizing switching surges by appropriate means etc. shall be provided by the Contractor.</p> <p>Circuit breakers shall be controlled solely by the DCS from the central control room. In the event any protective device is actuated central resetting shall be prevented.</p> <p>For monitoring and control of the loads, communicative instrumentation shall be installed on the MV or LV side of the substation. In this way, the power management requirements according to the ISO 50001 standard can be satisfied.</p>

	Switchboard rooms accommodating switchboards, motor control centres, elements of the DCS, and other control and automation equipment shall be equipped with air condition and shall be designed to operate at a pressure higher than ambient pressure to prevent dust ingress.
6. Energy Efficiency Classes	All electrical drives beyond 7.5 KW up to 375 KW shall conform at least to energy efficiency class IE3 according to IEC 60034-1 unless delivered with a variable frequency drive (IE 2 plus VFD). Electrical drives beyond 375 kW shall be supplied with VFD.
7. Electrical Cables and Equipment	<p>The Contractor shall consider in its design the cables that are certified and shall follow relevant standards and norms according to BS and IEC.</p> <p>For the design of the cabling and its installation, the Contractor shall, amongst others, consider the following:</p> <ul style="list-style-type: none"> a) Exposure to high temperatures shall be minimized by appropriate shielding; b) Cables in trenches shall allow access for maintenance and inspection personnel and effective drainage shall be provided; c) Trenches, ducts, trays, ladders etc. shall offer a usable space of at least 25% as spare; d) Wherever appropriate, empty conduits shall be provided; <p>Any equipment installed outdoors or in areas of high dust exposure shall be of at least IPX5 or IP65 respectively unless, due to the mode of installation, a higher protection class is required to prevent water or sea water ingress.</p>
8. DC Supply	The Contractor shall design and install a DC supply system operating at 24 V including rectifiers (2x100%) that conform to the capacity of the battery system (1x100%).
9. Earthing and Lightning Protection System	<p>The Contractor shall supply and install all necessary earthing equipment such as, but not limited to, earth leads, mats and electrodes etc. Relevant standards and guidelines such as, but not limited to, BS EN 50522, BS EN 62305, BS EN 7430, IEEE 80 shall be considered by the Contractor.</p> <p>Designing and installing the lightning protection system against lightning current and overvoltage, the Contractor shall consider BS EN 62305 or NFC17-102 and shall supply the relevant copper network or the early streamer emission air terminals as defined in the relevant standard. A risk analysis described in IEC 62305-2 shall be conducted in order to define the technically and economically optimal protection measures described in IEC 62305-3 and IEC 62305-4. The components to be protected shall be subdivided into several lightning protection zones (LPZ) that shall encompass both internal and external lightning protection systems. Current splitting, insulating interfaces and surge protection devices (SPD) shall be in accordance with IEC 60664-1.</p>
10. Emergency Power Supply System	The emergency power supply system shall consist of a suitably sized diesel driven genset that is housed in a noise suppressing environment and an uninterruptible power supply (UPS) system.

	<p>For the design of the genset module, the Contractor shall take into consideration the power ratings of the components of the WTE facility, balance of plant and the electrical consumers of the landfill, the duration of the operations without external grid connection as defined in Table 5-12. The fuel supply and storage for the genset system shall be designed accordingly.</p> <p>Designing the electrical capacity of the emergency genset module, the Contractor shall allow to operate all relevant electrical consumers and safety installations in accordance with EC 60364-5-56 at their power ratings as long as needed to reach a reliably safe status of the facilities or to bridge the power failure of the external grid. Amongst other main consumers, the Contractor shall also consider by-passing the turbine and the power consumption of the air cooled condenser in the design of the emergency genset capacity.</p> <p>In the event of a power failure, the battery backed UPS system shall facilitate a non-disruptive operation of all components that are eligible for the UPS for a duration as defined in Table 5-12 below. All equipment, systems, components, instrumentation and control equipment that are required for a safe bridging of the power failure or a safe shut down of the facility shall be powered by the UPS.</p> <p>The UPS shall be packaged type and of modern, true online double conversion design. The Contractor shall include all monitoring and self-checking features that are necessary to guarantee a continuous power supply to all eligible equipment.</p>
11. Indoor and Outdoor Installations	The Contractor shall provide indoor and outdoor installations such as, but not limited to, lighting in acc. with BS EN 12464-1 (and lighting poles), sockets, cabinets and distribution panels to cater for a safe and 24/7 operations of the equipment which is subject of this contract.
a) Indoor sockets and lighting	The power supply to indoor sockets and lighting shall be provided via indoor distribution panels with two feeding lines. The indoor lighting shall be fed by the emergency power supply system. For maintenance purposes, at least every 40 m the Contractor shall install 400 V AC industrial type sockets suitably rated and protected (IP65) and complying with BS EN 60309-2. Commercial 230 V AC sockets shall be provided wherever needed in the admin block and in any other part of the Site. Sufficient light intensity shall be provided both inside and outside. Energy saving illuminates (LED) shall be used wherever appropriate and possible.
b) Emergency Lighting	Emergency lighting shall be in accordance with BS EN 1838 and shall be provided to meet all the safety objectives such as the chance to leave a place safely or to ensure the safety of potentially hazardous workplaces.
c) Outdoor cabinets, sockets and lighting	Subject to the design considerations of the Contractor, the supply of the outdoor sockets and lighting shall be provided via either outdoor cabinets or via an indoor distribution panel. Outdoor lighting shall be eligible for emergency power supply.

	<p>Outdoor sockets shall be provided in a weatherproof enclosure (min IP65) and shall be located wherever appropriate. Higher water protection classes shall be provided in the event the installation is exposed to direct water/sea water attack.</p> <p>Outdoor lighting poles shall be sufficient in number and shall offer a sufficient light intensity. Outdoor illuminates used in at the lighting poles shall be LED.</p> <p>Whenever an outdoor cabinet shall be provided, the Contractor's design shall consider the sea-waterproof and weatherproof installation.</p>
12. Detailed Power System Study (PSS, including load flow and short-circuit analysis) for 11kV power export through Telisai Substation	<p>The Contractor shall carry out a detailed power flow study and fault level assessment for the 11kV power export as part of its design proposal to be submitted to the Department of Electrical Services (DES) for their review, comments and formal approval.</p> <p>The power flow study serves as a foundational tool in electrical power system engineering, used to assess how electrical energy is distributed throughout the network under steady-state operating conditions.</p>
(i) Purpose of power flow study	<p>Following are the purpose of the detailed power flow study to be conducted by the Contractor:</p> <ul style="list-style-type: none"> a) Assess system performance under normal and contingency conditions; b) Determine voltage levels, power flows, and losses across the network; c) Support planning and expansion of power systems; d) Optimize operations for cost, reliability, and efficiency; e) Voltage magnitude and phase angle at each bus; f) Real (active) and reactive power flow in each transmission line; g) Power losses in lines and transformers; h) Slack bus power and generator reactive power output; i) System planning and expansion; j) Voltage control and reactive power compensation; k) Contingency analysis; l) Economic dispatch and optimal power flow; m) Integration of renewables and distributed generation; n) Helps ensure Contractor's design proposal is technically compliant; and o) Enables DES to assess the impact and performance before giving final approval.
(ii) Power flow study requirements	<p>Following are the requirements of the detailed power flow study to be conducted by the Contractor:</p> <p>(a) System Parameters</p> <p>The Contractor shall include all relevant system data, including:</p> <ul style="list-style-type: none"> • Source impedance of incoming feeders/generators; • Line and transformer parameters; • Existing and proposed load details; and • Generator control settings and limits (P/Q, voltage regulation). <p>(b) Detailed Power Flow Study</p>

	<p>The Contractor shall perform a comprehensive steady-state load flow analysis including:</p> <ul style="list-style-type: none"> • Voltage profile at all buses (min/max under normal and contingency conditions); • Active and reactive power flows; • Line and transformer loadings with thermal limits; • Reactive power support devices and settings; and • Reverse power flow scenarios (if generation exceeds local demand). <p>(c) Study Coverage</p> <p>The study shall cover:</p> <ul style="list-style-type: none"> • Peak and minimum load scenarios; • Pre- and post-injection conditions with the 10MW source; • Tap settings and reactive compensation optimization; • Compliance with voltage regulation standards (e.g., $\pm 5\%$ of nominal); and • Software to be used for the study shall be of approved industry-standard with demonstrated track records of such studies conducted in the past.
(iii)	<p>Short circuit analysis</p> <p>The Contractor shall perform a short-circuit analysis based on IEC 60909 (or relevant national standard), considering:</p> <ol style="list-style-type: none"> a) Three-phase fault level at the 11kV busbar with the new injection; b) Comparison with existing fault ratings of switchgear, CTs, cables, and relays; c) Recommendations on upgrades or protections required; d) Potential mitigation techniques if fault levels exceed equipment ratings; and e) 11kV Busbar Fault Rating Review - Injecting an additional 10MW could alter fault currents significantly, potentially exceeding the existing equipment's short circuit withstand ratings. Calculate fault level using updated system impedance and source contributions. Assess switchgear and protection device ratings. Consider possible need for fault current limiting strategies (e.g., reactor, high impedance transformers). <p>In the event, busbar rating falls short of the thermal and mechanical requirements after injecting additional power, the Contractor shall be responsible to provide engineering solutions and associated actions, including but not limited to the following:</p> <ol style="list-style-type: none"> a) Upgrade the busbar system – The Contractor shall replace or reinforce existing busbars with higher-capacity conductors (e.g. larger cross-section, different materials like copper over aluminium) that can handle increased fault currents; b) Add busbar bracing or supports – The Contractor shall enhance mechanical support to improve the system's ability to withstand electrodynamic forces during a fault; c) Divide the load / reconfigure network topology – The Contractor shall split the system into sections or rerouting power flow that can reduce the fault level contributions at a given busbar; and d) Introduce fault current limiters as required.

(iv) Report format & submission	<p>The Contractor shall submit a formal report for each of the above studies i.e. detailed power flow study and fault level assessment at 11kV busbar. The content of the report, as a minimum shall include the following sections:</p> <ul style="list-style-type: none"> a) Executive summary; b) Single-line diagrams; c) Study methodology and assumptions; d) Simulation results and interpretation; and e) Recommendations and mitigation actions <p>All documentation to be submitted to DES shall be peer-reviewed and signed by a registered professional engineer complying to the prevailing law and regulations of Brunei Darussalam.</p>
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Table 5-12: Design requirements of the electrical system

Item	Unit	Minimum Requirement
DES grid		
Voltage	kV	132 +/- 2.5%
Frequency	Hz	50 +/- 2.5%
Transformer		
Capacity at natural air ventilation (AN)	MVA	To be defined by Contractor 30 (for 66kV per DES requirements)
AF rating surplus	% %	25% of nominal capacity
Switchboard room (or switchyard)		
Spare room	%	20% of room size
Emergency Power Supply		
Type	-	4-stroke turbo-charged diesel with intercooler
Capacity (active)	MW	to be defined by Contractor
Reserve margin	%	10% of capacity
Start-up time (up to full load at cos phi 0.8)	sec	<15
Fuel	-	diesel <u><0.5 wt-% sulphur</u>
UPS suitable to bridge a power failure of	min	>60

5.4.5 Building and Civil Works

1. General	<p>a) The civil and structural engineering and design of the Works shall be in accordance with current British standards as they may apply to the civil works. Besides the design codes and practices applicable to waste management infrastructure and concrete works for waste bunkers, the Contractor shall consider the code of practice BS 6349 1-4 related to the use of materials in marine environments.</p> <p>b) The Contractor shall use reasonable endeavours to utilize</p>
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	<p>methods and materials in the design and the construction that are environmentally sustainable.</p> <p>c) The Contractor shall include, within its design, a strategy for removal, replacement and upgrading of installed plant, equipment, fixtures and fittings during the lifetime of the facilities. This strategy shall, wherever possible, consider how these maintenance works can be undertaken whilst minimizing disruption to the provision of the Operation Service.</p> <p>d) The Contractor shall ensure that the Works are designed to enable access for items of heavy equipment and other heavy loads when undertaking maintenance in accordance with the Operation Service requirements. Equipment placed at roof top/deck shall be made accessible by staircase.</p>
2. Geotechnical investigations	<p>a) Information pertaining to subsurface exploration, borings, test pit locations, and other investigation shall be under the Contractor's responsibility.</p>
3. Topographical Survey	<p>a) Information required for all civil infrastructure works</p>
4. Earthworks and Cut & fill	<p>b) All equipment, tools, and machines used while carrying out earthworks shall be subject to the approval of the Employer's Representative and shall comply with all applicable H&S requirements.</p>
5. Building Requirements	<p>a) The Contractor shall provide a detailed design of the Site and the buildings that meets the requirement of a fully functional system according to chapter 5.4.2 and shall consider the following buildings and housing structures as a minimum requirement:</p> <p>b) Waste reception guard house;</p> <p>a) Waste tipping hall;</p> <p>b) Waste bunker;</p> <p>c) Machinery hall including turbine hall and bottom ash bunker;</p> <p>d) Workshop and stores;</p> <p>e) Housing for the leachate treatment plant;</p> <p>f) Housing for the bottom ash processing plant;</p> <p>g) Administration block including control room and visitors' centre;</p> <p>h) Main intake substation (MIS);</p> <p>i) Sub-station for the plant operations;</p> <p>j) Transfer tank and pump houses for domestic and external fire-fighting reticulation;</p> <p>k) Water treatment plant and pump houses for Raw water intake (as applicable);</p> <p>l) Raw water storage tank of at least one (1) MLD capacity;</p> <p>m) For the design of the buildings, their structures, foundations, facades and accessories the Contractor shall take into account the aggressive marine environment, the ambient conditions and climate resilience aspects stipulated in Chapter</p>

	5.4.2 and the lifetime expectations as stipulated in Table 5-7.
6. Waste Reception Guard House	<p>a) The waste reception guardhouse shall be located at, or nearby the harbour area entrance to the Site. As a minimum, the design of the guard house shall:</p> <p>b) Ensure that the guard house is incorporated into the fence;</p> <p>c) Include a fully equipped office room that is suitable to install the hardware for the weighing system;</p> <p>d) Allow for the installation of the necessary CIT infrastructure to link the guard house to the Site's LAN and telephone network and, if required, to the DCS network;</p> <p>e) In the event the staff access is far apart then a separate guard house shall be provided for the staff access;</p> <p>f) The guard house adjacent to the staff access shall be complete with a visitor safety briefing room to accommodate at least ten (10) pax at one time for safety briefing. The briefing room shall be complete with briefing audio / visual equipment and furniture for seating of the visitors during the briefing.</p>
7. Waste tipping hall	<p>a) The Contractor shall consider the following aspects in the design of the waste tipping hall:</p> <p>b) Fully enclosed tipping;</p> <p>c) Sufficient unloading bays to ensure efficient and convenient turn-around of delivery vehicles (minimum requirements as per Table 5-10);</p> <p>d) Width and geometry to allow for efficient use;</p> <p>e) Secured inspection area to allow for inspection without disturbing the tipping;</p> <p>f) Access to the tipping hall from the control room via a direct staircase;</p> <p>g) The tipping hall shall provide sufficient tipping/quarantine zones for the delivery of the contractual waste amount;</p> <p>h) In the event of breakdown of any authorized vehicle, the Contractor shall provide a dedicated area to facilitate safe recovery/maintenance of such vehicle without affecting the turn-around times of other authorized vehicles;</p> <p>i) The Contractor shall design and build the tipping area so that no impact due to any storm surges or flooding incidents is concerned, i.e. that the floor of the tipping area is located at a sufficient height.</p>
8. Waste bunker	<p>a) The Contractor shall design and construct a reinforced, water and leachate tight concrete waste bunker. Without limitation, the Contractor shall consider in its design and construction the following aspects.</p> <p>b) The bunker volume and storage to be designed to accommodate planned and unplanned shutdowns;</p> <p>c) The bunker volume shall be designed for the entire plant;</p>

	<ul style="list-style-type: none"> d) There shall be a direct view from the control room to the bunker; e) A waste crane maintenance area shall be provided; f) Any waste shall be prevented from entering into the sump system of the bunker; g) Fire safety and firefighting including the additional load due to firefighting water; h) Crack width shall be less than 0.1 mm; i) Cement shall be sulphate resistant; j) Floors and walls of the bunkers in accordance with BS EN 1992-1-1 and the UK National Annex to BS EN 1992-1-1 for the exposure class and the abrasion class being XA2 and XM3 respectively; k) Temperature increase due to storage of the MSW stored in the bunker, the maximum temperature being considered shall be submitted with the design documentation and shall be subject to approval by the Employer's Representative.
9. Machinery Hall and Turbine Housing, Bottom Ash Bunker	<ul style="list-style-type: none"> a) The machinery hall shall include the building envelope for the boiler, the APC system, the boiler feed water and desalination unit and other balance of plant components. b) All buildings shall facilitate easy access and sufficient working space for maintenance and replacement of components. Wherever deemed appropriate, the Contractor shall provide (glazed) gangways are to allow visitors to take a look into the set-up of the machinery and equipment.
a) Machinery Hall	<p>Amongst others, the Contractor shall consider the following for the design and construction of the machinery hall:</p> <ul style="list-style-type: none"> a) Boiler and turbine configuration; b) Integrating the boiler supports with the primary building structure; c) Crane accessibility (from the roof) and easy access to allow all maintenance works; d) Access from the elevator(s) at all levels; e) Preventing vibrations evolving from the process to be transferred to other buildings; f) Sufficient louvre area to provide for the maximum temperatures as per 5.4.2.2. g) A wear, abrasion and chemical resistant floor finishing wherever appropriate and required; h) Wherever chemicals or fuels are unloaded or stored, a sufficient retainment of at least the storage volume shall be foreseen.
b) Turbine Housing	<ul style="list-style-type: none"> a) Without limitation, the Contractor's design and construction considerations for the turbine housing shall include: b) The turbine housing shall be an enclosed, acoustically and thermally insulated building, and shall, with respect to the

	<p>vibrations, be fully detached from other building structures;</p> <ul style="list-style-type: none"> c) Roof, walls and the floor of turbine hall shall be acoustically and thermally insulated to meet the operational requirements and the sound pressure level equal or below 75 dB(A) 1 m outside the housing d) The turbo generator set shall be installed on a turbine deck that shall rest on a suitable vibration attenuating support structure. In any case, the turbine deck's supporting structure and foundations shall resist the dynamic forces and the resulting vibrations. The foundation shall be designed according to BS 10816-1. e) A maintenance crane shall be provided. f) All floors shall be made of reinforced concrete.
c) Bottom Ash Bunker	<p>In the design and construction of the bottom ash bunker, the Contractor shall include, without limitation, the following aspects:</p> <ul style="list-style-type: none"> a) The storage capacity of the bottom ash bunker shall be designed to accommodate any potential operational issue in the conveying equipment downstream towards the bottom ash processing plant; b) Walls and floors made of reinforced concrete complying with BS 8204-2, abrasion resistance class shall be at least AR2/DF. The floor shall be wear-proof. c) Crane rails shall allow easy maintenance and shall be easily accessible and detachable; d) Measures shall be provided to prevent bottom ash from clogging the sewerage system to drain the bottom ash bunker.
10. Workshop and Stores	<ul style="list-style-type: none"> a) The Contractor shall provide a fully furnished maintenance workshop that shall be equipped with the necessary equipment and tools to accomplish routine and specialist maintenance and overhaul of equipment. The workshop shall include separate compartments for mechanical, electrical and control & instrumentation (C&I) maintenance; b) When sizing and equipping the workshop, the Contractor shall take account of the location of the site and potentially limited local availability of skills and tools and supplies; c) The workshop shall be accessible from both outside and inside to allow large equipment to be maintained in the workshop. The workshop shall be provided with high bay doors, cranes, and lifting hoists as necessary; d) The mechanical workshop shall be ventilated, the electronic and control & instrumentation compartment air conditioned and shall be equipped with the necessary building services to operate the workshop, the installations and the tools; e) The storage area shall be sized and equipped to accommodate mandatory spare parts and any additional spare parts deemed necessary by the Contractor.
11. Housing of the leachate treatment	The Contractor shall consider the following as minimum requirements in the design of the housing for the LTP:

	<ul style="list-style-type: none"> a) An acid and alkali resistant floor finish shall be provided for all sections of the leachate treatment facility that may be exposed to acid or lye. b) A drainage system shall be provided to collect liquids, spills etc. that is connected to the Site's sewer system; c) A collection and disposal system shall be provided for RO rinsing and flushing liquids; d) The necessary CIT linkage shall be made to the Site's LAN and telephone network and linkage to the DCS network;
12. Housing for the bottom ash processing plant	See chapter 5.4.8.3
13. Administration Building	<ul style="list-style-type: none"> a) The Contractor shall design and construct the administration building within the overall building envelope of the WTE facility thereby allowing easy access from the administrative offices to the control room, the machinery and turbine hall, to the crane control room and other compartments of the facility. b) The administration building shall accommodate the following: c) Lobby and reception area; d) Permanent offices for the Contractor's staff; e) Central control room including separate server room; f) Visitor's centre with a viewing gallery and a meeting room; g) Laboratory and sample storage room; h) Changing and locker rooms for the Contactor's staff and third parties complete with shower facilities; i) Fire-Command Centre; j) Social facilities such as canteen, recreation room complete with indoor play area, rest and relaxation areas, nursing room, male and female prayer rooms complete with ablution facilities, etc. The kitchen shall be subject to Contractor's considerations on the food supply for the personnel; In the event there is a need for non-halal canteen facility then there must be a clear segregation of halal and non-halal facilities complete with separate storage, food handling, serving and dining areas with clear and distinct demarcation; k) First-Aid Centre complete with first-aid facilities complete with medical beds, triage room etc. as an immediate first-aid provision facility prior to shifting to the nearest clinic or hospital. The First-Aid Centre shall be located in such a way that it is accessible by Ambulance vehicle with a one-way route of incoming, pick-up and leave without having to manoeuvre for exit; l) Mechanical & electrical utility rooms such as electrical rooms, hosereel rooms and AHU rooms as applicable; m) It shall be subject to the design considerations of the Contractor to include other rooms and components as part of the administration building as needed; n) All rooms shall be sized to accommodate the envisaged

	<p>maximum number of people and to meet the minimum area requirements as defined in Table 5-13;</p> <ul style="list-style-type: none"> o) Building services, finishing works, doors and windows etc. shall be provided as stipulated in the relevant sub-chapters of this chapter 5.4.5; p) The different floor levels shall be accessible via staircases and one elevator at least that runs from the base floor to the highest floor level; q) The Contractor shall provide toilets for both male and female staff and visitors, respectively, in a sufficient number taking into account the number of employees and third parties and visitors as indicated in Table 5-13 below; r) Indoor signage shall be provided indicating (emergency) exits, fire escape diagrams, building plans, warning instructions, assembly/muster point locations etc. in an easily comprehensible format; s) Appropriate AHU room(s) or DFCU room(s) shall be provided by the Contractor and placing of any AC units in the ceiling voids shall be avoided for ease of maintenance.
a) Lobby and Reception Area	The reception desk shall be equipped with the necessary ICT equipment to dispatch any message, information or news as required.
b) Contractor's Offices	<ul style="list-style-type: none"> a) Apart from the minimum area requirement, the arrangement and the number of offices and meeting rooms for the Contractor's personnel shall be at the discretion of the Contractor; b) Rooms shall be made of sound-absorbent material or shall be provided with sound-absorbent installations to limit interference between and in the rooms. The walls, either brick or dry partition, shall be floor-to-floor height for sound proof installations; c) All rooms shall be fully furnished and equipped according to the Contractor's needs.
c) Central Control Room and Server Room	<ul style="list-style-type: none"> a) The control and server rooms shall be designed to accommodate the furniture for human machine interfaces, control panels and hardware needed for the DCS including the engineering and archiving hardware for the entire scope of Works at the extended capacity. A separate working area for engineering and documentation purposes shall be provided; b) The Contractor shall scrutinize the minimum area requirement and, if need be, shall advise the Employer's Representative if it is deemed inappropriate; c) The central control room shall be suitably located for easy access from the administrative area and shall be furnished with a window to allow visitors to watch the control room operations. In any case, the central control room shall be located on a floor that is accessible via elevator; d) The Contractor shall provide sufficient sound attenuation from the machinery hall and within the central control room itself to limit the noise ratings to 45 as per CIBSE Guide B4; e) Relative humidity and temperature shall be adjustable via an

	<p>air conditioning system solely dedicated to serve the central control room to provide room conditions of 22 to 25°C and 40 to 60% relative humidity. Dust ingress shall be prevented. In the event precision air-conditioning is required to maintain accurate levels of temperature and relative humidity control, then this shall be included by the Contractor accordingly;</p> <ul style="list-style-type: none"> f) All heat emitting hardware shall be placed within the separate server room(s) that shall be air conditioned. g) The Contractor shall design the Site wide communication system as needed to facilitate easy and unimpaired communication. h) The central control room's and the server room's flooring shall be of a highly durable and static-dissipative material (resistance to earth < 1x108 Ω, unless otherwise required by the Contractor's design). It shall be thermally insulated on all walls (four corners of the room), and the top and bottom slabs. Windows shall be double-glazed type; i) A toilet, hand wash facilities, a separate room to allow operating staff to meet, amenities such as refrigerator, a small kitchenette including equipment, etc. shall be provided; j) The Contract shall provide UPS system for the central control room and server room to meet the equipment requirements.
d) Visitors Center and Amenities	<p>The Contractor shall provide a visitor's centre and amenities including, but not limited to:</p> <ul style="list-style-type: none"> a) Video and lecture facilities; b) Gangways (glazed) along corridors allowing visitors to watch the machinery and equipment and their operations; c) Videos and lectures shall be held in the meeting room that shall be dedicated for this purpose, but which may be used for delegation visits and larger meetings during the Operation Service Period; d) The visitor's centre's meeting room shall have daylight illumination and shall be furnished with suitably sized windows that shall fit into the architectural lay-out of the building envelope.
e) Laboratory and Sample Storage Room	<ul style="list-style-type: none"> a) The Contractor shall design and build a fully furnished and equipped laboratory for chemical and physical analyses to control and monitor the operations of the WTE plant and its ancillaries for day-to-day business purposes, such as, but not limited to, fume hoods, tiled benches, glassware, stirring gear, pH, conductivity and redox meters, automatic samplers, calorimeter, shaker for gradation analyses, UV refractometer etc; b) Subject to its considerations on fulfilling the obligation with respect to the Performance Guarantees (see Section 4), the Contractor shall decide to either accordingly equip the laboratory to measure the relevant parameters or to ship samples to an ISO/IEC 17025 accredited laboratory. In the event, the Contractor opts to ship the samples to an ISO/IEC 17025 accredited laboratory, then the Contractor shall support this with the methodology for preserving the samples in the interim, shipping and the proximity / details of the ISO/IEC 17025 accredited laboratory for Employer's approval;

	<p>c) The sample storage room shall be furnished to allow the storage of retained samples for the period required by the relevant authorities and acceptable international standards;</p> <p>d) Floor, wall and ceiling finishing shall be chosen to meet the requirements of a laboratory (acid/lye resistant tiles, washable walls and ceiling etc.);</p> <p>e) Both the laboratory and the sample storage room shall be air-conditioned for 24/7 complete with double wall, double glass glazing, insulated ceiling, soffit of the ceiling underfloor beneath and roof.</p>
f) Changing and Locker Rooms with Showers and Toilets	<p>a) The Contractor shall provide changing and locker rooms with attached showers and toilets for both male and female employees. These shall be equipped with a number of lockers as per envisaged staff concept, with benches and with appropriate wall and floor finishing;</p> <p>b) Close to the changing rooms, fixtures for emergency shower and eye-wash situations shall be installed;</p> <p>c) Toilets, showers and hand wash facilities shall be accessible from the changing and locker rooms. Each shower and sink shall be equipped with both hot and cold water supply. A sufficient number of toilets shall be provided. Water saving equipment shall be used;</p> <p>d) Separate compartments with the same features shall be provided for external maintenance and repair personnel.</p>
g) Social Facilities	<p>a) In line with the staffing and shift concept, the Contractor shall provide a canteen and recreation area to allow staff to gather, eat and relax;</p> <p>b) Finishing works shall be subject to the considerations of the Contractor. Sound attenuation shall meet the CIBSE Guide 4B noise rating of 40;</p> <p>c) Prayer rooms shall be provided for both male and female employees and visitors;</p> <p>d) The area shall be equipped with air conditioning.</p>
h) Employer's Offices	<p>a) Located on a separate floor level, the Contractor shall provide fully furnished and air-conditioned offices for the Employer's personnel as defined in Table 5-13 that shall be equipped with all necessary building services and computer equipment to facilitate access to the PIMS via read-only access routines.</p>
i) First-Aid Centre	<p>a) General Requirement The Contractor shall design, construct, equip, staff, and operate a First-Aid Centre within the Site to provide immediate medical care and emergency response to plant personnel, contractors, visitors, and other authorized personnel during the operational phases of the Project.</p> <p>b) Location and Accessibility The First-Aid Centre shall be located within a clearly marked, easily accessible area of the Site, with unobstructed access for ambulances and emergency services.</p>

	<p>The facility shall be situated to provide rapid response across the entire Site, including operational and high-risk zones.</p> <p>c) Design and Space Requirements</p> <p>The First-Aid Centre shall be a purpose-built, air-conditioned structure compliant with applicable health, safety, and local authority regulations.</p> <p>It shall include at minimum:</p> <ul style="list-style-type: none"> • A reception and triage area; • Examination/treatment room(s); • Medical storage room; • Rest beds (minimum two beds or as required by applicable regulation); • A washroom with hygiene facilities; • Emergency eyewash and shower station (may be external if part of spill/emergency zone). <p>d) Equipment and Supplies</p> <p>The Centre shall be equipped with the following as a minimum and shall be regularly replenished to ensure they are valid and functional:</p> <ul style="list-style-type: none"> • First-aid kits and trauma response kits in accordance with local regulations and other regulations imposed by SHENA and/or Ministry of Health, Brunei Darussalam; • Basic diagnostic tools (BP monitor, thermometer, glucometer, etc.); • Oxygen supply and resuscitation equipment (including AED); • Stretcher and immobilization gear; • Personal protective equipment (PPE); • Cold storage for temperature-sensitive medicine (if required); • Record-keeping system for incidents and treatment logs. <p>e) Staffing</p> <p>Certified First-Aiders shall be present at all times (in shifts as appropriate) in the facilities during the Operations Service.</p> <p>f) Operational Requirements</p> <p>The First-Aid Centre shall be operational and maintained throughout the duration of the the Operation Service Period.</p> <p>The Contractor shall develop and implement a medical emergency response plan, integrated with the Site's Health, Safety, Security and Environmental Management Plan.</p> <p>All records and treatment logs shall be maintained and made available for inspection by the Employer or regulatory bodies.</p> <p>g) Compliance</p> <p>The First-Aid Centre and associated practices shall comply with:</p>
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	<ul style="list-style-type: none"> • All applicable laws, health and safety regulations of Brunei Darussalam; • International best practices for industrial first aid facilities; • Contractor's HSSE Policy and guidelines.
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Table 5-13: Area requirements for rooms in the administration building

Component	Number of People	Minimum Requirement
Lobby and reception area	n/a	Area: 30 m ²
Offices for Contractor's personnel	Subject to Contractor's staffing	No room smaller than 8 m ²
Central control room (exclusive server and engineering rooms and meeting room, size to be scrutinized by Contractor)	Subject to Contractor's requirements	Area: 50 m ² Clear height: 4 m
Meeting room for visitors	40	50 m ² Clear height: 3 m
Laboratory (subject to considerations of Contractor to equip the lab with sophisticated analysers, the size may be greater).	n/a	Area: 40 m ²
Changing and locker rooms (areas include separate toilets)	To accommodate lockers for entire staff and allow changing of two shifts concurrently	Male: 60 m ² Female: 20 m ²
Showers	To accommodate two shifts concurrently	Male: 20 m ² Female: 10 m ²
Changing and locker rooms with showers for external personnel		Male: 40 Female 20
Canteen, recreation room	To accommodate two shifts plus administrative personnel	80 m ²
Prayer rooms	20 male 10 female	Male: 20 m ² Female: 10 m ²
Employer and Employer's Representative rooms	4	2 rooms, 10 and 15m ²
Workshop area and storage facilities	n/a	Workshop: 200 m ² Storage area shall be subject to wear and spare part management of Contractor

5.4.6 Site Infrastructure

1. Site Clearing	<p>a) <u>General</u> This work shall consist of clearing and stripping topsoil in the area designated of approximately 8 hectares. The site clearing requirements shall comply with the "General Specification for Earthworks – GS 4:1999" published by Ministry of Development, Brunei Darussalam.</p> <p>b) <u>Clearing</u> Clearing shall consist of the cutting, removal and disposal of everything above ground level including objects overhanging the areas to be cleared such as tree branches, removal and</p>
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	<p>disposal of surface vegetation, the bases of stumps, roots, the underground parts of structures, and other obstructions to a depth of at least 0.50 metre below ground level.</p> <p>c) <u>Obstructions</u> Any graves and other infrastructure services obstructions can only be removed or relocated or diverted with the approval from all relevant authorities.</p> <p>d) <u>Sellable Trees</u> Special restrictions apply to the felling and disposal of all trees larger than 0.3 metre in diameter, measured from 1.5 metres above ground level, and shall be the property of the Government.</p> <p>The Contractor shall identify all such trees well in advance of the programme for the clearance and shall seek instructions from the Forestry Department, Ministry of Primary Resources and Tourism of Brunei Darussalam as to the handling and disposal. The Contractor shall comply with all the requirement of the Forestry Department.</p> <p>e) <u>Topsoil</u> Stripping topsoil shall consist of the removal of topsoil to an average depth of at least 100mm below ground level, and it is stockpiled within the site for use in the works, and/or disposal.</p> <p>Topsoil to be stockpiled for the works shall be sufficiently fertile to promote and support the growth of vegetation.</p> <p>f) <u>Disposal</u> Unwanted material from site clearing shall be disposed to the location and method approved by relevant authorities.</p>
2. Earthworks	<p>a) <u>General</u> The earthworks scope includes the site preparation, excavation, embankment construction and backfilling activities that cover the area of approximately 8 hectares for the development of the infrastructure. No works can be carried out beyond the allocated site boundaries without prior approval from the relevant authorities. The Contractor shall carry out the earthworks and associated works in relation to the additional space allocation, within the Employer's gazetted land, for switchyard required as part of the power export infrastructure at approximately 50m x 60m in plot size.</p> <p>The earthworks requirements shall comply to the "General Specification for Earthworks – GS 4:1999" published by Ministry of Development, Brunei Darussalam and BS 6031.</p> <p>b) <u>Durability</u></p>

	<p>The earthworks shall be designed to a minimum life of 40 years by taking into consideration the environmental conditions, usage and potential future modification to site.</p> <p>A minimum cross-fall of 2.5% shall be applied to the earthworks platform to facilitate adequate surface drainage and prevent water accumulation.</p> <p>Batters must be design for slope stability. It is recommended that for fill embankment slopes, it should have a minimum of 1.0 vertical to 3.0 horizontal, and for cut slopes it should have a minimum of 1.0 vertical to 2.5 horizontal.</p>
c)	<p><u>Erosion Control</u></p> <p>To prevent erosion, the surface of the batters should be turfed as quickly as possible and this may require temporary protection such as mulching until grass cover is established. Excessive surface water runoff that flow over the batter can be prevented by providing catch drains along the top of the cut batters.</p> <p>All new roads on embankments shall be constructed with roadside/toe drains for erosion control.</p>
d)	<p><u>Sediment Control</u></p> <p>The Contractor shall be responsible for preventing silt from being washed into public drains. Sediment control should be considered during the design and by implementing effective Earth-Control Measures for the construction site to meet the requirements under the applicable Laws and Authorities instructions.</p>
e)	<p><u>Minimum Platform Level</u></p> <p>The minimum platform level shall comply with the “Urban Drainage Design Manual” published by Department of Drainage and Sewerage, Public Works Department, Ministry of Development, Brunei Darussalam.</p> <p>The minimum platform level shall not be lower than the following:</p> <ul style="list-style-type: none"> • 300mm above the adjacent road/ground level. • 600mm above the highest recorded flood level, if any, as advised by JKR, or • other levels as may be specified by JKR.
f)	<p><u>Material for Filling</u></p> <p>Fill material for use in forming embankment shall be the suitable material obtained from excavation in cuttings. Where the quantity of such material is inadequate, the Contractor shall be responsible to obtain suitable materials from his own borrow pits which have been approved by the relevant authorities.</p>

	<p>The Contractor shall pay all necessary fees, taxes or royalties to the appropriate authorities and regulations.</p> <p>g) <u>Construction Requirements</u> All materials used in the embankment and as fill elsewhere shall be compacted as soon as practicable after being placed and spread.</p> <p>The degree of compaction of the top 1m of the embankment shall be compacted to not less than 95% of the maximum dry density and platform below the top 1m shall be compacted to not be less than 90% determined in accordance with BS1377.</p> <p>h) <u>Settlement</u> Platform level settlement shall not exceed 50mm at the end of the Defect Notification Period.</p>
3. Road Pavement	<p>a) <u>General</u> The scope of this work shall consist of the design and construction of internal road pavement within the development site and the access link road from the existing road to the development site of the WTE Plant.</p> <p>The requirements for the road pavement shall comply with the "General Specification for Flexible Pavement – GS1:1998" and the "General Specification for Road Reinforced Concrete – GS6:1999" published by Ministry of Development, Brunei Darussalam.</p> <p>b) <u>Type of Pavement</u> There are two (2) types of road pavements that may be adopted for this development. The flexible pavement shall be asphaltic road and the rigid pavement shall be reinforced concrete road.</p> <p>The design of the road pavement structure shall comply with the "AASHTO Guide for Design of Pavement Structures" published by the American Association of State Highway and Transportation Officials.</p> <p>c) <u>Estimation of Traffic for Pavement Design</u> The information to estimate the traffic and the growth for the design purposes of the pavement can be obtained from the data of the estimated waste generated from the year 2022 to year 2050 available from JASTRe. The Contractor's Qualified Person shall obtain the present vehicles used from JASTRe, and to presume the type of vehicles to be used in the future, for the transportation of the generated waste to the site of the proposed WTE Plant in his calculation for estimation of the equivalent single axle loads.</p>

	<p>d) <u>Design Life of Pavement</u> The road pavement shall be designed for a minimum life of 25 years before a terminal pavement condition at which partial reconstruction or a major overlay would be necessary to extend the life of the pavement.</p> <p>e) <u>Road Safety Features</u> The safety features on the roadways and at intersections shall be placed to keep users safe and control the flow of traffic in accordance to the requirements by Department of Roads, PWD.</p> <p>In addition to the standard pavement markings, road signs that relay information such as speed limits, upcoming intersections, and other directions to drivers should be strategically placed to keep them safe.</p>
4. Carriageways, Traffic Areas and Sidewalks	<p>Carriageways, roads and traffic areas shall be designed to accommodate the Contractor's mobile plant and vehicles, as well as the waste delivery vehicles approved to deliver the contractual waste.</p> <p>Besides waste delivery vehicles, private, commercial and industrial deliverers may be permitted to deliver waste via the main access route towards the WTE facility as per Contractor's discretion.</p> <p>The vehicle type and design of the vehicle discharge arrangements may change over the contract period and therefore the facility shall be flexible and capable of accepting a wide range of vehicles.</p> <p>Vehicle access and routing shall be designed to allow the vehicle turnaround times without any congestion on the site.</p> <p>The traffic areas shall be designed to facilitate safe, convenient routes separating transportation groups as far as practical. Attention shall be given to the provision of clear and well-defined routes for emergency vehicles (including, without limitation, recovery/maintenance for broken down vehicles), fire, police, and ambulance and daily site service vehicles to the Facility. In particular, but without limitation, the Contractor shall provide that:</p> <ul style="list-style-type: none"> ▪ Operational and non-operational traffic has separate circulation routes; ▪ Artificial illumination meets the requirements of the CIBSE Lighting Guide; and there is adequate illuminated signage, which indicates access to and exit from the Site and/or Facility. <p>The Contractor shall provide and maintain one access to the Site from the external road network i.e. from the current landfill site to the WTE plant. The Contractor shall also provide and maintain road connectivity to the switch yard outside of the WTE plant.</p> <p>Sidewalks to be separated from vehicle circulation areas using kerbs or painted markings on the pavement.</p> <p>Assembly areas for emergency evacuation to be clearly delineated on pavement and/or signage.</p>

<p>5. Drainage Works and De-watering System</p>	<p>The Contractor shall be responsible for the design and construction of a drainage system that shall be able to cope with the predicted intense rainfall events and storm surges as per Chapter 5.4.2.2 and 5.4.2.3 in order to protect the equipment and facilitate smooth operation of the Works in such events.</p> <p>Subject to the design considerations of the Contractor and their implications on the Site lay-out, the Contractor shall choose appropriate run-off coefficients for storm and rainwater management that shall be included with the design submissions.</p> <p>In preparing the design of the drainage system for the entire Site, the Contractor shall:</p> <ul style="list-style-type: none"> • Undertake such inspections and tests as are necessary with respect to water elevations, water flow, water generation, absorption, storage and drainage on, in, under and surrounding the planned Site; • Plan and design the surface drainage system with adequate water drainage channels, pipes, sewers, structures and appurtenances, adequate to manage the highest seasonal levels and volumes of storm water in accordance with the applicable environmental standards; • Design the surface water management system for [1 in 50] year return period flows at the periphery of the Site to facilitate run off management; • Plan and design the Site with adequate protection from flooding whether from rain, groundwater, storms or any other source; • Design the system to ensure that there is no contamination of groundwater or surface water; • Consider the drainage of any part of the Site that is necessary due to the handling of water, chemicals or liquids that shall be collected and, if need be, treated. <p>Areas that are used for washing vehicles or other components or the workshop shall be provided with oil and grease separators.</p> <p>a) General The scope of this work shall consist of the design and construction of surface drains, subsoil drains, culverts, sumps and other drainage structures.</p> <p>The drainage requirements shall comply to the "General Specification for Drainage Works – GS 4:1999" and the "Urban Drainage Design Manual" published by Ministry of Development, Brunei Darussalam.</p> <p>b) Sustainable Drainage System Sustainable drainage system shall be incorporated when designing the internal drainage system of the development. This is to assist in reducing the possibility of the flooding problem caused by the increasing of runoff due to this new development. The Contractor shall consider looking into managing the stormwater locally, to mimic natural drainage and encourage its infiltration, attenuation and passive treatment.</p>
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c) Existing Drains

No existing drain shall be interfered with or altered without the approval from Department of Drainage and Sewerage, Public Works Department, Ministry of Development, Brunei Darussalam (DDS, PWD).

However, pursuant to a development proposal, the Contractor may be required to improve and repair the damaged existing drain such as the outlet drain, the entrance culvert and the roadside/open drains.

Where the runoff from the development site is discharged into the existing downstream drain of the adjacent premises, the Contractor's designer (Qualified Person) will need to demonstrate to the DDS, PWD that the existing downstream drain is capable to cope with the runoff discharge from the development site. The Contractor shall be required to upgrade the existing downstream drain to the required size as determined by DDS, PWD if it is not sufficient.

d) Drainage Discharge Outlets

There are two (2) drainage discharge points identified where the proposed drainage outlet from the development may discharge into the existing drainage system of the adjacent premises.

Proposed drainage discharge outlet point No. 1 is the existing heavily silted 100 metres x 50 metres silt retention pond, and drainage discharge outlet point No. 2 is the silted 2 metres x 2 metres reinforced concrete box culvert.

The location of these discharge points is shown in Drawing No. DR/LP/01 and is enclosed in the Appendix 1 – Drawings appended herewith the Employer's Requirements.

e) De-silting of Existing Drainage System

The Contractor shall be required to de-silt and repair any damage drains/culverts where the proposed runoff from the development is discharged into the discharge outlet point No. 2 into the existing drainage system within the JASTRe's site boundary as shown in Drawing No. DR/LP/01 enclosed in the Appendix.

The de-silting of the silt retention pond at discharge outlet point No. 1 and its downstream drainage system shall be carried out by Department of Drainage and Sewerage, Public Works Department.

f) Estimation of Flood Runoff

	<p>The estimation of the total quantity of water flowing from the catchment during the period of the flood for the small catchment areas of this development, empirical methods such as the Rational Method may be adopted for estimating reasonable realistic hypothetical floods.</p> <p>g) Rainfall Intensity In determining the rainfall intensity for the design of the drainage system, the available intensity duration frequency (IDF) curve and the rainfall temporal patterns for Ukong in the Urban Drainage Design Manual by the Department of Drainage and Sewerage – PWD shall be adopted.</p> <p>h) Runoff Coefficient The runoff coefficient C values for rainfall intensities recommended in the Urban Drainage Design Manual by the Department of Drainage and Sewerage – PWD may be adopted.</p> <p>i) Design Criteria All drainage components in this development shall be designed to an initial storm of 5 year flood and for a major storm of 50 year flood. Reinforced concrete open channels shall form the basis of the drainage system for this development. All open channels shall be with a freeboard of at least 0.15 times the depth when designed to initial storm of 5 year flood event and checked for 50 year flood to ensure that no existing property is flooded. Reinforced concrete box culverts or pipe culverts shall be utilized for access/road crossing and shall be designed to fulfill two (2) conditions. The culverts shall firstly be designed for the initial storm of 5 year flood considering the culverts without surcharge or routing. Then the culvert is checked for major storm of 50 year flood, taking into account allowance for surcharge and routing attenuation. The surcharge water level for this condition should not extend to the edge of the road, with no upstream property allowed to be flooded.</p> <p>j) <u>Safety Railings</u> Safety railings shall be provided for all open drains more than 1.0 metre deep.</p>
6. Domestic and Firefighting Water Supply	<p>a) General The scope of this work shall consist of the design and construction of external water reticulation system for domestic usage</p>

	<p>and external fire fighting network outside and within the development site, to be used for the operation of the WTE Plant.</p> <p>The works shall comply with the “Design Manual for Water Supply Distribution Networks” and the latest requirements by Department of Water Services, Public Works Department, Ministry of Development, Brunei Darussalam and other relevant Authorities.</p>
b)	<p>Potable Water Source</p> <p>The source for the main feeder pipe supplying potable water for the domestic usage and external fire fighting within the development shall be tapped from either the existing 180mm or 225mm diameter distribution pipes along Jalan Telisai–Lumut. The Contractor’s designer (Qualified Person) will need to obtain the necessary information and approval from Department of Water Services, Public Works Department for the design of the portable water reticulation system for this development.</p>
	<p>Any proposed water pipe crossing the existing main road at Jalan Telisai–Lumut for tapping into the existing water distribution line should be pipe jacked through as no open cut method on the existing road to lay the water pipe will be allowed.</p>
c)	<p>Potable Water Demand</p> <p>The Contractor will estimate the daily water demand for the domestic usage and the requirements set out for the external fire fighting network as stated in Section 6.0 – External Fire Fighting.</p>
	<p>Furthermore, the Contractor will also need to consider the water demand required for the internal fire fighting system within building. This water storage capacity is not included in the external fire fighting tank.</p>
d)	<p>Potable Water Storage</p> <p>The potable water is assumed to be stored at two (2) locations. It can be expected that the existing pressure head at the main distribution pipe for the portable water is not sufficient to deliver the water demand up to the development site at higher ground. As such, the water storage at the lower ground level is proposed as the transfer tank for the potable water to deliver to the water tanks at higher ground level within the development site for fire fighting and the daily domestic usage.</p>
	<p>The water from the low level tanks is to be supplied to the high level tanks by means of a pumping system. The proposed transfer tank and the pump house shall be located within the marked area adjacent to the existing transfer tank and the pump house for the JASTRe waste disposal site as shown in Drawing No.</p>

	<p>WS/LP/01 enclosed in the Appendix 1B – Proposed external water supply corridor (potable and firewater) appended herewith these Employer's Requirements.</p> <p>The storage capacity of this transfer tank and the domestic tank shall be proposed by the Contractor's designer (Qualified Person), and should take into account of possible irregular pressure head at the tap-off location and disruption of water supply in near future. The storage capacity for the domestic tank shall be sized for 24 hours.</p> <p>The transfer tank at the low level ground and the daily domestic tank at the development site shall be pressed stainless steel with water level indicator to show the amount of water available. The external surface of the tank should clearly indicate the type of water tank.</p>
e)	<p>Potable Water Pumping System</p> <p>Pumps shall be provided at the vicinity of the low level transfer tank to draw the portable water to the high level fire fighting tank and the domestic tank. The possible route of the pumping main is indicated in Drawing No. WS/LP/01.</p> <p>Two sets of pumps, one on duty and the other on standby, shall be provided. The pump capacity shall be sized by the Contractor's Qualified Person to deliver a sufficient water flowrate to the fire fighting and domestic water storage.</p> <p>The pumpsets shall be operated by electricity, and in the event there is disruption of electrical supply, the hydrant pumpset shall be supplied with power from the emergency generator driven by diesel engine. All electrical cabling supplying power to the pumps shall be of fire rated type.</p> <p>The pumpsets shall be housed in a pump room adjacent to the proposed transfer tank for protection from weather, and elevated to a level not likely to be flooded. This location is indicated in Drawing no, WS/LP/01. Pump room should be ventilated by natural or mechanical means and provided with the necessary signages.</p> <p>Another similar set of pumps shall be located at the higher level for the domestic tank to deliver the portable water into the building for the daily domestic usage. These pumps may be housed together with the proposed hydrant pumps.</p>
f)	<p>Potable Water Pipeline Design</p> <p>The main feeder pipe from the tap-off source to the transfer tank shall be MDPE pipe of PN10. The pumping main and all</p>

	<p>exposed water pipes are to be ductile iron pipe complying to BS 4772 & BS EN598 and should be laid along the road shoulder.</p> <p>The ductile iron pipes, fittings and specials are to be of the following class designation: Pipes= K9; Fittings= K12; Tee= K14; Flange= KPN16. The bolts, nuts and washers for flange joints and fitting shall be stainless steel of grade 316. The ductile iron pipes and accessories shall be designed to withstand hydraulic working pressure of PN16</p> <p>The internal coating for the ductile iron pipes and fittings shall have a minimum 5mm thick cement mortar lining and the external coating shall be zinc coating and a finishing coating of bituminous material to minimum 70µm. Sluice valve (gate valve) shall comply to BS 5163-1986 with the pressure rating of PN16.</p> <p>g) <u>Potable Water Pipeline Testing</u> The field hydrostatic test pressure for ductile iron pipe and fitting shall be carried out to 150 psi. The water pressure testing and sterilization of the pipe are to be carried out prior to any connection to the existing water pipe. Connection to the existing water pipe will need the approval from Department of Water Services, Public Works Department.</p>
7. External Fire Fighting	<p>a) <u>General</u> The scope of this work shall consist of the design and construction of external fire fighting within the development site of the WTE Plant.</p> <p>The external fire fighting works shall comply with NFPA standards and the latest requirements and guidelines set up by the Fire and Rescue Department in Brunei Darussalam.</p> <p>b) <u>Hydrant</u> Hydrants of approved type should be located at not more than 30m away from the breeching inlet for the building and should not less than 6m from more than one storey building. Hydrants capable of withstanding a load of 26 tonnes from the fire brigade vehicles are generally spaced at not more than 60m interval along the access road and with one hydrant at the end of each cul-de-sac. Hydrants must be placed at strategic locations where it can fight fire from all sides of the building.</p> <p>Hydrant outlets are of twin outlets pillar type with instantaneous coupling and an underground sluice valve. In the pressurized pipe network, the hydrants should be capable of providing 1000 l/min of water at a minimum running pressure of 4 bars but not exceeding 7 bars. The 1000 l/min is based on each 65mm</p>

	<p>diameter outlet of a double outlet pillar hydrant discharging 500 l/min from each outlet simultaneously.</p> <p>Hydrant main with minimum 100mm diameter are laid underground and is of cement lined ductile iron pipe.</p> <p>c) <u>Hydrant Storage Tank</u> The external fire fighting storage tank shall be sized for a minimum effective capacity of 135,000 litres and should be refilled automatically from a water supply pipe capable of providing a minimum flowrate 1,200 l/min. For hydrant pumps larger than 3000 l/min, the makeup water flowrate should be such that together with the water stored, the hydrant pump will be able to operate for 1 hour. A 4-way breeching inlet shall also be provided to enable the fire brigade to help refill the tank.</p> <p>The hydrant storage tank shall be separated from the other water storage tanks but may be combined with water storage tanks for other fire fighting system.</p> <p>The storage tank shall be pressed stainless steel with water level indicator to show the amount of water available. The external surface of the tank should clearly indicate that this is a fire tank.</p> <p>d) <u>Hydrant Pumps</u> The hydrant pumps draw water from the fire water storage tank and two sets of pumps, one on duty and the other on standby, shall be provided. The pump capacity shall be sized to deliver a flowrate of 3000 l/min at a running pressure of not less than 4 bars for any three (3) hydrants outlets operating at the same time. This flowrate will have to be increased if the number of outlets to be operating at the same time is more than three.</p> <p>The hydrant pumpsets shall be operated by electricity, and in the event there is disruption of electrical supply, the hydrant pumpset shall be supplied with power from the emergency generator driven by diesel engine. The diesel engine emergency generator shall be capable of operating continuously for at least 2 hours at full load operation. All electrical cabling supplying power to the hydrant pumps shall be of fire rated type.</p> <p>In addition to the duty and standby pumpsets, a jockey pump shall be provided to maintain system pressure and avoiding to startup the duty pump to maintain system pressure. Jockey pump is of electric motor driven with the capacity of around 120 l/min.</p> <p>The hydrant pumpsets shall be housed in pump room together with the domestic water supply pumpset to protect from the weather, and away from location likely to be flooded. Pump</p>
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	<p>room should be ventilated by natural or mechanical means and provided with the necessary signage.</p> <p>e) <u>Pump Starter Panels and Controls</u> Pump starter panel should be completed with indicator lights, and ventilation slots provided with insect screen to prevent entry of vermin.</p> <p>Hydrant pumps shall start automatically upon actuation of the pressure switches but should only be stopped manually. Usually three (3) pressure switches are provided with the following suggested pressure settings:</p> <ul style="list-style-type: none"> • starting of the duty pumpset set at 80% of the system pressure; • starting of standby pumpset when the system pressure drop to 60%; and • starting and stopping the jockey pumpset at 90% and 110% of the system pressure respectively. <p>The pressure switches shall be installed in the test and drain line on the pump discharge side. The pressure settings should be clearly labeled on tags attached to each pressure switch.</p> <p>f) <u>Firefighting Water and Emergency Water Retention</u></p> <p>The Contractor shall design and construct a sufficiently sized storage system for the retention of potentially contaminated fire-fighting water after fire incidents and water that due to emergency situations has to be stored temporarily. All necessary piping, pumps, dosing and instrumentation and monitoring equipment shall be provided to dispose of fire-fighting water via the thermal system if contamination does not allow a discharge via the wastewater treatment plant.</p>
8. External Domestic Sewerage Reticulation System	<p>a) <u>General</u> The scope of this work shall consist of the design and construction of external domestic sewerage works within the development site of the WTE Plant</p> <p>The requirements for the sewerage works shall comply with the “Design Manual and Guideline for Sewerage” from Department of Drainage and Sewerage, Public Works Department, Ministry of Development, Brunei Darussalam</p> <p>b) <u>Equivalent Population</u> The minimum population discharging the domestic wastewater sewer shall be 60 persons.</p>

	<p>c) <u>Domestic Wastewater Treatment</u> The domestic wastewater effluent shall be treated within the development site. Due to low population, and to cover the surges in flow, a two compartment septic tank shall be used. The effluent shall then be discharged into the open drain within the development.</p> <p>The average effluent characteristics commonly adopted by the Department of Drainage and Sewerage, Public Works Department shall be as follow.</p> <table> <tbody> <tr> <td>Dry weather wastewater generation rate</td><td>350 l/EP per day</td></tr> <tr> <td>Unit BOD5 contribution</td><td>60 g/EP per day</td></tr> <tr> <td>Unit Suspended Solids (SS)</td><td>70 g/EP per day</td></tr> <tr> <td>Wastewater BOD5 concentration</td><td>170 mg/l</td></tr> <tr> <td>Wastewater SS concentration</td><td>200 mg/l</td></tr> </tbody> </table> <p>d) <u>Criteria for Gravity Sewer</u> Gravity sewer pipe network shall be designed to maintain minimum scouring velocities at the average dry weather flow in order to avoid the settlement of solids. To ensure that the sewage deposits are removed from the pipe invert at least once during each day, peak dry weather flow velocities should not be less than 0.8 m/s. The maximum flow velocity of 3.0 m/s shall be adopted to prevent erosion inside the pipe.</p> <p>All gravity sewer pipes shall use vitrified clay pipe to BS EN 295 as approved by the Department of Drainage and Sewerage, Public Works Department, and shall not be less than 150mm in diameter.</p> <p>Manholes shall be provided as an access point for maintenance and inspection operation and connection of lateral sewers. The recommended maximum spacing for manholes with 150mm diameter sewer pipe is 40 metres.</p>	Dry weather wastewater generation rate	350 l/EP per day	Unit BOD5 contribution	60 g/EP per day	Unit Suspended Solids (SS)	70 g/EP per day	Wastewater BOD5 concentration	170 mg/l	Wastewater SS concentration	200 mg/l
Dry weather wastewater generation rate	350 l/EP per day										
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Unit Suspended Solids (SS)	70 g/EP per day										
Wastewater BOD5 concentration	170 mg/l										
Wastewater SS concentration	200 mg/l										
9. Wastewater Treatment Plant	Wastewater shall be collected via the wastewater drainage system and shall be treated in an appropriately designed and sufficiently sized wastewater treatment plant. The effluent from that treatment shall be discharged at the location as defined in the EIA. The discharge standards as per regulatory requirements shall be met any time.										
10. Leachate Treatment Plant	Leachate derived from the waste shall be collected and treated at the Leachate Treatment Plant which shall be sufficiently sized.										
11. Raw Water Intake, Reticulation and storage	<p>a) The Department of Drainage and Sewerage and Department of Water Services of the Ministry of Development has identified two locations as source for raw water intake for the use in the WTE Plant. Please refer to Appendix 4C – Proposed raw water intake location appended herewith these Employer's Requirements. By providing this information, Employer does not provide any</p>										

	<p>guarantee or assurance that the above sources identified are suitable and sufficient for the WTE Plant requirements. All such review, research, study related to ensuring the suitability and sufficiency of the source identified shall rest with the Contractor. There shall not be any claims (including, but not limited to, time and cost) against the Contract in the event the above identified sources are not suitable and/or sufficient. In such event, the Contractor shall be responsible to provide its alternative source at its own cost within the Contract.</p> <ul style="list-style-type: none"> b) The identified supply of the raw water source for the operation of WTE Plant shall be either from Sungai Danau or Sungai Pepakan. The Contractor's designer (Qualified Person) will need to carry out the feasibility study and to address any possible negative impacts on the surrounding area such as impact to the surrounding environment and potential changes to the ecosystem all to the satisfaction of the relevant Authorities. c) The study shall also include, but not limited to, the sufficiency of the raw water supply, the proposed location where the water source can be drawn out and the surrounding treatment of the river bank/bed, proposed treatment of the raw water, if any, and the proposed route of the pipe that delivers the raw water to the WTE Plant. d) The Contractor's Qualified Person shall liaise with the Land Department and/or relevant Authorities for any applications/approvals for land acquisitions, either from the government or private land owners, that is affected by the proposed pipeline route. The time and cost incurred in the applications/approvals of any land acquisitions shall be included in the Contractor's tender. e) The raw water reticulation system proposed by the Contractor shall be reliable and efficient. The quantity of the raw water supply and the storage for the operation of the WTE Plant shall be based on the table shown below. The storage of the raw water supply for the operation of the plant will be within the site development area, and should have sufficient capacity for uninterrupted operation of the plant. f) The Contractor shall include any water pre-treatment system and pumping system with redundancy required to maintain the water pressure for the long distance reticulation of the raw water to the WTE Plant from the source. The identification of suitable location(s) of the pre-treatment and pump room(s) near to the tapping source and/or along the route, associated land and other infrastructure (including but not limited to power, telecom, CCTV for remote security monitoring etc) and associated approvals from relevant authorities shall be the obligations of the Contractor under this Contract.
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	<p>g) The Contractor shall include any treatment plant / system for the raw water necessary to achieve the required water quality of the raw water obtained from the source for the usage in the WTE Plant. The acceptable level of water quality for the use in the WTE Plant shall be defined by the Contractor, including necessary pre-treatment at the intake location prior to transporting the raw water to the WTE.</p> <p>h) The Contractor shall design and construct a storage tank for the raw water at the WTE plant with a minimum capacity of 24 hours of operations of the WTE.</p> <p>i) The Contractor shall be responsible to maintain the water supply system in its entirety including all the sub-systems such as pumping system, treatment plant / system, water storage tank designed and constructed by the Contractor.</p>
12. Perimeter fencing and internal fencing for segregation of hazardous and non-hazardous area access	<p>a) General Requirement</p> <p>The Contractor shall design, supply, install, and maintain perimeter and internal fencing systems to secure the Site and segregate hazardous and non-hazardous areas in accordance with applicable laws, international safety standards, and the Contractor's Health, Safety and Environmental Policy requirements.</p> <p>b) Perimeter Fencing</p> <p>Scope and Purpose</p> <p>The entire Project Site shall be enclosed with a secure, tamper-resistant perimeter fence to prevent unauthorized access and to protect plant assets and personnel.</p> <p>The fencing shall act as the primary physical barrier for site security during both construction and operation phases.</p> <p>Minimum Specifications</p> <p>Fence height shall not be less than 2.4 meters unless otherwise approved by the Employer or mandated by local regulation.</p> <p>The fence shall be constructed from durable, corrosion-resistant materials suitable for the Site's environmental conditions (e.g., coastal, industrial, or high-wind zones).</p> <p>The fencing shall include:</p> <ul style="list-style-type: none"> • Access-controlled vehicle and pedestrian gates • Emergency exit gates clearly marked and unobstructed • Appropriate security lighting and surveillance infrastructure (e.g., CCTV posts, if specified) <p>Interface with Security System</p> <p>The fencing system shall integrate with the Site's security and access control system such as CCTV monitoring, gate / barrier</p>

	<p>access system (as applicable), including provisions for patrols, alarm triggers, and surveillance coverage.</p> <p>c) Internal Fencing for Hazard Segregation</p> <p>Purpose and Layout</p> <p>Internal fencing shall be installed to physically segregate high-risk or hazardous areas (e.g., waste bunker, incineration hall, chemical storage zones, high-voltage installations) from general access and non-hazardous zones.</p> <p>The layout and extent shall be based on the Contractor's risk assessment and approved by the Employer as part of the HSE plan.</p> <p>d) Access Control and Signage</p> <p>Internal fences shall include lockable gates with restricted access for authorized personnel only, with physical or electronic access control systems as appropriate.</p> <p>Hazard warning signs, safety notices, and restricted access indications shall be prominently displayed in accordance with applicable safety standards and in local and English languages.</p> <p>e) Construction Requirements</p> <p>Internal fencing shall be of robust construction, minimum 1.8 meters in height (unless otherwise specified), and resistant to damage from operational activities or environmental factors.</p> <p>Where chemical or explosive hazards exist, fencing materials shall be non-sparking and chemically resistant.</p> <p>f) Maintenance and Inspection</p> <p>All fencing systems shall be regularly inspected and maintained in good condition by the Contractor during the Works and the Operation Service Period.</p> <p>Damaged or compromised fencing or gates shall be repaired or replaced immediately to maintain the integrity of site safety and security.</p> <p>g) Compliance</p> <p>All fencing works shall comply with:</p> <ul style="list-style-type: none"> a) Applicable security and occupational safety laws and regulations of Brunei Darussalam b) International best practices for industrial plant security and safety c) Contractor's Security Plan and HSSE Requirements
13. Others	<p>The Contractor shall carry out all associated architectural, civil & structural works related to the Mechanical & Electrical Works.</p> <p>This shall include, but not limited to,</p> <ul style="list-style-type: none"> a) any retaining walls and or other soil erosion control / protection measures for the slim overhead poles as per authorities' requirements;

	<ul style="list-style-type: none"> b) all associated works related to WTE plant sub-station; c) all associated works related to Main-Intake Substation; d) all associated works related to fenced-off transition switch yard; e) suitable access roads must be provided for cranes and crew trucks to facilitate maintenance of slimpoles and overhead lines;
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5.4.7 Building Services

1. General	<p>The following building services shall be provided to all Site areas as needed:</p> <ul style="list-style-type: none"> a) LV distribution (MSB, SSB & DB's with surge protection devices); b) LED Lighting; c) Communication, telephone and computer networks (ICT); d) Elevators / Scissors Lift; e) Fire Protection (Fire detection, alarm and suppression systems, Fire Hose Reel, Fire Sprinkler System, Fire Hydrants); f) Mechanical Ventilation and air conditioning; g) Grounding and Lightning protection; h) Plumbing and sanitary installations; i) CCTV system; j) Access control, security and alarm systems; k) Acoustics and sound insulation; l) Loose and fixed furnitures. <p>With respect to the electrical installation, the Contractor shall liaise with DES to get all necessary approvals and consents to install and operate the equipment and electrically driven components.</p> <p>All installations shall be tested and commissioned according to the Contractor's program within the Tests on Completion of Design-Build.</p>
2. LV Distribution	<p>The Contractor shall supply power via separate LV switchboards for every detached building. Every floor of the administration block shall be equipped with a LV distribution board to avoid failures to cause other floors to be affected.</p> <p>Wherever appropriate, the Contractor shall install industrial type sufficiently rated 400V/230 V AC sockets meeting BS EN 60309 to operate tools and other equipment. Protection classes of the sockets shall be IP65 in outdoor applications and IP44 for indoor applications where no dust ingress is foreseen. In the event dust ingress or water attack is likely, higher protection classes shall be considered.</p> <p>Indoor distribution boards shall be of protection class IP55 within the process area and of IP31 within dry and dust free rooms. Outdoor distribution boards shall be located sufficiently high to avoid seawater and water attack but shall be nevertheless of IP65.</p>
3. Lighting	Indoor lighting services and illumination levels shall be in line with the minimum recommendations as per CIBSE code for the

	<p>appropriate Site area and operational function. A lighting simulation report shall be submitted prior for approval of design.</p> <p>The illumination level shall not be below the level that is necessary to perform work or other essential activity in any particular location of the Site.</p> <p>Emergency lighting luminaires shall be of the self-contained type complying with BS 4533. The duration of emergency lighting luminaires shall be maintained at least 4 hours after main supply failure.</p> <p>Wherever appropriate and feasible, the Contractor shall use energy saving lighting (mainly LED).</p> <p>Sufficient outdoor lighting of roads, walkways and parking areas shall be provided to ensure the safety and security of the operation of the Site, the safe movement of people and vehicles. The exterior of the buildings shall be provided with lights for safe night operations.</p> <p>Exterior illumination intensity shall be reconciled with the airport authorities to prevent any interference with air traffic and by providing aircraft warning lights in compliance to Department of Civil Aviation requirements and obtain approvals.</p> <p>Outdoor lighting installation shall be of IP 65 as long as seawater attack can be prevented.</p>
4. CIT System	Telephone, communication and computer networks shall be installed wherever needed to allow internal and external communications, operations and high-speed data exchange (for example via Gigabyte Ethernet) to meet the operational requirements of the components interlinked.
5. Elevators	<p>The Contractor shall provide and install:</p> <ul style="list-style-type: none"> a) At least one elevator that runs to all floors/platforms within the machinery boiler hall and that allows access to all floors within the administration block capable to transport 1,000 kg at least. b) Elevators shall have appropriate finishing according to their intended use and shall meet all safety requirements. The emergency call shall be, amongst others, forwarded to the central control room. c) To include scissors lift if required for maintenance purposes
1. Fire Protection (Fire Detection, Alarm and Suppression, Fire Hose Reel, Sprinkler System, Fire Hydrants)	<p>The Contractor shall be responsible for the design, supply and installation of fire protection (fire detection, alarm and suppression systems, fire hose reel, sprinkler system, fire hydrants) that meet both its insurer's requirements, NFPA requirements, and those of the Fire Rescue Service of Brunei (FRS) whichever is more stringent. The Contractor shall liaise with FRS on the approval scheme, timeline and all submissions to be provided in the course of the approval of the fire service installations.</p> <p>Fire service installations shall include, but are not limited to, fire hydrants, fire monitors, sprinkler systems, fire extinguishers, fire</p>

	<p>detection equipment, fire alarm panels, alarm sirens, fire alarm system etc.</p> <p>The Contractor shall provide fire services installations for the entire Site wherever needed. Particular considerations shall be applied to the fire detection, alarm and suppression equipment within the WTE facility and its hereto attached civil structures, and wherever flammable materials are handled or stored, such as, but not limited to, waste, waste oil, auxiliary fuel, diesel etc.</p> <p>Firefighting water shall be of required water quality and shall be stored in a sufficient amount for all fire hydrants and firefighting and suppression systems (pumps, cannons, sprinkler, hose reels etc.). Rainwater shall be collected for firefighting purposes. The firefighting water storage is set by FRS but nevertheless shall be assessed by the Contractor.</p> <p>The Contractor shall be responsible for the direct link of the facility's fire alarm system to the FRS fire alarm reception desk.</p> <p>The following firefighting equipment, detection equipment and alarm notifications shall be provided and incorporated into the bunkers and tipping areas:</p> <ul style="list-style-type: none"> a) Pan-tilt fire monitors shall be provided to cover the entire bunker area. Each fire monitor shall be capable of delivering not less than 200 litres per second at 6 bar or as per requirement of FRS whichever is more stringent; b) A stationary sprinkler system shall be installed to protect the structural integrity of the roof over the bunker and the tipping hall in the event of a fire. The design of the sprinkler system shall be in accordance with BS 9990 or the requirements of FRS whichever is more stringent; c) An automatic fire detection system for preventive recognition of glowing fires and smouldering waste shall be provided including infrared fire detection cameras that are installed robustly, offer a high thermal imaging resolution with autofocus, refresh rates > 30 s⁻¹ and that are highly accurate (+/-2°C) within the operating temperature range (up to 350°C at least). Fire detection cameras shall be of IP67 protection class. d) All bunker fire alarm alerts and fire monitor control functions shall be provided at the crane control room, complete with visual and audible alarm notification and fire monitors remote control. Fire alarm alerts shall be also made available in the central control room and shall be recorded by the DCS. <p>The fire service installations shall be supplied by the emergency power supply system.</p> <p>The Contractor's fire safety assessment, fire alarm and fire detection and suppression system shall be forwarded to the Employer's Representative as part of the design documentation.</p>
2. Mechanical Ventilation and Air Conditioning	<p>Air leakage rates shall comply with Building Regulations.</p> <p>Mechanical Ventilation rates shall be calculated according to CIBSE and BRE guidance.</p>

	<p>Ventilation to appliances shall be provided where such ventilation is necessary to allow their normal and safe operation. The mechanical ventilation and air conditioning (ACMV) systems shall be logically designed for an efficient operation.</p> <p>Where grilles or diffusers are used within rooms the Contractor shall ensure they are:</p> <ul style="list-style-type: none"> • arranged to avoid draughts; and • designed to minimize noise intrusion into the space. <p>The design of ACMV systems for the offices and social rooms shall minimize odour nuisance from the rest of the Site.</p> <p>Mechanical Ventilation and air conditioning systems shall be in line with the climatic conditions of the Site to facilitate a healthy working environment for the Contractor's and Employer's Personnel, and third-party sub-contractors and visitors.</p> <p>The Contractor shall install mechanical ventilation systems at indoor areas of the Site to ensure a safe and healthy working environment for the operators and workers. Mechanical ventilation of any room or compartment shall facilitate a sufficient air exchange rate without generating nuisance to the staff working in the compartment.</p> <p>The Contractor shall liaise with FRS to reconcile the automatic override requirement of the ventilation and air conditioning systems control in the event of a fire incident.</p>
3. Grounding and Lightning Protection	All electronic equipment and installations shall be protected against lightning and electrical surge as per chapter 5.4.4.
4. Plumbing and Sanitary Installations	<p>The plumbing and sanitary installations for the water supply and wastewater shall comply with the national building codes of Brunei. Fixtures shall be of a water saving design.</p> <p>The Contractor shall provide a water supply system wherever needed but shall at least meet the following minimum requirements:</p> <ul style="list-style-type: none"> a) A potable water supply system shall be installed in the admin block, in the central control room, in the laboratory, in the maintenance workshop and in the leachate treatment plant compartment. Potable water shall be supplied by either the internal desalination plant or by external supply. b) Eye wash fixtures and emergency showers shall be supplied with potable water wherever the Contractor deems these necessary, for example, but not limited to areas where chemicals, supplies and dust (e.g. APC residues, absorbent) are handled. c) Subject to the design of the Contractor, flushing water for toilets shall be provided either from collected non contaminated rainwater which may be complemented by water from the desalination plant. <p>All drains and sinks shall be connected to the sewer system within the Site that shall be connected to the wastewater treatment plant.</p>

	No rainwater shall be collected via the Site's sewer system but by the drainage system.
5. CCTV System	<p>The Contractor shall design and install a CCTV system for monitoring and surveillance of the operations in the following areas:</p> <p><u>Process related locations:</u></p> <ul style="list-style-type: none"> a) Weighbridge and access ramp to the tipping hall; b) Tipping hall, bunker and feeding hoppers; c) Combustion chambers/grates; d) Bottom ash bunker and subsequent conveying system and processing; e) Fly ash unloading area; f) Residues landfill. <p><u>Other strategic areas:</u></p> <ul style="list-style-type: none"> a) All access gates and revolving doors; b) Surveillance points at regular intervals along the perimeter and hazardous area fencing without any blind spots unless covered by the locations above. <p>All process related CCTV cameras shall be designed to meet the process requirements and shall be colour CCD high-definition cameras having a resolution of 1080p or higher, auto focus, low and zero light capability.</p> <p>Cameras shall be of IP65 protection class. Outdoor cameras shall meet the conditions of the corrosive marine environment.</p> <p>Wherever necessary they shall be of a pan-tilt design and shall be equipped with an appropriate lens cleaning system and shall be appropriately protected against the process environment and any hereto relating potential damages.</p> <p>All images from the CCTV system shall be visible in the central control room. An appropriately sized storage system for HD images shall be provided.</p> <p>In the event of a power failure the CCTV system shall be supplied by the UPS system.</p> <p>The CCTV system shall be complete with its database and storage servers. The servers shall be able to store for a minimum of six (6) months data without having to archive. The Contractor shall have proper data archive, storage and protection policies in place for the facility. A minimum of past two (2) years data shall be archived, preserved, maintained and handed over to the Employer at the end of the Contract Period.</p> <p>The CCTV system shall be provided with visual panels and control access at the following areas:</p> <ul style="list-style-type: none"> a) Central Control Room b) Guard House(s)

	The CCTV system servers shall be located in the Server Room.
6. Access Control System and Security System	<p>An appropriate access control system shall be provided and installed for the entire Site and, subject to the design considerations of the Contractor, to the administration building and the machinery hall. The access control system shall include a smart card system for Contractor's Personnel and Employer's Personnel and, in the event of overhaul and maintenance, for third party personnel.</p> <p>Access to the Site shall be allowed via the external gate from the public roads and from the internal road towards the waste reception area towards the east. The external access to the WTE shall have one primary access and egress for the Waste Delivery trucks and secondary access for staff and staff vehicles. Automatic gates with controls at the Guard House shall be provided and linked with the access control and security system for all the access to the WTE plant from the external road. During peak hours there shall be barrier access for vehicles entering the primary and secondary access whereby the automatic gates will only be used for non-peak hours. Entry of staff and visitors.</p> <p>The Contractor shall provide with permanent access cards for all its staff and temporary access cards for visitors. The access control shall be zoned and provided according to the zone of access in line with the Operation Security Policy of the Contractor for the facility. The access cards for hazardous zones shall be clearly demarcated with different colour and identification that are clearly visible.</p> <p>In the event of any non-authorized access a suitable alarm and security system shall be installed.</p> <p>The access control system and its lay-out shall be provided as part of the Contractor's design documentation.</p> <p>The access control system shall be entitled for uninterrupted power supply.</p> <p>The access control system shall be complete with its database and storage servers. The servers shall be able to store for a minimum of one (1) year data without having to archive. The Contractor shall have proper data archive, storage and protection policies in place for the facility. A minimum of past five (5) years data shall be archived, preserved, maintained and handed over to the Employer at the end of the Contract Period.</p> <p>The access control system servers shall be located in the Server Room.</p>
7. Acoustics and Sound Insulation	<p>BS 8233 shall be used as a guidance document in developing the acoustic design.</p> <p>The Contractor shall comply with the Noise at Work Regulation The Plant shall be designed to acoustic levels that are appropriate for users of each area, and as appropriate for the use Appropriate acoustic separation performance shall be provided between adjacent spaces.</p>

	Noise reduction within circulation areas shall be in accordance with Building Regulation recommendations.
8. Loose and Fixed furniture	The contractor shall provide all furniture and fitting required for furnishing of the complex and such provisions shall be fit for purpose. All fitting and furnishings shall be of the highest standard expected to last for the 25 years period or as appropriately to be rejuvenated by the Contractor during the Contract duration to ensure they are functional and fit-for-purpose throughout the Contract duration.

5.4.8 Bottom Ash Processing Plant

1. Process and Mechanical works	<p>The Contractor shall be responsible for designing and building the bottom ash processing plant including bottom ash storage to satisfy the requirements of the envisaged bottom ash reuse or disposal to the landfill.</p> <p>Subject to the design considerations of the Contractor, an intermediate bottom ash storage (bunker) shall be provided. The floor of the bottom ash storage hall shall allow run-off from the wet bottom ash via a drainage system. The drained run-off from the bottom ash storage area shall be forwarded after either mechanical or gravity cleaning to buffer tanks prior to the leachate treatment system.</p> <p>The intermediate bottom ash storage area shall be sized to accommodate short term stoppages in the conveying system (e.g. the overhead cranes and belt conveyors).</p> <p>Bottom ash storage areas shall be equipped with CCTV to monitor operations.</p> <p>The bottom ash conveyors shall be dimensioned such that any item able to pass the bottom ash discharge chute can be conveyed to the bottom ash processing plant within the bottom ash treatment building.</p> <p>All conveyors towards the building that accommodate the bottom ash processing equipment shall be enclosed to avoid dust egress to other compartments of the WTE facility. The bottom ash processing building shall not be connected to any other structures of the machinery hall or the administration block.</p> <p>Bottom ash conveyors shall be capable of handling residues containing glass, steel packing bands, wire, bed springs, metal rods, steel cans and drums, aluminium slag, rocks, bricks, concrete, and other materials commonly found in MSW residue without causing choking or plugging of the conveying system.</p> <p>Designing the conveying and processing equipment and its arrangement, the Contractor shall consider either redundancy or shall allow bottom ash to bypass any potentially failing conveying or processing equipment to avoid an impact to the operations of the WTE facility.</p> <p>Conveyors shall be robust and reliable and shall allow easy access for maintenance.</p> <p>The Contractor shall arrange the bottom ash treatment components so that ample space is provided for all mobile equipment</p>
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	<p>and sufficient intermediate storage is available to accommodate periodic shutdowns of the processing equipment, for instance due to failure of downstream equipment or for routine maintenance.</p> <p>Besides the conveying equipment, the Contractor shall provide a system that consists of magnets, eddy current separators, screens, crushers and other equipment required for a complete and functional system. Ample space and access shall be provided for maintenance of all system components. The Contractor shall consider in its design potential damages of the eddy current separator due to any remaining ferrous metals.</p> <p>The Contractor shall design the processing arrangement to achieve a high product cleanliness of the metal fractions without compromising the leachability characteristics of the mineral fraction.</p> <p>Subject to the design considerations of the Contractor in the light of the limiting area available, metals shall be either stored in containers or shall be compacted by a metal press.</p> <p>The Contractor shall submit the design documentation throughout the design review as per chapter 5.6.</p>
2. Electrical Works	<p>All necessary electrical works shall be provided including, but not limited to switchboard room(s), if required centralized motor control centres and VFD cabinets, local distribution panels, etc.</p> <p>Lighting shall be installed to allow 24/7 operations.</p>
3. Civil Works and Housing	<p>The roof of the bottom ash housing shall be designed to ensure unimpeded operation of mobile equipment during operations.</p> <p>Wherever reasonable and applicable, the supporting structures of the building and the access doors shall be equipped with impact protectors while elevated curbs or any rim shall be protected with edge angles or embedded steel plates to prevent damages from wheel loader buckets.</p> <p>Doors to the building shall be of durable design.</p>
4. Storage Areas	<p>The bottom ash residue building shall be designed for a minimum of 60 days maturation and the storage area for the reusable mineral fractions shall be designed for 30 days storage.</p> <p>Storage areas shall be easily accessible from outside.</p> <p>Storage of hazardous and non-hazardous areas must be segregated. All chemical and hazardous items stored shall be properly labelled with the indication of the Material Safety Data Sheet.</p> <p>The Contractor shall comply with all prevailing regulations including regulations and requirements of SHENA on such storage and the associated limits of storage for hazardous materials.</p>
5. Dust Suppression	<p>To limit the dust generation during processing, the Contractor shall consider a sufficient, yet not excessive, dousing prior to processing the bottom ash if the residual moisture from the wet deasher is not sufficient.</p> <p>An appropriate air extraction system shall be installed to prevent dust egress from the building. Exhaust air shall be cleaned by bag</p>

	<p>house filtering or any other appropriate technology and shall meet the emission limits as defined in Table 4-2. The design of the air extraction system shall be presented with the design documentation.</p> <p>Cabins of mobile equipment operating in the bottom ash processing building shall be equipped with an environmental conditioning system including fine particle filters. Slightly pressurized cabins shall be provided.</p> <p>Heavy duty equipment such as crushers shall be equipped with a sprinkler to allow dousing during crushing.</p>
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Table 5-14: [not used]

5.4.9 Leachate Treatment

1. Leachate Collection, Management and Treatment System	<p>The Contractor shall design and build a system to control, manage and treat leachate at the WTE in accordance with the following requirements:</p> <ul style="list-style-type: none"> • The leachate collection system shall provide for the progressive installation of control measures for the management of leachate; • The design shall ensure that piping is not blocked by sedimentation, debris, algal or fungal growth and that structural integrity is maintained at all times; • The system shall be capable of dealing with the maximum leachate flow at any time during the lifespan of the WTE; • Leachate shall be treated to meet the effluent discharge standards in the Schedule of Performance Guarantees; • The design shall provide for the segregation of surface water from leachate; • Subject to the design of the Contractor, leachate from different compartments for APC residues and residues from the bottom ash processing plant shall be collected and treated so that the leachate discharge standards are met any time; • The design shall provide a suitable system for the transfer of leachate from the collection system to the leachate treatment plant; • Leachate levels shall be monitored continuously and shall be capable of being read electronically; • The leachate treatment system shall be capable of running automatically monitored and controlled from the central control room with manual override from the local control station. <p>All components of the leachate collection, extraction, transfer and treatment system shall be capable of being maintained in a clean condition to ensure effective operation.</p>
2. Concentrate disposal	The Contractor shall design and build or organise a system for the safe collection, transport and disposal of the LTP concentrate.

	Subject to its design, the Contractor shall at its discretion, re-inject the concentrate after leachate treatment into the air pollution control system or shall evaporate it. In the latter case, the residues after evaporation shall be disposed in the landfill.
3. Monitoring System	The Contractor shall design and establish a monitoring system including monitoring wells to facilitate the regular assessment of the quality of the effluent discharge.

5.4.10 Operation Control System and Instrumentation Works

1. System Description	<p>The Contractor shall design and install a state-of-the-art control and monitoring system for the Site that meets reliability, flexibility and expandability requirements and that allows safe operation of the WTE, its balance of plant and other components. Besides this, the control and monitoring concept shall provide an update feature allowing easy migration towards the new system.</p> <p>The operation and monitoring of the WTE system shall take place via a higher-level process control system. The control system shall be intended for fully automatic operation of the system. All necessary controls, safety and protection functions shall be performed automatically without manual intervention. The normal operation of the system between minimum throughput and maximum throughput shall be largely automatic under observation and operation by the staff.</p> <p>The monitoring and operation of the system shall take place via screen operating stations directly from the central control room. For the operation of the system, alerting, logging and trend records, a control system suitable according to the state of the art shall be used.</p> <p>The start-up and shutdown of the system and any load changes that have been coordinated with the respective network operator shall only be carried out in the presence of the personnel in the control room.</p> <p>Specialized tasks of largely self-sufficient systems shall be provided in separate local control systems with appropriate signal exchange to the process control system.</p> <p>The control system automatically shall record all necessary process data, establish links to these data and issue control commands to all relevant actuators after a defined program sequence or through operator intervention.</p> <p>The control technology shall have an uninterruptible power supply, which ensures that safe operation is guaranteed even in the event of a power failure. If it nevertheless fails, the system shall be automatically moved to a safe state.</p>
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	Should the Contractor opt for expansion of the WTE, operation subsystems shall provide spare capacity of at least 20% for all components.
2. SCADA and Distributed Control System	<p>a) SCADA</p> <p>The WTE facility shall be monitored via 3 operator stations from the control room. The operator stations shall be designed as equal and self-sufficient stations. Each terminal shall access all process pictures, faults, configuration screens and reports. The operator stations shall have access to all printers connected to the control level.</p> <p>Integrated in the control system shall be fault message handling, limit value monitoring and trend display. Operating / input masks for e.g. Software controller and setpoint input shall be stored for operation in the system screens. The process pictures shall be organized hierarchically.</p> <p>The data traffic shall take place via the redundant ETHERNET BUS. The dynamic plant pictures shall contain the process representation including detail-related sub-pictures and trend diagrams.</p> <p><u>Alarm and message system</u></p> <p>The alarm and reporting system shall be an integral part of the overall control system. All alarm messages shall be displayed in chronological order with the date and time as well as the measuring point abbreviation (according to the plant coding system) and plain text.</p> <p>For a clear alarm, the alarm system shall be hierarchically structured and simplified, so that a distinction shall be made in:</p> <ul style="list-style-type: none"> ▪ New, not yet acknowledged alarms; ▪ Pending/active, already acknowledged alarms ▪ Inactive alarms that were acknowledged ▪ Alarm priorities <p>To record the operator interventions (manual and automatic), a message system shall also be included, which stores the most important messages and status changes. This mainly concerns the switching on and off of units, motors, manual / automatic switching, states of binary inputs, violation of limit values and the like.</p> <p><u>Diagnosis</u></p> <p>In order to maintain the availability of the WTE system, the system shall allow a quick diagnosis of possible faults, such as but not limited to, drifting and defects of sensors and transmitters, input/output self-diagnostics, analyses of hardware faults etc. The automation components shall be monitored by a powerful diagnostic tool. Faults that occur shall be immediately transmitted to</p>

	<p>the control system and alerted on the operator stations as an alarm message.</p> <p><u>Logging and archiving</u></p> <p>All data shall be collected and stored in a common database. This shall apply to measurements as well as to alarms, limit value overruns, messages and operator interventions.</p> <p>The long-term data backup shall be carried out in the system with external data carriers.</p> <p>All events shall be printed out via the log printer. The hierarchical reporting structure shall be used to specifically influence the print control.</p> <p>b) DCS-System</p> <p>The entire I&C structure shall have a modular structure and is structured in hierarchy levels.</p> <p>The DCS system shall be divided into several process stations specified by the process. The individual process stations of the DCS system shall take over the process control tasks. The stations shall be housed in metal-enclosed system cabinets. The control system cabinets shall be installed in the central control room. In a few exceptions, for example for the control of the turbine generator set and for the bottom ash processing plant, control cabinets having a protection class IP 54 shall be installed in the field that shall have an override</p> <p>The process stations essentially shall consist of the following components:</p> <ul style="list-style-type: none"> ▪ Process computer input and output level; ▪ Bus system; ▪ Power supply unit. <p>The individual process stations shall be connected to the control level via a redundant bus system.</p> <p>The DCS system shall perform all control and regulation functions using software controllers or software programs.</p> <p>A variety of functions and control types shall be available as standard blocks or function blocks:</p> <ul style="list-style-type: none"> ▪ Fixed value, cascade, ratio controller ▪ Three-point step controller ▪ Motor and solenoid valves ▪ P, PI, PID algorithm ▪ Integrator and differentiator ▪ Limiter, minimum and maximum value selection and many more <p>The process stations shall be connected to the field level via input / output modules.</p>
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	<p>Field encoders with 2- or 4-wire transmitters shall provide a standard signal with 4 - 20 mA. These signals shall be read in via analog input modules. Analog output modules shall provide 4 - 20 mA signals for actuators and other control commands in the field.</p> <p>Any binary signals coming out of the field (such as limit switches, motor controls, pressure and level switches, flow switches, etc.) shall be executed as floating contacts. Power shall be supplied by the hardware of the I/O module.</p> <p>The binary output signals for motor controls and solenoid valves shall be designed as 24 V DC signals. The channels of the output modules shall be short-circuit-proof and overvoltage-proof.</p> <p>Essentially, the following bus systems shall be available:</p> <ul style="list-style-type: none"> ▪ Within the field level between process station and I/O modules; ▪ Between the process station and the operator control and monitoring system; ▪ Towards completed external control units. <p>In addition to data transmission, the bus system also shall allow the transmission of the configured data and also all system and program applications, such as, but not limited to, loading and saving of data and programs, system diagnostics, facilitating modifications of the programming etc. in parallel to the control and monitoring operation.</p> <p>The Contractor shall liaise with the relevant authorities including, but not limited to, Department of Electrical Services to comply with their requirements for compliance.</p>
3. Central Control Room	<p>The central control room for the entire facility shall be accommodated in the administration building close to the bunker area.</p> <p>From there, the most important plant components shall be operated and/or monitored, which are, but are not necessarily limited to:</p> <ul style="list-style-type: none"> ▪ Waste supply cranes; ▪ Incineration line including heat recovery boiler, APC system and the associated auxiliary equipment; ▪ Feed water and steam system; ▪ Steam turbine and generator; ▪ Air cooled condenser; Compressed air supply; ▪ Bottom ash cranes (having a manual override from the PLC located at the bottom ash processing plant); ▪ Fire alarm system and firefighting monitors in the bunker area; ▪ Leachate treatment plant.

	<p>All important information (operating and fault messages, measured values) shall be logged and archived in the central control room.</p> <p>In the control room, 3 operator stations each with two 20 "flat screens with high-resolution graphics and function keyboards shall be used for process monitoring and operation.</p> <p>Via an enlarged projection screen (optical rear projection), the Contractor shall facilitate the display of the overall process or individual sections thereof.</p> <p>In addition, an engineering workstation shall be provided for system diagnostics as well as for the configuration of all automation units connected to the process bus.</p>
4. Local control systems	<p>The following local control systems shall be installed that shall facilitate an easy and constantly safe operations of the entire facility:</p> <p>a) Combustion control</p> <p>The combustion control shall facilitate a fully automated control of the combustion process from waste feeding to desired steam generation, taking account of the power generation limits and internal constraints. Steam generation fluctuations shall be kept within +/-5% of the nominal steam generation rate.</p> <p>b) Turbine control</p> <p>The turbine monitoring cabinet shall take on the following main functions:</p> <ul style="list-style-type: none"> ▪ Speed control during the transition phase of acceleration and synchronization; ▪ Frequency control with required insulation mode; ▪ Droop control on the support of the power grid during the transitions; ▪ Load control or limitation of the turbine or the generator; ▪ Pressure control or limitation of the live steam pipe; ▪ Equipment for the control or limitation of the energy supply and delivery; Isochronous load distribution between the units; ▪ Valve lift control; ▪ Control of turbine auxiliary components such as oil pumps, oil heaters, barrier steam valves, rotor turning devices, etc.; ▪ Turbine protection according to IEC 61511; ▪ Machine monitoring system (Vibration and axis offset); ▪ Data acquisition for proper machine monitoring; ▪ MMS (human-machine interface). <p>c) Generator</p>

The locale control cabinet of the generator shall include

- The exciting system;
- The generator protection as well;
- The synchronization system.

The control exciting system shall include:

- Voltage regulation;
- Cos-phi control (generator transition);
- Q-Control;
- Excitation current control.

The following limits shall be executed

- Excitation current limit;
- Under excitation limit;
- Idling limit;
- Stator current limit;
- U / F-limiting.

Generator protection shall have the following protection functions:

- Differential protection;
- Over current-time protection;
- Overvoltage protection;
- Under voltage protection;
- Unbalance protection;
- Reverse power protection;
- Over frequency;
- Overload protection;
- Under excitation protection;
- Over fluxing;
- Earthing closure (selective and start-up closure);
- Rotor earthing fault monitoring;
- Circuit breaker failure protection;
- Forward power monitoring.

The synchronization system shall be designed in a way that it is possible to synchronize both the generator circuit breaker and the transition circuit breaker. In addition, manual synchronization in the on-site control cabinet shall be possible. The synchronization system shall be connected to the control system with a Profibus interface.

5. Measuring and instrumentation	<p>The Contractor shall design and install the measuring and instrumentation equipment of the Works that shall allow a high level of automation wherever possible unless operational constraints do require manual intervention.</p> <p>The Contractor shall submit with the design documentation a complete list of the measuring and instrumentation components including, but not limited to, information on quantities and installation location, supplier, accuracy/sensitivity, supply voltage, measuring range, factory calibration, manufacturers certificates etc. The list shall be subject to the approval of the Employer's Representative.</p> <p>For all field devices, if possible, a uniform manufacturer shall be selected.</p> <p>All devices shall be designed to withstand the corrosive marine environment and shall be suitable for and resistant towards the process environment they are exposed to.</p> <p>The following voltages are permitted as supply voltage for measuring and control devices: 24 V DC, 230 V AC and 400 V AC.</p> <p>Transducers with 4 - 20 mA signal or bus signal with Profibus PA protocol shall be used for the conversion of the physical quantities</p> <p>Alarm and control signals shall execute in 24 V DC technologies. Likewise, the auxiliary voltage supply of the entire measuring technology shall be implemented in 24 V DC. The auxiliary voltages of the measuring circuits shall individually be protected or fed directly by the DCS. Analog measuring signals and auxiliary power supply shall be galvanically isolated from each other.</p> <p>Measuring devices for safety functions shall use 4 - 20 mA signals. It is preferable to use measuring instruments with SIL 2 approval. If SIL 2 approved devices are not available, multiple instrumentation is used.</p> <p>The measuring instruments shall, if possible, be provided in a compact design. The process connections of the sensors shall be preferably provided in flange design unless stated otherwise. The instruments shall be placed so that the display can be read at eye level.</p> <p>Control equipment in hazardous, potentially explosive atmospheres shall be designed according to the relevant equipment group or category in accordance with BS EN 60079.</p> <p>The accuracy classes of the measuring devices shall be selected according to the requirements of the process engineering and the required control quality, at least the accuracy class 1 shall be used.</p> <p>As a protection class, at least IP 65 in accordance with EN 60529 shall be provided for outdoor applications, splash water or high atmospheric humidity. The prescribed degree of protection IP 65 refers to measuring and regulating devices for machine and</p>
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process engineering (e.g. field devices, position sensors, electrical actuators, solenoid valves, on-site displays, etc.).

For the electrical and control cabinets in electrical rooms, at least IP 20 (refers to the ventilation slots in the doors) shall be provided.

Transmitters shall be arranged easily accessible.

Deposits, contamination, resistance, accessibility and degradability during operation etc. shall be taken into account.

The Contractor shall ensure, that even during longer standstill periods of individual system components, the measurements remain functional without major maintenance work so that correct readings are immediately available when restarting.

Measuring devices shall be installed vibration-free.

In principle, all measured values, which are integrated into the control system, shall also be readable on site.

Measurements shall be set up in such a way that the displayed values correspond to the actual conditions even when the plant part is at a standstill and no unnecessary fault messages are pending.

If for installation, maintenance, calibration, adjustment, evaluation, parameterization etc., additional devices, tools, devices, drivers, etc. are required, those shall also be included in the delivery.

Pressure measurements

For all pressure measuring points, where the process medium is fed directly to the measuring transducer, 3-way valve blocks are to be used. For differential pressure measurement, 5-way valve blocks shall be installed.

For pressure or differential pressure measurements in steam, high pressure or flue gas pipelines double shut off devices shall be installed and approved third-party inspection test certificates shall be provided. Onsite testing of welded connections shall be conducted by approved third-party inspection companies and Contractor shall furnish accordingly the reports from these inspections duly signed / certified by the approved third-party inspection companies.

Accuracy for both pressure and differential pressure transducers shall be $\pm 0.25\%$ of the full range.

Flow measurement for liquids:

The measuring principle shall be selected according to the requirements of the medium to be measured and the required accuracy. The measuring accuracy shall be $\pm 1\%$ of the measuring range end value if venturi measurements and $\pm 0.25\%$ if orifices are used. If magnetic-inductive measurements are applied, the measuring transducer shall have an accuracy of less than $\pm 0.5\%$.

	<p>The measurements shall also provide sufficiently accurate measured values during start-up and shutdown procedures.</p> <p>Depending on the medium, an illuminator shall be provided for rotameter.</p> <p><u>Temperature measurements</u></p> <p>Temperature measurements shall be in line with the process requirements (e.g. Pt 100 resistance thermometers or thermocouples with head transmitters shall be used for remotely measured temperature measurements in accordance with the measuring range). External transmitters shall be used in areas with ambient temperatures > 50 ° C. In general, replaceable double measuring inserts shall be used. The second element shall also be wired to the connection base.</p> <p>All temperature transmitters shall be carried out with element break monitoring.</p> <p><u>Level measurements</u></p> <p>For overfill protection, two independent level monitoring devices or type-tested measuring devices shall be provided. Ultrasonic measuring devices are not permitted as overfill safety devices.</p>
6. Process related CCTV System	see chapter 5.4.7.10
7. Plant Information Management System (PIMS)	<p>The PIMS shall facilitate both an external access to allow the Employer and its personnel to monitor the Works' performance between the periodical reporting and to manage the Contractor's plant information and reporting obligations which shall be subject to the Contractor's considerations.</p> <p>The Contractor shall, however, install a read only access for all performance and Performance Guarantee relevant data that shall be provided via comprehensive reports and that shall be collated from the aggregated data of the SCADA/DCS that are used for reporting anyway.</p> <p>Subject to the design considerations of the Contractor, i.e. whether he installs a computerised maintenance management software, the reports shall include maintenance plans and records for major equipment of the Works as well.</p>

5.4.11 Ambient Air Quality Monitoring Stations

1. General	The Contractor shall procure and install monitoring stations to periodically measure ambient air quality parameters as per Department of Environment, Parks and Recreation (JASTRe) approved EIA and EMMP instructions.
2. Parameters and Sampling Rate	The parameters and sampling rates shall be as defined in the Department of Environment, Parks and Recreation (JASTRe) approved EIA and EMMP.

5.5 Progress Milestones Requirements

1. General	<p>This section describes the sequencing and intermediate progress milestones that the Contractor shall comply with during the Design-Build Period.</p> <p>The Contractor shall complete each of the following activities, items of work or stages by the date or within the period specified for each such activity or item or stage in the table below. Days and week numbers refer to the number of calendar days or weeks after the Commencement Date unless otherwise stated.</p> <p>For all those items of the list below that are related to submission of documents, reference is made to Chapter 5.6.</p>
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Table 5-15: Key activities and milestones during Design-Build period

No.	Activity/item of work/stages	Date or period by which item is to be submitted
1	Commencement date	As per Sub- Clause 8.1. of GCC
2	Submission of time programme	As per Sub-Clause 8.3 of GCC
3	Review of time programme by ER	7 days after date of submission by the Contractor
4	Submission of revised time programme	Not later than 49 days after receipt of Notice of Commencement Date
5	Submission of draft concept design (including indicative CEMP)	As per Contractor's agreed programme
6	Submission indicative Contractor's Site Organisation Plan (including Site Mobilisation plan and Contractor's Site facilities plan)	Jointly with Contractor's draft concept design
7	Review of the indicative CEMP	14 days (re-submission of updated CEMP after review jointly with permit design)
8	Review of draft concept design by ER	Not later than 42 days after date of submission by the Contractor

No.	Activity/item of work/stages	Date or period by which item is to be submitted
9	Submission of final concept design	Not later than 28 days after receipt of ER review and comments or concept design review meeting whatever is earlier
10	Submission of Quality Assurance Plan for Design-Build	Within 28 days of receipt of Notice of Commencement Date
11	Submission of draft permitting design	As per Contractor's agreed programme
12	Review of draft permitting design by ER	21 days after date of submission by the Contractor
13	Permitting design submitted to authorities	Not later than 14 days after receipt of ER review and comments
14	Submission of all licenses, consents, clearances, Notices required for commencement of Construction Work	Not later than 14 days after receipt of ER review and comments
15	Submission of Health and Safety Plan	Not later than 28 days before commencement of Works on Site
16	Updating and finalising CEMP	As per detailed design submission programme
17	Submission of Site Organization Plan	Not later than 42 days before mobilising the first equipment or personnel, or start of the construction Works whatever is earlier
18	Submission of HAZOP study report	Within 120 days of receipt of notice of Commencement Date
19	Submission of final Site organisation plan	Not later than 30 days prior to commencement of Site mobilisation
20	Review and approval of final Site organisation plan	7 days after date of submission by the Contractor
21	Submission of detailed design of civil, structural, process, mechanical, electrical, control and installation components	As per agreed Contractor's design programme and progress
22	Review and approval of detailed design package as defined in Chapter 5.6	7 days after date of submission by the Contractor (provided the Contractor's design packages do allow), max. review period 14 days
23	Start Site mobilization	As per Contractor's revised agreed programme and upon notice to proceed with issuing permit,
24	Submission of construction stage documents	Not later than 28 days prior to commencement of that element
25	Submission of plant delivery documents	Not later than 28 days prior to commencement of that element
26	Finalizing concrete works waste bunker	As per Contractor's agreed programme
27	Assembly/installation of boilers M&E equipment completed	As per Contractor's agreed programme
28	Air cooled condenser completed	As per Contractor's agreed programme
29	Installation of turbine/genset completed	As per Contractor's agreed programme

No.	Activity/item of work/stages	Date or period by which item is to be submitted
30	APC system installed	As per Contractor's agreed programme
31	Submission of draft Programme on Tests on Completion of Design-Build	Not later than 144 days prior to commencement of the Tests on Completion of Design-Build
32	Review of draft Testing programme by ER	14 days after date of submission by the Contractor
33	Agreed testing programme	Not later than 7 days after receipt of ER review and comments
34	Submission of Draft CEMP for the Operation Service Period	Not later than 126 prior to commencement of commissioning phase
35	Submission of draft As-built documents and asset sheets	Not later than 21 days prior to commencement of the Tests on Completion of Design-Build
36	Hydrostatic pressure tests of boilers completed	As per agreed testing programme
37	Start of the "cold" functioning tests (pre-commissioning tests)	As per agreed testing programme
38	First waste firing	As per agreed testing programme
39	RO installation/landfill completed	As per Contractor's agreed programme
40	Notice of Tests on Completion of Design-Build	As per GCC Sub-Clause 11.1
41	Commencement of Tests on Completion of Design-Build	Not later than 63 days before the date for completion of the Design-Build
42	Submission of Quality Assurance Plan for Operation Service	Not later than 42 days before the date for completion of the Design-Build Period
43	Submission of the final CEMP for the Operation Service Period	Not later than 28 days before the completion of the Design-Build Period
44	Final approved as-built documents and asset sheets	Not later than 28 days after completion of the Pre-commissioning
45	Draft Operation and Maintenance Plan	Not later than 56 days prior to commencement of Tests on Completion of Design-Build
46	Final Operation and Maintenance Plan	Not later than 21 days before commencement of Operation Services
47	Nomination of Plant Manager	Not later than 182 days before the commencement of Operation services
48	Issue of Commissioning certificate	As per Sub-Clause 11.7 of GCC
49	Time for Completion of Design-Build	As stated in GCC Sub Clause 1.1.78

5.6 Contractor's Documents

1. General	<p>The Contractor shall submit to the Employer's Representative the documents listed in Table 5-16 unless otherwise instructed by the Employer or the Employer's Representative. Any requests for additional documentation by any relevant authority that is dealing with the permitting and the approval of the Design-Build shall be forwarded to the Contractor by the Employer's Representative for the Contractor to accordingly respond to the concerned authority directly as preparation of all necessary documentations, submission and obtaining the relevant approvals from all authorities concerned shall rest with the Contractor.</p> <p>All those documents that are related to design review, off-site or onsite manufacturing and construction and assembly works shall be submitted by the Contractor in due course taking into account the programme and the review period.</p> <p>Standardized English notations shall be applied in all documentation and drawings.</p> <p>The Employer's Representative shall be entitled to request any other document if reasonable and if required for the design review and for the programme.</p> <p>The list of documents below is not exhaustive and the Contractor shall be responsible for updating the list to make it comprehensive as per the Contract to meet all the Contract obligations on deliverables, including full compliance to all relevant authority requirements.</p>
2. Documents to be kept on-site	<p>The Contractor shall keep the following documentation on Site during the Design-Build Period:</p> <ul style="list-style-type: none">a) Copies of all the Contractor's Design-Build Documents listed in Table 5-16 below;b) A copy of all permits and licenses;c) Sampling and testing records, calibration records;d) Safety records. <p>A daily logbook of all construction activities that shall summarize all relevant information based on site activities. The format and content of the logbook shall be subject to the approval of the Employer's Representative.</p>

Table 5-16: List of Contractor's documents to be provided during Design-Build Period

No	Description	Submission for ⁷	Submission format	Number of originals/copies ⁸	Review period by ER
1.	Programme as per Sub-Clause 8.3 of GCC, including design review programme	Review and confirmation	In a readable scale min. A3 Electronic format MPP (or MPP compatible) files	1 Electronic 3 Hard-copies	7 days
2.	<p>Concept design consisting of a report and a drawing part including but not limited to (all items relate to the concept design stage and shall be, apart from the description part, further substantiated in the detail design)</p> <ul style="list-style-type: none"> • Description of the main process units as defined in Chapter 5.4.1 that may be regrouped according to the Contractor's process block diagram and the Contractor's coding system, including design parameters and assumptions, heat and mass balances and any other information deemed relevant to get⁹a full picture of the delivered facilities. • Grate design and dimensions • CFD simulation of furnace and boiler • Comprehensive P&I diagrams main process units (including flow, temperature, pressure, materials used etc.) • Description of the control and instrumentation concept including plant information management system • Description of the electrical system (including transformer, HV/MV/LV switchyards and switchboards) arrangements and rooms, approval status of powerhouse, list of electrical consumers including efficiency classes etc.) • Description of the air conditioning and mechanical ventilation system, including single line piping and equipment diagram. • Description of the sprinkler and fire hose reel system and single line piping diagram. • Description of the fire suppression system and piping diagram • Description of the fire detection, fighting and alarm system, including P&IDs • Design specification of the landfill (including base liner) and leachate treatment and management system • Indicative filling plan of the landfill based on mass balances • Description of architectural design and lay-out of buildings and other structures, materials to be used, energy saving standards applied etc. • Foundation concept • Description of the odour control concept • Description of the fire detection, fighting and alarm system, including P&IDs • Description of the drainage concept and storm water management plan including flooding and natural hazards • Site organisation plan including description of Contractor's facilities, equipment and storage 	<p>Review and comments</p> <p>Upon finalization of review a joint three day duration design review meeting shall be held immediately thereafter to settle any discrepancies, open issues etc. and to sign-off the concept design which shall be frozen and regarded as basis of the final design. Unless agreed by the Employer's Representative in writing during the review, the Contractor shall not be entitled to proceed with the detailed design or with placing any order.</p> <p>The Contractor and the Employer's Representative shall seek for conducting the review in the shortest possible time.</p>	Report in A4, drawings in scale and format as per list of drawings Electronic format DWG (DXF), Excel, Word	1 Electronic 3 Hard-copies	Max. 42 days

⁷ The Contractor shall incorporate reviews and comments from the ER in the draft version so that final version is considered as approved without additional review and commenting period

⁸ May be changed during the Contract execution as deemed reasonable by the Parties

⁹ Days are meant to be calendar days

No	Description	Submission for ⁷	Submission format	Number of originals/copies ⁸	Review period by ER
	<p>areas and construction camp, Site mobilization arrangements including utilities needed (power, water, sewer)</p> <ul style="list-style-type: none"> • Structural design criteria (e.g. seismic, wind, equipment etc) to be adopted on civil works, buildings and other structures. • Durability plan to meet asset life requirements • Drawings as per Chapter 5.7. • Site Landscape Plan showing compliance with BCCS Green Protocol <p>Note: The Contractor shall ensure all necessary drawings, reports and documentations required from all disciplines (including, but not limited to, architectural, civil & structural, mechanical & electrical) for the submission to authorities for statutory approval process in full compliance.</p>				
3.	Draft Construction Environmental Management Plan (CEMP) as per Chapter 5.12	Review and Comments	Report in A4, flow charts and graphical content in A3 or bigger	1 Electronic	14 days
4.	<p>Permitting documentation, based on a confirmed concept design, shall be prepared based on the instructions of the Environmental Authority and MHI. that shall consist of a set of documents similar to the concept documentation, consisting of, but not limited to:</p> <ul style="list-style-type: none"> • Description of the main process units and their operations, main design parameters and assumptions, block flow diagrams, heat and mass balances • Description of the civil engineering and civil works • Process flow (or P&I) diagrams for main process units • Description of air and water pollution abatement measures including location of pollutants' sources • Description of the odour control and sound suppression concept • Description of the control and instrumentation concept including plant information management system • Statement on the CEMS and other pollutants' monitoring measures • Approved electrical design by licensed engineer according list of accredited electrical engineers that are licensed to perform electrical works (see Chapter 5.4.4) <ul style="list-style-type: none"> • Emergency power supply and UPS system • Description of H&S measures • Emissions and pollution control system for the WTE plant • Description of the mechanical and electrical engineering works • Tentative CEMP • Description of the emergency response and fire protection concept • Draft EMMP/CEMP covering mitigation of environmental impacts and environmental emergency response during the construction phase and the Operation Service Period (including EMP) 	Review and comments	<p>Report in A4, drawings in scale and format as per list of drawings</p> <p>Electronic format DWG (DXF), Excel, Word</p>	1 Electronic 3 Hard-copies	21 days

No	Description	Submission for ⁷	Submission format	Number of originals/copies ⁸	Review period by ER
	<ul style="list-style-type: none"> • Drainage concept and storm water management plan including flooding and natural hazards • Explanation and statement where to source fill materials • Tentative construction milestone plan • Indicative capital expenditures • Drawings as per Chapter 5.7. 				
5.	Quality Assurance Plan for Design-Build requirement as per Chapter 5.13	Review and comment	Report in A4, flow charts and graphical content in A3 or bigger	1 Electronic 2 Hard-copies	Review period shall end no later than 14 days before commencement of Works on Site
6.	<p>The detailed design documentation shall be provided by the Contractor in a consecutive way as defined in the design review that shall be included in the programme as per Sub-Clause 8.3 of GGC. The design review process shall be split into three parts; a process and mechanical review, an electrical, instrumentation and control design review, and a civil design review. These parts may overlap though. Besides the specific information and documentation requested as per Chapter 5.4.3, the documentation for each detailed design package to be reviewed shall include, but is not limited to the following:</p> <p>Process and mechanical design review:</p> <ul style="list-style-type: none"> • Specification of main equipment and components including design parameters to a level of detail mutually to be agreed upon after finalizing the concept design • Functional description of process units according to Contractor's arrangements • In the event of the boiler design review: stress analysis including specification of corrosion wear-off margin • Thermal insulation design • List of electrical consumers and envisaged consumption • Specification of material grades used • Final structural design of component or process unit and buildings that are subject of the design package • Comprehensive P&I diagrams for the relevant process units dealt with in each consecutive design review (including flow, temperature, pressure, materials used etc.) including functional description as basis for the process control (either via DCS or PLC) • Piping plan including clash analyses • HAZOP analyses as required due to operational conditions • Pollution control monitoring and on-line analyzers • Drawings shall be as per Chapter 5.7. <p>Electrical, instrumentation and control design review</p>	<p>Review and approval The Contractor shall tailor packages to allow a 7 days review (max. 14 days review).</p> <p>If deemed necessary by the Employer's Representative design review meetings with the Contractor shall be held in Malé to clarify open topics.</p>	<p>Report in A4, supplemental information in A4/A3, drawings in scale and format as per list of drawings Electronic format DWG (DXF), Excel, Word</p>	1 Electronic 3 Hard-copies	Up to 14 days per design package

No	Description	Submission for ⁷	Submission format	Number of originals/copies ⁸	Review period by ER
	<ul style="list-style-type: none"> ● Providing detailed electrical design that has been reviewed and approved by licensed engineer according to list of accredited electrical engineers that are licensed to perform electrical works ● Emergency power supply concept including UPS and list of consumers with emergency power supply ● Diagrams for both electrical and control wiring ● Bill of quantity of A/D and D/A cards including evidence of spare space in control panels ● Providing design heat load calculation for ACMV reviewed and approved by accredited mechanical engineer. ● Providing detailed design calculation for Sprinkler System, Fire Suppression System reviewed and approved by accredited mechanical engineer. ● Description of the access control system and the vehicle recognition system (if any) ● Description of the weighbridge including software embedding into the PIMS ● Description of the PIMS and the access for the Employer's staff <p>Civil design review:</p> <ul style="list-style-type: none"> ● Architectural lay-out of buildings including facade, Materials to be used, energy efficiency etc. ● As needed temporary design works (e.g. framework of bunker) ● Foundation design including calculations ● Structural engineering calculations for civil works, buildings and structures ● Specification of protection layers for areas handling hazardous substances ● Specification of steelworks coatings ● Specification of outside infrastructure and utilities to be provided ● Specification of baseliner system, leachate management (including storage) and treatment ● Building services provision ● Setting-out details ● Drawings as per Chapter 5.7 				
7.	Updated CEMP (developed concurrently with the detailed design) as per Chapter 5.11 complete with description of pollution control system, analyzers, and monitoring, mitigation measures non-compliance response measures.	Review and approval	Report in A4, flow charts and graphical content in A3 or bigger	1 Electronic 2 Hard-copies	28 days prior to commencement of construction of each Works section
8.	Health and Safety Plan as per requirements of Chapter 5.12	Review and comment	Report in A4, flow charts and graphical content in A3 or bigger	1 Electronic 2 Hard-copies	Review period shall end no later than 14 days before commencement of Works on Site

No	Description	Submission for ⁷	Submission format	Number of originals/copies ⁸	Review period by ER
9.	Procurement, manufacturing and shipment plan	Review and comment	Electronically only	1 Electronic	max 3 days
10.	Program of factory acceptance tests	For perusal	Electronically only	1 Electronic	n/a
11.	Site Organization Plan as per Chapter 5.8	Approval	Report in A4, flow charts and graphical content in A3 or bigger	1 Electronic 2 Hard-copies	7
12.	Construction stage documents (submission deadline as per section and phasing requirements)				
a.	For construction stage and method of construction (i.e. earthworks, formworks, etc.), the Contractor shall submit method statements, construction drawings, sketches etc.	Review and approval	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale	1 Hardcopy to the Employer's Representative 1 Electronic copy	Maximum 7 days
b.	For construction material and on-site delivery, the Contractor shall submit data sheets, manufacturers' specification with all necessary technical details, certificates etc. For hazardous materials, Safety Data Sheets shall be submitted.	Review and approval	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale, drawings as DXF/DWG	1 Hardcopy to the Employer's Representative 1 Electronic copy	Maximum 7 days (per report)
c.	Inspection and test reports: For all equipment that were inspected by the Employer, the Employer's Representative or third parties, the contractor shall submit the relevant final test and inspection reports.	For perusal unless approval has been agreed upon during inspection	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale, drawings as DXF/DWG	1 electronic copy	Maximum 7 days
d.	The Contractor shall provide the documentation for the equipment, machinery, vehicles etc. that will be delivered to the Site and that will be part of the Permanent Works including but not limited to technical specification, material certificates, assembly drawings, test reports. The level of detail shall be reconciled with the Employer's Representative.	Review and approval			Max 7 days
e.	For trial areas and test fields of the landfill, the Contractor shall submit method statements, work drawings, sketches according to the respective requirements defined in Chapter 5.47 of these Employer's requirements.	Review and approval Directly after completion of trial area and test fields results (In-situ tests or laboratory tests)	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale	1 Hardcopy to the Employer's Representative 1 Electronic copy	Max 3 days after receipt of test results
13.	For subcontractor works and works specific skills (i.e. welding) the Contractor shall submit all necessary certificates, procedures, time schedule as requested by the Employer's Representative	Review and approval	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale	1 Hardcopy to the Employer's Representative 1 Electronic copy	Maximum 7 days
14.	List of suggested ISO/IEC 17025 accredited firms or laboratories to calibrate and to check the installation of the CEMS, to sample and to analyse pollutants which are discontinuously measured	Approval	A4	1 Electronic copy	Maximum 7 days
15.	Programme on Tests on Completion of Design-Build	Review and approval	Reports in A4, flow charts and graphical	1 Electronic	7 days

No	Description	Submission for ⁷	Submission format	Number of originals/copies ⁸	Review period by ER
			elements in A3 or in a readable format and scale	2 Hard-copies	
16.	Draft CEMP for the Operation Service Period	Review and comment	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale	1 Electronic 2 Hard-copies	28 days
17.	Reports on Tests on Completion of Design-Build	Review, comment and approval	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale and photo documentation	1 Electronic 2 Hard-copies	Maximum 7 days
18.	Final CEMP for the Operation Service Period	Review and comment	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale	1 Electronic 2 Hard-copies	14 days
19.	Draft As-built documentation shall include, but shall not be limited to: <ul style="list-style-type: none"> • The final version of the design calculations • Key construction and assembly records and tests • Final versions of all drawings prepared during the Design-Build Period including history of changes made • Final P&I diagrams • Asset data sheets and final versions of the specifications including test reports, manufacturer's and external certificates, • Quality control records for Materials • Borehole records and soil test reports 	Review, comment and approval	Reports in A4, flow charts and graphical elements in A3 or in a readable format and scale + Photo documentation Electronical format in DWG Hardcopies in scale and format as per list of drawings in Chapter 5.7.	1 Electronic 2 Hard-copies	Review period shall end no later than 14 days after issuing Commissioning Certificate
20.	Quality Assurance Plan for Operation Service	Review and comment	Report in A4, flow charts and graphical content in A3 or bigger	1 Electronic 2 Hard-copies	Review period shall end no later than 21 days before commencement of Operation Services
21.	Draft Operation and Maintenance Manuals	Review, comment, approval	Report in A4, flow charts and graphical content in A3 or bigger	1 Electronic 2 Hard-copies	Review period shall end no later than 28 days before commencement of Operation Services
22.	Final as-built documentation	Approval	As above	As above	
23.	On Site Logbook	To be kept on site during construction works	No folder allowed. Document shall be bounded and hand-written	1	

5.7 List of Drawings

1. General	<p>The Contractor shall provide the following drawings during the different phases of the project. If the Contractor does not deem the defined formats and scales appropriate it shall suggest alternatives.</p> <p>Subject to further reasonable request of the Employer's Representative, the Contractor shall provide additional drawings as needed.</p> <p>The Contractor and the Employer's Representative shall agree on the expected level of detail prior to submission of the drawings.</p> <p>The list of drawings below is not exhaustive and the Contractor shall be responsible for updating the list to make it comprehensive as per the Contract to meet all the Contract obligations on deliverables, including full compliance to all relevant authority requirements.</p>
2. Concept Design Stage	<p>The Contractor shall provide the following drawings during the concept design stage as an integral part of the concept design documentation.</p>

Table 5-17: Drawings requested for review during the concept design

Format	Scale (indicative)	Description
A0	1:500	Overall site layout plan
A0	1:500(200)	Layout plan of the Contractor's and the Employer's facilities, storage areas for Materials and equipment
A0	1:500	Layout plan with roads, carriageways and sidewalks (cross sections as deemed appropriate)
A0	1:500	Overall drainage system layout plan and cross sections including ducts, pipes, outfalls, backflow inverters, retention ponds etc.
A0	1:500	External Domestic Sewerage Reticulation System Layout. Longitudinal Profile as deemed required.
A0	1:500	External Water Supply and Storage Layout as deemed required
A0	1:200	Layout plan tipping hall, bunker, machinery hall including waste feeding, combustion, APC system, turbine hall etc. level +0.000
A0	1:200	Layout plan machinery hall as above, all other relevant levels (+X.XXX)
A0	1:200	Cross sections machinery hall as above (all directions)
A0	1:200	Machinery hall facades (all directions)
A1	1:100	Ventilation and louvre system for machinery hall
A0	1:200	Machinery hall roof top view including apertures for maintenance
A0	1:200	Machinery hall – foundation plan (general layout)
A0	1:200	Layout plan bottom ash conveying system and treatment plant
A0	1:200	Cross sections (all directions) bottom ash conveying system and treatment plant
A1	1:100	Maintenance building/workshop: layout plan, views, cross sections
A1	1:100	Administration block layout all floor levels, cross sections (all directions)

Format	Scale (indicative)	Description
A0	1:200	Access ramps views, cross sections
A0	1:200(500)	Firefighting system – layout and cross sections including firefighting water supply and storage, chemicals and hazardous goods storage
A0	1:200(500)	Top view and cross sections landfill including details of base liner system, leachate collection
A0	1:500	External Domestic Sewerage Reticulation System Layout, longitudinal Profile and Details as deemed required
A0	1:500	External Water Supply and Storage System Layout, Longitudinal Profile and details including raw water supply to the plant as deemed required
A0	1:200(500)	Layout plan and cross sections leachate collection, management, storage and treatment system
A0	1:200	Layout plan and cross sections leachate treatment plant and perEIDte, concentrate storage tanks and hereto related pumps
A0	1:200(500)	Pipe routing plan (major pipes, diameter to be agreed between Contractor and Employer's Representative)
A0	1:200	Layout plan and cross sections of air cooled condenser
A0	1:200(500)	Utility provision layout plan and cross section as appropriate
A0	n/a	Single line diagram
A0	1:500	Layout plan for external environmental monitoring stations and wells.
A1	1:200	Layout plan for on-line analyzers, cabinets and measuring room
A1	To suitable scale acceptable to authorities	All Mechanical & Electrical Layouts
A1	NTS	Single line and piping diagram

3. Detailed Design Stage

During the detailed design stage, the Contractor shall provide the set of drawings that were agreed for the concept design phase but that reveal the level of detail pertaining to the detailed design. In addition, the following drawings shall be submitted for review by the Employer's Representative.

Table 5-18: Drawings requested for review during the detailed design

Format	Scale (indicative)	Description
A0	1:500	Layout landscaping plan
A0	1:500	Roads, carriageways, sidewalk including indication of slopes
A0	1:500	Drainage system layout plan and cross sections including indication of slopes, ducts, pipes, outfalls, backflow inverters, retention ponds etc.
A1	1:200	Cross section weighbridge and waste reception guard house
A1	1:200	Architectural layout of all buildings (including administrative block, visitor's centre, laboratory, maintenance workshop and storage room, switchboard rooms, control rooms, server rooms) at different levels and cross sections

Format	Scale (indica-tive)	Description
A1	1:50, 1:20	Details of windows, doors, insulation in the admin block
A2	1:50	Details of roads, carriageways, pavement structure (typical cross sections)
A0/A1	1:100	Details of reinforcement plan (foundations, slabs, reinforced concrete elements, culverts etc.) of critical components such as bunker, turbine deck).
A2	1:25	Details of leachate collection system (cross and longitudinal section)
A1	1:100	Detailed layout of leachate treatment plant including chemical dosing station
A1	1:25	Details of site utilities (water inlet, water outlet, sewerage manholes, etc.)
A2	1:20	Details of landfill dam penetration/leachate collection pipes
A1	1:50	Standard design for monitoring wells, and monitoring stations
A0	1:200	Layout and cross sections tipping hall including bays and bay flap door/roller gate and access door
A0	1:200 (100/50)	Layout and cross sections bunker including cranes, crane rails and feeding hoppers, including fire monitors and crane control room
A0	1:200 (100/50/10)	Layout and cross sections of feeding chute, pusher, grate, furnace and boiler first pass including primary and secondary air supply system and heat exchangers including details of secondary air injection nozzles
A0	1:100	View and cross sections of fire-proof material and cladding in furnace and first boiler pass
A0	1:100	Layout and cross sections boiler including superheaters and eco (including any ancillary equipment located close to the boiler)
A1	1:100(10)	Layout and cross section of SNCR section including details of injection nozzles
A1	1:100	Layout cross section turbine hall, including turbine, generator, condenser, hot-well and condensate pumps
A0/A1	1:100	Layout and cross section of APC system including ID fan and stack
A0/A1	1:100	Layout and cross sections condensate system consisting of condensate collection tank, degasser, boiler feed water pumps and boiler make-up water system
A0/A1	1:100	Layout and cross section air cooled condenser and auxiliaries
A0	1:100(200)	Layout and cross sections of bottom ash treatment plant starting at deasher, including bottom ash bunker and conveying equipment
A0	1:100	Layout and cross sections of supplies, chemical storage, waste oil storage, fuel storage and supply pumps and conveying equipment
A1	1:100	Layout and cross section of APC residue storage and filling station
A1	1:100	Layout and cross section of emergency genset room
A1	1:100	Layout for Measuring Room

Format	Scale (indica-tive)	Description
A1	To suitable scale acceptable to au-thorities	All Mechanical & Electrical Layouts
A1	NTS	Single Line Diagram

5.8 Interfaces

1. General	This chapter describes how the interfaces with key stakeholders will be managed and the physical limits of the Contractor's responsibilities.
2. Hardware Interfaces	<p>In preparing the design, the Contractor shall take into account the interfaces with existing or to-be-built infrastructure as set forth below.</p> <p>The Contractor shall actively clarify all details of the interfaces with the Employer, DES, DWS, the auxiliary fuel and consumables suppliers, and all other interfacing parties.</p> <p>The Contractor shall accomplish all necessary design and construction works and shall supply the necessary materials for laying any cables, pipes, preparing ducts, culverts, conduits, roads and carriageways etc. up to the transfer points and construct any temporary or permanent building to accommodate any hereto related equipment.</p>
a) Waste Supply	<p>All incoming waste will be delivered to the bunker by the Employer or by approved third parties. The point of transfer of responsibility for the waste, defined as the Waste Delivery Point will be the tipping bay at the tipping hall.</p> <p>The waste volume delivered shall be recorded by the Contractor at the weighbridge located close to the entry to the Site from the waste reception area.</p> <p>All the weighbridge data to be automatically fed to a database system in the Central Control Room for the Contractor to access this information. Following minimum information shall be recorded and stored in the database:</p> <ul style="list-style-type: none"> a) Truck registration b) Arrival time c) Truck empty weight d) Truck loaded weight with the waste e) Weight of the waste delivered by the truck f) Recorded by (Name / Designation / Company) g) Witnessed by (Name / Designation / Company) <p>The Employer at their sole discretion may nominate a representative onsite during operations to witness any waste delivered and associated weight.</p> <p>The database shall be accessible by web through mobile applications and the Contractor shall allow access to the Employer's Representative and other members of the employer to for this data. The mobile application shall have the capability to generate report of the waste delivered over a specific period, grouped by a specific truck registration, grouped by the person who witnessed etc. for ease of reference. The mobile application shall accompany with a dashboard to display the key statistics.</p>

	<p>The Contractor shall ensure the database is regularly backed up and the database server shall be able to keep this data without having to archive for a minimum of two (2) years. For each archival the Contractor shall deliver a set of archived files including readable .txt formats, .csv formats and .pdf reports to the Employer for record keeping. The obligation to ensure the data is properly backed-up and archived rests with the Contractor. These data are crucial as supporting documents for Contractor's entitlement for the corresponding tipping fees.</p>
h) Treated Bottom Ash and Fly Ash	<p>The Contractor shall be responsible to safely and responsibly dispose of treated Bottom Ash and Fly Ash after processing outside of the WTE Site, either as valuable fractions for recycling according to the Contractor's discretion or to the Landfill whereby a Landfill charge shall apply.</p>
i) Power Import	<p>Power import requirements to the DES grid has two following categories to comply with DES requirements:-</p> <ul style="list-style-type: none"> a) Category 1 - Where the exported power is anticipated to be less than 10MW; b) Category 2 – Where the exported power is anticipated to be 10MW and above; <p>For Category 1 please refer to the 11kV network in terms of the boundary limits with DES and the obligations of the Contractor. This can be found in Appendix 1E of these Employer's Requirements.</p> <p>For Category 2 please refer to the 66kV network in terms of the boundary limits with DES and the obligations of the Contractor. This can be found in Appendix 1F of these Employer's Requirements.</p> <p>A matrix showing the scope demarcation between the Contractor and the Department of Electrical Services for the Power Export (11kV / 66kV) can be found in Appendix 1D of these Employer's Requirements. Whilst the above reflects the current requirements of DES, the exact physical location of the transfer point is subject to further arrangements between the Contractor and DES.</p> <p>The feed-in interface to DES shall be at the existing DES 66kV slimpole transmission line segment Telisai-Sg. Liang and all required infrastructure up to the interface point shall be provided and installed by the Contractor.</p> <p>Besides this, the requirements as described in Chapter 5.4.4 shall apply.</p> <p>Power during the Design-Build period shall be provided by the Contractor.</p>
j) Power Export	<p>Power export requirements to the DES grid has two following categories to comply with DES requirements:-</p> <ul style="list-style-type: none"> a) Category 1 - Where the exported power is anticipated to be less than 10MW;

	<p>b) Category 2 – Where the exported power is anticipated to be 10MW and above;</p> <p>For Category 1 please refer to the 11kV network in terms of the boundary limits with DES and the obligations of the Contractor. This can be found in Appendix 1E of these Employer's Requirements.</p> <p>For Category 2 please refer to the 66kV network in terms of the boundary limits with DES and the obligations of the Contractor. This can be found in Appendix 1F of these Employer's Requirements.</p> <p>A matrix showing the scope demarcation between the Contractor and the Department of Electrical Services for the Power Export (11kV / 66kV) can be found in Appendix 1D of these Employer's Requirements. Whilst the above reflects the current requirements of DES, the exact physical location of the transfer point is subject to further arrangements between the Contractor and DES.</p> <p>The supply interface to DES shall be to DES 66kV slimpole transmission line segment Telisai-Sg. Liang and all required infrastructure up to the interface point shall be provided and installed by the Contractor.</p> <p>Besides this, the requirements as described in Chapter 5.4.4 shall apply.</p> <p>For 10MW below, the power export metering is anticipated to be located at the new Main Intake Substation at the Waste to Energy Plant Site. For 10MW and above, the power export metering is anticipated to be located the switchyard adjacent to the Waste to Energy Plant Site. The above locations are indicative only. The Contractor shall liaise with the DES for the Contractor's procurement of such metering devices, necessary approvals for the same and compliance with the associated requirements set by DES.</p> <p>The metering devices required shall be categorized as follows:</p> <ul style="list-style-type: none"> a) Consumption Meter – Refers to a device that measures the amount of electricity used over time by the WTE Plant. DES will monitor and record these readings on a monthly basis. The Contractor shall also keep the daily records of such meter readings. b) Bi-Directional Meter – A smart device that measures electricity flow in two directions: from the grid to the WTE Plant, and from the WTE Plant back to the grid. It tracks the electricity consumed from the grid and records the electricity generated and sent back to the grid. The difference between imported and exported energy can then be calculated. DES will monitor and record the readings on a monthly basis. The Contractor shall also keep the daily records of such meter readings.
k) Raw water supply	The raw water supply for the WTE shall be either from Sungai Danau or Sungai Pepakan, subject to the Contractor's own

	<p>investigations and studies. Please refer to Appendix 4C of these Employer's Requirements for the proposed locations for raw water intake.</p> <p>The Contractor shall be responsible to design and construct all necessary infrastructure for the raw water supply at the river.</p>
i) External Domestic Water Supply	<p>Domestic water supply will be delivered by DWS. The point of transfer of responsibility for the domestic water supply will be the tapping point to the Department of Water Services pipeline at Jalan Telisai. The Contractor shall liaise with the Department of Water Services for the exact tapping co-ordinates and the associated metering location. Contractor shall purchase and provide the metering to comply with the authority requirements.</p> <p>The Contractor shall be responsible to provide all necessary infrastructure up to the proposed tap off point from the existing water distribution pipes mentioned in Section 5.4.6 Item 7.</p> <p>During the design and construction period it shall be subject to the considerations of the Contractor how to supply the required amount of water.</p>
m) Treated Wastewater Discharge	<p>Wastewater shall be collected and treated during the construction phase and thereafter during the Operation Service Period.</p> <p>External Domestic Sewage shall be treated in a septic tank and the effluent after treatment from the septic tank shall be discharged into the surface drains.</p> <p>Effluent from the leachate treatment plant shall be discharged at the nearest outflow channel and the Contractor shall ensure the design of the channel is suitable to take the flow form the leachate treatment plant. All discharged effluent from the leachate treatment plant shall comply with the Employer's Requirements including any prevailing regulations such as the environmental regulations.</p> <p>The Contractor shall discharge the treated wastewater at the nearest outflow channel and the Contractor shall ensure the design of the channel is suitable to take the flow form the wastewater treatment plant. All discharged effluent from the wastewater treatment plant shall comply with the Employer's Requirements including any prevailing regulations such as the environmental regulations.</p>
n) Auxiliary Fuel and Consumables	<p>Auxiliary fuel and consumables are under the responsibility of the Contractor and shall be delivered by road trucks.</p> <p>The Contractor shall be responsible for the design and construction of all necessary infrastructure for delivery of auxiliary fuel and consumables by road trucks.</p>
o) Road works	<p>Road works for the WTE shall include:</p> <ul style="list-style-type: none"> a) all internal road networks at the Waste to Energy Plant; b) link road connecting the Waste to Energy Plant and the existing landfill site road for connectivity ensuring the logistics

	<p>operators shall deliver the waste to the Waste to Energy Plant;</p> <ul style="list-style-type: none"> c) link roads to the Switchyard / Main Intake substations to provide access for operations and maintenance; d) link roads to the slim poles and overhead lines to provide access for operations and maintenance; <p>The Contractor shall be responsible to design and construct all necessary infrastructure for the road works.</p>
p) Telecommunication and Network	<p>Tie in for telephone line to PABX, connection for broadband fibre optic, shall be under the responsibility of the Contractor. The Contractor shall liaise with the telecom operator(s) and UNN for the nearest tie-in point to the Waste to Energy Plant;</p>

5.9 Site Delineation, Use, Access and Possession Details

1. General	This section describes the location and boundaries of the Site and the location of the parts of the Site that the Contractor will be granted possession of under GCC Sub-Clause 2.1 as well as of all access restrictions which may affect the Site.
2. Site delineation	The Site boundaries are shown on Appendix 1 – JASTRe's gazetted site boundary indicating the Waste to Energy plant and associated proposed infrastructure locations of these Employer's Requirements. The Contractor shall minimize the land take of the facilities that are within its scope.
3. Site restriction	<p>The Site is located within the Employer's main gazetted land boundary. The gazetted land boundary includes the current land fill operations together with the associated facilities for the landfill operator. The boundary of the Employer's main gazetted land also includes High Voltage power transmission lines that are live. The Contractor shall ensure proper measures in liaison with the relevant authorities including DES (the asset owner for the existing High Voltage transmission lines) wherever an interfacing at these location for the Contractor's Works is envisaged.</p> <p>The Site is provided to the Contractor for the Works as-is basis. The Contractor shall be responsible to carry out all the necessary investigations, surveys and studies to aid its design, build and operation of the facilities under the Contract.</p>
4. Access to the Site	<p>Contractor shall propose and seek approval from relevant authorities for temporary access road(s) during construction to avoid disruption to the current landfill operations.</p> <p>Contractor shall ensure adequate traffic management measures for the construction vehicles entering and exiting the Site onto the main public road. Vehicle cleaning bays and silt ponds shall be in place to ensure dusts, debris etc. are not transported to the main road by these construction vehicles' traffic.</p>
5. Site Utilities	<p>Raw Water supply connection point: The Contractor shall study and select in liaison with the relevant authorities on either of the sources identified i.e. Sg. Pepakan or Sg. Danau.</p> <p>Domestic and Firewater supply connection point: The source for the main feeder pipe supplying potable water for the domestic usage and external fire fighting within the development shall be tapped from either the existing 180mm or 225mm diameter distribution pipes along Jalan Telisai–Lumut. The Contractor's Qualified Person will need to obtain the necessary information and approval from Department of Water Services, Public Works Department for the design of the potable water reticulation system for this development.</p>

	<p>Sewerage connection: There is no public sewer trunk available for the Site. The Contractor shall construct external domestic sewerage works within the development site of the Waste Incineration Plant.</p> <p>Drainage discharge connection: The location of the two (2) drainage discharge points is shown in Drawing No. DR/LP/01 and is enclosed in the Appendix 1C of these Employer's Requirements.</p> <p>Electricity connection point: Nearest Landfill substation Main Switchboard (if allowed by relevant authorities) or Contractor to provide their own Generator Set. In the event tapping-in for temporary power is allowed by the relevant authorities, the Contractor shall be responsible for obtaining a temporary power connection, meter and paying all charges, including the charges for usage, therewith as per the tariff imposed by the relevant authorities.</p> <p>Telecom and Fibre Optic connection point: Telephone manholes and fiber optic distribution box facilities located near the landfill. The contractor shall apply for their own telephone and fibre optic line in accordance with UNN requirements for site communications, including both landline and Wi-Fi.</p> <p>During the construction phase, the Contractor shall provide its own power supply system according to its needs.</p>
6. Construction Camp	<p>The Contractor shall secure its own location and provisions for the Construction Camp.</p> <p>The Contractor shall provide provision for a soil and waste system and discharge to a septic tank where the effluent shall be pumped out to the nearest channel. For monitoring purposes, the effluent water shall be sent to the laboratory testing facility of the local government authority to comply with environmental authority and local regulatory requirements. Should the result not be acceptable to the local authority, a provision to de-sludge the septic tank every day through an authorised waste management company is to be carried out.</p> <p>The Contractor shall provide a canteen and kitchen facilities, laundry area, toilet and bathroom for their workers.</p>

5.10 Site Organisation

1. General	<p>This Section describes the requirements for the Contractor during the construction period particularly in order to organise its works based on effective and high-quality standards. The Contractor shall abide by the environmental regulations, shall comply with the EMMP and the EIA and with all standards that are applicable to the Works.</p> <p>Working hours shall be as defined in the Particular Conditions of Contract unless agreed otherwise.</p> <p>The Contractor shall maintain a public liaison during the Design-Build period.</p>
2. Site Delineation and Description	See chapter 5.9 (Site delineation, use, access and possession details)
3. Site Concept and Works	See chapter 5.4 (design parameter and technical specifications)
4. Site Programme	The Contractor shall develop and submit a Works Programme according the requirements of chapter 5.5 (Phasing and section requirements) and chapter 5.6 (Contractor's documents) that shall include all Site related subjects.
5. Interfaces	See chapter 5.8
6. Site Organisation Plan	<p>The Contractor shall submit not later than the period defined in Chapter 5.5, Table 5-15, a Site Organisation Plan with</p> <ul style="list-style-type: none"> • A clear description and location (in form of a drawing) of the Contractor's Site facilities (offices, warehouses, storage and assembly areas, workers camp, etc.); • A description of the supply of Plant and Materials and their storage for later use and installation; • A clear description and location (in form of a drawing) of Site arrangements, equipment and/or facilities to be provided by the Contractor to the Employer; • Any other details relating to the Site, such as Site wide policies and procedures, that the Contractor shall be aware of (security arrangements to be complied with and implemented by the Contractor, in particular, transportation of personnel, handling and transportation of Goods on Site, disposal of construction waste, rubbish and debris, etc.); • An identification and description of borrow pits or dredging areas (including all permits in the final version before construction commences). <p>The Contractor shall be fully responsible to keep the Site Organisation Plan and shall inform the Employer's Representative about any deviation and shall update it accordingly.</p>

	The Contractor shall provide and maintain all required temporary facilities and shall make good and remove them on completion of the Contract. These facilities shall include such items as the provision of hard standings, access roads, surfacing, drainage, provision of utility services from metered supply points provided by others, security fencing of its own area, lighting and all other work required to allow the Contractor to fulfil its obligations.
7. Health, Safety, Environmental and Social Requirements	See chapter 5.11 and 5.12
8. Quality Assurance Requirements	See chapter 5.13
9. Minimizing of Nuisance and Disturbance	<p>All work on Site shall be undertaken in such a manner as to minimize nuisance and disturbance to others working on the site, or to persons outside the site, from smoke, fumes, noise, vibration, discharge of water from the site or from any other cause.</p> <p>All plant and equipment used by the Contractor during the Works shall be effectively attenuated by provisions of efficient silencers, mufflers, acoustic linings, shields, acoustic enclosures or screens. Plant and equipment shall be maintained in good order and operated to minimize noise and dust emissions. Plant and equipment shall be located, as far as practicable, away from adjacent occupied buildings.</p>
10. Plant and Labour Returns	The Contractor shall submit statements to the Employer's Representative of the Contractor's Personnel and Equipment on Site at the frequencies specified in Chapter 5.14.
11. Site Use	<p>The Contractor shall not undertake any activities on the Site, other than those necessary to fulfil the purposes of this Contract.</p> <p>Access and entry to the Site shall be granted by the Contractor to authorized personnel and vehicles only that are necessary to carry out the Works.</p> <p>The Contractor shall maintain the proposed Site and its peripheral area in order to prevent storm water, fire, etc. from a peripheral area entering the Site.</p> <p>All temporary Site installations shall comply with the requirements of local utility companies, and the general regulations concerning legal and industrial procedures for health and safety and protection of the environment.</p> <p>A workers' camp with all commodities, according to labour and health and safety regulations, shall be provided, erected and maintained.</p> <p>Arrangements for temporary power supply and motive power for Contractor's and Employer's Representative's facilities shall be the responsibility of the Contractor, who shall also bear the maintenance and consumption costs.</p>

	<p>The Site installation shall be independently protected according to local legislation. The Contractor shall ensure the protection of the Site against power failure. Alarm signals which may be necessary for the protection of the Site shall be provided by the Contractor. In case the electricity provider requires inspecting and approving the installations, the Contractor shall arrange for these.</p>
12. Contractor's Site Facilities	<p>The Site arrangements, equipment and facilities to be provided by the Contractor for its own purposes as well as for the Employer and Employer's Representative shall be developed and submitted for approval after contract award, during concept design stage.</p> <p>The Contractor's temporary Site offices, stores and parking areas shall be located within the Site, consistent with the requirement for him to minimize the environmental impact on the Site.</p> <p>The Contractor shall, before commencing work, erect an office for its own use in a position and to a standard and layout to be agreed by the Employer's Representative. The office shall be substantially built, weather-proof, well-lit and suitably furnished. It shall be properly secure to keep safe the papers, documents and drawings handed to the Contractor by the Employer's Representative for use in carrying out the Works. The Contractor's office shall not be removed from the Site until the Employer's Representative, by notice in writing, calls upon the Contractor to do so.</p> <p>The Contractor shall provide, erect, construct, maintain and subsequently remove all temporary catering and sanitary arrangements, stores, workshops, compounds, parking areas, drainage, lighting and the like, necessary for the completion of the Works for the use of its own staff and work force plus those of its Subcontractors in accordance with the latest legislation.</p> <p>The Contractor shall not permit any person to live permanently on the Site or any animals to be brought on to the Site. Security personnel and guard dogs properly trained and controlled shall be exempted, as well as the Contractor's staff staying in the construction camp if the Contractor decides to build it on-site.</p> <p>The Contractor shall arrange for the installation of telecommunication facilities (telephone, internet etc) for the use of its own staff and for those of its Subcontractors. These services shall be located in the Contractor's offices. The Contractor shall be responsible for the task of establishing, using, maintaining and removing the system. The Contractor's Representative shall be provided with a mobile telephone by the Contractor.</p> <p>The Contractor shall be responsible for preparing the necessary design documentations, submissions to authorities and obtaining necessary approvals prior to the construction and thereafter upon construction for occupation in accordance with the prevailing regulations.</p>
13. Facilities for the Employer's Representative	<p>The Contractor shall provide and maintain temporary offices, fixtures and equipment throughout the Design-Build Period, for the exclusive use of the Employer's Representative and its staff as</p>

	<p>per the table below. The scheduling of the erection of the Employer's Representative's offices shall be decided upon due consultation with the Employer's Representative.</p> <p>The Employer's Representative's main office shall be established on the same site as the Contractor's Representative's main office. The temporary office area shall be covered by a hard-standing surface (such as macadam), and properly drained and fenced off. A parking area shall be allocated within this area with space for 2 cars for the use of the Employer's Representative's staff. The parking area shall be clearly signposted.</p> <p>Rooms within the office shall be divided by full height partitions, suitably insulated. Floors shall be close boarded and carpeted with industrial quality carpets, with the exception of messing and washroom areas where the floors shall be linoleum covered.</p> <p>There shall be adequate natural and artificial lighting and ventilation and windows shall be fitted with blinds. Air conditioning units shall be fitted and adequate power points provided in each room.</p> <p>The Contractor shall be responsible for providing, maintaining and removing the electrical, water, telecom connection (broad band, high speed) and sanitation services. The Contractor shall be responsible for the cost of all bills and user charges relating to their use or consumption.</p> <p>The Contractor shall be responsible for preparing the necessary design documentations, submissions to authorities and obtaining necessary approvals prior to the construction and thereafter upon construction for occupation in accordance with the prevailing regulations.</p>
14. Construction Supervision	<p>The Contractor's shall include full-time supervisors on Site in compliance to statutory requirements by the authorities nominated from the Contractor's designer during the construction stage of the Works. All construction reports from the Contractor shall accompany with the endorsement / certification from the Contractor's designer (including the Qualified Personnel of the design consultancy registered with the Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam).</p>

Table 5-19: Requirements for Employer's Representative facilities during construction

Component	Number of People	Minimum Requirement
Offices for Employer's Representative's personnel	10	Min working space of 5 m ² per person, fully equipped with furniture, each person provided with a computer of latest specification fit-for-purpose use loaded with at least latest office programs and AutoCAD versions (all appropriately licensed for the usage period),, additional 2 laptops with latest specification fit-for-purpose use and loading with at least latest office programs and AutoCAD versions (all appropriately licensed for the usage

Component	Number of People	Minimum Requirement
		<p>period), fax, fixed land-line telephone for reception and PABX complete with individual extension telephone handsets and internet connection</p> <p>Eight (8) of the ten (10) pax of the Employer's Representative's Personnel shall be placed in an open office concept whereby the remaining two (2) shall have a separate enclosed office with full height partition and glass windows (complete with blinds).</p> <p>Common printing facility for the open office with at least two laserjet printers capable of printing colour and at least A3 size and one heavy duty colour photocopier capable of printing and copying A3 size.</p> <p>Two (2) individual office rooms shall have its own colour laserjet printers with at least A3 size printing capability.</p> <p>All papers, toners and other consumables required to operate the office effectively shall be supplied regularly by the Contractor.</p>
Meeting rooms for visitors	One big meeting Room for 30 pax capacity One small meeting room for 15 pax capacity	<p>Clear height: 3 m</p> <p>Common for Contractor and Employer's representative</p>
Changing and locker rooms (areas include separate toilets)	4	1 for Male, 1 for Female
Showers, washroom	4	1 for Male, 1 for Female
Canteen, recreation room	4	15 m ² , with kitchenette and fully equipped
Safety gears	10	Including but not limited to safety boots, helmets, safety gloves, safety goggles, ear-plugs, fire-resistant coveralls and vests

15. Security/Fencing and Signboards	<p>The Contractor shall deliver, install, and maintain a security fence around the Site. The fence shall consist of wire mesh of at least 2.0 m height, supported on posts and foundations and provide access to the site. The fencing plan shall be submitted to the Employer's Representative for approval.</p> <p>The cost of maintaining security at the construction site during the Design-Build Period and the general measures concerning safety, hygiene, insurance, if necessary, police protection as well, shall all be paid for by the Contractor.</p> <p>Unless otherwise agreed with the Employer's Representative, project signboards shall be erected not more than 4 weeks after the date for commencement of the Works. Other advertising signs</p>
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	shall not be erected on the Site unless permitted by the Employer's Representative.
16. Fire Protection	<p>The Contractor shall provide and maintain all required temporary fire protection equipment during the performance of work according to local regulations and by laws.</p> <p>Burning rubbish and construction waste materials is not permitted, except land clearing-slash that may be allowed in strict conformance with existing regulations.</p>
17. Traffic Control	<p>Temporary traffic arrangements shall comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.</p> <p>No material or equipment shall be stored where it shall interfere with the free and safe passage of public traffic, or in such a manner that it creates a hazard to the public, and at the end of each day's work and at other times when construction operations are suspended for any reason, the Contractor shall remove all equipment and other obstructions from that portion of the roadway open for use by public traffic.</p> <p>During the Design-Build Period the Contractor shall be responsible for the maintenance of all travelled roads and parking lots so that they are preserved in a reasonable condition to allow continuous vehicular travel and safe pedestrian movement.</p> <p>The Contractor shall undertake dust control by watering roadways and other travelled construction areas to continuously reduce dust to the satisfaction of the Employer's Requirements.</p>

5.11 Contractor's Environmental Management Plan (CEMP)

1. General	<p>The Contractor shall prepare a Contractors Environmental Management Plan (CEMP) describing specific design features that will ensure environmental protection and setting out the working methods, management, and mitigation and monitoring measures that will be put in place, for each of the various construction activities, during the implementation of the Works.</p> <p>The scope of the CEMP shall address all of the issues itemised in the project EMP contained with the Environmental Impact Assessment as listed in Appendix 3.2. The CEMP shall be consistent with the environmental management plan (EMP) in the EIA report of the project. The CEMP shall have the same level or stricter set of measures than those included in the EMP.</p> <p>The CEMP shall consider ISO 14001 when detailing the environmental management system in place.</p>
5. Environmental Manager and Officers	<p>The Contractor shall appoint an Environmental Manager who shall be permanently based on the Site for the full duration of the Works from the date of the Contractor's mobilization until the commissioning of Works has been completed. In addition, the Contractor shall appoint at least one Environmental Officer for every shift during construction period that shall be trained accordingly. The Contractor shall ensure that no construction activities shall be without the Environmental Manager and/or one Environmental Officer on duty.</p>
6. Commitment	<p>The Contractor shall ensure that his Project Manager, Environmental Manager, and all key personnel including but not limited to professional engineers, site supervisors and all persons responsible for directing work on the site are provided with appropriate training to ensure their understanding and compliance with the requirements of the CEMP.</p>
7. Submission of CEMP	<p>The CEMP shall be submitted to the Employer's Representative on the date indicated in sub-chapter 5.5 (Phasing Requirements) and no construction work shall be carried out on Site until the CEMP has been approved by the Employer's Representative.</p> <p>If the Contractor fails to apply the CEMP or in any way fails to exercise due care of the natural environment, the Employer's Representative will arrange necessary measures to be implemented by others and to recover the cost from payments due to the Contractor.</p> <p>This section of the specification shall prevail over any other section in the event of ambiguity or conflict in requirements for environmental protection or treatment of social issues.</p>

8. Equipment	<p>The Contractor shall mobilize on-site the required field equipment for environmental monitoring as necessary to demonstrate compliance with the requirements of the CEMP.</p> <p>All laboratory and test equipment shall comply with the relevant standards of the International Standards Organization (ISO).</p>
9. Content of the CEMP	<p>The CEMP shall, inter alia:</p> <ul style="list-style-type: none"> ● Describe the features of the Contractor's design that will ensure environmental protection during construction; ● Describe how the Contractor will address all the issues and recommendations of the project EMP; ● Identify the key environmental risks associated with all aspects the Contractor's construction activities, including: <ul style="list-style-type: none"> ○ dust emissions ○ emissions from equipment and vehicles ○ noise and vibration impacts from construction traffic ○ risks from exploitation of sand, aggregates and rip rap materials ○ risks from spills/contamination of soil and groundwater ○ risks from soil handling ○ risks to surface water quality; ● Detail all site-specific measures that the Contractor will implement during construction to manage and mitigate the identified environmental risks; ● Describe the Contractor's procedures for monitoring and reporting compliance with the CEMP; ● Detail the members of the Contractor's staff who will be responsible for implementing the mitigation measures in the CEMP and monitoring compliance; <p>Describe the Contractor's stakeholder grievance mechanism for environmental matters.</p>
10. Monitoring and Reporting	<p>The CEMP shall undertake monitoring on a monthly basis. The Contractor shall include a report on compliance with the CEMP in its Monthly progress reports.</p> <p>Should any environmental incidents be observed or reported by the workers, this shall be reported to the Employer's Representative immediately and if deemed a breach of the compliance requirements then corrective action is to be taken according to the response procedures given in the EMMP.</p>

5.12 Health, Safety and Security Plan

1. General	<p>The Contractor shall prepare a Health and Safety plan (H&S plan) describing all specific features that will ensure the health and safety of the Contractor's Personnel and Employer's Personnel on Site and persons who may visit the Site. The H&S plan shall be aligned with ISO 45001.</p> <p>The plan will cover all types of construction activities during the implementation of the Works. The scope of the H&S plan shall address all of the issues itemised and committed in the National legal context with regard to:</p> <ul style="list-style-type: none"> • Labour • Occupational and Community Health and Safety <p>and shall be aligned with international best practice standards.</p> <p>A H&S plan shall be in force at all times during the Contract.</p> <p>The Contractor shall also prepare a Site Security plan for the WTE addressing all applicable requirements to ensure the security of Contractor's personnel, Employer's Personnel on Site, persons who may visit the Site, and the WTE.</p>
2. Health and Safety Manager and Officers	<p>The Contractor shall appoint a Health and Safety Manager who shall be permanently based on the Site for the full duration of the Works from the date of the Contractor's mobilization until the commissioning of Works has been completed. In addition, the Contractor shall appoint at least one full time Health and Safety Officer (or equivalent) for every shift during the construction period and during the full duration of the Operation Service. The Contractor shall ensure that no construction activities or plant operation shall be without the Health and Safety Manager and/or one Health and Safety Officer on duty. All such resources in managing the safety shall comply with all prevailing regulations of SHENA in terms of their registration, accreditation and qualification.</p> <p>The Health and Safety Manager holds the power within the Contractor's organization to be able to suspend the Works if considered necessary in the event of health and safety non-conformities, and to allocate all resources, personnel and equipment required to take any corrective action considered necessary.</p>
3. Commitment	<p>The Contractor shall ensure that all the personnel on site comply with the requirements of the approved H&S Plan.</p> <p>The Contractor shall provide H&S training to the Contractor's Personnel and Employer's Personnel as necessary to ensure safe practices and compliance with the requirements of the H&S Plan.</p>
4. The H&S plan	<p>The H&S plan shall detail all site-specific measures the Contractor shall implement during the construction period to identify, manage and reduce all risks to health and safety. The H&S Plan shall include measures to prevent accidents, arrangements for first aid and arrangements for emergency response. The plan shall be</p>

	<p>designed to ensure the protection of all Contractor's Personnel, the Employer's Personnel and all other persons who may visit the Site. The H&S Plan shall be consistent with the EIA report and applicable IFC EHS Guidelines.</p> <p>The Health and Safety Plan shall include, but not be limited to, a description of how the Contractor will,</p> <ul style="list-style-type: none"> a) Carry out all its health and safety responsibilities as required under the applicable law; b) Provide medical staff; first aid facilities and supplies; sick bay and means of emergency transfer to hospital facilities c) Provide ongoing health and safety training for the Contractor's Personnel and Employer's Personnel; d) Develop and manage all required health and safety monitoring and reporting procedures; e) Manage all health and safety claims. <p>The H&S plan shall be submitted to the Employer's Representative on the date indicated in Section 5.6 (Contractor's documents) and no physical work shall be carried out until the H&S plan has been approved by the Employer's Representative.</p>
5. Measures to be taken in event of H&S non-compliance	If the Contractor fails to apply the H&S plan or in any way fails to exercise due care, the Employer's Representative will arrange necessary health and safety measures to be implemented by others and to recover the cost from payments due to the Contractor.
6. Reporting	<p>The Contractor shall include a report on accidents on site, and health and safety compliance in its monthly progress reports.</p> <p>Should any Health and Safety incidents be observed or reported by the workers, this shall be reported to the Employer's Representative immediately.</p>
7. Quantitative Risk and Safety Assessments	<p>The Contractor is responsible to verify if this project will come under COMAH Regulations (SHENA) based on the Contractor's proposal for Design, Build, Operations and Maintenance.</p> <p>As a minimum the Contractor shall carry out the following regardless of whether the project falls under COMAH Regulations (SHENA) or otherwise:</p> <ul style="list-style-type: none"> a) Coarse Quantitative Risk Assessment (QRA) <ul style="list-style-type: none"> i. The objective of the QRA study is to provide a risk profile for the facilities on the identified Major Accident Hazards (MAHs) such as fire and explosion, occupational hazard, structural failure etc. But with the limited design information available at the early stage of the design development prior to submission to any authorities for approval. b) Coarse HAZID <ul style="list-style-type: none"> i. The objective of the Hazard Identification (HAZID) is to identify the potential hazards associated with the facility

and its operations as part of the risk management process at an early stage of the design to provide input for further risk assessment and allow for design improvement. But with the limited design information available at the early stage of the design development prior to submission to any authorities for approval.

The above shall allow the Contractor to establish the requirements accordingly. The Contractor shall be responsible to comply fully with COMAH Regulations (SHENA) accordingly if any such findings from the above studies determine as such. The Contractor shall accordingly liaise with SHENA for concurrence on this matter and report to Employer's Representative accordingly. In the event it is concluded that the project will fall under COMAH Regulations (SHENA), then the corresponding 'Duty Holder' shall be the Contractor for this Contract. This is notwithstanding any other duties and responsibilities the Contractor shall comply with Workplace Safety and Health Act (Chapter 277) and any other associated laws and regulations in place.

Notwithstanding the outcome of the QRA and HAZID studies above, the Contractor shall be responsible to carry out the following studies and safety assessments during the design development to ensure the design and subsequent construction, operations and maintenance processes are aligned with the recommendations from the below studies:

- a) Human Factor Engineering (HFE) and Human Reliability Analysis (HRA)
 - i. Human actions and reliability significantly contribute to health, safety and workplace performance. Therefore, it is essential that appropriate consideration is given to human factors and reliability during the early phases of the project design and execution. Human Factors Engineering (HFE) is a multidisciplinary science that focuses on the interaction between human and the work system in order to optimise safety and performance. The overall objective is to design systems, roles and organisations that align with human capabilities and limitations. Elimination or reducing risks during the design phase of new plant and equipment is considered to be reasonably practicable and more effective. This includes designing-out human performance problems and increasing the likelihood of detecting human errors and failures.
- b) Fire and Explosion Risk Assessment (FERA)
 - i. FERA is to assess and evaluate the risk arising from potential fire/ explosion hazards during normal operations of WTE that may pose a threat to personnel and/ or the integrity of the facilities. The study shall include hazard identification, scenario identification for fire, frequency analysis, consequence modelling, event tree analysis and fire & explosion impact assessment.
- c) As Low As Reasonably Practicable (ALARP)

	<p>i. The objectives of the ALARP workshop are to ensure the risks associated with the project are managed and controlled to ALARP levels by:</p> <ul style="list-style-type: none"> • Identifying, analysing and evaluating key risk drivers, outstanding key design issues or any other identified facility vulnerabilities; • Identifying additional Risk Reduction Measure (RRM) for the identified issues; and • Determining which RRM identified from safety studies conducted are considered worthwhile to be implemented or to be analysed further. <p>The Contractor shall be responsible to engage an experienced consultant (including the associated facilitators for the workshops) carrying out such workshops and studies. The workshops and studies shall include participation of the Employer's Representative's personnel, Contractor's design consultants, operation personnel of the Contractor (if any identified at that stage of the design development).</p> <p>The Contractor shall submit two (2) hard copies and one (1) soft copy in .pdf of all such safety study assessments and subsequent close-out reports for the records and reference of the Employer.</p>
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5.13 Quality Assurance and Control Requirements

1. General	All Works, Equipment and Materials shall be executed and controlled by a Quality Management Plan in accordance with the requirements of ISO 9001 or equivalent and as approved by the Employer's Representative.
2. Quality Management Plan	<p>The Contractor shall develop a written project specific Quality Management Plan ("QMP") that details the Contractor's quality assurance and quality control ("QA/QC") procedures to be implemented in conducting the work. The Contractor's QMP is subject to review and comment by the Employer. The Contractor's shall address the following as a minimum:</p> <ul style="list-style-type: none"> ▪ General Objectives; ▪ Roles and responsibilities Communication; ▪ Review; ▪ Document control; ▪ Specific QA/QC procedures relating to the following project activities: <ul style="list-style-type: none"> ○ Design; ○ Construction Commissioning; ○ Operation and Maintenance. <p>The Contractor shall, as part of the Work, implement the quality management measures applicable to the Work as described in the submitted Contractor's QMP</p>
3. Structure of QMP	<p>The Quality Management Plan shall indicate the approach and system structure that the detailed plan will take and shall include the following:</p> <ol style="list-style-type: none"> a) Project details including name, Contract Number; b) A summary of the Project requirements including all proposed quality activities; c) All Quality Assurance System details including proposed Reporting and Quality Control Procedures, proposed by the Contractor for its use in the execution of the Works; d) A list of all the Codes of Practice, Standards and Specifications that the Contractor proposes to apply to its work. This shall include those that differ from or complement the requirements of the Contract or those specified in the Contract; e) The Contractor's proposals for internal, subcontractor and contractor-under-subcontractor quality assurance audits, including a schedule; f) A statement detailing the records that the Contractor proposes to keep, the time during which they will be prepared and the subsequent period and manner in which they will be indexed, prepared and stored; and g) Inspection and test plans for every activity requiring inspection and testing. The plans shall identify the level of inspection

	<p>and testing required and stipulate who is responsible for releasing an activity from a "Hold Point".</p>
4. Submission of Quality Management Plan (QMP)	<p>Within the deadline defined in Table 5-15, the Contractor shall submit a detailed QMP to the Employer's Representative for its review and comments.</p> <p>The QMP shall be revised as necessary from time to time to maintain it up to date. All proposed changes to the Contractor's QMP shall be submitted to the Employer's Representative for review and comment.</p>
5. Quality Organization	<p>The Contractor shall submit a detailed organization chart. It shall identify the responsibilities, authority and interrelation of all personnel who manage, perform and verify items affecting quality system and the works. The organization chart shall be specific only to this Contract.</p> <p>The chart shall identify the quality management representative who shall act as the Quality Coordinator for the Contractor in all dealings with the Employer's Representative. The role of Contractor's quality management representative shall be a full time role and shall be fully assigned on the quality management matters without sharing any other role in the project.</p>
6. Identification and Traceability	<p>The Contractor shall produce and maintain procedures for identifying the product from applicable drawings, specifications and other documents during all stages of production, delivery and installation traceability of materials and equipment shall be documented in the Quality Assurance Management Plan.</p> <p>Notwithstanding the requirements of the Contractor's Quality System, the Contractor shall retain all Inspection Certificates, Test Certificates and Certificates of Conformity, which shall be collated to allow easy traceability and made available for inspection by the Employer's Representative at the Contractor's premises.</p>
7. Quality Audit	<p>The Contractor shall make available on request any documents, which relate to their recent internal audits.</p> <p>Periodically, the Employer's Representative shall conduct compliance audits of the quality system. During any audits by the Engineer, the Contractor shall provide qualified staff to accompany the auditor</p>
8. Monitoring of the Contractor's Performance	<p>The Contractor shall take due cognizance of any reports from the Employer's Representative and action them and integrate them into the Contractor's working quality procedures, method statements or works instructions.</p>

5.14 Reporting and Progress Monitoring

1. General	This section describes the Employer's requirements to those listed under GCC Sub-Clause 4.21 [Progress Reports].
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Table 5-20: Reporting requirements

Nº	Name of the report	Number of originals/copies	Submission format	amendments	Frequency
1	Monthly progress report (including a Monthly EHS activity report)	1 original/2 copies	Hardcopy/softcopy		On the last day of each working month
2	On site log book	1 original	Hardcopy		To be reviewed on-site
3	Records of Contractor's Personnel and Equipment	1 original			On the last day of each working month for the Equipment and weekly for the Personnel (next working day)
4	Environmental Monitoring Report	1 original	Hardcopy/ softcopy		Monthly or quarterly as per JASTRe requirements

Table 5-21: Meeting requirements

Nº	Name of the Meeting	Description	Frequency
1	Pre-Construction-Meeting:	A pre-construction meeting shall be held within 14 days of issue of the Letter of Acceptance. The Contractor shall be notified at least 5 days in advance of time and place of meeting. The Representatives nominated by the Contractor, Representatives of major sub-contractors including Contractor's design team as presented in the tender, the Employer, the Employer's Representative, shall attend. Agenda for the meeting shall be drafted by the Employer's Representative, though Contractor shall advise Employer's Representative with due endeavour of further topics to be discussed.	Once
2	Site meeting	On a regular basis to discuss and resolve day to day issues amongst the Contractor, sub-contractors, third parties and the Employer's Representative, a weekly technical site meeting shall be held on a fixed day ("jour fixe") agreed between the Contractor and the Employer's Representative throughout the construction period	As possible once a week
3	Monthly progress meeting	Apart from regular site meetings to discuss and resolve day to day issues amongst the Construction Company and the Employer's Representative, Progress Meetings shall be held on a monthly basis	Upon agreement at a specific end of a month

Nº	Name of the Meeting	Description	Frequency
		<p>unless agreed otherwise with the Employer/Employer's Representative throughout the construction period.</p> <p>The Contractor shall be notified at least 5 days prior to the meeting. The Contractor shall present the work process with reference to the work program, take detailed minutes and distribute them accordingly. The agenda shall be agreed amongst all parties in advance.</p>	
4	Pre commissioning meeting	As per Chapter 5.16	
5	Other specific meetings	<p>In case meetings with outside bodies, e.g. presentation of the project to the public or any involved regulating authorities, the Contractor is obliged to send appropriate members of staff and assist the Employer's Representative with any required documentation.</p> <p>For specific meetings in the presence of senior/high level Representatives of the parties the Contractor shall be notified at least 14 days in advance of time and place of meeting.</p>	Occasionally

5.15 Testing and Inspection Requirements during Construction

1. General	<p>During construction and before any tests on Completion of Design-Build, the Contractor shall, as part of the Works, perform or cause to be performed any tests, procedures, as may be required by the laws, regulations, codes and standards to demonstrate or ensure that the Works are in conformity with, the Contract Documents, the laws and regulations, and these Employer's Requirements respectively.</p> <p>The Employer reserves its right to request any additional test or visit any other manufacturing site that are not explicitly listed in this chapter 5.15.</p>
2. Requested Samples, Tests and Procedures	<p>In addition to the tests, studies and investigations required, the Contractor shall also perform, such tests, procedures, studies and investigations as may be reasonably requested by the Employer's Representative, prior to and during performance of each portion of the Work, and shall provide to the Employer's Representative, two (2) copies of each report made in connection with such tests, procedures, studies or investigations.</p> <p>All samples, tests, inspection and certificate requirements shall comply with the applicable laws and standards mentioned in chapter 5.1, chapter 5.4.3 and chapter 5.4.6. In addition, without limiting, the following shall apply:</p> <ul style="list-style-type: none"> ▪ For earthworks: General Specification for Earthworks – GS1999 published by Ministry of Development, Brunei Darussalam and BS 6031 or similar; ▪ For civil infrastructure works (concrete): BS EN 12350-1 and BS 1881-108 or similar; ▪ For civil infrastructure works (steel bars): BS 4449; ▪ For external sewerage reticulation system: BS EN 1610 or similar;

	<ul style="list-style-type: none"> ▪ For installation works: BS 6700 or similar; ▪ For steel works (relevant steel codes according BS could be found on https://mdmetric.com/tech/bssteelcode.pdf) or similar; ▪ For road pavement: General Specification for Flexible Pavement – GS1:1998, General Specification for Road Reinforced Concrete – GS6:1999 published by Ministry of Development, Brunei Darussalam and BS 594987; ▪ External Water Supply and External Fire Fighting: Design Manual for Water Supply Distribution Networks published by Ministry of Development, Brunei Darussalam and BS EN 805.
3. Inspection of Reinforcement	The Contractor shall allow the Employer's Representative to inspect completed reinforcement before it is obscured by formwork and prior to pouring any concrete. Unless otherwise agreed with the Employer's Representative, the Contractor shall notify the Employer's Representative at least 24 hours before a section of completed reinforcement is ready for inspection.
4. Inspection by Inspection Agencies	The Employer may require that various Goods to be supplied conform to the requirements given in these Employer's Requirements. As directed by the Employer's Representative, the Contractor shall obtain the certificates of inspection from an internationally known and accredited inspection agency in the format acceptable to the Employer. Where the local authorities require approved third-party inspection company's certification are required, the Contractor shall be responsible to engage such third-party inspection company's approved by the relevant authorities for inspection and certification.
5. Pre-shipment Inspection and Factory Testing	<p>Without limitation, the Employer shall be entitled to carry out inspection visits to the manufacturing sites, carry out pre-shipment inspections and witness factory testing of the following equipment or pre-assembled components thereof:</p> <ul style="list-style-type: none"> ▪ Turbine; ▪ Generator; ▪ ID fans; ▪ Boiler feed water pumps; ▪ Condenser; ▪ Emergency diesel generator; ▪ Waste cranes; ▪ Grate; ▪ Furnace and boiler components; ▪ Raw water supply pumps; ▪ Switchboards and Equipments Control Panel.

	<p>The Contractor shall provide the Employer's Representative the test program and test process at least one month prior to the scheduled testing and get its approval. The Contractor shall organize the inspection and make all arrangements with the manufacturer. The inspection programme shall be agreed with the Employer's Representative.</p> <p>The inspection at the specific manufacturer shall include:</p> <ul style="list-style-type: none"> a) Introduction to design standards and procedures adopted; b) Introduction to relevant procedures and quality control standards; c) Review of involved manufacturer personnel's qualification and skills; d) Manufacturing process and quality assurance procedure; e) Testing procedures, product conformity certificate, quality management system certificate and any other relevant certificates etc. regarding the products; f) Packing & dispatching procedure.
6. Construction Supervision	<p>The Contractor's shall include full-time supervisors on Site, in compliance to the statutory requirements of the authorities, nominated from the Contractor's designer during the construction stage of the Works. All testing and inspection reports from the Contractor shall accompany with the endorsement / certification from the Contractor's designer (including the Qualified Personnel of the design consultancy registered with the Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam).</p>

5.16 Tests on Completion of Design-Build

1. General	<p>The intention of the Tests on Completion of Design-Build is to demonstrate that the performance of the Works can meet the Performance Guarantees as per in Chapter 4 and that each element of the Works can be operated safely under all operating conditions that can be reasonably assumed.</p> <p>The Contractor shall perform all necessary testing and commissioning activities in order to ensure satisfactory operation of the completed system and compliance with these Employer's Requirements.</p> <p>All inspections, testing and commissioning shall be clearly identified in the quality assurance management plan identifying the witness, inspection and hold points as required by the Contractor, the Employer's Representative or both.</p> <p>The Contractor shall elaborate a detailed testing program (see sub-clause 2 below) and shall give not less than 5 working days advance notice (in writing) of any testing and/or commissioning for the Employer or Employer's Representative to witness tests.</p> <p>Testing procedures shall be in accordance with requirements of this section, the Employer's Requirements and as determined by current international standards as deemed necessary to ensure a satisfactory system performance. The Contractor shall demonstrate by its Programme of Tests on Completion of Design-Build how it intends to satisfy the needs for an accurate recording of all throughput data delivered by the crane scales.</p> <p>The Contractor shall undertake to conduct the Tests on Completions with its own personnel that shall be sufficiently qualified and that shall be present during the test period on a 24-hour basis. All measurement devices other than those installed in the facilities that are needed to carry out the tests shall be provided by the Contractor.</p> <p>The Employer may request the Contractor to conduct control measurements for stationary measurement devices if deemed appropriate, such as, of the results of the flue gas flow rate measurements.</p> <p>All costs associated with testing (and retesting, if required) shall be borne by the Contractor.</p>
2. Program of Tests on Completion of Design-Build	<p>The Contractor shall submit for approval by the Employer's Representative a commissioning and testing program that shall include full details of all tests to be carried out, standards or limits to be achieved, measurements to be carried out and the requirements to be fulfilled prior to each test program. The timetable for submission shall be as indicated in Table 5-15.</p> <p>No tests shall be carried out until the schedule has been approved by the Employer's Representative. The schedule may be submitted in stages, provided a list of stages has previously been approved.</p> <p>Test procedures shall unambiguously show the extent of testing covered by each staged submission, the method of testing, acceptance</p>

	<p>criteria, the relevant drawing (or modification) status, and the location.</p> <p>The Contractor shall assign in its program the responsibilities and roles of its personnel clearly and shall also define the requirements the Employer's Personnel have to fulfil.</p> <p>The program of Tests on Completion of Design-Build shall consist of the following elements:</p> <ul style="list-style-type: none"> a) Pre-commissioning tests to satisfy the Employer's requirement with respect to the functionally coherent and correct arrangement of the Works and to verify that all components of the Works are safe and fit for the purpose for which they were designed. These tests shall include, but are not limited to, hydrostatic pressure tests, functional tests of the DCS and PLC components, auxiliary burner test, dry-out of refractory lining, third party inspection of the correct installation and calibration of the CEMS, tests of cranes and their calibration, leakage tests etc. b) Commissioning tests to verify that the Works can be operated safely under all operational conditions, including, but not limited to, start-up and shake down procedures, operating at all load points as per stoker capacity diagram, ramping up in mechanical and thermal capacity, emergency stop procedures, by-passing turbine and boiler blow down, salt retention tests for the RO etc. The duration of these commissioning tests shall be at least 28 days unless otherwise defined. c) Trial Operations and Performance guarantee tests of the Works to demonstrate the fulfilment of the Performance Guarantees as per Chapter 4. The Contractor shall not be entitled to commence with these tests unless the Employer's Representative has consented to the successful completion of the commissioning tests. The trial operations and the tests on the Performance Guarantees shall encompass the tests listed in Table 5-22.
3. Pre-inspection by the Contractor's designer prior to inviting authorities for inspection	<p>The Contractor's shall carry out all the pre-inspections with their full-time supervisors on Site nominated from the Contractor's designer and Contractor's designer (including the Qualified Personnel of the design consultancy registered with the Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam). All pre-inspection reports from the Contractor shall accompany with the endorsement / certification from the Contractor's designer (including the Qualified Personnel of the design consultancy registered with the Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam).</p>

Table 5-22: Trial operations and performance guarantee tests

Test	Requirements and Description	Frequency and Duration
Reliability Test	<p>Continuous operation of each line of the WTE facility shall reach 95% availability at least. Availability is defined as the counts of operational hours divided by the total number of hours in 30 days. The facility shall be regarded available if the turbine is operated and the steam flow of each boiler as defined in Chapter 4 exceeds 95% of the guaranteed throughput per line as per Chapter 4. Shutdown times up to 2 hours are not deducted from the operational hours as long as the affected line has been operated for more than 24 hours continuously prior and after to that stoppage.</p> <p>During the reliability test period, routine measurement of normal operational parameters shall be collected and reported to illustrate normal operation during the test period. This shall include waste throughput, appropriate temperature, pressures, flow rates, electrical generation, etc., as defined in the test program to be submitted by the Contractor</p> <p>In the event 95% reliability will not be reached (or it can be justifiably expected that it will not be reached), the Contractor shall restart the reliability test period until the 95% reliability criteria is met during a 30 days duration of the test.</p>	One, 30 days duration
Throughput Capacity Test	<p>Uninterrupted operations of the WTE plant at full load for five consecutive days (120 hours) shall demonstrate compliance with the Schedule of Performance Guarantees. The plant shall have reached a throughput of not less than the defined tonnage per line or, as the case may be, a throughput that is adjusted according to the methodology as defined below in this Chapter. The amount of waste shall be recorded with calibrated crane scales.</p> <p>The facility shall not have passed the throughput capacity test, even though the tonnage processed meets the capacity requirements stated above, if the facility fails the bottom ash quality or the air emission tests.</p> <p>The throughput capacity test shall be repeated from the beginning if the throughput does not reach the defined tonnage per line, or as may be adjusted according to the methodology as defined below in this Chapter within the 120 hours of continuous operations or in the event of any shut down.</p> <p>The Minimum Performance Guarantee of 95% of the defined WTE throughput must be achieved by the Contractor.</p>	One, 5 days duration
Net Power Output Test	<p>Operation of the WTE facility at full load for 8 hours to demonstrate the guaranteed net electricity exports as per bid form [Bid form GV1] in Appendix 23 to Letter of Tender in Section 4. The boiler shall be nominally fouled during at least 1,000 hours continuous operations without cleaning.</p> <p>During the test, the power demand of the WTE facility and all ancillaries shall be satisfied by the power generated with the facility's turbo-generator system.</p> <p>The relevant net power output as per bid form [Bid form GV1] of Section 4 shall be tested subject to the operational status of the LTP. Intermediate net power outputs, i.e. for NCVs between the given NCV of the load points as per bid form [Bid form GV1] shall be interpolated.</p>	Three, concurrently to the 5 days throughput capacity test, 8 hours duration each

Test	Requirements and Description	Frequency and Duration
	<p>The test shall not be considered as passed if the guaranteed or the adjusted values, respectively, are not reached. Tests shall be continued until the net power out is met.</p> <p>The Minimum Performance Guarantee of 95% of the defined Net Power Output must be achieved by the Contractor.</p>	
Bottom Ash Quality Test	<p>The bottom ash quality shall meet the performance guarantee for total carbon of less than or equal to the standard as defined in Table 4-1 during the throughput capacity tests as average. Representative samples shall be taken every 12 hours. TOC content in any of the samples shall not exceed the variance value defined in Table 4-1.</p> <p>The Contractor shall submit the sampling program and methodology to obtain representative samples with the Program on Test on Completion of Design-Build.</p> <p>The bottom ash quality test shall not be deemed fulfilled if the throughput capacity test requirements are not met and shall be repeated jointly with the throughput capacity test.</p>	10 samples, concurrently to 5 days throughput capacity test
Air Emission Compliance Test	<p>Air emission tests shall be carried out using the calibrated CEMS for all continuously measured pollutants and using a suitably experienced independent ISO/IEC 17025 laboratory to carry out tests on for all discontinuously measured parameters.</p> <p>The Employer may request the Contractor to operate the facility during the 30 days reliability test with maximum flue gas flow rate for each line over a period of 24 hours each.</p> <p>The independent laboratory shall also be required to certify that installation of the sampling points has been carried out according to Good International Industry Practice and that the CEMS is correctly calibrated. The Contractor shall not commence the Performance Guarantee tests until such time as the laboratory has issued a certificate on the installation of the sampling points and the calibration of the CEMS.</p> <p>The laboratory shall be engaged and paid for by the Contractor. The selection of the independent laboratory shall be subject to the approval of the Employer's Representative.</p> <p>In the event that any of the pollutants as per Table 4-2 does not meet the half-hourly or the daily average limits the Contractor shall immediately notify the Environmental Authority and the Employer and shall rectify the defect in the shortest possible time. The reliability and the throughput capacity test for each line shall not be deemed fulfilled if any of the pollutants' limits are exceeded.</p>	<p>Continuously during the 30 days reliability and the 5 days throughput capacity tests plus three samples of the discontinuously measured parameters over a period of three days during the throughput capacity test.</p> <p>Air emission tests shall be carried out for each line at each stack.</p>
Combustion Conditions	<p>To satisfy the needs for proof of maintaining the temperature and residence time, the Contractor shall submit a methodology for how to validate that residence time and temperatures are kept under most unfavourable conditions no later than 182 days prior to the Tests on Completion of Design-Build which shall be subject to the Employer's Representative approval.</p> <p>The combustion conditions shall be verified under the conditions that shall be agreed upon by the Contractor and the Employer's Representative by an independent accredited and ISO certified third party.</p> <p>The combustion temperature shall be met any time during the Test on Completion of Design-Build.</p>	Verification latest 10 days prior to 30 days reliability test at most unfavourable conditions.

Test	Requirements and Description	Frequency and Duration
Tests on LTP Discharge Standards	<p>The tests on LTP discharge standards shall be conducted once sufficient leachate is collected to accomplish the 2 days lasting tests. The LTP shall be operated at full capacity and shall meet all discharge standards as per Table 4-3. The 2-hours composite samples shall be taken every 24 hours by an automatic sampler and shall be analysed by an ISO/IEC 17025 accredited laboratory.</p> <p>In the event any of the discharge limits is exceeded, the 2 days test shall be repeated.</p>	One, 2 days (48 hours) duration, 2-hour composite samples every 12 hours
Sound Pressure Level Test	The Contractor shall carry out acoustic audit measurements on the actual noise emissions due to the operation of the entire Site at the design rating. The noise measurements shall be performed by an independent acoustic consultant in accordance with the requirements specified in the schedule of performance guarantees.	One, one day (24 hours) duration, measurements during night and daytime

4. Calculation of NCV of Processed Waste	<p>The Employer acknowledges the difficulties in determining intermediate NCV values, i.e. other than the NCVs given in the stoker capacity diagram during the Tests on Completion of Design-Build.</p> <p>Therefore, these shall be calculated by using the boiler as a calorimeter and applying ASME PTC 34 methods (and, as the case may be, ASME PTC 4) and the relevant performance data recorded by the DCS and/or additional data collected with portable devices if agreed by the Employer's Representative. The Contractor shall prepare a methodology based on ASME PTC 34 (and ASME PTC 4 as required) that shall enable a calculation of the NCV pertaining to measured live steam rates which shall be reviewed and approved by the Employer's Representative. The Contractor shall install and calibrate the measuring, control and instrumentation devices accordingly. Gross calorific values shall be calculated based on a heat and mass balance for the boiler as calorimeter and shall be transferred into net calorific values using the moisture content of the flue gas. Any operational interference to the live steam rate or the net electricity export such as, but not limited to, soot blowing, boiler blow down etc. shall be considered in the calculations.</p> <p>The so calculated NCV values shall be recorded by the DCS on an hourly basis based on the discrete measurements that shall be aggregated to hourly averages notwithstanding any further aggregation that may be required for the NCV adjustment.</p>
5. Test Reports	<p>The Contractor shall provide reports on the Tests on Completion of Design-Build which shall record that the appropriate tests have been completed to demonstrate that the Works has been constructed in accordance with these Employer's Requirements.</p> <p>The Contractor shall prepare and forward to the Employer's Representative an original and four copies of a test report no later than 14 days after completion of each test, whether witnessed by the Employer's Representative or not.</p>

	<p>If the Employer's Representative is satisfied that a part of a test, has been carried out in accordance with the Contract and the approved test procedure, the Employer's Representative shall sign for this part of the test on the appropriate test sheet. When signatures have been obtained from the Employer's Representative for all parts of the test, the test shall be deemed successful and the Contractor shall issue and submit to the Employer's Representative the appropriate test report including, but not limited to the following:</p> <ul style="list-style-type: none">a) A listing of all national, and other regulatory agency requirements and the respective test results indicating conformance and compliance or lack of conformance and/or compliance with these requirements.b) All necessary certificates relating to calibrations, testing, evaluation, analyses, and performance required pursuant to the commissioning plan;c) A summary of test results supported by calculations (for example, the NCV determination) demonstrating the ability to meet the requirements relating to all tests;d) A certification signed by the Contractor stating that the tests were conducted in accordance with the approved program for the Tests on Completion of Design-Build, and stating the extent to which the test requirements were satisfied, and if appropriate, by what means and by when the Contractor intends to rectify any defects in the facilities.
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5.17 Permits and Licenses to be Obtained by the Parties

<p>1. General</p>	<p>The Contractor shall obtain the following permits, licences and consents prior to the commencement of construction works on Site and during Design and Build.</p> <p>The list below is not exhaustive and the responsibility to ensure all the required permits, licenses and consents for the relevant stages of the project shall rest with the Contractor. List below is only a reference and the Employer does not guarantee that these permits and licenses listed below are sufficient to demonstrate compliance and clear the relevant stages of the project for completion.</p>
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Table 5-23: List of permits and approval to be obtained by the Contractor during Design-Build

No.	Compliances/ Requirements	Remarks	Institution
1.	Planning Permission ¹	Statutory	Town and Country Planning Department, Ministry of Development
2.	Construction permit ¹ <ul style="list-style-type: none"> • Form 'A'³– Development Approval • Form 'C'³– Permit to Commence Works² 	Statutory	Authority on Building Control and Construction Industry (ABCi)
3.	Environmental Clearance <ul style="list-style-type: none"> • Written notification to comply with Environmental Protection and Management Act • Environmental Impact Assessment (Construction) • Construction Environmental Monitoring and Management (CEMMP) 	Statutory	Department of Environment, Parks and Recreation, Ministry of Development
4.	Temporary Water Connection	Statutory	Department of Water Services (DWS)
5.	Temporary power supply	Statutory	Department of Electrical Services
6.	Approval for Temporary Site Accommodation and Offices ⁴	Statutory	Brunei Fire and Research Department (BFRD)
7.	Permit-to-Dig ⁵	Statutory	Department of Roads Department of Water Services Department of Drainage and Sewerage Department of Electrical Services Berakas Power Company Sdn Bhd Petroleum Authority of Brunei Darussalam
8.	Wayleaves in relation to state land	Statutory	Land Department, Ministry of Development

No.	Compliances/ Requirements	Remarks	Institution
9.	Department of Civil Aviation	Statutory	Tall constructions such as tower, flares etc for clearance in relation to obstruction to flight paths
10.	License to Generate Electricity	Statutory	Autoriti Elektrik Negara Brunei Darussalam
11.	Others ⁶	Statutory	Please see details below
12.	Design Notification (COMAH Regulations, 2013) ⁷	Statutory	Safety, Health and Environment National Authority, Brunei Darussalam (SHENA)
13.	Personal Protecting Equipment Compliance and Hoisting Machines Compliances (Workplace Health and Safety Order)	Statutory	Safety, Health and Environment National Authority, Brunei Darussalam (SHENA)
14.	Approval of boilers and pressure vessels (subject to third-party inspection and certification)	Statutory	Safety, Health and Environment National Authority, Brunei Darussalam (SHENA)
15.	Radiation License (involving radiation equipment including import, use, storage, disposal, manufacture, transport and sale of any radioactive materials and controlled apparatus)	Statutory	Safety, Health and Environment National Authority, Brunei Darussalam (SHENA)
16.	Registration and Inspection of Weighing scales used for trade	Statutory	Weights and Measures Unit (SDT), Ministry of Finance and Economy, Brunei Darussalam
17.	License (Poisons Act Chapter 114) ⁸	Statutory	Ministry of Health, Brunei Darussalam

Note:

1. Prior engagements by the Contractor's designer (including the Qualified Personnel of the design consultancy registered with the Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam) with various authorities such as the following are required (below list is not exhaustive):
 - a. Department of Water Services (DWS)
 - b. Department of Drainage and Sewerage (DDS)
 - c. Department of Electrical Services (DES)
 - d. Brunei Fire and Research Department (BFRD)
 - e. Unified National Network (UNN)
2. Submission of Form 'C' to ABCi will require endorsements by Contractor registered licensed by ABCi and registered with the Ministry of Development with Class VI with required categories (either by one the lead construction contractor or supported by the sub-contractors carrying the relevant class and categories to undertake the Works). The Form 'C' shall be accompanied with a certification by an independent Accredited Checker registered with ABCi to carry out the accredited checking on structural works as required by the law and regulations.
3. Submission of Form 'A' and Form 'C' to ABCi will require endorsements by the following:
 - a. Architectural Consultancy Practise in compliance to Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam
 - b. Civil & Structural Engineering Consultancy Practice in compliance to Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam
 - c. Mechanical & Electrical Engineering Consultancy Practice in compliance to Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam
4. In the event the temporary Site accommodation and offices are to be occupied for more than three (3) years then the regular approval process of permanent facilities applies. The Contractor shall liaise with ABCi and BFRD accordingly for this.
5. Any subsequent need to dig along the road reserve requires permit to dig and depending upon the services in that

No.	Compliances/ Requirements	Remarks	Institution
	<p>area the Department of Roads will direct the Contractor to seek endorsements from the various asset owners before clearance is given.</p> <p>6. Other approvals required but may not be directly related to construction are the following (below list is not exhaustive):-</p> <ul style="list-style-type: none"> a. Registration of branch of an Overseas Company or Joint Venture Company in Brunei Darussalam - Ministry of Finance and Economy, Brunei Darussalam b. Foreign Employees Recruitment Clearance – Job Centre Brunei, Prime Minister's Office, Brunei Darussalam c. Clearance / Support Letter for Foreign Worker's License (LPA) - Department of Energy, Prime Minister's Office, Brunei Darussalam d. Approval for Foreign Worker's License (LPA) – Department of Labour, Ministry of Home Affairs, Brunei Darussalam e. Employment Visa for Foreign Workers based on approved LPA – Department of Immigration and National Registration, Ministry of Home Affairs, Brunei Darussalam f. Health Screening for Arrived Foreign Workers – Foreign Worker's Health Screening Centre, Ministry of Health, Brunei Darussalam g. National Identity Card Registration – Department of Immigration and National Registration, Ministry of Home Affairs, Brunei Darussalam h. Cable Crossings - Authority for Info-Communications Technology Industry (AITI) i. Oil and Gas Pipeline crossing – Petroleum Authority, Brunei Darussalam j. Registered Health and Safety Officers - Safety, Health and Environment National Authority, Brunei Darussalam (SHENA) k. Importation of equipment and materials – Royal Customs and Excise Department, Prime Minister's Office <p>7. In the event any of the thresholds associated with the project reaches Schedule 5 Division 2 of Chapter 277 of Workplace Safety and Health S44/2009 as amended by S 95/2013, S 56/2018 and S44/2020.</p> <p>8. License required if any of the items imported and stored for the project fall under this act.</p>		

6 Operation Service Period

6.1 Laws, Regulations, Codes and Standards

1. General	<p>The Contractor shall operate and maintain the Works in accordance with the Contract Documents, the Operation and Maintenance Manuals, the Operation and Maintenance Plan, ALL relevant statutory and regulatory requirements, all applicable permits and consents, and Good International Industry Practice.</p> <p>The individual standards and codes given in the sub-sections under 6.1 is not exhaustive and the obligation to comply with all prevailing laws and regulations shall rest with the Contractor. In the event of any contradiction and/or ambiguity amongst the local laws, regulations & codes and international codes listed elsewhere in these sub-sections under 6.1 the most stringent amongst them shall apply unless or otherwise overridden by the relevant Brunei authorities to apply the contrary.</p> <p>During the Operation Service Period, the Contractor shall apply codes and standards applicable to the operation and maintenance of waste to energy plants in Brunei. If no particular standard or code is specified in these Employer's Requirements, the Contractor shall apply the following standards (in order of priority):</p> <ul style="list-style-type: none">• Relevant codes and standards of practices of Brunei• British standards• European standards (EN) or similar international standards (e.g. American ASME/ASTM, AASHTO, API standards)• NFPA standards• Other international codes of practice (ISO, DIN, etc.) <p>All codes and standards referred in this specification shall be understood to be the latest version.</p> <p>Although all applicable codes and standards may not be specified herein, the Contractor shall be responsible for determining the applicable codes, acquiring copies at its sole expense, and complying with the requirements of such codes and standards</p> <p>Where the requirements of these Employer's Requirements differ from the requirements of the relevant codes and standards, then the more stringent requirements shall apply.</p>
2. O&M Guidelines	<p>For general operation and maintenance activities the following guidelines in their latest versions shall be applied</p> <ul style="list-style-type: none">• Environmental Protection and Management Act (Amendment) Order 2025 (Confidential Draft)• Code of Practice for Pollution Control 2025 (Confidential Draft)• IFC Performance Standards and guidance notes

	<ul style="list-style-type: none"> • IFC EHS general guidelines • IFC EHS sector guidelines: Waste management facilities, Thermal power and Electric power transmission and distribution
3. HSE Codes and Standards	<p>For Health & Safety and Environment the following codes and standards shall be applied:</p> <ul style="list-style-type: none"> • Relevant laws and regulations of Brunei Darussalam • Regulations and guidelines published by Safety, Health and Environment National Authority, Brunei Darussalam (SHENA) • Regulations and guidelines published by the relevant authorities for Environment of Brunei Darussalam including but not limited to Department of Environment, Parks and Recreation Pollution Control Guidelines for Industrial Development in Brunei Darussalam June 2003, and any update thereof; and Safety, Health and Environment National Authority, Brunei Darussalam • Regulations and guidelines published by the Department of Electrical Services, Department of Energy, Prime Minister's Office, Brunei Darussalam • Regulations and guidelines published by the Autoriti Elektrik Negara Brunei Darussalam • Health, Safety and Environment Manual published by the Ministry of Development, Brunei Darussalam • ISO 45001 • Regulations and guidelines published by Public Works Department, Ministry of Development, Brunei Darussalam • Brunei Darussalam Standard (PBD) Building Guidelines and Requirements published by the Authority on Building Control and Construction Industry (ABCi) • British H&S Executive guidelines (EH 44 and HSE Information sheet 36) • The US National Board Inspection Code or British Pressure System Safety Regulations for recurrent boiler and pressurized vessel tests and inspections
4. Quality Assurance	<p>For Quality Assurance the following code shall apply:</p> <ul style="list-style-type: none"> • ISO 9001 or similar international standard.
5. Labour, Employment and Professional Accreditation	<p>For labour and employment, the following codes and standards shall be applied:</p> <ul style="list-style-type: none"> • Labour Act (Chapter 93) • Brunei's Employment Order • Architects, Professional Engineers and Quantity Surveyors Act (Chapter 266) • Licensed Land Surveyors Act (Chapter 100)

6. Generation, Import and Export of Electricity	<p>For electricity generation and export, the following codes and standards shall apply:</p> <ul style="list-style-type: none"> • The Power Purchase Agreement between the Contractor and the Department of Electrical Services, Brunei Darussalam (DES) as shown in Appendix 1 – Power Purchase Agreement of Section 2 • Brunei Darussalam National Grid Code (2nd Revision) or any other latest edition in use published by Autoriti Elektrik Negara Brunei Darussalam (AENBD) as shown in Appendix 4A of Section 3 – Employer's Requirements • Licensing Process for Electricity Generation Activity published by Autoriti Elektrik Negara Brunei Darussalam (AENBD) as shown in Appendix 4B of Section 3 – Employer's Requirements
7. Wastewater Discharge	<p>For wastewater discharges, the following regulatory requirements shall apply as per the approved EIA/EMMP and applicable regulations</p>
8. Air Emissions	<p>For air emissions, the following code shall apply unless otherwise specified:</p> <ul style="list-style-type: none"> ▪ Annex's E and F Code of Practice for Pollution Control 2025 (Confidential Draft) and any update thereof ▪ European Industrial Emissions Directive Standards (IED 2010/75) along with the BAT conclusions as per Commission Implementing Decision EU 2019/2010 and the latest European BAT Reference Document for Waste Incineration (BREF WTE); ▪ IFC EHS general guidelines: Air Emissions and Ambient Air Quality ▪ IFC EHS Guidelines for Waste Management Facilities

6.2 Permits and Licenses to be Obtained prior to Commencement of the Operation Service Period

1. General	<p>The Contractor shall obtain, and maintain in force, all permits, licenses and consents required by law including those listed in Table 6-1 below.</p> <p>The listed permits and approvals shall be obtained prior to the commencement of the Operation Service Period.</p> <p>The list below is not exhaustive and the responsibility to ensure all the required permits, licenses and consents for the relevant stages of the project shall rest with the Contractor. List below is only a reference and the Employer does not guarantee that these permits and licenses listed below are sufficient to demonstrate compliance and clear the relevant stages of the project for Commencement of Operations.</p>
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Table 6-1: List of permits and approvals to be obtained by the Contractor

No.	Compliances/ Requirements	Remarks	Institution
1	Fire Certification	Statutory	Brunei Fire and Research Department (BFRD)
2	Occupation ^{1, 2 & 3} <ul style="list-style-type: none"> • Form 'E' – Occupation Permit 	Statutory	Authority on Building Control and Construction Industry (ABCi)
3	Approval of Safety Case Studies for initial start-up and operations (COMAH Regulations, 2013) ⁴	Statutory	Safety, Health and Environment National Authority, Brunei Darussalam (SHENA)
4	Radiation License (involving radiation equipment including import, use, storage, disposal, manufacture, transport and sale of any radioactive materials and controlled apparatus)	Statutory	Safety, Health and Environment National Authority, Brunei Darussalam (SHENA)
5	Registration and Inspection of Weighing scales used for trade	Statutory	Weights and Measures Unit (SDT), Ministry of Finance and Economy
6	License (Poisons Act Chapter 114) ⁵	Statutory	Ministry of Health, Brunei Darussalam
7	Environmental Clearance <ul style="list-style-type: none"> • Written notification to comply with Environmental Protection and Management Act • Environmental Impact Assessment (Operation) Operation Environmental Monitoring and Management (EMMP)	Statutory	Department of Environment, Parks and Recreation, Ministry of Development
8	Permit-to-Dig (in the event of subsequent maintenance) of services belonging to the Contractor both outside and inside the Employer's Gazetted Land but external to WTE plant boundary ⁶	Statutory	Department of Roads Department of Water Services Department of Drainage and Sewerage Department of Electrical

No.	Compliances/ Requirements	Remarks	Institution
			Services Berakas Power Company Sdn Bhd Petroleum Authority of Brunei Darussalam
9	Others ⁷		

Note:

1. Prior engagements by the Contractor's designer (including the Qualified Personnel of the design consultancy registered with the Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam) with various authorities such as the following are required (below list is not exhaustive):-
 - a. Department of Water Services (DWS)
 - b. Department of Drainage and Sewerage (DDS)
 - c. Department of Electrical Services (DES)
 - d. Brunei Fire and Research Department (BFRD)
 - e. Unified National Network (UNN)
2. Submission of Form 'E' to ABCi will require endorsements by Contractor registered licensed by ABCi and registered with the Ministry of Development with Class VI with required categories (either by one the lead construction contractor or supported by the sub-contractors carrying the relevant class and categories to undertake the Works). The Form 'C' shall be accompanied with a certification by an independent Accredited Checker (where there are changes to the design from the previously approved Form 'C' during construction stage) registered with ABCi to carry out the accredited checking on structural works as required by the law and regulations.
3. Submission of Form 'E' to ABCi will require endorsements by the following:
 - a. Architectural Consultancy Practise in compliance to Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam
 - b. Civil & Structural Engineering Consultancy Practice in compliance to Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam
 - c. Mechanical & Electrical Engineering Consultancy Practice in compliance to Board of Architects, Professional Engineers and Quantity Surveyors of Brunei Darussalam
4. In the event any of the thresholds associated with the project reaches Schedule 5 Division 2 of Chapter 277 of Workplace Safety and Health S44/2009 as amended by S 95/2013, S 56/2018 and S44/2020.
5. License required if any of the items imported and stored for the project fall under this act.
6. Any subsequent need to dig along the road reserve requires permit to dig and depending upon the services in that area the Department of Roads will direct the Contractor to seek endorsements from the various asset owners before clearance is given.
7. Other approvals required but may not be directly related to operations are the following (below list is not exhaustive):
 - a. Foreign Employees Recruitment Clearance – Job Centre Brunei, Prime Minister's Office, Brunei Darussalam
 - b. Clearance / Support Letter for Foreign Worker's License (LPA) - Department of Energy, Prime Minister's Office, Brunei Darussalam
 - c. Approval for Foreign Worker's License (LPA) – Department of Labour, Ministry of Home Affairs, Brunei Darussalam
 - d. Employment Visa for Foreign Workers based on approved LPA – Department of Immigration and National Registration, Ministry of Home Affairs, Brunei Darussalam
 - e. Health Screening for Arrived Foreign Workers – Foreign Worker's Health Screening Centre, Ministry of Health, Brunei Darussalam
 - f. National Identity Card Registration – Department of Immigration and National Registration, Ministry of Home Affairs, Brunei Darussalam
 - g. Registered Health and Safety Officers - Safety, Health and Environment National Authority, Brunei Darussalam (SHENA)
 - h. Importation of equipment and materials – Royal Customs and Excise Department, Prime Minister's Office

6.3 Interfaces

1. General	This sub Chapter describes the main interfaces that the Contractor will need to manage during the Operation Service Period.
2. Right of the Employer to Access the Site	The Contractor shall cooperate with, and provide access to the Employer, the Employer's Representative, any testing agent engaged by the Employer, and any representative from a governmental authority having jurisdiction, for the purposes of conducting inspections of or tests to part or all of the Works any time.
3. Waste Delivery	<p>The point at which responsibility for the waste transfers to the Contractor, defined as the Waste Delivery Point shall be the WTE plant's tipping bay at the bunker.</p> <p>The rules relating to the acceptance or rejection of the waste shall be as detailed in Chapter 6.4.4 of these Employer Requirements.</p>
4. Sales of Bottom Ash and other Recyclables	The Contractor shall be responsible for the marketing and resale of recyclable materials from the Works at the Contractor's discretion. All proceeds from such resale shall belong to the Contractor. Contractor shall keep records of such proceeds from sale and include in the monthly reporting to the Employer for record purposes.
5. Electricity Exports and Imports	<p>Electrical power generated by the WTE facility will be exported to the grid operated by DES. The terms of the export of electricity shall be governed under a Power Purchasing Agreement between the Contractor and DES. The Contractor is required to comply with the terms of that PPA.</p> <p>The Contractor shall work with DES to develop written procedures governing the interfaces between the Contractor, and DES.</p> <p>The limit of the Contractor's responsibility during the Operation Service Period, including its obligation to operate and maintain electricity infrastructure, shall be as shown in Appendices 1E and Appendix 1F as appended herewith these Employer's Requirements for 11kV and 66kV Network respectively.</p> <p>Subject to the considerations of the Contractor, electricity supply shall be governed by the supply agreement between the Contractor and DES.</p> <p>The boundary of obligations between DES and the Contractor under this Contract as well as in relation to the PPA for the Operations and Maintenance of the electricity export and import infrastructure can be seen in Appendix 1D as appended herewith these Employer's Requirements. This shall be read in conjunction with the appropriate category that the Contractor has committed to</p>

	deliver in terms of the power export i.e. Category 1 (less than 10MW) or Category 2 (10MW and above).
6. Firefighting	<p>The Contractor shall liaise with the Brunei Fire and Rescue Department (BFRD) to ensure their requirements are met and agree with them on a fire fighting philosophy and strategy accordingly. This shall include, but not limited to, providing necessary infrastructure provisions within the site in compliance with the BFRD requirements and prevailing law and regulations governing the same.</p> <p>The Contractor shall also engage with BFRD to agree upon if there is a dedicated line required between the WTE plant and the nearest response centre of BFRD for sending any emergency signals in the event of any fire in the facility in addition to reaching out to BFRD through the hotline.</p> <p>The contractor shall provide several warning signs (in all strategic locations) and the telephone numbers of the local authority (BFRD, police and other emergency contact phone lines) at their site facilities. There should also be a fire marshal assigned for the facility and conduct regular fire drills to meet the authority requirements.</p>
7. Utilities	The Contractor shall be responsible for obtaining and maintaining all necessary permits and agreements for the supply of utilities as required for the efficient operation and maintenance of the Works. All costs in relation to the above including those for the consumptions shall be paid by the Contractor.
8. Environmental Regulation	<p>The Department of Environment, Parks, and Recreation is the regulating agency responsible for the protection, conservation and management of environment and biodiversity, as well as waste management and pollution prevention under the Environmental Protection and Management Act Revised Edition 2022 and Amendment Order 2025.</p> <p>The Contractor shall obtain all the regulatory permits and approvals, including but not limited to those indicated in Chapter above and shall comply with the terms of those permits.</p> <p>The Contractor shall i) cooperate with Environmental Authority inspectors, and ii) afford them all reasonably required access and assistance, and iii) promptly provide all regulatory reports and information requested by the Environmental Authority.</p>
9. Other Contractors	<p>The Employer may contract with third party contractors to undertake works within the Site that are not included within the scope of the Contractor's responsibility.</p> <p>The Contractor shall cooperate with such contractors and afford them all reasonably required access and assistance.</p> <p>The Employer shall be responsible for coordinating the work of the Contractor and any such third-party contractors that are assigned by the Employer for the works outside the Contractor's</p>

responsibility. The Contractor shall, to the extent reasonably possible, arrange its work so as not to interfere with the work of other contractors.

The Contractor may make a claim for reasonable compensation (under Article 20.1 of the GCC) in the case that its performance is adversely impacted by the activities of third-party contractors engaged by the Employer.

Figure 6-1: [not used]

6.4 Operation Management Requirements

6.4.1 Summary of Obligations for Operation Service

1. Standards of Performance Applicable During the Operation Service Period	<p>The Contractor shall ensure that the Operation Service complies at all times with:</p> <ul style="list-style-type: none">a) The conditions of any permit or consent issued by the Environmental Authority and other regulatory authorities; andb) The minimum standards specified in the Schedule of Performance Guarantees; andc) Any additional requirements set out in these Employer's Requirements. <p>The Contractor shall at all times operate and maintain the Works in accordance with the approved Contractor's Documents including:</p> <ul style="list-style-type: none">a) The Operation and Maintenance Manuals;b) The Environmental Management Plan (i.e. the CEMP);c) The H&S Plan;d) The Quality Assurance Plan; ande) The Operation and Maintenance Plan. <p>Where no specific performance standard exists in the Contract the Contractor shall at all times operate and maintain the Works in accordance with Good International Industry Practice.</p>
2. Ownership of Equipment and Materials Used in the Operation Service	<p>The Contractor acknowledges that, subject to the exceptions listed below in this sub-paragraph, all equipment, apparatus, machinery, mobile plant and vehicles relating to the operation and maintenance of the Works shall be deemed to have been paid for by the Employer through the fees paid under this agreement and are therefore the property of the Employer. All right, title, and interest in and to all such equipment, apparatus, machinery and vehicles, shall vest in the Employer.</p> <p>However, the Employer shall not have right of ownership over i) temporary site equipment brought onto the Site to undertake specific maintenance or remedial works, and ii) the personal property of the Contractor's Personnel.</p>
3. Free Issue Materials and Equipment	<p>The Contractor shall procure, at its own expense, all equipment, materials, fuels, electricity, consumables and other items necessary to perform the Operation Service. The Employer shall not provide any free-issue materials or equipment.</p> <p>For the avoidance of doubt, the raw waste shall be supplied to the Contractor free of charge.</p>
4. Green and sustainable	The Employer places high importance on environmental stewardship and long-term sustainability in the development and operation of the

operations considerations	<p>WTE Plant. The Contractor shall integrate green and sustainable design concepts throughout the lifecycle of the WTE Plant, with the aim of minimizing environmental impact while ensuring operational efficiency and regulatory compliance.</p> <p>The Contractor is expected to adopt sustainable operational practices post-commissioning. This includes continuous monitoring and optimisation of energy and water consumption, minimisation of greenhouse gas emissions, compliance with environmental performance indicators, and transparent environmental reporting. Opportunities for on-site renewable energy integration, green landscaping, and the establishment of educational or community engagement facilities may also be considered, where relevant. All systems and processes shall be designed with durability, ease of maintenance, and adaptability to evolving environmental standards in mind.</p> <p>The Employer encourages the Contractor to align with recognised green building or sustainability frameworks (e.g., LEED, BREEAM, ISO 14001, BCAI-Green Mark, BAGUS (Brunei Darussalam)) where applicable, and to propose innovative solutions that enhance the overall environmental performance of the WTE Plant over its entire Design-Build-Operate-Own-Transfer (DBOOT) lifecycle.</p>
5. Carbon credits and environmental revenue strategy	<p>As part of the Contractor's responsibilities during the operational phase, the Contractor shall explore and pursue opportunities for the registration, certification, and monetisation of carbon credits or other environmental attributes arising from the operation of the WTE Plant ("Environmental Attributes").</p> <p>The Contractor shall assess the potential eligibility of the WTE Plant under relevant international or regional carbon market mechanisms, such as the Clean Development Mechanism (CDM), Verified Carbon Standard (VCS/Verra), Gold Standard, or any emerging compliance or voluntary carbon markets recognised under Article 6 of the Paris Agreement or equivalent regulatory frameworks. The scope of eligible carbon credits may include, but is not limited to:</p> <ul style="list-style-type: none"> a) Greenhouse gas (GHG) emissions avoided through displacement of fossil fuel-based electricity; b) Methane avoidance from waste diversion from landfills; c) Energy efficiency measures and resource recovery processes; and d) Renewable or low-carbon energy generation. <p>The Contractor shall, as part of its operations proposal, include a carbon credit development plan that outlines:</p> <ul style="list-style-type: none"> a) The methodology(ies) to be adopted and applicable baseline emissions scenarios; b) Proposed verification and certification bodies; c) Monitoring, Reporting, and Verification (MRV) systems; d) Roles and responsibilities for documentation and compliance;

	<p>e) A financial model estimating revenue potential from carbon credit sales over the operational term.</p> <p>The Contractor shall be solely responsible for securing all necessary accreditations, certifications, and third-party verifications to qualify the WTE Plant for applicable Environmental Attributes and shall bear the associated costs. The revenue generated from the sale of Environmental Attributes shall accrue to the Contractor as part of its financial sustainability model, subject to transparency and periodic reporting to the Employer during the operating period.</p> <p>The Contractor shall furnish to the Employer with periodic updates on the status of carbon credit registration, volume of credits issued and sold, and associated impacts on greenhouse gas reduction, as part of the Contractor's environmental and operational reporting obligations.</p>
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6.4.2 Staff Organization and Training

1. Staff Organization	<p>Prior to the commencement of the Operation Service, the Contractor shall submit an Operation Service Staffing Plan as further described in Chapter 6.5.</p> <p>The Contractor shall ensure that its staff has expertise and experience consistent with i) its original proposal and ii) the requirements specified in Chapter 7 of these ER.</p> <p>Changes to the Contractor's Personnel shall be notified to the Employer's Representative at the end of each Calendar Month.</p>
2. Plant Manager	<p>The Contractor shall appoint a plant manager (the "Plant Manager") who shall be in overall charge of the Contractor's activities during the Operation Service Period.</p>
3. Emergency Contacts	<p>The Contractor shall ensure that it has a responsible officer in charge at all times during Operation Service Period, on a twenty four (24) hours per day seven (7) days per week basis. Such officer shall be empowered to represent the Contractor and shall be accessible to the Employer.</p> <p>The Contractor shall provide the Employer and Employer's Representative with a list showing the names and contact details of all the senior Contractor's Personnel tasked with managing emergency responses, including the Plant Manager, deputy plant manager, and shift managers. The list shall be maintained up-to-date and reissued following each update.</p>
4. Training of the Contractor's Personnel	<p>The Contractor shall ensure that all of its personnel employed at the Site are appropriately trained and certified.</p>

	<p>The Contractor shall prepare and implement a staff training plan (the “Staff Training Plan”) for the training of the Contractor’s Personnel during the Operation Service Period. The Staff Training Plan shall be submitted to the Employer’s Representative for comment but shall not require the approval of the Employer’s Representative.</p> <p>The Contractor shall conduct regular performance appraisal (at least twice a year) for all its Contractor’s Personnel which shall include specific section to evaluate the quality and effectiveness of the Contractor’s training programmes. A copy of such performance appraisal shall be furnished to Employer’s Representative upon request.</p>
5. Training of the Employer’s Personnel	<p>The Contractor shall provide the following training to the Employer’s Personnel in accordance with GCC sub clause 10.5:</p> <ul style="list-style-type: none"> a) Familiarity training on an as-needed basis to nominated members of the Employer’s supervisory staff covering the basic principles of the design, operation and maintenance of the Works and the Contractor’s procedures for reporting and quality control; b) Training with respect to the Contractor’s Health and Safety procedures; c) Training with respect to Emergency Procedures; d) Training of follow-on O&M staff prior to handover of the Works as further described in chapter 6.10 of these Employer’s Requirements.
6. Compliance to Laws and Regulations	<p>The Contractor shall ensure compliance to all the laws and regulations on the staffing including, but not limited to, maximum number of working hours allowed, regulatory requirements to be complied for shift workers, providing regular day-offs in compliance to regulatory requirements, presence of Health and Safety Officer on all shifts, designated Health and Safety Manager etc.</p>
7. Local Business Development and Bruneianisation	<p>The Contractor shall ensure all the commitments made during the tender in relation to the Local Business Development and Bruneianisation.</p> <p>The Contractor shall continuously seek improvements to maximise the active involvement of the local business, supply chains.</p> <p>The inclusion of Bruneians in the staff organisation shall be maximised by the Contractor. The Contractor shall also have a regular staff development and knowledge transfer program for ensuring the required skill sets are acquired by local Bruneians.</p>
8. Public Relations Officer	<p>The Contractor shall appoint a suitably qualified and experienced Public Relations Officer from Brunei Darussalam to actively engage any matters pertaining to the plant operations and associated communications with the public.</p>

	The Contractor shall not issue out press releases or operation videos etc to media or public without a written approval of the Employer.
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6.4.3 Operation Requirements-General Obligations

1. Hours of Operation	<p>The Contractor shall operate the Site on a continuous twenty-four (24) hours, seven (7) day per week basis except in the event of a planned shutdown. During planned shutdown, the Contractor shall still accept waste from the Employer, and shall not divert any waste when delivered.</p> <p>The Contractor shall ensure that the waste reception area is able to receive waste deliveries during waste delivery hours.</p>
2. Traffic Management	<p>The Contractor shall provide for the safe and efficient flow of vehicular traffic on the Site.</p> <p>The Contractor shall use its best efforts to avoid congestion of vehicles and spill-over of line ups off the Site boundaries.</p> <p>The Contractor shall provide an adequate number of employees to control and direct traffic.</p>
3. Inventory Management	<p>The Contractor shall maintain on Site a sufficient inventory of spare parts, fuel, consumables, and other Materials, as necessary to ensure the reliable the safe operation of the Works.</p> <p>The Contractor shall implement a computerized inventory management system.</p>
4. Security	<p>The Contractor shall maintain such security as is necessary to safeguard the Works. Fences and security gates shall be maintained in good condition.</p>
5. Signage	<p>The Contractor shall obtain the prior permission of the Employer's Representative before erecting any signage at the Site.</p> <p>The Contractor shall be permitted to display its name and logo at the entrance to the Site.</p> <p>All signage and displays shall be maintained in good order.</p> <p>The Contractor shall comply with the relevant laws and regulations including getting necessary approvals from the relevant authorities for the signages.</p>
6. Site Infrastructure, Roadways and Lighting	<p>The Contractor shall maintain, and keep in good repair, all site infrastructure, roadways, parking areas, and exterior lighting. The Contractor shall promptly replace all defective lighting. The Contractor shall be responsible to fully maintain the drainage, water supply system, firefighting system, sewerage system, internal</p>

	roads and the access link road outside the development site of the WTE Plant designed and constructed by the Contractor.
7. Site Tidiness	<p>The Contractor shall maintain the Site in a clean and tidy condition. Waste receiving and storage areas and residue storage areas shall be maintained free of litter, controlled for dust and odour, and shall be washed down daily.</p> <p>All facility roads and areas of significant vehicle activity shall be swept at least weekly.</p>
8. Ambient Air Quality Monitoring Stations	Until further notice by Environmental Authority, the Contractor shall operate the ambient air quality monitoring stations for the pollutants as defined in the EIA and EMMP for operations.
9. Control of Dust, Odours, Noise and Pests	<p>The Contractor shall employ such measures as are necessary to control potential environmental nuisance including, but not limited to, odours, litter, pests, insects, rodents and birds.</p> <p>The Contractor shall meet the minimum standards for the control of dust and APC residues as per laws, regulations and guidelines stipulated in Chapter 5.1 and 6.1 of this Employer's Requirements and as per the stipulations of the Operational EMMP or as directed by JASTRe</p>
10. Ownership of Valuable Fractions	Any valuable fractions arising from the waste shall belong to the Contractor in line with the transfer of the title for the waste. The Contractor shall accordingly deal with it as part of its business operations as long as it is in compliance to any prevailing laws and regulations. However, the Contractor shall not allow the scavenging of materials from waste at the Site by public.
11. Complaints	The Contractor shall establish and implement procedures for receiving, handling and resolving complaints. These procedures shall be consistent with the Grievance and Redress Mechanism in the EIA, EMMP and any other reports submitted and approved by the relevant authorities. The Contractor shall include summaries of complaints received in the Monthly and Annual reports. The Contractor's Public Relations Officer shall be responsible for handling all such complaints including liaison with any relevant authorities in relation to such complaints.
12. Visitor Centre	<p>The Contractor shall be responsible for running the visitor centre, including:</p> <ul style="list-style-type: none"> • Developing displays, presentation materials and videos to explain waste to energy; • Presenting lectures/tutorials to visitors; • Providing visitors with supervised tours of the WTE <p>The Contractor shall consult with the Employer and Employer's Representative to agree the key messages to be conveyed through the visitor centre.</p>

	<p>Any statistical data related to the plant operations, waste generated, power exported etc shall be confirmed with the Employer for clearance for use before using those information for any of the above materials.</p> <p>The Contractor shall ensure the safety of all visitors while at the Plant by placing in measures such as:</p> <ul style="list-style-type: none"> a) Proper safety briefing is conducted; b) Ensuring the visitors adhere to all the PPE requirements before admitting entering the plant; c) Visitors are appropriately logged and provided with a visitor identification pass; d) Dedicated focal person to act as a guide throughout the visiting period. <p>The Contractor shall be responsible to decide on the schedules and timing of the third-party visits to suit the plant operations and associated permissible safety and environmental conditions of the plant.</p>
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6.4.4 Acceptance and Processing of Waste

1. Coordination with the Employer	<p>The Contractor shall consult with the Employer to coordinate the flow of waste to the Works.</p> <p>Prior to the start of each year the Contractor and the Employer shall jointly agree on a schedule for the projected throughput in the next year, making due allowance for any necessary plant shutdowns.</p> <p>If necessary, the Contractor shall adapt the operation within the limits of the Works capacity to accommodate variations in flow of the waste.</p>
2. Waste Delivery	<p>Except with the prior approval of the Employer's Representative, the Contractor shall not receive deliveries of waste from other organizations or persons.</p> <p>The Contractor shall be responsible to treat the Contract Waste, which is defined as all the waste delivered by the Employer at the WTE throughout the Operation Service Period.</p>
3. Waste Screening	<p>The Employer is not able to fully control the quality or characteristics of the waste, and it is anticipated that deliveries of waste received at the Works may from time to time contain quantities of Non-conforming waste (hereinafter "Non-conforming Waste").</p> <p>Non-conforming Waste means any waste that cannot be safely processed through the combustion unit including Hazardous Waste which includes:</p> <ul style="list-style-type: none"> (a) explosive or highly flammable waste such as ammunition, dry and wet carbide waste, fireworks, self-igniting waste and other explosive materials;

	<p>(b) radioactive waste;</p> <p>(c) chemicals with a strong exothermic reaction (e.g. magnesium dust, solvents, etc.); and</p> <p>(d) high pressure containers (e.g. containers for liquids such as hot water, ammonia and propane); and.</p> <p>(e) or are otherwise regulated by Law,</p> <p>Non-conforming Waste also includes waste which contains an excessive amount of non-combustible wastes and/or more than 1% halogenated organic compounds by weight (expressed as chlorine).</p> <p>The Contractor shall develop and implement a procedure to screen Non-conforming Waste.</p> <p>The Contractor has the right to inspect all waste delivery vehicles delivering waste to the Works. The Contractor shall ensure that at least one competent employee is available in the waste reception area at all times when the facility is accepting waste.</p> <p>In the event that inspections reveal that a vehicle contains Non-conforming Waste, then the Contractor may reject the whole delivery in accordance with sub-paragraph [6.4.4 (4)] below.</p> <p>If the Contractor agrees to accept a truckload containing Non-conforming Waste, or in the case that Non-conforming Waste is inadvertently received, the Contractor shall either:</p> <ul style="list-style-type: none"> a) separate out the Non-conforming Waste and transfer it to a dedicated intermediate storage area for subsequent collection by waste supplier; or b) mix the Non-conforming Waste with other wastes so that it can be processed in small quantities.
4. Contractor's Right to Reject Waste	<p>The Contractor shall have the right to reject a delivery of waste, if the Contractor reasonably determines that:</p> <ul style="list-style-type: none"> a) Any portion of the load contains Non-conforming Waste b) The delivery driver has not followed the agreed procedures for inspection and weighing of the waste, c) The delivery driver has not complied with the applicable health and safety procedures; or d) The plant is unable to accept the waste for technical reasons. <p>Any waste so rejected shall be excluded from the record of waste received and the Contractor shall notify the Employer of each such occurrence together with the reason for rejection. The same shall not be accounted for in the calculation of the tipping fees.</p>

6.4.5 Waste Incineration and Energy Generation

1. Operation of the Incinerator Units	The Contractor shall operate the incinerator to achieve the standards specified in the Schedule of Performance Guarantees.
2. Use of Auxiliary Fuel	The Contractor shall maintain the minimum combustion conditions specified in the Schedule of Guarantees (PG7) at all times. In the event auxiliary fuel is to be used, this shall be procured at the Contractor's expenses and shall be covered by the Contract Price. The same shall apply to any auxiliary fuel required for start-up and shut down procedures which shall be included in the Contract Price.
3. Generation of Electricity from Waste	<p>The Contractor shall use its best endeavours to maximize electricity production, subject to any limitations of electricity demand.</p> <p>The Contractor shall at all times comply with the technical conditions of the Power Purchase Agreement (PPA) between the Contractor and DES and shall meet the minimum standards electricity exports specified in the Schedule of Performance Guarantees.</p>
4. Sale of Surplus Energy	The Contractor may at any time propose schemes for the use of surplus energy generated at the Site, along with proposals for the equitable sharing of costs, sales or profits.

6.4.6 Residual Waste Disposal

1. Bottom Ash Processing	<p>The Contractor shall, at its discretion, process the bottom ash in order to maximize the amount of bottom ash that can be recycled.</p> <p>Following processing, the recyclable fraction of the bottom ash shall be transferred to storage facilities as defined in 5.4.8 ready for collection by the Contractor's selected offtaker. All such arrangements with the selected offtaker shall be the responsibility of the Contractor. The Contractor shall report to the Employer, for information, in their monthly report the amount of such recyclable fraction of bottom ash sent to the selected offtaker and the details of the offtaker.</p> <p>The Contractor shall transfer the non-recyclable fraction of the bottom ash to landfill at its own costs including paying any prevailing charges of the landfill imposed by the landfill operator.</p> <p>All costs associated with such disposal shall be paid by the Contractor, including, but not limited to, transportation, charges for the landfill imposed by the landfill operator. The Contractor shall report to the Employer, for information, in their monthly report the amount of such bottom ash sent to the selected offtaker and the associated charges paid to the landfill operator.</p> <p>Besides the Total Organic Carbon (TOC) content of the raw bottom ash, the Contractor shall monitor the content of heavy metals and soluble salt components of the processed fraction that shall be used as recycled bottom ash for construction purposes. At</p>
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	<p>least, the following components shall be analysed from representative samples every 6 months:</p> <ul style="list-style-type: none"> a) Grading b) TOC c) Chloride d) Sulphate e) Water soluble content f) Cadmium g) Chromium h) Copper i) Nickel j) Mercury k) Zinc l) BTEX (benzene, toluene, ethylbenzene, and xylene)/ PAHs (Polycyclic Aromatic Hydrocarbons). <p>Results of this monitoring shall be submitted with the monthly or, as the case may be, annual reports as per Chapter 6.8.</p>
2. Recyclable Metals	<p>Without compromising the quality of the mineral fractions, the Contractor shall remove from the bottom ash ferrous and non-ferrous metal objects to the highest possible extent.</p>
3. Air Pollution Control (APC) Residues	<p>APC residues shall be disposed safely to the landfill, meeting the European standards (1999/31/EC) as defined for hazardous waste (except acceptance tests).</p> <p>The Contractor shall handle and dispose of all APC residues and ensure that processing is conducted in a manner that prevents fugitive emissions and escape of dust. The Contractor shall, at all times, meet the minimum standards for the control of dust as per laws, regulation and guidelines stipulated in Chapter 5.1 and 6.1 of this Employer's Requirements.</p> <p>The area around the APC residues silo shall be kept clean at all times and spills shall be dealt with immediately.</p> <p>The driver of the APC residues transport vehicle shall be required to use personal protective equipment during loading and unloading to prevent the inhalation of dust and fumes.</p> <p>The Contractor shall be responsible to stabilize the APC residues and ensure it meets relevant requirements and standards, subject to the Employer and authority approvals in case of disposal at landfill.</p> <p>Alternatively, the Contractor shall be responsible to contract with hazardous waste management providers registered with the</p>

	<p>Department of Environment, Parks and Recreation for the safe collection of the APC residues and treatment / disposal.</p> <p>The Contractor shall report to the Employer, for information, in their monthly report the amount of such APC residues sent to the hazardous waste management providers registered with the Department of Environment, Parks and Recreation and the associated charges paid by the Contractor. The report shall also include the inventory size of the APC residues stored as an interim at the Site.</p>
4. Monitoring of Residues	<p>The Contractor shall monitor and record the type and quantities of waste residues removed from Site or sent to landfill.</p> <p>The Contractor shall also ensure that each vehicle removing bottom ash or other recyclable materials from the Site correctly uses the weighbridge at the Site and that the weight has been accurately recorded for each such vehicle.</p> <p>Aggregated records shall be submitted to the Employer together with the monthly reports as per Chapter 6.8.</p>

6.4.7 Residual Waste and the Leachate Treatment Plant

1. Residual Waste Disposal	<p>The Contractor shall submit to the Employer's Representative, for review and approval, an annual Residual Waste Plan as further described in Chapter [6.4.10]. The Residual Waste Plan shall take account of the types of waste that are landfilled and shall consider the separated disposal of the residual bottom ash and the APC residues.</p>
2. Landfilling	<p>The Contractor shall be responsible to treat, stabilize and dispose of all APC residues and any other residual wastes (i.e. excluding bottom ash for recycling and valuable wastes to be exported for reuse) to the adjacent landfill with applicable charges. Appropriate treatment to the bottom ash and APC residues shall ensure safe disposal approved by the Department of Environment, Parks and Recreation.</p> <p>The Contractor shall be responsible for the transport of wastes to the landfill site.</p> <p>The method of treated APC residue disposal shall be as detailed in the Contractor's approved Operation and Maintenance Plan and the Contractor's approved Annual Residual Waste Plan. The Contractor shall arrange all APC disposal as necessary to achieve the most efficient use of the available landfill volume.</p> <p>The Contractor shall not dispose of any waste to landfill except for approved residues from the WTE Plant and shall not permit third parties to dispose of wastes to the landfill unless, as an exception, consented by the Employer. Any waste covered by such consent</p>

	shall be of mineral nature with a total organic carbon content of less than 5% by weight.
3. Operation of the Leachate Treatment Plant	<p>The Contractor shall collect leachate from the WTE and treat it at the Leachate Treatment Plant (LTP).</p> <p>The Contractor shall operate and maintain the LTP and all associated collection systems and outfalls in accordance with regulatory requirements. Treated effluent from the LTP shall comply with the discharge standards specified in the Schedule of Performance Guarantees.</p>
4. Monitoring Groundwater	<p>The Contractor shall establish a monitoring program that allows to regularly assess the groundwater quality in the closer vicinity of and beneath the landfill.</p> <p>Samples shall be taken at least every three months and shall be analysed by independent accredited laboratory so that any potential leakage of the multi-barrier system can be detected. Parameters to be measured shall be agreed between the Contractor and the Environmental Authority but shall include at least the following: polycyclic aromatic hydrocarbons, phenols, cadmium, arsenic, ammonium, nitrites, hexavalent chromium and chromium total, copper, iron, lead, mercury, zinc.</p> <p>Sampling program and results shall be included in the relevant monthly reports.</p>

6.4.8 Maintenance and Asset Replacement

1. General	<p>All maintenance and asset replacement shall be carried out in line with Good International Industrial Practice. The Contractor shall at all times maintain the Works in good repair.</p> <p>The Contractor shall ensure that all maintenance works are carried out according to the latest safety standards and that all staff is sufficiently qualified for the tasks assigned.</p> <p>The Contractor shall prepare detailed procedures for all maintenance works. The Contractor shall ensure that live electrical components deactivated before commencing work on them.</p> <p>The Contractor shall be responsible to provide the necessary spare and wear parts, tools, lubricants, grease etc. for all maintenance works at its expenses any time irrespective whether the maintenance is carried out by its own or by third party personnel.</p>
2. Works Reliability	<p>The Contractor shall develop and implement preventive, condition based and corrective maintenance programmes to achieve the standards for availability and reliability specified in the Schedule of Performance Guarantees and that are required to meet regulatory requirements.</p>

	In no case, the applied maintenance for preventive and condition-based maintenance shall be inferior to the manufacturers' and suppliers' recommended cycles and measures.
3. Planning of Shutdowns	<p>The Contractor shall submit to the Employer's Representative an Annual Maintenance Plan as further described in chapter [6.5]. The annual plan shall include an indicative schedule of planned shutdowns of major items of Plant for the next five-year period that shall be updated every year and whenever needed.</p> <p>Insofar as is practical, the Contractor shall consider the preferences of DES (and other energy customers if applicable) when preparing the indicative schedule of planned shutdowns and shall ensure compliance at all times with the terms of the Power Purchase Agreement with DES.</p> <p>In case of multiple treatment lines, the Contractor shall not schedule shutdowns for more than one incinerator unit at a time, other than for a total WTE facility maintenance shutdown or unless required for maintaining common systems.</p>
4. Planned Facility Shutdowns	<p>The Contractor shall closely coordinate with the Employer's Representative on the planned shutdown of any part, or all, of the Works that will have an impact on the waste throughput.</p> <p>The notice for shutdown shall be submitted to the Employer's Representative no later than 60 days prior to the shutdown, and shall state the rationale, time and duration of the planned shutdown.</p> <p>Following the coordination with the Employer's Representative the Contractor shall notify both the Employer and DES of the timing, nature and duration of the planned interruption.</p> <p>Prior to any shutdown, the Contractor shall seek to empty the bunker and shall then use the available bunker volume as a buffer for the ongoing waste delivery unless otherwise agreed upon by the Parties (e.g. in case of a revision of the bunker cranes).</p>
5. Unplanned Shutdowns	The Contractor shall promptly notify the Employer's Representative in the event that the Works suffers an unplanned interruption leading to a reduction in waste throughput. The Contractor shall forthwith undertake the necessary actions to bring the Works back to full operation.
6. Maintenance Management System	The Contractor shall maintain a computerized maintenance management system to track all maintenance activities at the Site, including but not limited to preventative maintenance schedules and work orders.
7. Asset Replacement	The Contractor shall undertake asset replacement in accordance with the Contractor's proposal under Section 5 – Part 3B – Bill No. 2B - Asset Replacement Requirements and the associated Asset Replacement listed therein. All costs associated with this are deemed part of the Contract Price and deemed included in the

	<p>tipping fees Section 5 – Part 6 – Schedule of Tipping Fees accordingly.</p> <p>When an asset is to be replaced, the specification of the replacement asset shall be at least equal to or better than the original, and the design life of the replacement asset shall be in accordance with the asset life table in chapter 5.4 (Table 5-9) of these Employer's Requirements.</p>
8. Recurrent Tests and Inspections	<p>Besides the below mentioned tests on the Performance Guarantees, the Contractor shall include in its Works Testing Plan all components that need regular periodic testing and inspections due to their operational parameters or due to their safety requirements, such as pressurized vessels (steam boilers and the like) or elevators. The relevant regulations as per Chapter 6.1.3 shall apply.</p>

6.4.9 Compliance Monitoring and Testing

1. Access	<p>The Contractor shall provide access to the Employer, the Environmental Authority or any other legal Authority for sampling and testing including, without limitation, flue gas emission sampling, APC residues, bottom ash testing, leachate treatment, wastewater discharge testing, and noise level records.</p>
2. Testing Plan	<p>The Contractor shall prepare a Works Testing Plan (the "Works Testing Plan") in accordance with the specification provided in chapter 6.5. The Works Testing Plan shall be submitted to the Employer's Representative for approval.</p> <p>The Contractor shall thereafter undertake all sampling, testing, calibration and reporting in accordance with the approved Works Testing Plan.</p>
3. PG1: Waste capacity	<p>Waste capacity shall be measured using the crane scales. The Employer may request the Contractor to demonstrate the waste processing capacity any time upon 5 days' notice. However, the Contractor shall not be required to undertake testing more than once per year.</p> <p>The Contractor shall have the scales inspected and calibrated every third year or earlier (if warranted by the law and regulations such as Weights and Measurements Acts and associated regulations set by the relevant authorities) at least by an approved independent specialist scale calibration company.</p> <p>The methodology for Throughput Capacity Test described in Chapter 5.16 shall apply. The Minimum Performance Guarantee of 95% of the defined WTE throughput must be achieved by the Contractor.</p>
4. PG2: Minimum Annual Waste throughput	<p>Waste throughput shall be measured using the weigh bridge located at the waste acceptance building. The Contractor shall</p>

	<p>ensure that the weigh scales are accurate to within [+/- 0,2%] tolerance. The Contractor shall have the scales inspected and calibrated every third year or earlier (if warranted by the law and regulations such as Weights and Measurements Acts and associated regulations set by the relevant authorities) at least by an approved independent scale calibration company.</p> <p>The methodology described in Chapter 5.16 shall apply to align the waste throughput with the NCV of the waste.</p>
5. PG3: Delivered Annual Waste Throughput Above Minimum Annual Waste Throughput	<p>Waste throughput shall be measured using the weigh bridge located at the waste acceptance building. The Contractor shall ensure that the weigh scales are accurate to within [+/- 0,2%] tolerance. The Contractor shall have the scales inspected and calibrated every third year or earlier (if warranted by the law and regulations such as Weights and Measurements Acts and associated regulations set by the relevant authorities) at least by an approved independent scale calibration company.</p> <p>The methodology described in Chapter 5.16 shall apply to align the waste throughput with the NCV of the waste.</p>
6. PG4: Net Power Output	<p>The net power output shall be tested prior to Contract Completion and Handover.</p> <p>The Minimum Performance Guarantee of 95% of the defined Net Power Output must be achieved by the Contractor.</p>
7. PG5 Carbon-content of bottom ash (TOC)	<p>Total organic carbon in the bottom ash shall be measured two times per month (every fortnight) at the conveyor belt to the bottom ash treatment plant.</p> <p>The Contractor shall test the samples either in-house using the on-site laboratory, or externally using an accredited laboratory. In the case, that the samples are tested in-house, the Contractor shall arrange for at least four samples per year to be analysed by an external accredited laboratory.</p> <p>In the event the results of the in-house and external tests differ by more than 10% and any of the external analyses yields a TOC content above 3.5%, the Contractor shall not be permitted to continue measuring in-house until the Employer Representative has been satisfied of the efficacy of the Contractor's sampling, testing and quality assurance processes.</p> <p>The Contractor shall keep retain samples for one year.</p>
8. PG6: Air emissions monitoring	<p>The Contractor shall monitor the air emission concentrations of all pollutants included in these Employer's Requirements chapter 4, Table 4-2.</p> <p>Air emissions are regulated by the Environmental Authority. The Environmental Authority shall be entitled at any time to inspect and test the air emissions measuring equipment in order to satisfy themselves of the accuracy and reliability of Contractor's air emissions results.</p>

	<p>If any of the emission limits are breached, the Contractor shall immediately notify the Employer's Representative for rectification action and reporting to the Environmental Authority. The Environmental Authority may require the Contractor to shut-down the facility until defects have been rectified.</p> <p>The parameters listed in Table 4-2 that are to be monitored continuously shall be measured using the CEMS system. The CEMS shall be calibrated by a third-party laboratory or firm that is accredited according to ISO/IEC 17025 at least every third year unless shorter calibration intervals are instructed by Environmental Authority. In addition to the calibration, the Contractor shall conduct functionality checks and shall demonstrate that the CEMS is continuously self-calibrated using test gases for the different pollutants. Procurement documentation and certificates of the test gases shall be provided with the annual reports.</p> <p>The parameters that are to be measured discontinuously shall be tested by a third-party laboratory or firm that is accredited according to ISO/IEC 17025.</p> <p>After successful commissioning, the discontinuous sampling shall be carried out every second months on one day during the first 12 months and thereafter every 6 months a sample shall be taken each day over a period of three days. In either case the sampling cycles as defined in note 3 to Table 4-2 shall be considered.</p> <p>Samples containing discontinuously measured pollutants shall be preserved appropriately to avoid losses and decomposition of pollutants during storage and shipment.</p> <p>Third party testing and calibrating agents shall submit copies of its test and calibration reports simultaneously to the Contractor, Employer and the Environmental Authority.</p> <p>Copies of all current and historical CEMS records shall be made available to the Employer's Representative upon request.</p>
9. PG7 Combustion Conditions	<p>The Contractor shall record the combustion temperature continuously via appropriate measurement devices installed in the post combustion zone. The Contractor shall check the functionality of the temperature measurements annually (to be documented in the annual report as per Chapter 6.8) and to calibrate the temperature measurement every three years via an appropriate traverse measurement carried out by an accredited laboratory or firm pursuant to ISO 17025.</p> <p>It shall be at the discretion of the Employer to request the Contractor to validate the residence time concurrently to the calibration of the temperature measurement.</p>
10. PG8: Discharges from the Leachate Treatment Plant	<p>The Contractor shall monitor all of the pollutants listed in Table 4-3.</p> <p>The leachate treatment plant discharges are regulated by the Environmental Authority. If any of the discharge limits are breached, the Contractor shall immediately notify the Employer's</p>

	<p>Representative and Environmental Authority. The Environmental Authority shall be entitled at any time to inspect and test the wastewater measuring equipment in order to satisfy themselves of the accuracy and reliability of Contractor's results.</p> <p>Concentrations of the pollutants listed in Table 4-3 shall be measured monthly in a 2-hour composite sample taken by an automatic sampler. Samples shall be taken from the permeate collection tank.</p> <p>The Contractor shall engage, at its own expense, an ISO/IEC 17025 accredited laboratory or firm to analyse the samples which will be verified four times a year by reference samples taken on behalf of the Environmental Authority.</p> <p>In the event the reference sample taken on behalf of the Environmental Authority differs from the Contractor's sample, the average value of the two samples shall be used. The Contractor shall keep retain samples for one year.</p> <p>All samples taken shall be duly preserved for storage and/or shipment.</p>
11. PG9: Discharges from the Wastewater Treatment Plant	<p>Samples from the wastewater treatment plant shall be taken and analysed twice per year by the Contractor or an external accredited laboratory.</p> <p>The Environmental Authority may validate the measurement by a reference sample. In the event that the reference sample yields a higher concentration, the average of the two samples shall be used.</p>
12. PG10: Noise	<p>Tests for noise shall be carried out following any noise complaint or at the request of the Employer's Representative. However, the Contractor shall not be required to undertake noise testing more than once every two years.</p>
13. Calibration of Monitoring and Testing Equipment	<p>Unless specific calibration tolerances and frequencies are specified in these Employer's Requirements, all monitoring and testing equipment shall be checked and calibrated in accordance with i) the manufacturer's recommendations, and ii) the operation and maintenance manuals, and iii) regulatory requirements.</p> <p>In addition, the Employer's Representative may direct the Contractor to undertake calibration tests on any apparatus if, acting reasonably, he has concerns over the accuracy of the Contractor's data.</p>
14. External laboratories and validation of test results	<p>External laboratories, where specified in these Employer's Requirements, shall be ISO/IEC 17025 accredited. The Contractor shall obtain the approval of the Employer's Representative prior to the appointment of an external laboratory.</p> <p>The costs of all sampling and testing carried out in-house or by external laboratories shall be borne by the Contractor.</p>

6.4.10 Contractor's Plans and Documents-Operation Service

1. General	<p>With respect to each of the Contractor's plans and other documents listed in this Chapter, the Contractor shall meet the following requirements:</p> <ul style="list-style-type: none"> a) The Contractor shall submit each of the documents to the Employer's Representative for review and comment, or review and approval, in accordance with the requirements and timetable listed in Table 6-2 below; b) The Contractor shall update the plans and documents where indicated in Table 6-2 below. The requirement for review and approval of the updated document shall be the same as those for the original document, unless stated otherwise.
2. O&M Manuals	<p>The requirements for the Operation and Maintenance Manuals shall be as described in GCC 5.6.</p>
3. Contractor's Environmental Management Plan (Operations)	<p>The Contractor shall provide and obtain approval for the Environmental Monitoring and Management Plan (EMMP) for operations from the Environmental Authority and implement the same accordingly based on approval conditions.</p>
4. Health and Safety Plan (Operations)	<p>The Contractor shall develop a Health and Safety Plan covering all aspects of the Contractor's Operation Service activities. The plan shall be designed to ensure the protection of all Contractor's Personnel, the Employer's Personnel and all other persons who may visit the Site.</p> <p>The Health and Safety Plan (Operations) of the Contractor shall include, but not be limited to, a description of how the Contractor will:</p> <ul style="list-style-type: none"> a) carry out all its health and safety responsibilities as required under the applicable law; b) provide ongoing health and safety training for the Contractor's Personnel and Employer's Personnel; c) develop and manage all required health and safety monitoring and reporting procedures; d) manage all health and safety claims.
5. Emergency Response Plan	<p>The Contractor shall prepare an emergency response plan to manage emergencies including,</p> <ul style="list-style-type: none"> a) major failure of equipment; b) fires and explosions c) spills and pollution incidents; d) extreme weather conditions; e) natural disasters; and f) other similar emergencies;

	<p>The Contractor shall include in the Emergency Response Plan:</p> <ul style="list-style-type: none"> a) contingency plans for all identified emergencies; b) the identities of key Contractor emergency response coordination staff, together with emergency contact details; c) procedures to provide immediate notification to the Employer and Employer's Representative upon the occurrence of any emergency; d) the location of emergency equipment and other resources; e) training programs for the Contractor staff; f) intended emergency responses to tackle incidents due to operational failure of components, fire, storm and flooding hazards or the like; and g) a program for emergency response exercises.
6. Operation Service Staffing Plan	<p>Prior to the commencement of the Operation Service, the Contractor shall submit an Operation Service staffing plan which shall include:</p> <ul style="list-style-type: none"> a) the Contractor's proposed organization for carrying out the Operation Service; and b) the names, qualifications and experience of all operation and maintenance personnel; and c) CVs for all key staff for which minimum qualification and experience criteria have been set in chapter 7
7. Works Testing Plan	<p>Prior to the commencement of the Operation Service, the Contractor shall submit a Works Testing Plan for the Operation Service Period which shall include:</p> <ul style="list-style-type: none"> a) Procedures for functionality checks, safety and operational testing of relevant equipment and components; b) Self-calibrating, calibrating the CEMS, the reference measurements required for the CEMS reports, the temperature measurement in the post combustion zone and all hereto related reporting; c) Procedures for validating the measurements required to calculate the NCVs as per Chapter 5.16; d) Procedures for sampling, testing and reporting on wastewater discharges from the leachate treatment plant; e) Procedures for sampling, testing and reporting on bottom ash and APC residues; f) Protocols for retesting and validation after a failure; g) Sampling and testing timetables; h) Requirements for calibration of all testing and monitoring equipment (covering calibration methodology, frequency, and acceptable accuracy ranges);

	<p>i) Details of the organizational arrangements for sampling, testing, reporting and quality control.</p>
8. Annual Residual Waste Plan	<p>The Contractor shall submit an annual Residual Waste Plan which shall include:</p> <ul style="list-style-type: none"> a) A methodology for the disposal of all residual wastes; b) A summary of the area and volume of landfill already filled; c) A plan for filling landfill sub-cells in the next year; and d) An estimate for the useful remaining life of each of the landfill sub-cells.
9. Annual Maintenance Plan	<p>The Contractor shall submit an annual Maintenance Plan which, amongst others, shall include:</p> <ul style="list-style-type: none"> a) A summary of the main maintenance issues affecting the Works; b) An indicative schedule of planned shutdowns over the next two-year period; c) A program for Asset Replacement over the next two-year period.
10. Staff Training Plan	<p>The Contractor shall submit its staff training plan, which shall include:</p> <ul style="list-style-type: none"> a) A training needs assessment for the Contractor's Personnel; b) An annual training plan for the development of staff competencies.
11. Quality Assurance Plan	<p>The Contractor shall either update the existing Design-Build Quality Assurance Plan or develop a new Quality Assurance Plan designed for the purposes of the Operational Service. The Quality Assurance Plan shall be as described in chapter 6.6.</p>
12. Transition Plan	<p>Prior to Contract Completion, the Contractor shall develop and submit a Transition Plan as further described in chapter 6.9.</p>
13. Plan for the Tests Prior to Contract Completion	<p>Prior to Contract Completion, the Contractor shall develop and submit a Plan for the Tests Prior to Contract Completion as further described in chapter 6.9.</p>
14. Documents to be kept on Site during the OS Period	<p>The Contractor shall at all times hold the following documentation on Site during the Operation Service Period:</p> <ul style="list-style-type: none"> a) The Contractor's Design-Build Documents listed in Chapter 5; b) Commissioning testing records and Commissioning Certificate; c) The Contractor's Operation Service plans and documents listed in Table 6-2; d) CEMS records, sampling and testing records, calibration records, incidence and failure records, and safety records covering the entire period of the Operation Service to date unless otherwise agreed;

	e) A copy of all permits and licenses listed in chapter 6.2 above; f) Copies of all relevant codes of practice, regulations, laws and guidelines governing the generation and export of electricity.
15. Site Security Plan	The Contractor shall develop and submit a Site Security Plan during the Operation Service Period.

Table 6-2: Schedule of documents to be submitted by the Contractor (Operation Service)

Title	Initial submission date	Update frequency	ER Approval requirements	Form of submission/ Nr copies
Operation and Maintenance Manuals	As specified in Chapter 5.6	As necessary to re- main up to date	Review and approval (as GCC 9.12). Manual updates do not require approval.	Soft copy + 2 hard copies
Contractor's Environmental Management Plan (Operations)	3 Months prior to the Operation Service commencement date	As necessary to re- main up to date	Review and approval	Soft copy + 2 hard copies
Updated Health & Safety (H&S) Plan	2 Months prior to the Operation Service commencement date	As necessary to re- main up to date	Review and approval	Soft copy + 2 hard copies
Emergency Response Plan	3 Months prior to the Operation Service commencement date	As necessary to re- main up to date	Review and approval	Soft copy + 2 hard copies
Operation Service Staffing Plan	2 Months prior to the Operation Service commencement date	Not required	Review and approval	Soft copy + 2 hard copies
Works Testing Plan	2 Months prior to the Operation Service commencement date	As necessary to re- main up to date	Review and approval	Soft copy + 2 hard copies
Annual Residual Waste Plan	2 Months prior to the Operation Service commencement date	Annually	Review and approval	Soft copy + 2 hard copies
Annual Maintenance Plan	2 Months prior to the Operation Service commencement date	Annually	Review and com- ment	Soft copy + 2 hard copies
Staff Training Plan	[for discussion]	Annually	Review and com- ment	Soft copy
Quality Assurance Plan (Operation Service)	2 Months prior to the Operation Service commencement date	As necessary to re- main up to date	Review and com- ment	Soft copy + 2 hard copies
Transition Plan	[2 years] prior to the Contract Completion Date	n/a	Review and approval	Soft copy + 2 hard copies
Plan for the Tests prior to Contract Completion	[6 Months] prior to the Contract Completion Date	n/a	Review and approval	Soft copy + 2 hard copies

Title	Initial submission date	Update frequency	ER Approval requirements	Form of submission/ Nr copies
Site Security Plan	<i>2 Months prior to the Operation Service commencement date</i>	<i>Annually</i>	<i>Review and approval</i>	<i>Soft copy + 2 hard copies</i>

6.5 Health, Safety, Environmental and Social Requirements

6.5.1 Health and Safety on Site

1. Health and Safety on Site	<p>The Contractor undertakes to comply, and to ensure its subcontractors comply, with the Health and Safety Plan (Operations).</p> <p>The contents of the Health and Safety Plan (Operations) shall be as described in Chapter 6.4.10.</p>
2. H&S Manager	<p>The Contractor shall appoint a Health & Safety Manager (the “H&S Manager”) who shall be permanently based on the Site for the full duration of the Operation Service. The H&S Manager shall fulfil the role of Accident Prevention Officer under GCC sub clause 6.7 (Health and Safety) and shall also oversee medical personnel, first aid arrangements and supplies, sick bay and readiness to evacuate serious cases.</p> <p>The H&S Manager shall have the authority within the Contractor’s organization to be able to allocate such any resources, personnel and equipment as are required to correct H&S relating deficiencies.</p> <p>During the shift cycles, the H&S Manager shall be represented by a suitably trained, relevant authority approved shift Health and Safety Officer that shall be supervising all H&S related matters.</p> <p>The Contractor shall ensure compliance to all the laws and regulations including specific guidelines and requirements of SHENA.</p>
3. Health and Safety ad Emergency Response Training	<p>The Contractor shall provide health and safety training for each of the Contractor’s Personnel (including the staff of its subcontractors) and shall keep records of such training.</p> <p>The training activities shall be as specified in the approved Health and Safety Plan and approved Emergency Response Plan. They shall include (as applicable):</p> <ol style="list-style-type: none">Induction training for all Contractor’s Personnel;Ongoing job-specific technical training;Emergency response training; andFirst aid training for designated first aid staff.
4. Firefighting	<p>The Contractor shall</p> <ol style="list-style-type: none">Designation of trained Fire Wardens for the various zones of the SitePrepare and be able to implement a fire response plan (which will form part of the Emergency Preparedness Plan);Regularly inspect, test and maintain all firefighting installations and equipment;

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| | <ul style="list-style-type: none">d) Provide sufficient firefighting water according to the legal requirements; ande) Train and inform periodically its staff, the Employer's dedicated staff and other authorities about the implemented fire-fighting measures and plans. |
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6.5.2 Contractor's Environmental Management Plan (Operations)

1. EMP (Operations)	<p>The Contractor shall prepare the Environmental Management Plan for operations presented in the project Environmental Impact Assessment (EIA) in Appendix 3.2 relevant to the Operation Service.</p> <p>The Operation Service activities described in the EMP shall follow the structure, norms, and standards defined in Chapter 5.1 and 6.1. and shall be consistent with and shall not relax conditions and requirements as per the EMP included in the EIA.</p>
2. Environmental Manager	<p>The Contractor shall appoint an Environmental Manager who shall be permanently based on the Site for the full duration of the Operation Service. The Environmental Manager shall fulfil the role defined under GCC sub clause 4.18 (Protection of the Environment).</p> <p>During the shift cycles, the Environmental Manager shall be represented by a suitably trained shift staff that shall be supervising all environmental related matters.</p> <p>The Environmental Manager shall ensure that all key Contractor's personnel including but not limited to professional engineers, site supervisors and all persons responsible for directing work on the site are familiar with the EMP and are required to adhere to its requirements.</p> <p>The roles of Health & Safety Manager and Environmental Manager as well as the corresponding shift members (described in Chapter 6.5.1) may be vested in a single individual, provided that this individual complies with all requirements for both positions.</p>
3. Provisions to be included in the EMP	<p>The Contractor shall consider the particular environment and location of the Site and shall pay particular attention shall be included, but not limited, to the following items below:</p> <ul style="list-style-type: none"> a) Air emissions and dust control; b) Noise & vibration control; c) Effluent management; d) Waste management; e) Hazardous substance handling and storage management, including spill contingency; f) Erosion, soil & vegetation management; g) Traffic management; h) Recruitment and labour management, including the skills development and local procurement; i) Flooding and natural hazards j) Storm water management.

6.6 Quality Assurance and Control Requirements

1. Quality assurance requirements	<p>The Contractor's quality assurance system during the Operation Service Period shall be in accordance with ISO 9001 or similar international standard</p> <p>The Contractor shall develop a written quality assurance manual that details the Contractor's quality assurance and control procedures. The Quality Assurance Manual shall include the following:</p> <ul style="list-style-type: none">a) Roles and responsibilitiesb) Communicationsc) Review of documents prior to issued) Records and document controle) Specific quality assurance and quality control procedures covering specific aspects of the Operation Service (waste acceptance, monitoring, etc.) <p>The quality assurance procedures shall be in accordance with the requirements of GCC 4.9.</p>
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6.7 Not used

6.8 Reporting during Operation Service Period

1. Information to be Reported Immediately	<p>The Contractor shall immediately notify the Employer's Representative, either verbally or in writing, if any of the following events occur:</p> <ul style="list-style-type: none"> a) An unplanned interruption to the normal operation of the facility; b) A material breach of a condition of an environmental permit; c) A material breach of a condition in the Power Purchase Agreement between the Contractor and DES including but not limited to any breach of a condition in the license to generate electricity; d) An emergency event such as a fire, flood or any other emergency event as defined in the Emergency Preparedness Plan; e) Any complaints from the public made to the Contractor and the associated actions taken by the Contractor and its Public Relations Officer; f) Any requests from third-party visitor groups to visit the Site; g) A serious accident, or fatality on the Site. <p>The Contractor shall, within one week of such event provide a detailed written report to the Employer's Representative setting out the circumstances and cause of the event, and the measures taken by the Contractor to mitigate or resolve the problem.</p>
2. Site Diary	<p>The Contractor shall maintain an electronic site diary that shall be mirrored into the PIMS to allow the Employer's Representative any time to satisfy itself about the ongoing Operation Service. The format and content shall be subject to the Contractor's discretion. In any case the site diary shall convey information that cannot be retrieved from the PIMS data archive.</p>
3. Monthly Report	<p>Within 7 days of the end of each calendar Month, the Contractor shall submit a monthly report to the Employer's Representative summarising the performance of the Works during the previous Month. The layout and format of the reports shall be discussed and agreed with the Employer's Representative.</p> <p>The Monthly report shall include:</p> <ul style="list-style-type: none"> a) The amounts of waste processed including, waste delivered, incinerator throughput, Non-conforming Waste received and rejected, and hazardous waste received and disposed; b) The amount of recyclables (i.e. bottom ash, metals and other valuables) processed, stored on Site, and, as the case may be, the results of the bottom ash monitoring as per Chapter 6.4.6.1 and 6.4.6.4. c) The amounts of non-recyclable residues disposed to landfill; d) Availability and downtime statistics for all major items of Plant, including the incinerator units, together with a report on the

	<p>causes of Plant downtime;</p> <ul style="list-style-type: none"> e) A report on air emissions quality (including CEMS results and the results of tests of discontinuously monitored parameters), carried out in the Month; f) A report on leachate collection and treatment showing leachate levels, flows, tests undertaken pre and post treatment, and leachate discharge compliance rate; g) A report on compliance with the Schedule of Performance Guarantees; h) Records of electricity generated, exported and imported; i) Records of steam production; j) Records of consumption of chemicals and other consumables; k) A summary of major Plant and equipment repairs undertaken together with a summary of Asset Replacement undertaken in the Month; l) A summary of any laboratory tests undertaken and the results thereof; m) A report on health and safety incidents (including accidents), environmental issues (dust control, noise, smell, groundwater etc.), security breaches, and other exceptional events during the Month; n) A summary of complaints received, and responses provided; o) A programme of activities for the following three Months including, but not limited to, planned shutdowns, the envisaged waste throughput in the subsequent months, repairs and asset replacements etc; p) Any other data / information stated elsewhere in this Employer's Requirements to be submitted to the Employer / Employer's Representative as part of Contractor's reporting process (other than those of emergency and urgent in nature which shall be reported immediately); q) Any other data reasonably requested by the Employer's Representative <p>The Monthly report shall be submitted in electronic form only. Format and style of the report shall be agreed between the Parties.</p>
4. Annual Report	<p>Within 28 days of each anniversary of the commencement of the Operation Service (or such other date as may be agreed with the Employer's Representative) the Contractor shall submit a report to the Employer's Representative summarising the performance of the Works during the previous year of the Operation Service Period. The layout and format of the reports shall be discussed and agreed with the Employer's Representative.</p> <p>The Annual report shall include:</p> <ul style="list-style-type: none"> a) A summary overview of the performance of the Works in the year under consideration;

	<ul style="list-style-type: none"> b) A year-end summary of all the statistics and events provided in the Monthly reports; c) A table showing the Contractor's year-end performance with respect to the standards specified in the Schedule of Performance Guarantees; d) A summary of the results of non-destructive wall thickness testing undertaken in the year under consideration; e) A comparison of performance with previous years; f) A detailed inventory of consumables, mobile plant, vehicles, spare parts, special tools, computer and office equipment, stored at the Site; g) A current list of all Contractor's Personnel setting out each person's name, position and function; h) A declaration by the Contractor that it has the necessary financial resources, Contractor's Personnel, spare parts inventory, and stocks of consumables to operate the Works during the coming year. <p>The annual report shall be submitted in hard copy (six copies) and soft copy.</p>
5. Emission Statement	The Contractor shall submit the annual emission statement according to the requirements of the Environmental Authority.

6.9 Contract Extension, Handback or Decommissioning Requirements

1. General	<p>If the Project is required to be transferred to the Employer pursuant to GCC Sub-Clause 16A.5, the Contractor is required to handback the Project to the Employer, at the Handback Date, the Works shall:</p> <ul style="list-style-type: none"> i. Be in a reasonable condition of repair, cleanliness and appearance taking into account its age and allowing for reasonable wear and tear; ii. Comply with the minimum handback condition requirements listed in sub paragraph [2] below; iii. Be fully capable of being operated and maintained in accordance with the Operating and Maintenance Plan, and the CEMP, and iv. Be capable of meeting the Performance Guarantees and standards specified in the Schedule of Performance Guarantees. <p>The procedures for a joint inspection, testing and remedying of defects prior to handback shall be as detailed in the GCC 11.8, 11.9, 11.11 and 11.12. Further details to the inspection and testing shall be as defined in sub paragraphs [3] and [7] below.</p> <p>If the Project is required to be Decommissioned pursuant to GCC Sub-Clause 16B, the Contractor shall be required to complete the Decommissioning of the WTE and rehabilitation of the Site.</p>
2. Handback Condition Requirements	<p>Notwithstanding the outcome of the joint inspection as per GCC Sub-Clause 11.8, at the Handback Date the following minimum condition requirements shall apply:</p> <ul style="list-style-type: none"> a) Residual operation span of the turbine before the next main revision: 40.000 h (a main revision is referring to a comprehensive overhaul or modification of a turbine's core components and systems. This process involves a thorough inspection, repair, and replacement of parts to ensure the turbine's optimal performance, reliability, and efficiency) b) 50% of the grate bars shall have been replaced during the last revision; c) Boiler wall residual thickness: 2 mm over minimum wall thickness; d) Superheater wall residual thickness: 1.5 mm over minimum wall thickness e) Filter bags: at least 50% replaced in the last six months of the Operation Service Period; f) Oscillation speed of the drive systems: in Zone A/B according to ISO 10816

	<p>g) Annual revision of both lines undertaken during the 12 months prior to handback;</p> <p>h) Inspection and calibration of the CEMS through a third party during the year of handback;</p> <p>i) Calibration of the weighbridge and the load cells of the crane scales through third party in the year of handback;</p> <p>j) LTP membranes: shall have been replaced in last six Months of the Operation Service Period;</p> <p>k) Minimum thickness of wear plates as defined in Table 5-11 of at least 60%.</p> <p>To assess the status of the Works, the Contractor shall provide access to the following information (dating back to the last five years of the Operation Service Period if not otherwise specified):</p> <p>a) Latest version of the as-built documentation including all updates;</p> <p>b) Measurements of wall thickness of all boiler components during the last five years of the Operation Service Period;</p> <p>c) Maintenance records and reports of major equipment (subject to further agreement between the Contractor and the Employer), inclusive of all lists of equipment and material that were replaced, purchased, and repaired.</p> <p>d) Operational and performance data, calibration and test records;</p> <p>e) Specification of additional equipment and components installed and operated (throughout the Operation Service Period);</p> <p>The Employer may request additional information as it transpires prior to the Handback Date or during the Handback Period (as applicable).</p>
3. Independent Survey prior to Handback	<p>The Parties agree to engage an Independent Surveyor to conduct a condition survey and a residual lifetime assessment to eventually define the scope of outstanding maintenance work and asset replacement alongside the joint inspection as per GCC Sub-Clause 11.8.</p> <p>The Independent Surveyor shall be paid by both parties and will be selected upon due consultation between the Contractor and the Employer based on its experience that shall in no case be less than 15 years in surveying and assessing the status of WTE facilities worldwide. Given the scope of such survey, the Parties acknowledge that the Independent Surveyor may be consisting of several individuals or may be a company.</p> <p>The Independent Surveyor shall be appointed not later than 27 months prior to completion of the Operation Service period months after the joint inspection of the Employer and the Contractor as</p>

	<p>per GCC Sub-Clause 11.8. Within 28 days after the appointment, the Independent Surveyor shall submit to both the Contractor and the Employer an inspection programme that shall be approved by the Contractor and the Employer within 14 days.</p> <p>Besides the information stipulated in sub paragraph [2], the Independent Surveyor shall be entitled to collect all the information required to assess the condition of the Works and the residual lifetime of the assets.</p> <p>The Independent Surveyor shall limit the interference with the ongoing operations as far as practicable.</p> <p>Any equipment that is reasonably requested by the surveyor to facilitate measurements, assess the status of assets or to conduct tests to determine the residual lifetime shall be provided by the Contractor.</p> <p>Within 28 days after the survey, the Independent Surveyor shall submit a report to the Contractor and the Employer which shall detail the outstanding remedying work the Contractor shall carry out to meet the obligations of the Contract.</p>
4. Handback Inventories	<p>At the Handback Date, the Contractor shall hand-over the following stocks of consumables, spare parts and special tools:</p> <ul style="list-style-type: none"> a) Spare parts sufficient for [24 Months] operation of the Works based on manufacturer's recommendations and good industry practice; b) Chemicals sufficient for [6 Months] operations; c) Fuel stock for the emergency generators sufficient for [2 weeks] of continuous operation; d) Other consumable supplies (e.g. lubricants etc.) sufficient for [6 Months] operations; e) All special tools as are necessary to carry out maintenance in accordance with the manufacturers' recommendations. <p>No less than six months prior to the Contract Completion Date, the Employer and the Contractor shall meet and agree on:</p> <ul style="list-style-type: none"> f) a detailed inventory of spare parts, special tools, and consumables to satisfy the requirements indicated above; and g) the list of employees of the Contractor operating the Works who would be transferred to the Employer upon the Handback Date to ensure the safe and reliable operation of the Works <p>For the avoidance of doubt, the above inventories shall be provided at the Contractor's expense.</p>
5. [Not Used]	[Not Used]
6. Training of Follow-on O&M Personnel	Following approval of the decommissioning and handback plan, the Contractor shall provide formal and on-the-job training for up to 30 personnel in accordance with GCC 10.5. The members of staff to be trained shall be nominated by the Employer. The

	<p>Employer may seek recommendations from the Contractor on the qualifications and experience requirements of follow-on staff.</p> <p>The aim of the training shall be to equip the follow-on O&M personnel with the knowledge and skills necessary to operate and maintain the Works. The training shall cover at least the following:</p> <ul style="list-style-type: none"> a) managing, operating, controlling, monitoring and maintaining the Works, the individual treatment processes and all associated plant and equipment; b) data filing and processing and reporting; c) assembly, dismantling and maintenance of equipment and Plant; d) fault diagnosis and rectification e) Operation and Maintenance Manuals, f) Occupational Health and Safety Management Plan g) Emergency Preparedness Plan h) Quality Assurance Plan <p>All training shall be commenced no later than 12 Months prior to the Contract Completion Date and completed by the end of the Operation Service Period.</p> <p>The Contractor shall bear the cost of planning the training program and providing trainers, training materials and training venues. The Employer shall be responsible for all wages, travel and subsistence associated with the participation of its nominated personnel in the approved training program.</p>
7. Tests prior to Contract Completion	<p>The following tests shall be considered as minimum requirement for the tests prior to handback:</p> <ul style="list-style-type: none"> a) Demonstration of the performance of the thermal system according to the stoker capacity diagram (all load points) according to bid form [Bid form GV1] in Appendix 23 to Letter of Tender in Section 4; b) Testing the net power output as per bid form [Bid form GV1] at all load points; c) Test as per a) and b) above shall be complemented by verification of compliance with PG6; d) Tests of the water treatment plant at full capacity to meet the boiler feed water quality requirements; e) Performance demonstration of the leachate treatment plant at full capacity to meet the discharge standards as per PG8; f) Noise emission level tests to meet PG10; g) Water Pressure tests and any other tests deemed required for all external water supply pipelines; h) Performance tests on all pumps;

	<ul style="list-style-type: none"> i) Water leakage and mirror tests for all external sewerage reticulation pipelines; j) Verification of the proper installation and functionality of all mechanical and electrical systems. Providing detailed documentation of all tests, inspections, and results to the Employer and relevant authorities; k) Test on air-conditioning temperature and humidity. l) Performance test on all air-conditioning equipment. <p>Notwithstanding the above, subject to the performance of the Works prior to these tests, the Employer may request that any or all of the tests that were conducted during the Tests on Completion of Design-Build shall be carried out as part of the Tests Prior to Contract Completion.</p> <p>No later than six Months prior to the Contract Completion Date the Contractor shall submit to the Employer's Representative, for review and approval, a plan and schedule for the Tests prior to Contract Completion. Apart from the tests as specified above and without limitation, the plan shall include vibration and oscillation velocity tests, boiler wall and other wall thickness measurements, non-destructive measurements etc.</p> <p>Following approval, the Contractor shall proceed with the implementation of the testing plan in accordance with the agreed timetable and the provisions of GCC 11.8 to GCC 11.12.</p> <p>During the tests, the Contractor shall operate all systems within the Works under normal operating conditions, including, but not limited to, routine equipment operation, maintenance services and electrical usage.</p> <p>The Contractor shall give at least 24 hours' notice, in writing, to the Employer's Representative before any of the Tests prior to Contract Completion are carried out.</p> <p>Cost for the tests shall be borne by the Contractor.</p>
8. Decommissioning Requirements	<p>If the Employer elects to Decommission the Project, pursuant to and in accordance with GCC Sub-Clause 16B, the Contractor shall prepare a decommissioning and site rehabilitation plan for the Employer's review and approval.</p> <p>The decommissioning and site rehabilitation plan shall address environmental protection aspects including;</p> <ul style="list-style-type: none"> a) A site assessment for extent and nature of any contamination. If contamination is found on site, implement appropriate measures to restore the site to a safe condition b) Implement dust suppression measures during the demolition and decommissioning activities c) Use techniques that minimise release of contaminants and control the direction of debris

	<p>d) Conduct post-demolition monitoring to ensure the site is free from contamination and remediation efforts have been successful</p> <p>e) Prepare and submit an Environmental Monitoring Close Out report to JASTRe.</p> <p>Decommissioning activities and the removal of all equipment and structures within the Site and up to the Interfaces, shall be conducted by the Contractor and shall include at minimum:</p> <p>a) All of the Works including below ground foundations, except for piles, to be fully removed from the Site and up to the Interfaces by the Contractor,</p> <p>Upon the removal of all equipment and structures from the Site, at least two (2) meters of arable soil shall be deposited over the below-ground areas of the Site, in a manner not subject to erosion. Such arable soil, if not readily available without causing de-vegetation, may be produced by mixing overburden with compost to increase soil carbon and nutrients.</p> <p>Roads and accessways shall remain with the exception of all handrails, support structures and items associated with it which shall be removed from the Site at the discretion of the Company. All items related to landscaping including trees and lawns shall remain.</p> <p>Rehabilitation measures within the Site shall be conducted by the Contractor and shall include at minimum:</p> <p>a) the Site shall be recontoured, depressions filled and revegetated to create a final surface that is consistent with the original topography of the area;</p> <p>b) final landforms and slopes shall be designed to protect groundwater quality, to prevent surface water ponding, to facilitate revegetation, to convey runoff in a non-erosive manner, and to account for long term settlement; and</p> <p>c) the Site shall be revegetated in such a way as to establish a diverse, effective, and long-lasting vegetative cover that is capable of self-regeneration without continued dependence on irrigation, soil amendments or fertilizer, and is at least equal in extent of cover to the natural vegetation of the surrounding area.</p>
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7 Contractor's Personnel Requirements

7.1 General Qualification Requirements

1. Qualifications applicable to both the Design Build Period and the Operation Service Period	All key personnel employed at the Site shall be able to read, and converse in English. In addition to complying to any specific Local Business Development and Bruneianisation commitment in the Contract, the Contractor is encouraged to use local labour that has the necessary skills.
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7.2 Key Staff Requirements During Design-Build Period

1. General	During the Design-Build Period, the Contractor's key staff shall have qualifications and experience consistent with the minimum requirements specified in Table 7-1 below. It shall be within the Contractor's responsibility to provide a sufficient number of staff and lead positions to carry out the tasks regardless to which subcontractor the staff belong. All staff who is dealing with the Employer and the Employer's Representative shall be proficient in English and shall proof this by a Common European Framework of Reference (CEFR) for languages certificate of C1 or TOEFL iBT score of 95, respectively or similar.
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Table 7-1: Minimum qualifications and experience (Design-Build)

No.	Position	Min Qualifications	Total Work Experience [years]	Experience In Similar Work [years]
1.	Project Manager	Professional qualification with an engineering master's degree and additional qualification as project manager (PMI/PMP® or similar certification), English proficiency required Minimum 5 years' experience in leading and managing Project Engineering Team with at least three (3) projects, particularly in Engineering Services in Waste Incineration and Waste to Energy Plant Industry.	15	12 years WTE plant experience
2.	Lead Design Engineer (cum Process Design)	Professional qualification with master's degree or equivalent in mechanical engineering or equivalent, English proficiency required Minimum 5 years' experience in leading and managing Project Engineering Team with at least three (3) projects, particularly in Engineering Services in Waste Incineration and Waste to Energy Plant Industry. Chartered from IChemE, IMechE or equivalent including TSE/HSSE specialist.	15	12 years WTE plant experience
3.	Design Engineer (Civil / Structural Design)	Professional qualification with bachelor/master's degree or equivalent in civil engineering	12	8 years WTE plant experience

No.	Position	Min Qualifications	Total Work Experience [years]	Experience In Similar Work [years]
		with structural engineering background, English proficiency required		
4.	Design Engineer (Electrical & Control)	Professional qualification with bachelor/master's degree or equivalent in /electrical engineering, English proficiency required	10	7 years WTE plant experience
5.	Design Engineer (Process/Mechanical)	Professional qualification with bachelor/master's degree or equivalent in mechanical engineering, English proficiency required	15	7 years WTE plant experience
6.	Design Engineer (Civil/Landfill Engineering)	Professional qualification with bachelor's degree or equivalent in /civil engineering	12	8
7.	Construction Manager	Professional qualification with bachelor/master's degree or equivalent in architecture/mechanical/civil engineering, English proficiency required	15	8
8.	Commissioning Managers	Suitable qualification as (professional certificate) or equivalent experience in all related subjects (process, mechanical, electrical/control etc.), English proficiency required	15	8
9.	Site Supervisors	Suitable qualification as or equivalent experience in all related subjects (civil, process, mechanical, electrical etc.), lead supervisor with English proficiency	15	8
10.	Health & Safety Manager	Suitable qualification or equivalent experience including any necessary approvals / accreditation required by the local authorities	10	5
11.	Health & Safety Officer	Suitable qualification or equivalent experience including any necessary approvals / accreditation required by the local authorities	8	5
12.	Environmental Manager	Suitable qualification or equivalent experience	8	5
13.	Quality Manager (Quality Assurance / Quality Control)	Suitable qualification as quality engineer or via additional certified trainings and track record in quality management	8	8
14.	Technical Support (permitting)	Suitable technical qualification, English proficiency required	8	5
15.	Quantity Surveyor	Suitable qualification or equivalent experience	10	8
16.	QA/QC Engineer 1-C&S / 1- Electrical / 1-Mechanical	Suitable qualification as QA/QC Engineer or via additional certified trainings and track record in QA/QC management	8	8

7.3 Key Staff Requirements During Operation Service Period

1. General	During the Operation Service Period, the Contractor's key staff shall have qualifications and experience consistent with the minimum requirements specified in Table 7-2 below. The
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	administration staffing, such as accounting, procurement, HR services etc. shall be subject to the Contractor's considerations.
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Table 7-2: Minimum qualifications and experience (Operation Service)

No.	Position	Minimum Qualification	Total Work Experience [years]	Experience In Similar Work [years]
1.	Plant Manager	Professional qualification with bachelor/master's degree or equivalent in mechanical or process engineering, English proficiency as per chapter 7.2 required	15	10
2.	O&M and Deputy Plant Manager	Professional qualification with bachelor's degree or equivalent in mechanical/ship engineering, English proficiency as per chapter 7.2 required	10	5
3.	Workshop Manager(s)	Suitable qualification (professional certificate) or equivalent experience	10	5
4.	Shift Managers	Suitable qualification (professional certificate) or equivalent experience	8	3
5.	Instrumentation & Control Technician	Bachelor/technician or equivalent in instrumentation & control technology for power plants or the like	8	3
6.	Electrical Technician	Bachelor/technician or equivalent experience in electrical works	8	3
7.	Mechanical Technician	Bachelor/technician or equivalent in mechanical works	8	3
8.	Laboratory Technician	Suitable qualification or equivalent experience as laboratory assistant or technician	8	3
9.	Health & Safety Manager*	Suitable qualification (including any necessary approvals / accreditation required by the local authorities) or equivalent experience as H&S officer in power plants, WTE or similar posts	8	3
10.	Health & Safety Officer	Suitable qualification (including any necessary approvals / accreditation required by the local authorities) or equivalent experience as H&S officer in power plants, process plants, WTE or similar posts	8	5
11.	Environmental Manager*	Suitable qualification or equivalent experience as environmental manager in power plants, WTE or similar posts	8	5
12.	Quality Manager*	Suitable qualification or equivalent experience	8	3
13.	Public Relations Officer	Suitable qualification or equivalent experience; well versed in both English and local Malay language	15	5

*not necessarily full-time responsibility

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NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3 – EMPLOYER’S REQUIREMENTS

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

This section lists down the appendices to Employer’s Requirements that were referenced in Section 3 – Part 1 – Employer’s Requirements and as well as to supplement the Employer’s Requirements.

The reference documents in these appendices are provided in good faith for guidance and the Contractor shall be responsible for interpreting the same. No warranty or representation of any kind is given as to the sufficiency, accuracy or completeness of such reference documents. These reference documents do not purport to be comprehensive or to have been verified by the Employer or the Employer’s consultants or to have been verified by any third parties whose information has been issued by the Employer, or the Employer’s consultants, on behalf of such parties.

The Employer and the Employer’s consultants:

- a) Shall not be liable for any errors, omissions or lack of specificity in such reference documents; and
- b) Shall not be liable or responsible for negligence or failure to exercise any degree of skill or care in connection with the production and/or compilation of these reference documents or for any action taken by the Contractor as a result of these reference documents.

Any reliance on or use of these reference documents is entirely at the risk of the Contractor.

The Contractor shall be responsible for carrying out its own review and checks to satisfy itself as to the sufficiency, adequacy and correctness of these reference documents before relying on and using such information to produce any part of the Contractor’s deliverables.

Appendix Reference	Appendix Title	Page Ref.
Appendix 1 – Reference Drawings		
Appendix 1A	JASTRe’s gazetted site boundary indicating the Waste to Energy plant and associated proposed infrastructure locations <ul style="list-style-type: none">• Proposed Site / Location Plan – B940-01• JASTRe’s Gazetted site boundary (expanded) – TU/PA9301/2025	ER1A/1 – ER1A/2
Appendix 1B	Proposed external water supply corridor (potable and firewater) <ul style="list-style-type: none">• Drawing WS/LP/01• Drawing WS/LP/01 – Sheet 1• Drawing WS/LP/01 – Sheet 2• Drawing WS/LP/01 – Sheet 3• Drawing WS/LP/01 – Sheet 4	ER1B/1 – ER1B/5
Appendix 1C	Location of drainage discharge points <ul style="list-style-type: none">• Drawing DR/LP/01	ER1C/1
Appendix 1D	Scope demarcation between the Contractor and the Department of Electrical Services for the Power Export (11kV / 66kV)	ER1D/1 – ER1D/3

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Appendix Reference	Appendix Title	Page Ref.
Appendix 1E	<p>Proposed 11kV network</p> <ul style="list-style-type: none"> • Proposed 11kV cable route from WTE substation to DES MIS Telisai (For power export less than 10MW) – ZRJ/11KV/001 • Single line diagram – Existing MIS Telisai switchgear (for power export Less than 10MW) – Indicating additional by DBOOT Contractor & existing – ZRJ/11KV/201 • Proposed 11kV schematic diagram WTE Substation to MIS Telisai (for power export less than 10MW) – ZRJ/11KV/202 	ER1E/1 – ER1E/3
Appendix 1F	<p>Proposed 66kV network</p> <ul style="list-style-type: none"> • Proposed overhead 66kV route (for power export 10MW and more) – ZRJ/66KV/001 • 66kV schematic diagram (for power export 10MW and more) – ZRJ/66KV/201 	ER1F/1 – ER1F/2
Appendix 2 – Site Data		
Appendix 2A	<p>Topographical Survey</p> <ul style="list-style-type: none"> • Topographical survey report – Sg. Paku • Master Traverse Drawing • Master Plan 01 • Sheets 02 • Sheets 03 • Sheets 04 • Sheets 05 	ER2A/1 – ER2A/9
Appendix 2B	Soil investigation reports	To be furnished
Appendix 3 – Municipal Solid Waste Data		
Appendix 3A	Overall waste statistics	ER3A/1 – ER3A/5
Appendix 3B	Existing wase management eco system for Brunei Darussalam	ER3B/1
Appendix 3C	<p>Previous solid waste studies for the Sg. Paku land fill site & Brunei Darussalam and municipal solid waste sampling data</p> <ul style="list-style-type: none"> • Report on Waste Characteristic Study (WCS) – May 2025 • Report on Waste Characteristic Study (WCS) – October 2019 	ER3C/1 – ER3C/93
Appendix 3D	Projected Total Waste Growth	ER3D/1

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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Appendix Reference	Appendix Title	Page Ref.
Appendix 4 – Other Relevant Information from Stakeholders & Authorities		
Appendix 4A	Brunei Grid Code (2 nd Revision) published by the Autoriti Elektrik Negara Brunei Darussalam	ER4A/1 – ER4A/80
Appendix 4B	Licensing process for electricity generation activity by the Autoriti Elektrik Negara Brunei Darussalam <ul style="list-style-type: none"> • Licensing process for electricity generation activity • Documents to be submitted • Payment process for electricity generation license • General license application Form A 	ER4B/1 – ER4B/7
Appendix 4C	Proposed raw water intake location	ER4C/1
Appendix 4D	Confidential draft of Environmental protection and management act (amendment) order, 2025	ER4D/1 – ER4D/18
Appendix 4E	Confidential draft of code of practice for pollution control 2025	ER4E/1 – ER4E/70
Appendix 5 – Schedule of current approvals and permissions obtained by the Employer		
Appendix 5A	Schedule of current approvals and permissions obtained by the Employer	ER5A/1

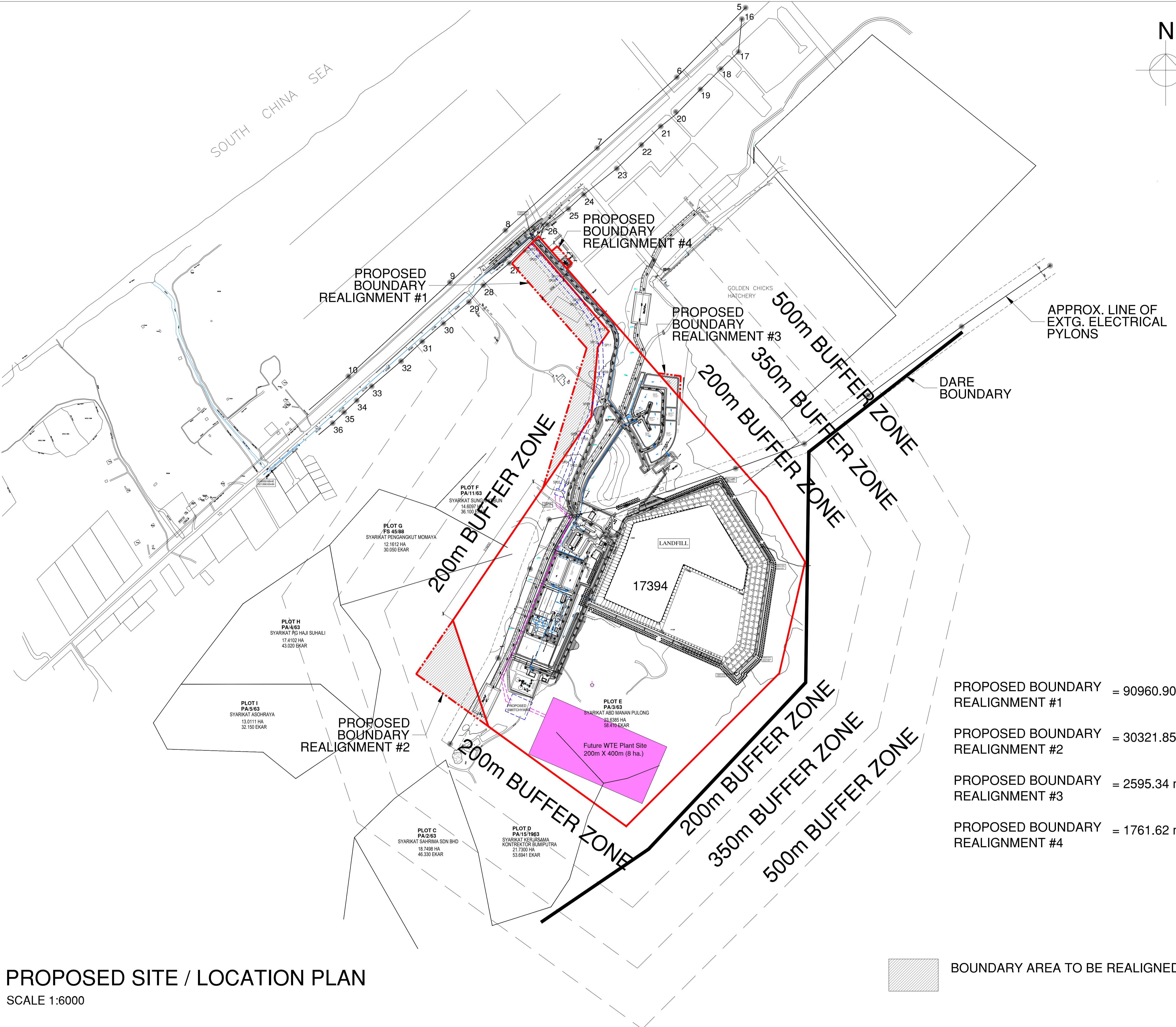
**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

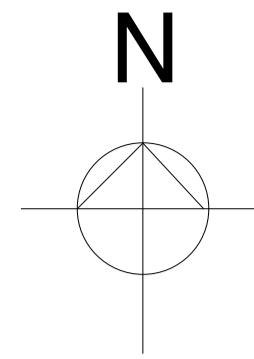
PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 1 – REFERENCE DRAWINGS

**APPENDIX 1A – JASTRE’S GAZETTED SITE BOUNDARY INDICATING THE
WASTE TO ENERGY PLANT AND ASSOCIATED PROPOSED INFRASTRUCTURE
LOCATIONS**



ER1A/1



Client:



جاین عالم سکیت تامن دان ریکریاسی
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KEMENTERIAN PEMBANGUNAN | BRUNEI DARUSSALAM

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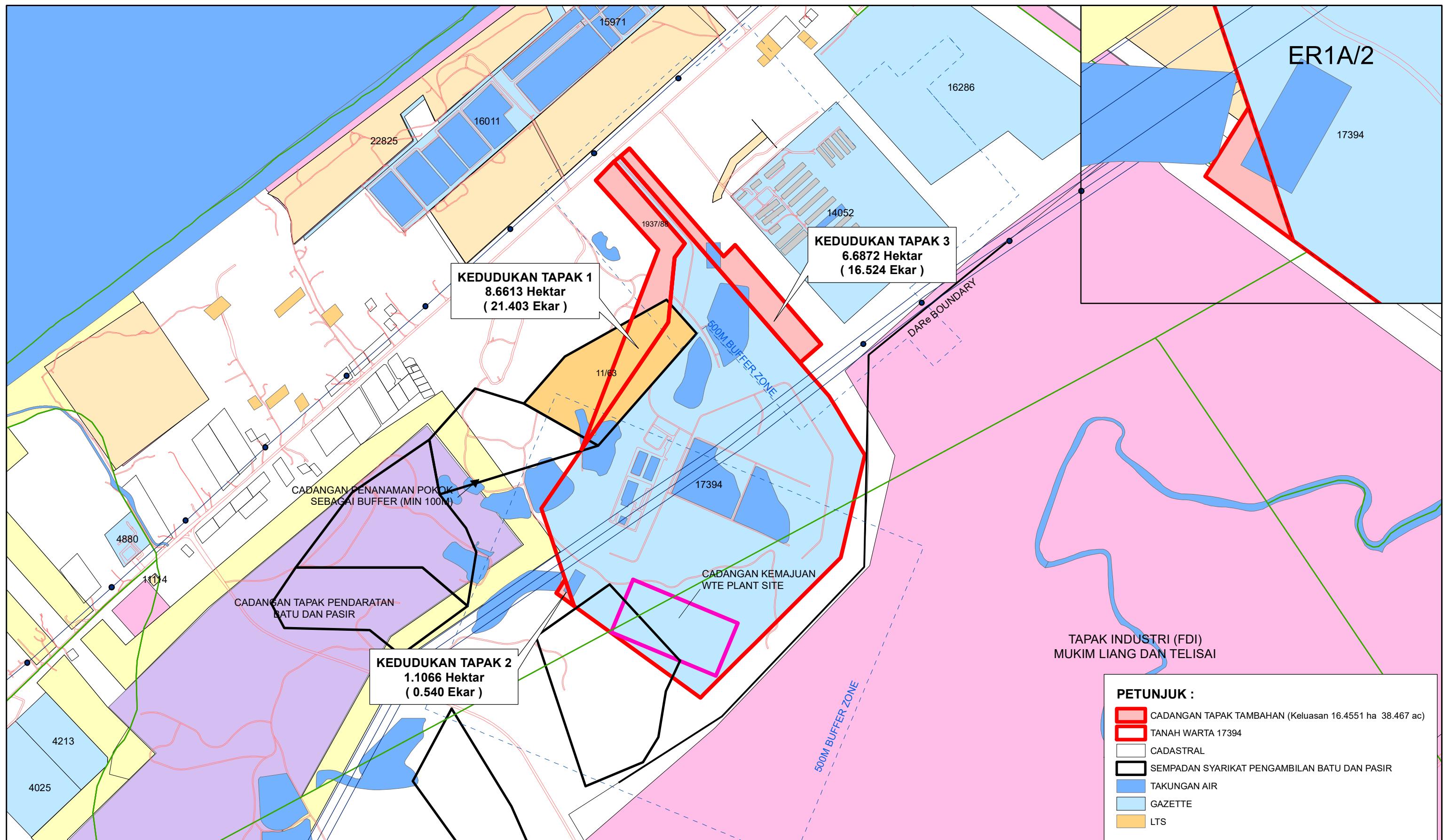
Project:

REQUEST FOR PROPOSAL TO INVEST, DESIGN,
BUILD, OWN, OPERATE AND TRANSFER WASTE TO
ENERGY PLANT AT LOT 17394, KG. SG. PAKU,
TUTONG, NEGARA BRUNEI DARUSSALAM

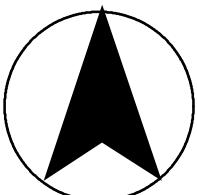
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PROPOSED SITE / LOCATION PLAN

Drawn: Jirah	Dwg. No.
Scale: 1:6000	Size:A1
Date: Aug 2023	

Contractor shall check all dimensions on site before work commences. Any discrepancies shall be reported to the Architect immediately. © Arkitek Aziz



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JABATAN PERANCANG BANDAR DAN DESA
KEMENTERIAN PEMBANGUNAN
NEGARA BRUNEI DARUSSALAM

CADANGAN TAPAK TAMBAHAN BAGI PROJEK WASTE TO ENERGY (WTE),
DI KAMPUNG SUNGAI PAKU, MUKIM TELISAI,
DAERAH TUTONG,
NEGARA BRUNEI DARUSSALAM

Rujukan Fail :-	JPB / PP / 8.10.3 (TUT) PT.3	
Skala :-	1 : 12 500	A3
Tarikh :-	18/06/2025	
Tarikh Pindaan :-	22/07/2025	
Dilukis oleh :-	SAL	
Bil Lukisan :-	TU / PA9301 / 2025	

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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SECTION 3

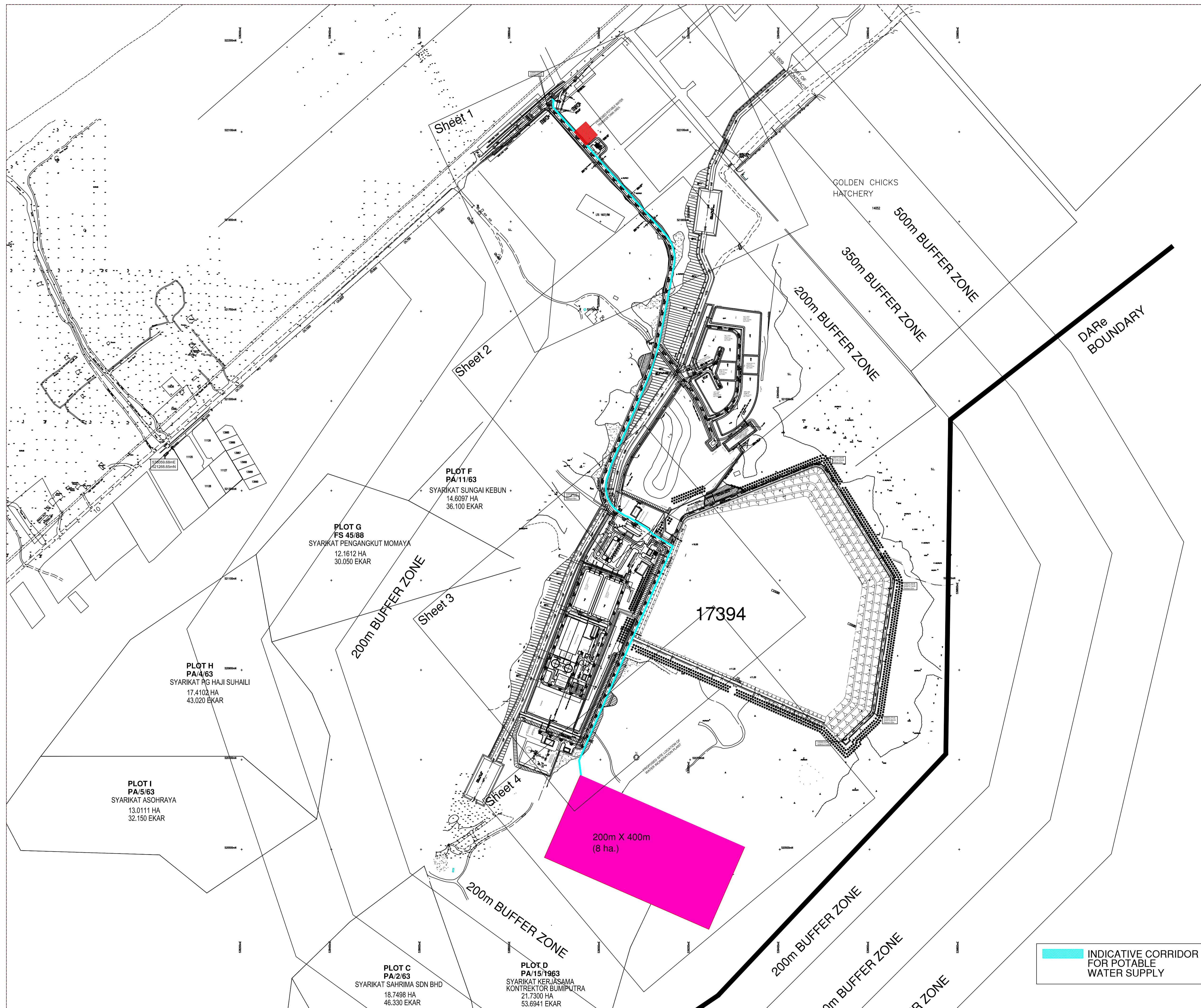
PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 1 – REFERENCE DRAWINGS

APPENDIX 1B – PROPOSED EXTERNAL WATER SUPPLY CORRIDOR

(POTABLE AND FIREWATER)

ER1B/1



Client:



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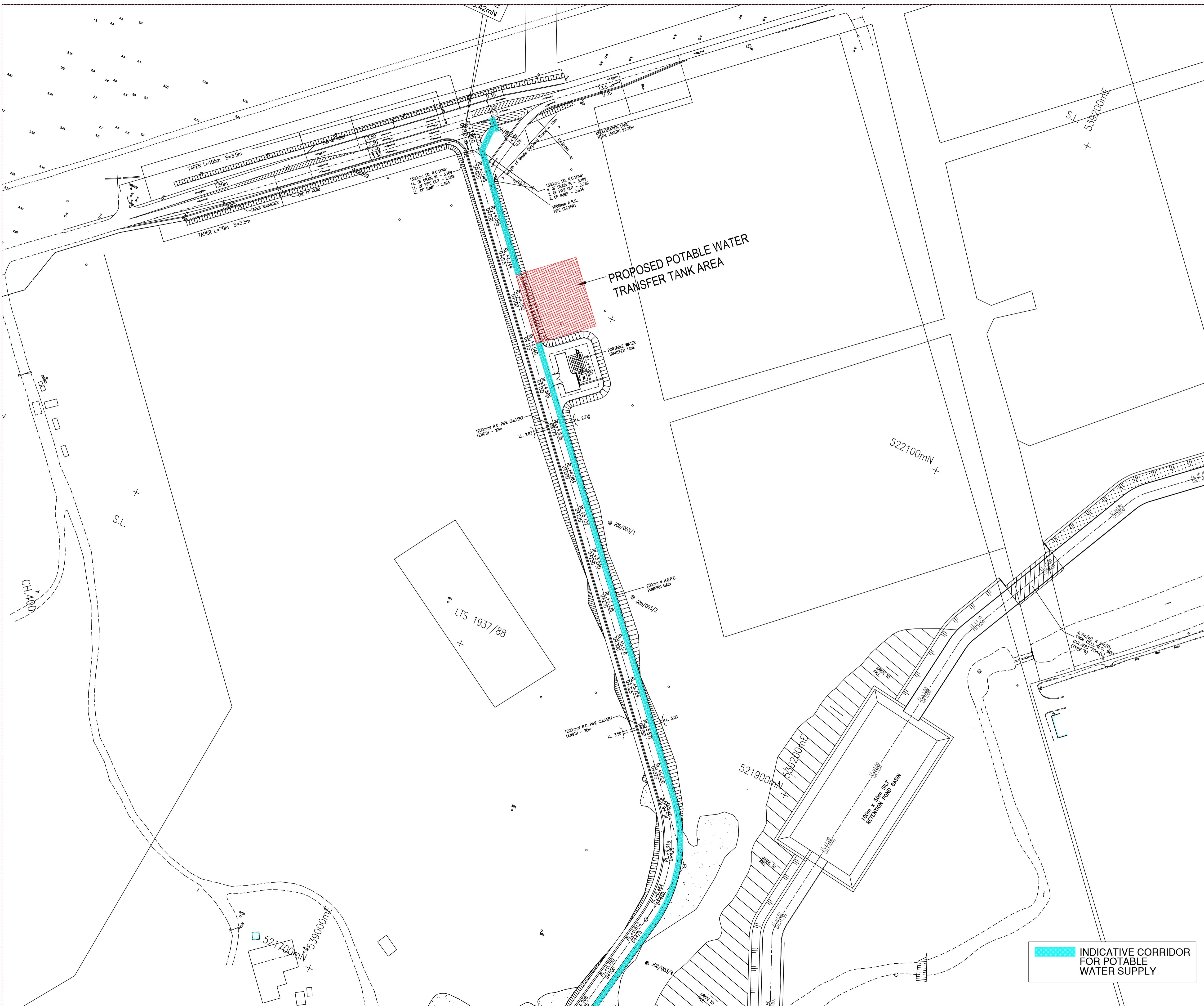
REQUEST FOR PROPOSAL TO INVEST, DESIGN,
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ENERGY PLANT AT LOT 17394, KG. SG. PAKU,
TUTONG, NEGARA BRUNEI DARUSSALAM

Title:
EXTERNAL WATER SUPPLY OVERALL PLAN

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Scale: 1:4000
Date: April 2025
Dwg. No.
Size:A1
WS/LP/01

Contractor shall check all dimensions on site before work commences. Any discrepancies shall be reported to the Architect immediately. © Arkitek Aziz

ER1B/2



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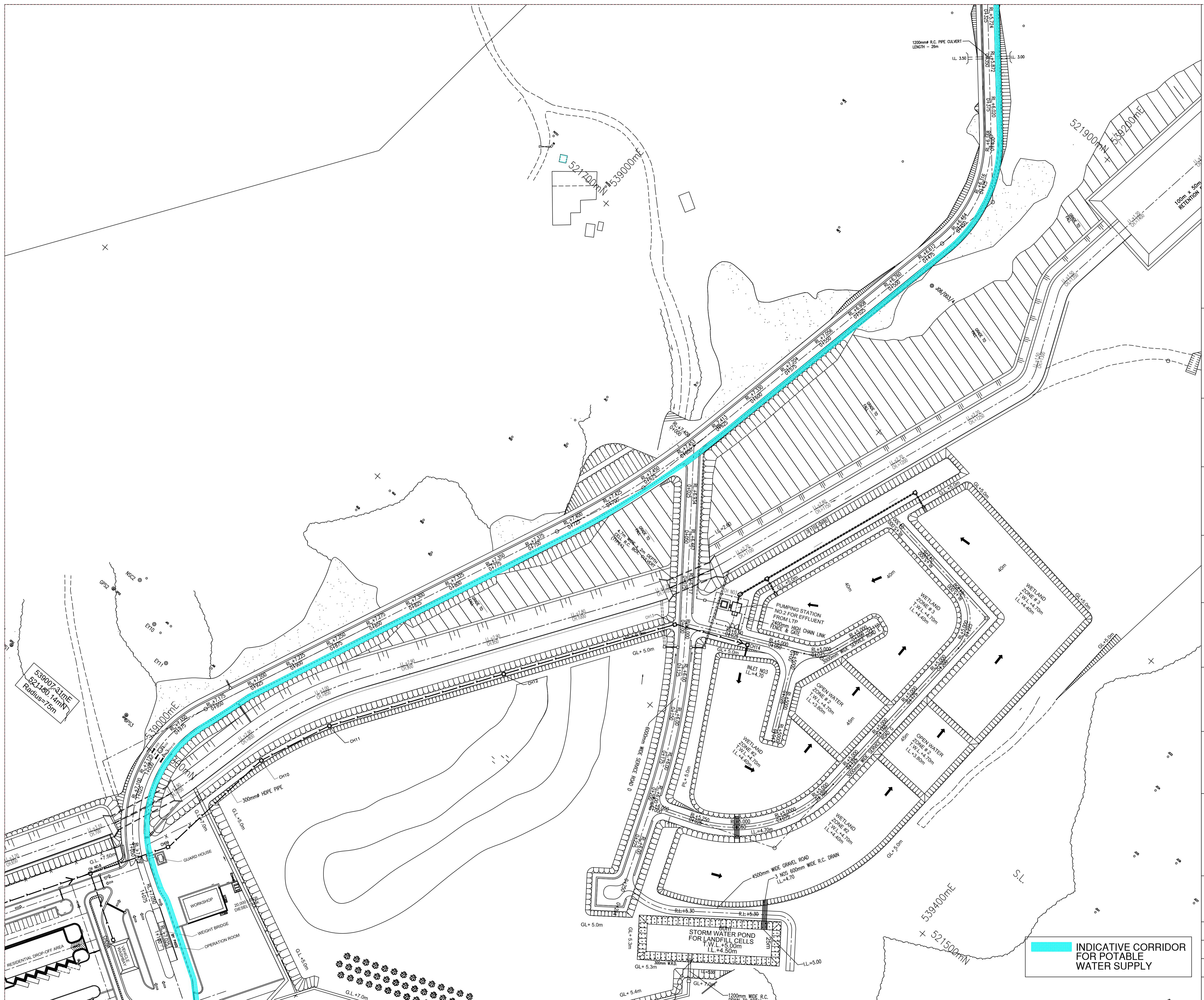
Project:
REQUEST FOR PROPOSAL TO INVEST, DESIGN,
BUILD, OWN, OPERATE AND TRANSFER WASTE TO
ENERGY PLANT AT LOT 17394, KG. SG. PAKU,
TUTONG, NEGARA BRUNEI DARUSSALAM

Title:
EXTERNAL WATER SUPPLY

Drawn: ZJ	Dwg. No.
Scale: 1:1000	Size:A1
Date: April 2025	

WS/LP/01 - Sheet 1

Contractor shall check all dimensions on site before work commences. Any discrepancies shall be reported to the Architect immediately. © Arkitek Aziz



Client:



جایتن عالم سکیتر تامن دان ریکریاسی
JABATAN ALAM SEKITAR, TAMAN DAN REKREASI
KEMENTERIAN PEMBANGUNAN | BRUNEI DARUSSALAM

Project Manager and Quantity Surveyor:

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Project:

REQUEST FOR PROPOSAL TO INVEST, DESIGN,
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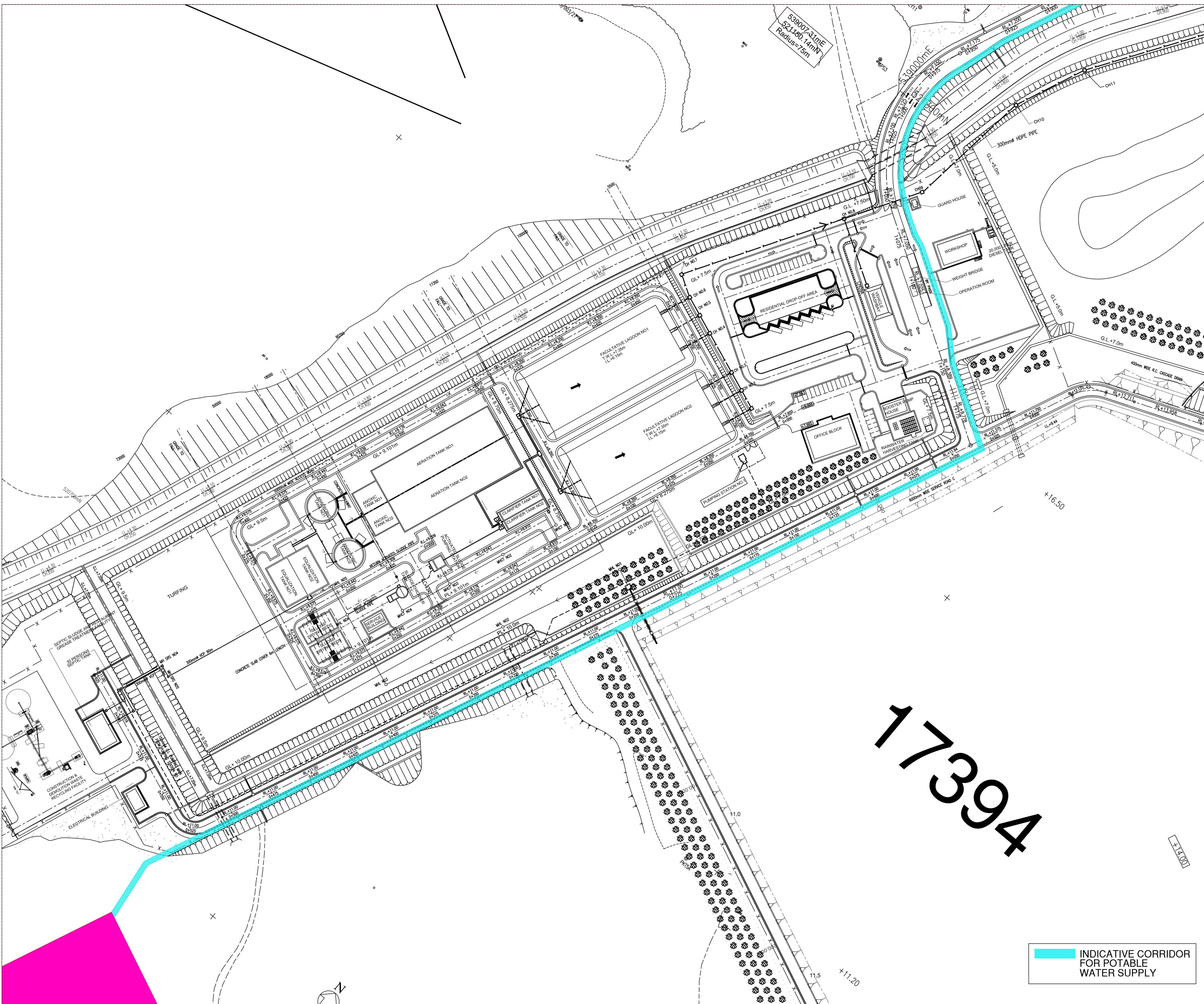
Title:
EXTERNAL WATER SUPPLY

Drawn: ZJ	Dwg. No.
Scale: 1:1000	Size:A1
Date: April 2025	

INDICATIVE CORRIDOR
FOR POTABLE
WATER SUPPLY

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ER1B/4



Client:



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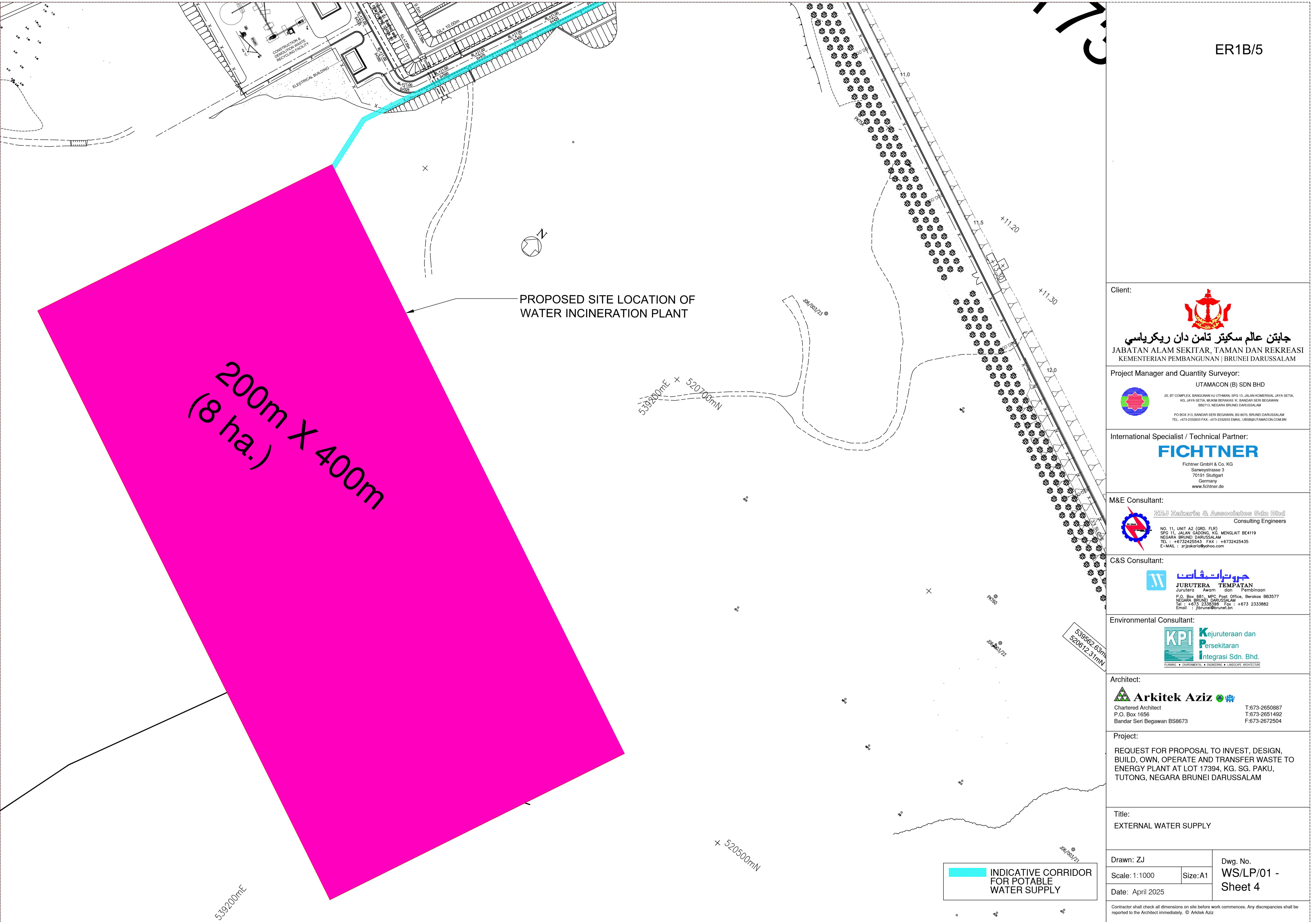
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REQUEST FOR PROPOSAL TO INVEST, DESIGN,
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TUTONG, NEGARA BRUNEI DARUSSALAM

Title:
EXTERNAL WATER SUPPLY

Drawn: ZJ Scale: 1:1000 Date: April 2025
Dwg. No. WS/LP/01 - Sheet 3
Size:A1

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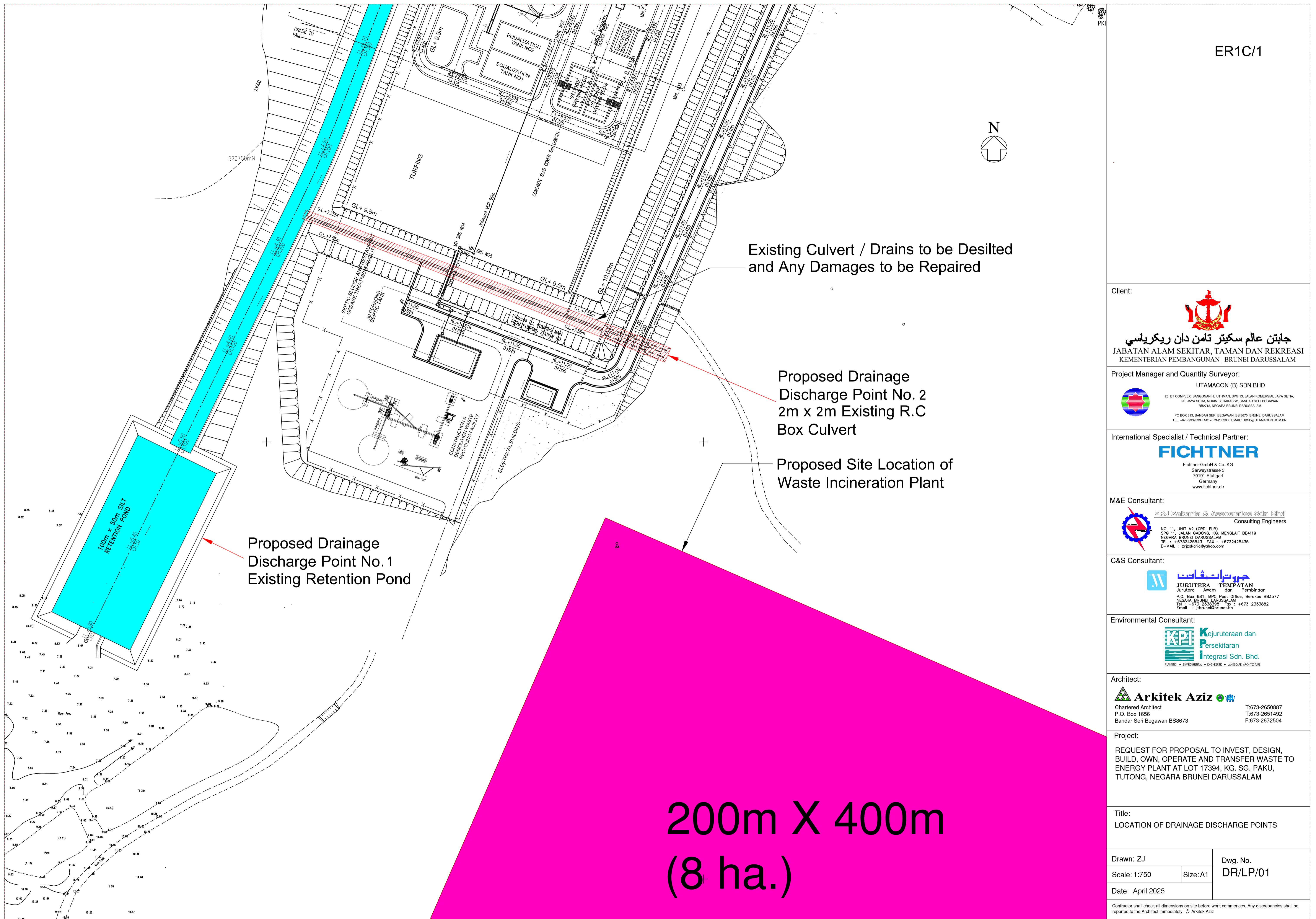
**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 1 – REFERENCE DRAWINGS

APPENDIX 1C – LOCATION OF DRAINAGE DISCHARGE POINTS



SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 1 – REFERENCE DRAWINGS

APPENDIX 1D – SCOPE DEMARCATON BETWEEN THE CONTRACTOR AND

THE DEPARTMENT OF ELECTRICAL SERVICES

FOR THE POWER EXPORT (11KV / 66KV)

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE
AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394,
KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**

SECTION 3 – EMPLOYER'S REQUIREMENTS

PART 2 – APPENDICES TO EMPLOYER'S REQUIREMENTS

**APPENDIX 1D – SCOPE DEMARCATON BETWEEN THE CONTRACTOR AND THE DEPARTMENT OF ELECTRICAL SERVICES
FOR THE 11KV AND 66KV NETWORK**

This appendix aims to provide a high-level demarcation of scope and division of responsibilities between the Department of Electrical Services and the Contractor on the power infrastructure. The same shall form as a basis for the Power Purchase Agreement between the Contractor and the Department of Electrical Services. Notwithstanding the below illustration, the obligations to comply and obtain any relevant authority approvals and other third-party utility service providers shall be the responsibility of the Contractor. License to generate electricity shall be obtained by the Contractor from Autoriti Elektrik Negara Brunei Darussalam by complying to the latest Grid Code published by the Autoriti Elektrik Negara Brunei Darussalam.

Ref.	Scope Component	Power Infrastructure when power export to grid is less than 10MW				Power Infrastructure when power export to grid is 10MW and above			
		Contractor	DES	Employer	Others	Contractor	DES	Employer	Others
1	Provision of land for infrastructure	Obtain way leaves and associated approvals for outside the boundary of Employer's Gazetted Land	Allow wayleaves / works within the DES 11KV Telisai Main Intake Sub-Station Boundary	Employer upto the boundary of Employer's Gazetted Land	Approvals from Various authorities and other third-party utility service providers in relation to road reserve usage	Obtain way leaves and associated approvals for outside the boundary of Employer's Gazetted Land	Allow tapping in / termination at existing main 66kV slim poles at the intersection road of Jalan Telisai and road leading to Landfill	Employer upto the boundary of Employer's Gazetted Land	Approvals from Various authorities and other third-party utility service providers in relation to road reserve usage (if any spill over from the Gazetted Land before tie-in to slim poles)
2	Power Purchase Agreement (PPA)	Party to PPA	Party to PPA	Employer Facilitates the PPA signing together with DBOOT Contract signing	N/A	Party to PPA	Party to PPA	Employer Facilitates the PPA signing together with DBOOT Contract signing	N/A
3	DES requirements and standards for all the	Fully responsible for Compliance	As an authority and approver	NIL	N/A	Fully responsible for Compliance	As an authority and approver	NIL	N/A

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE
AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394,
KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**

Ref.	Scope Component	Power Infrastructure when power export to grid is less than 10MW				Power Infrastructure when power export to grid is 10MW and above			
		Contractor	DES	Employer	Others	Contractor	DES	Employer	Others
	associated works on the power infrastructure.								
4	License to generate electricity	Fully responsible for Compliance	N/A	N/A	AENBD as approver	Fully responsible for Compliance	N/A	N/A	AENBD as approver
5	Other building and construction permits	Fully responsible for Compliance	N/A	N/A	ABCi as an approver	Fully responsible for Compliance	N/A	N/A	ABCi as an approver
6	Any other relevant authority approvals	Fully responsible for Compliance	N/A	N/A	Concerned authorities as an approver	Fully responsible for Compliance	N/A	N/A	Concerned authorities as an approver
7	Design, procurement, pre-construction, construction, testing, pre-commissioning, commissioning and start-up	Fully responsible	As an authority on approval matters where required on authority compliance	Stagewise No objection clearance on compliance to Contract commitment	Concerned authorities and other third-party utility service providers as an approver where required on authority compliance	Fully responsible	As an authority on approval matters where required on authority compliance	Stagewise No objection clearance on compliance to Contract commitment	Concerned authorities and other third-party utility service providers as an approver where required on authority compliance
8	Operation permits	Fully responsible	As an authority on approval matters where required on authority compliance	Stagewise No objection clearance on compliance to Contract commitment	Concerned authorities and other third-party utility service providers as an approver where required on authority compliance	Fully responsible	<ul style="list-style-type: none"> • As an authority on approval matters where required on authority compliance 	<ul style="list-style-type: none"> • Stagewise No objection clearance on compliance to Contract commitment 	Concerned authorities and other third-party utility service providers as an approver where required on authority compliance
9	Operation and Maintenance	Fully responsible	<ul style="list-style-type: none"> • As an authority on approval matters where required on authority compliance 	<ul style="list-style-type: none"> • Stagewise No objection clearance on compliance to Contract commitment 	Concerned authorities and other third-party utility service providers as an approver where required on authority compliance	Fully responsible	<ul style="list-style-type: none"> • As an authority on approval matters where required on authority compliance 	<ul style="list-style-type: none"> • Stagewise No objection clearance on compliance to Contract commitment 	Concerned authorities and other third-party utility service providers as an approver where required on authority compliance

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE
AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394,
KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**

Ref.	Scope Component	Power Infrastructure when power export to grid is less than 10MW				Power Infrastructure when power export to grid is 10MW and above			
		Contractor	DES	Employer	Others	Contractor	DES	Employer	Others
			<ul style="list-style-type: none"> Pay to the Contractor for the power exported to the grid as per PPA Contract administration of PPA 	<ul style="list-style-type: none"> Payment of Tipping Fees to the Contractor Contract administration of DBOOT contract 	compliance		<ul style="list-style-type: none"> Pay to the Contractor for the power exported to the grid as per PPA 	<ul style="list-style-type: none"> Payment of Tipping Fees to the Contractor Contract administration of DBOOT contract 	compliance
10	Transfer	Pre-Transfer Rejuvenation, joint inspections, and handover	<ul style="list-style-type: none"> As an authority on approval matters where required on authority compliance Pay all payments due to the Contractor under the PPA 	<ul style="list-style-type: none"> Stagewise No objection clearance on compliance to Contract commitment Pay all payments due to the Contractor under Contractor 	Concerned authorities and other third-party utility service providers as an approver where required on authority compliance	Pre-Transfer Rejuvenation, joint inspections, and handover	<ul style="list-style-type: none"> As an authority on approval matters where required on authority compliance Pay all payments due to the Contractor under the PPA 	<ul style="list-style-type: none"> Stagewise No objection clearance on compliance to Contract commitment Pay all payments due to the Contractor under Contractor 	Concerned authorities and other third-party utility service providers as an approver where required on authority compliance
11	Physical Scope Boundaries between DES and the Contractor	Please refer to the attached Schematic with Drawing Nos. ZRJ/11KV/001, ZRJ/11KV/201 and ZRJ/11KV/202				Please refer to the attached Schematic with Drawing Nos. ZRJ/66KV/001-1, ZRJ/66KV/001-2 and ZRJ/66KV/201			

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

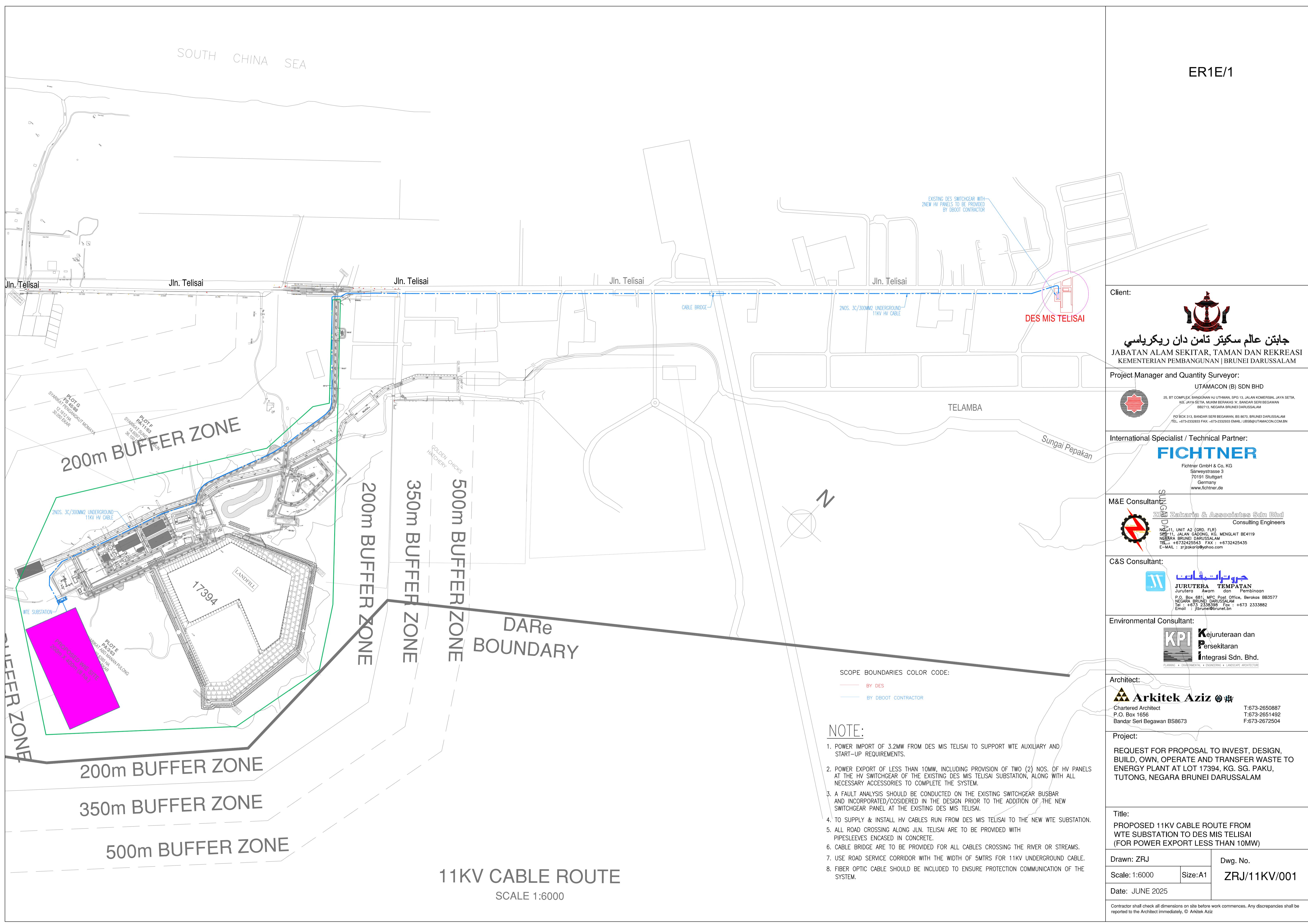
PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

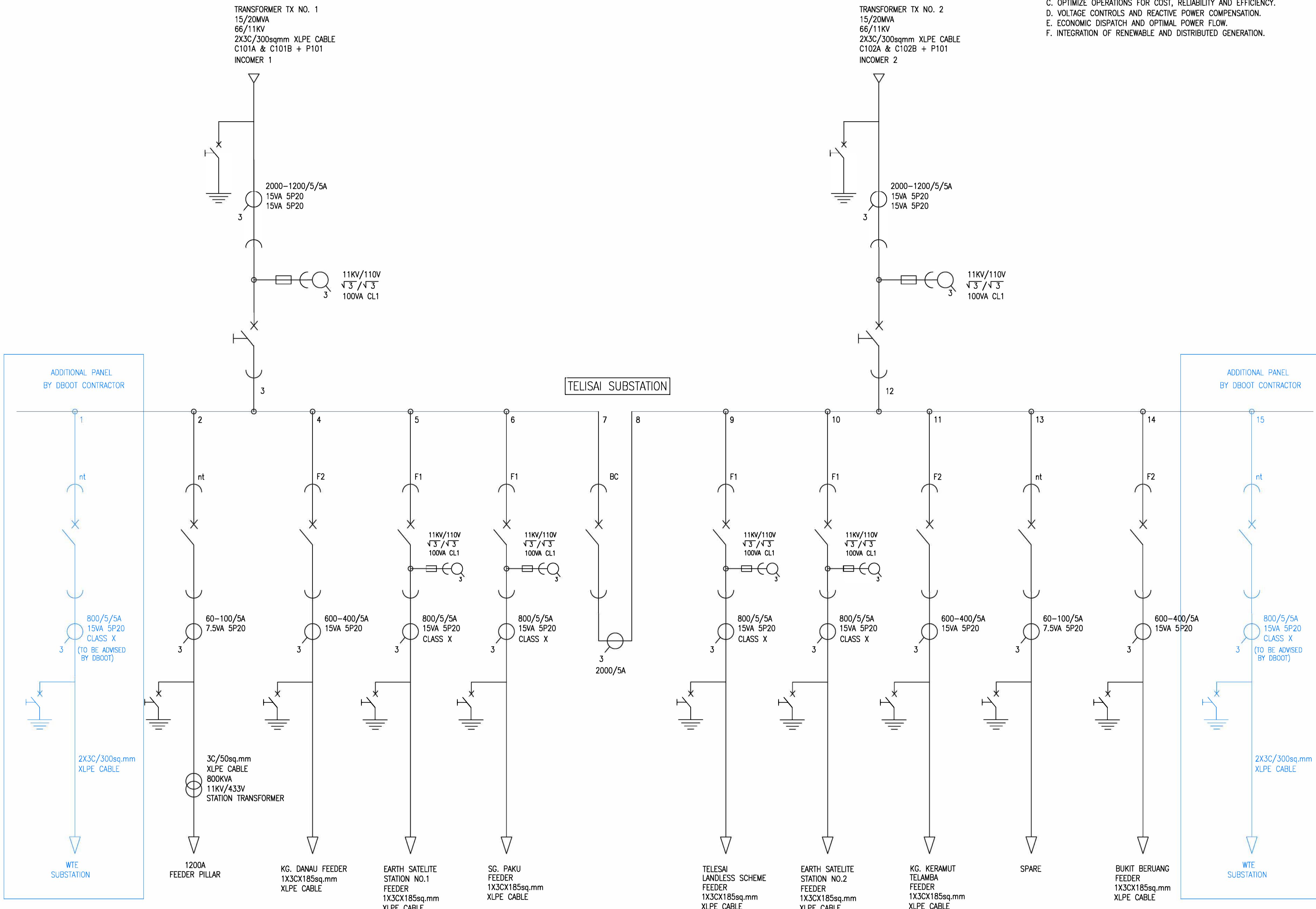
APPENDIX 1 – REFERENCE DRAWINGS

APPENDIX 1E – PROPOSED 11KV NETWORK

SOUTH CHINA SEA

ER1E/1





EXISTING TELISAI SUBSTATION SWITCHGEAR SINGLE LINE DIAGRAM

NOTE:

1. A DETAILED POWER FLOW ANALYSIS OR LOAD FLOW ANALYSIS SHOULD BE CARRIED OUT ON ON THE EXISTING SWITCHGEAR BUSBAR AND COSIDERED IN THE DESIGN BEFORE ADDING AN ADDITIONAL SWITCHGEAR PANEL AT THE EXISTING DES MIS TELISAI.
 2. THE PURPOSE OF THE POWER FLOW ANALYSIS IS TO:
 - A. ASSESS SYSTEM PERFORMANCE UNDER NORMAL AND CONTINGENCY CONDITIONS.
 - B. SUPPORT PLANNING AND EXPANSION OF POWER SYSTEMS.
 - C. OPTIMIZE OPERATIONS FOR COST, RELIABILITY AND EFFICIENCY.
 - D. VOLTAGE CONTROLS AND REACTIVE POWER COMPENSATION.
 - E. ECONOMIC DISPATCH AND OPTIMAL POWER FLOW.
 - F. INTEGRATION OF RENEWABLE AND DISTRIBUTED GENERATION.

Client:



جابتن عالم سکیتر تامن دان ریکریاسی

JABATAN ALAM SEKITAR, TAMAN DAN REKREASI KEMENTERIAN PEMBANGUNAN | BRUNEI DARUSSALAM

Project Manager and Quantity Surveyor:



UTAMACON (B) SDN BHD

International Specialist / Technical Partner:



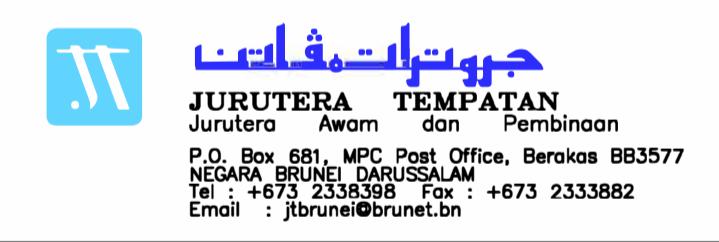
Fichtner GmbH & Co. KG
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Banda: 001-00

REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG NEGARA BRUNEI DARUSSALAM

Title:
SINGLE LINE DIAGRAM
EXISTING MIS TELISAI SWITCHGEAR
(FOR POWER EXPORT LESS THAN 10MW)

SCOPE BOUNDARIES COLOR CODE:

BY DES

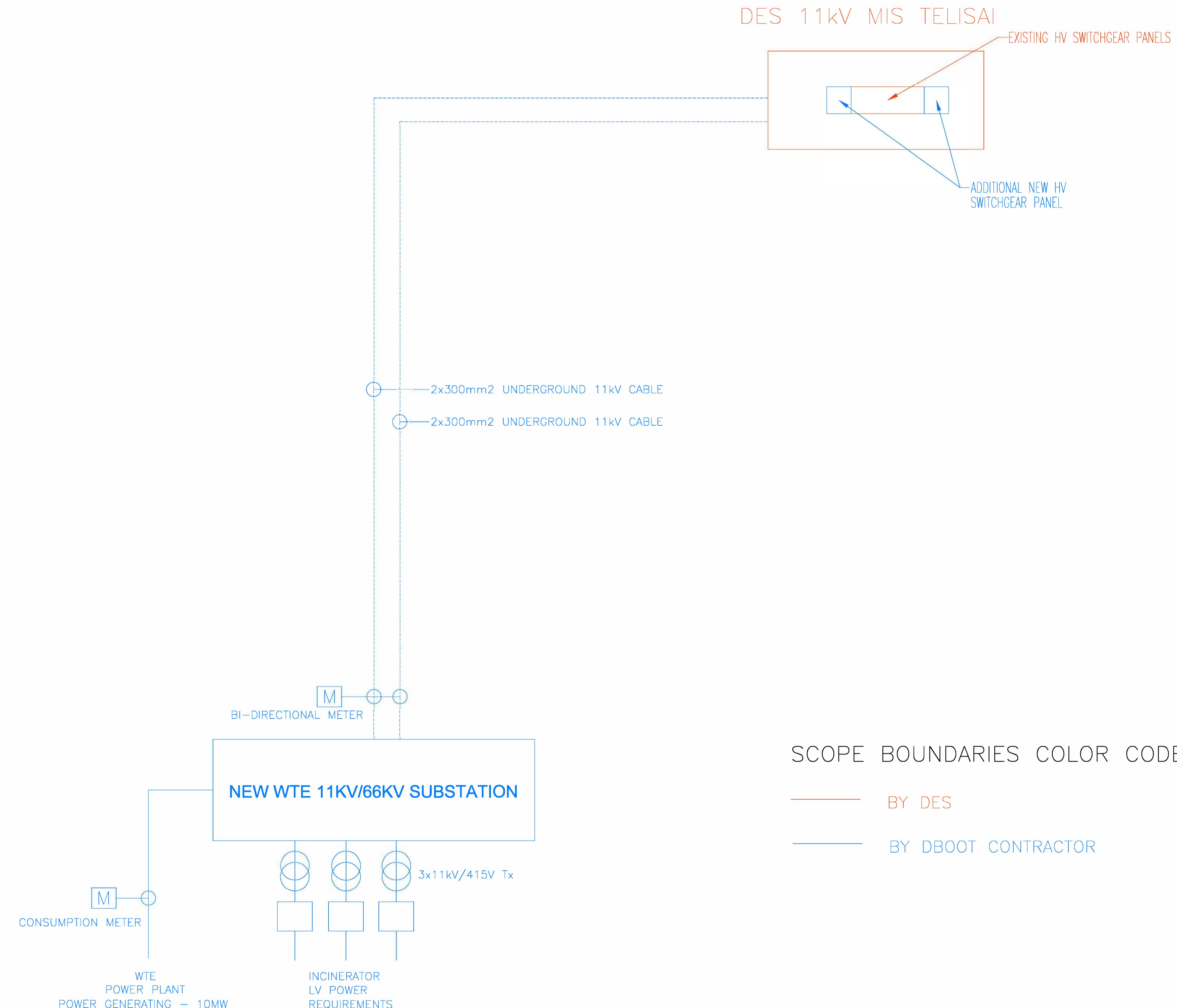
Drawn: ZB

Drawn Eng.

Page No.

Dwg.

ZR



11KV SCHEMATIC DIAGRAM

Client:	<p>جایتن عالم سکیتر تامن دان ریکریاسی JABATAN ALAM SEKITAR, TAMAN DAN REKREASI KEMENTERIAN PEMBANGUNAN BRUNEI DARUSSALAM</p>	
Project Manager and Quantity Surveyor:	<p>UTAMACON (B) SDN BHD</p> <p>25, BT COMPLEX, BANGUNAN HJ UTHMAN, SPG 13, JALAN KOMERSIAL JAYA SETIA, KG. JAYA SETIA, MAKAN BERAKAS 'K', BANDAR SERI BEGAWAN BSB713, NEGARA BRUNEI DARUSSALAM</p> <p>PO BOX 313, BANDAR SERI BEGAWAN, BS 8670, BRUNEI DARUSSALAM TEL: +673 233633 FAX: +673 233933 EMAIL: USBSB@UTAMACON.COM.BN</p>	
International Specialist / Technical Partner:	<p>FICHTNER</p> <p>Fichtner GmbH & Co. KG Sarweystrasse 3 70191 Stuttgart Germany www.fichtner.de</p>	
M&E Consultant:	<p>ZRJ Zakaria & Associates Sdn Bhd</p> <p>Consulting Engineers</p> <p>NO. 11, UNIT A2 (GRD. FLR) SPG 11, JALAN GADING, KG. MENGLAIT BE4119 NEGARA BRUNEI DARUSSALAM TEL : +6732425543, FAX : +6732425435 E-MAIL : zrjzakaria@yahoo.com</p>	
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Project:	<p>REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM</p>	
Title:	<p>PROPOSED 11KV SCHEMATIC DIAGRAM WTE SUBSTATION TO DES MIS TELISAI (FOR POWER EXPORT LESS THAN 10MW)</p>	
Drawn: ZRJ	Dwg. No.	ZRJ/11KV/202
Scale: 1:6000	Size:A1	
Date: JUNE 2025		
<p>Contractor shall check all dimensions on site before work commences. Any discrepancies shall be reported to the Architect immediately. © Arkitek Aziz</p>		

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SECTION 3

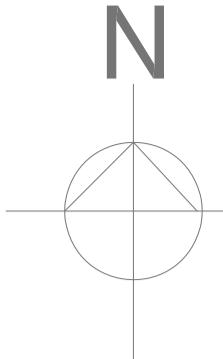
PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 1 – REFERENCE DRAWINGS

APPENDIX 1F – PROPOSED 66KV NETWORK

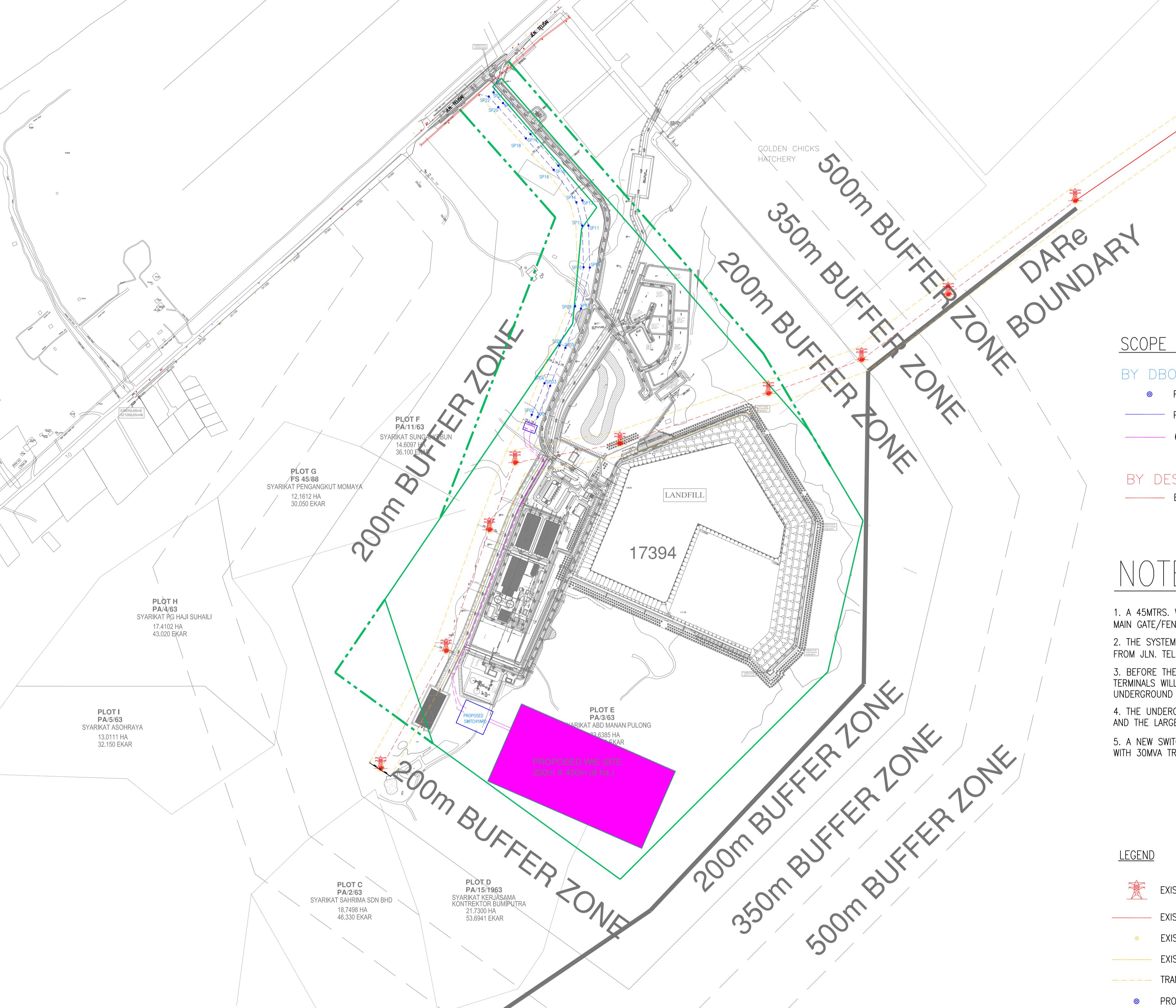
ER1F/1

SOUTH CHINA SEA



PROPOSED SITE/LOCATION PLAN

SCALE 1:6000



Client:



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TUTONG, NEGARA BRUNEI DARUSSALAM

Title:

PROPOSED OVERHEAD 66KV ROUTE
(FOR POWER EXPORT 10MW AND MORE)

Drawn: ZRJ

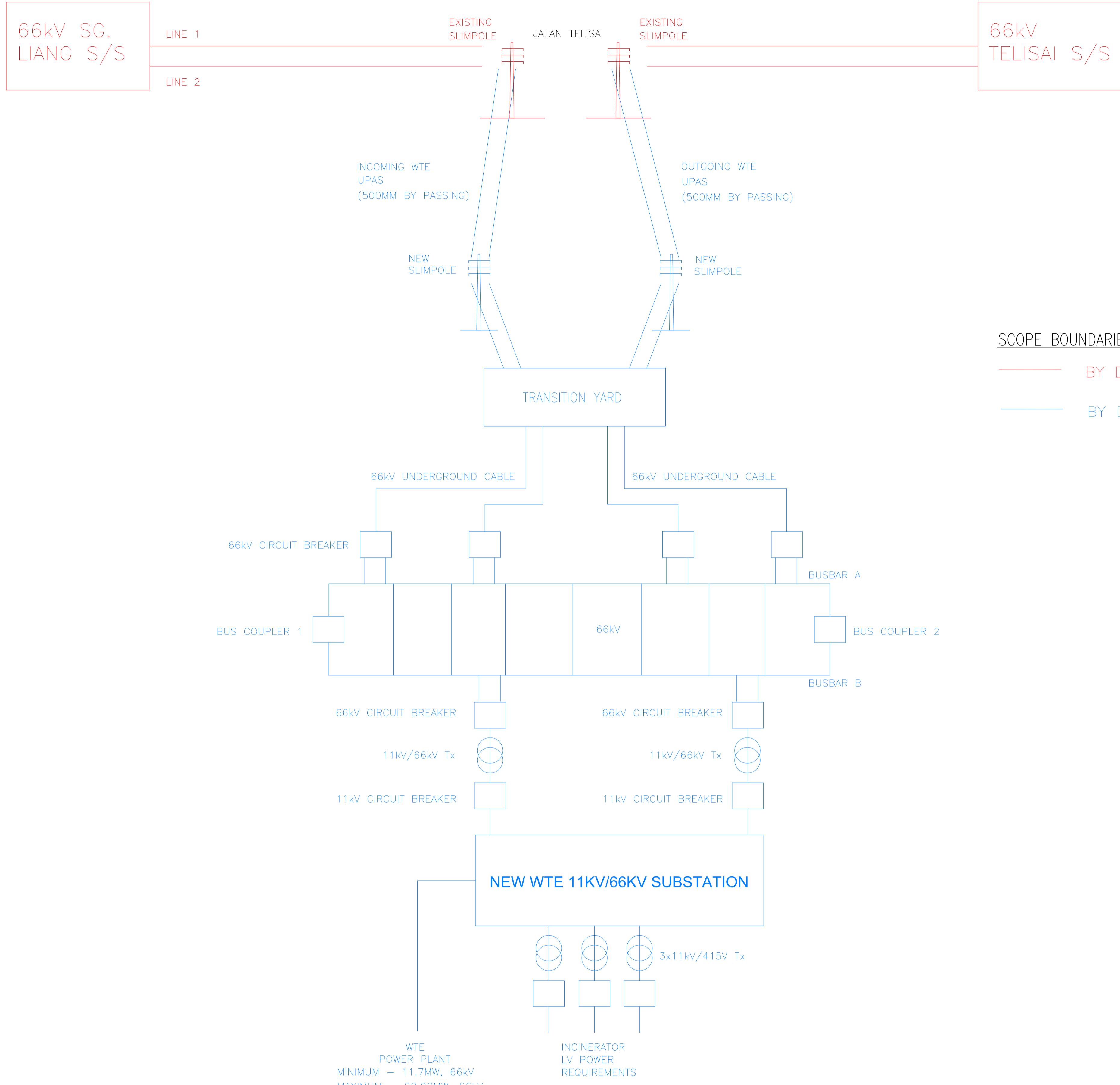
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Date: JUNE 2025

Dwg. No.

ZRJ/66KV/001

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66KV SCHEMATIC DIAGRAM

ER1F/2

Client:



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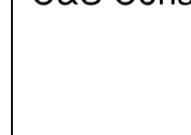
M&E Consultant:



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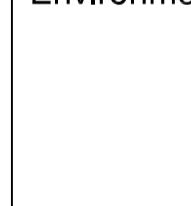
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P.O. Box 681, MPC Post Office, Berokas BB3577
NEGARA BRUNEI DARUSSALAM
Tel : +673 2333882 Fax : +673 2333882
Email : jtbrunei@brunei.bn

Environmental Consultant:



Kejuruteraan dan
Persekutuan
Integrasi Sdn. Bhd.
PLANNING • ENVIRONMENTAL • ENGINEERING • LANDSCAPE ARCHITECTURE

Architect:



Chartered Architect
P.O. Box 1656
Bandar Seri Begawan BS8673
T:673-2650887
T:673-2651492
F:673-2672504

Project:

REQUEST FOR PROPOSAL TO INVEST, DESIGN,
BUILD, OWN, OPERATE AND TRANSFER WASTE TO
ENERGY PLANT AT LOT 17394, KG. SG. PAKU,
TUTONG, NEGARA BRUNEI DARUSSALAM

Title:

66kV SCHEMATIC DIAGRAM
(FOR POWER EXPORT 10MW AND MORE)

Drawn: ZRJ

Dwg. No.

Scale: 1:6000

Size:A1

Date: JUNE 2025

ZRJ/66KV/201

Contractor shall check all dimensions on site before work commences. Any discrepancies shall be reported to the Architect immediately. © Arkitek Aziz

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 2 – SITE DATA

APPENDIX 2A – TOPOGRAPHIC SURVEY



- Cadastral
- Topography
- Hydrography
- Survey Computation
- UAV Mapping

- Land Subdivision
- Global Navigation Satellite Systems
- Geomatic Services
- Strata Title

TOPOGRAPHICAL SURVEY REPORT

Date: 25 Rejab 1445H / 06th February 2024

Project Title : PERMOHONAN PENGUKURAN TOPOGRAFI DAN KAJIAN TANAH DI TAPAK
PELUPUSAN SAMPAH SUNGAI PAKU (TAPAK LOT 17394) BAGI RENCANA PROJEK
WASTE TO ENERGY

Prepared By : SYARIKAT JURUUKUR FADLY

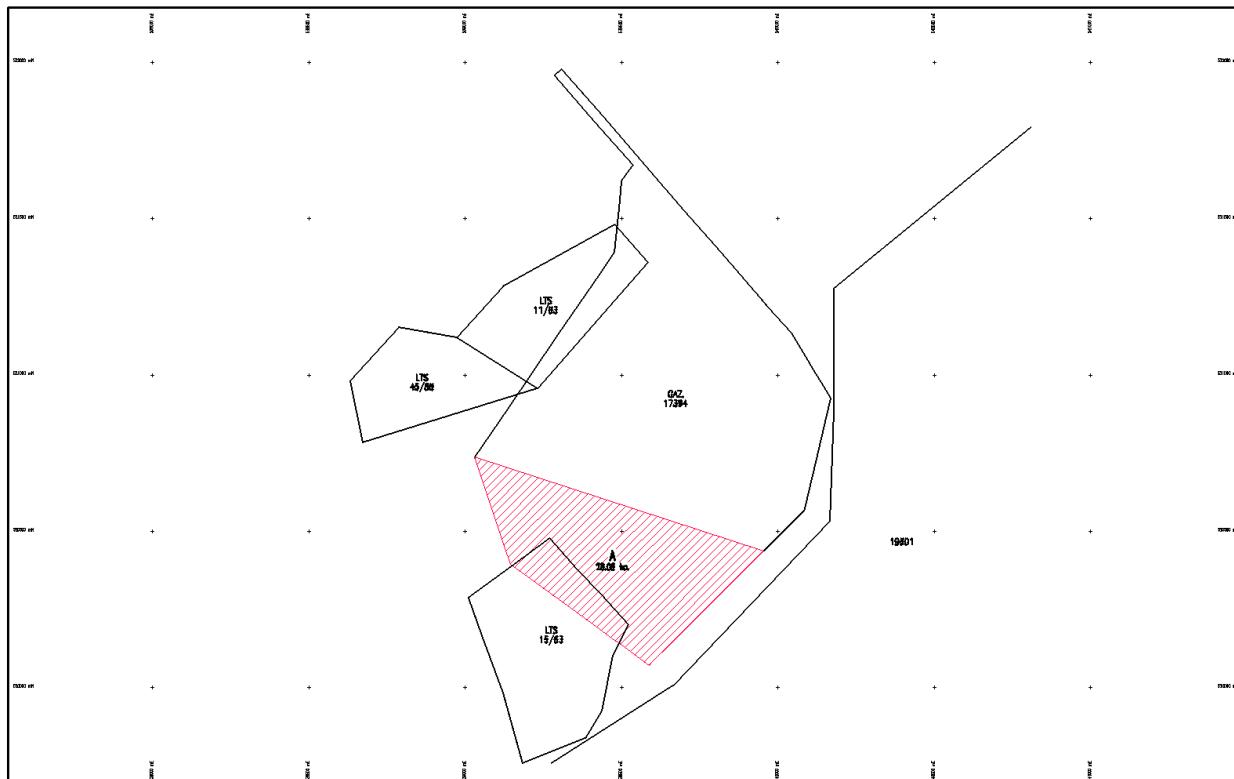
Contract No. : JUA23/024/TS/TU

A. SCOPE

- a) To locate the exact coordinates (given) on a plot of land, staking and topographic survey.

Point	Easting	Northing
Point A	539953.294	520435.919
310/465	539931.030	520413.750
310/466	539830.950	520313.360
310/467	539799.640	520282.170
310/475	539782.250	520264.850
310/474	539731.500	520214.290
310/472	539657.290	520140.370
310/471	539601.650	520084.930
310/470	539588.860	520072.190
310/469	539510.510	520129.050
310/468	539497.710	520138.330
308/917	539471.540	520157.330
308/916	539429.100	520188.120
308/915	539263.410	520308.370
308/914	539144.040	520394.990
308/913	539124.490	520453.370
308/912	539052.130	520669.390
308/911	539029.260	520737.680

- b) The said plot is **28.08 acres** in area located at Tapak Pelupusan Sampah Sungai Paku (Tapak Lot 17394), Kg Sungai Paku, Tutong District.



Site Layout Plan : Tapak Pelupusan Sampah Sungai Paku

- c) The summary of the accuracy for this job is as follows:

No. of Traverse	Distance (Metre)	Horizontal Accuracy	Vertical Accuracy	
			Misclose:	-0.035
1	1359.864	1: 11159	Allowable Misclose	0.117

B. PRELIMINARY WORKS

Prior to commencing the Survey works, the following shall be established:

- a) Obtaining all the pertinent survey information from Brunei Survey Department.
- b) Planimetric control survey shall be by method of GPS Geodetic Baseline survey method or traversing from the primary control stations in the vicinity of the survey areas to the survey reference marks that will be emplaced generally at the suitable locations within the survey area
- c) Traverses shall close to better than 1:10,000.
- d) The levels shall be referenced to the nearest pair of acceptable Government Bench Marks.

- e) Levels shall be in term of Brunei State Datum and related to the latest published values of Survey Department Bench Marks at the time of survey. Maximum misclosure for the leveling shall not exceed $100 \sqrt{k}$ mm where k is the distance within a level loop in kilometres.
- f) The Datum shall be referenced to Geocentric RSO (GRSO) using Survey Department Continuous Operating Reference Station (CORS) and approved Coordinated Cadastral Infrastructure (CCI) or Geodetic Marks.
- g) Personnel:
 - 2 Fully-qualified and experienced survey teams were deployed
 - Fully-qualified and experienced office-processing team

C. FINAL DELIVERABLES

- i. Upon completion of the survey works, the following final deliverables shall be submitted:
 - a) Four (4) sets of hardcopy drawings of the Survey Plan in A1 sizesheets
 - b) One (1) copy of burned CD (CAD File & ArcINFO)
 - c) Field Book
 - d) Computation Sheets
 - e) Report

Your Best Regard,

(HAJI MAHADI BIN HAJI MOHAMAD TAHIR)

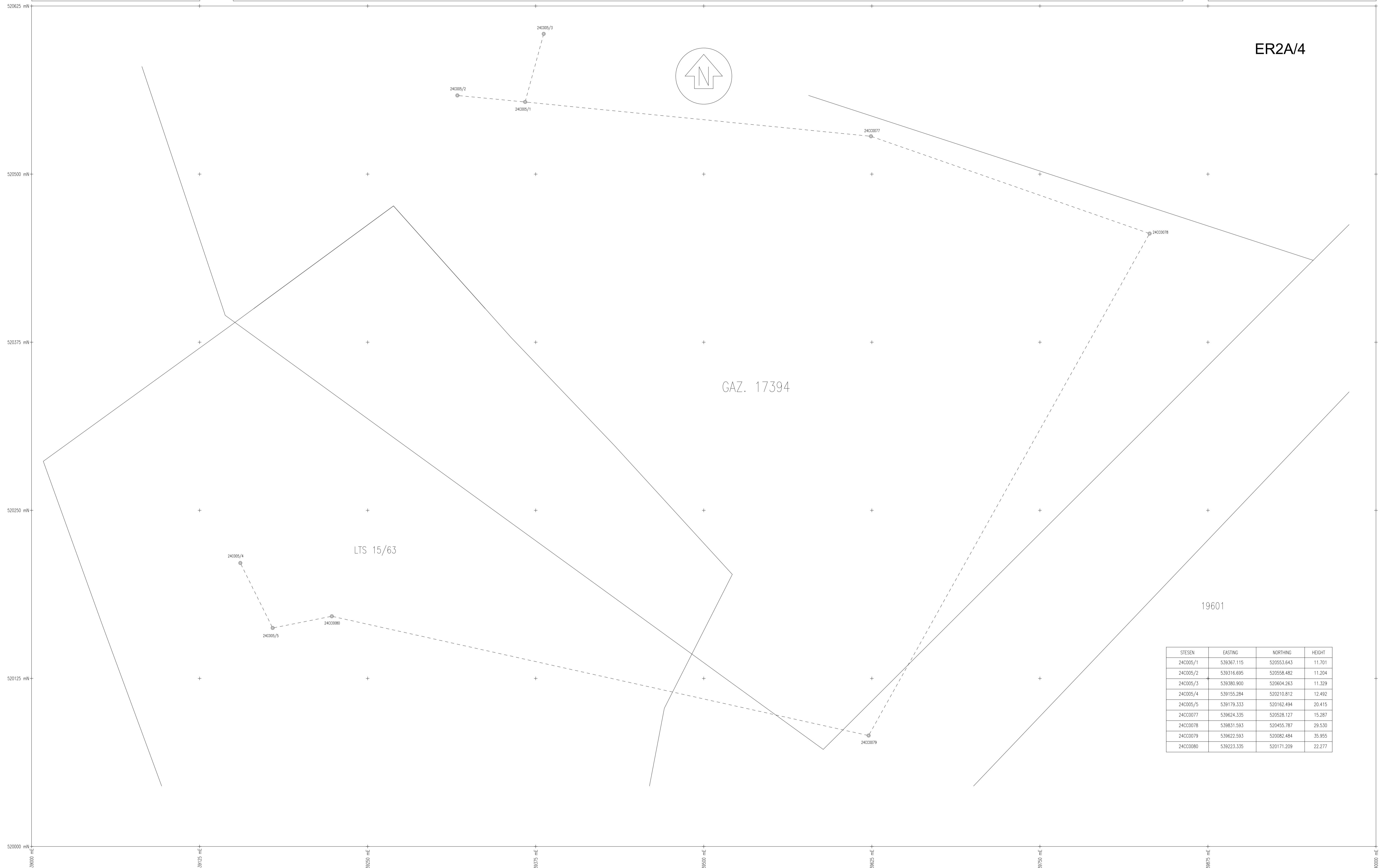
JURUUKUR BERLESEN

BRUNEI DARUSSALAM

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hmt486@gmail.com



Sheet Number 01 Of 01	
PLOTTING ORIGIN	N 520000
	E 539000

CODE	DESCRIPTION	LEVEL	LEVEL
24C005/1	Point 1	520250 mN	539625 mE
24C005/2	Point 2	520500 mN	539625 mE
24C005/3	Point 3	520553 mN	539625 mE
24C005/4	Point 4	520553 mN	539625 mE
24C005/5	Point 5	520553 mN	539625 mE
24C005/6	Point 6	520553 mN	539625 mE
24C005/7	Point 7	520553 mN	539625 mE
24C005/8	Point 8	520553 mN	539625 mE
24C005/9	Point 9	520553 mN	539625 mE
24C006/1	Point 10	520553 mN	539625 mE
24C006/2	Point 11	520553 mN	539625 mE
24C006/3	Point 12	520553 mN	539625 mE
24C006/4	Point 13	520553 mN	539625 mE
24C006/5	Point 14	520553 mN	539625 mE
24C006/6	Point 15	520553 mN	539625 mE
24C006/7	Point 16	520553 mN	539625 mE
24C006/8	Point 17	520553 mN	539625 mE
24C006/9	Point 18	520553 mN	539625 mE
24C007/1	Point 19	520553 mN	539625 mE
24C007/2	Point 20	520553 mN	539625 mE
24C007/3	Point 21	520553 mN	539625 mE
24C007/4	Point 22	520553 mN	539625 mE
24C007/5	Point 23	520553 mN	539625 mE
24C007/6	Point 24	520553 mN	539625 mE
24C007/7	Point 25	520553 mN	539625 mE
24C007/8	Point 26	520553 mN	539625 mE
24C007/9	Point 27	520553 mN	539625 mE
24C008/1	Point 28	520553 mN	539625 mE
24C008/2	Point 29	520553 mN	539625 mE
24C008/3	Point 30	520553 mN	539625 mE
24C008/4	Point 31	520553 mN	539625 mE
24C008/5	Point 32	520553 mN	539625 mE
24C008/6	Point 33	520553 mN	539625 mE
24C008/7	Point 34	520553 mN	539625 mE
24C008/8	Point 35	520553 mN	539625 mE
24C008/9	Point 36	520553 mN	539625 mE
24C009/1	Point 37	520553 mN	539625 mE
24C009/2	Point 38	520553 mN	539625 mE
24C009/3	Point 39	520553 mN	539625 mE
24C009/4	Point 40	520553 mN	539625 mE
24C009/5	Point 41	520553 mN	539625 mE
24C009/6	Point 42	520553 mN	539625 mE
24C009/7	Point 43	520553 mN	539625 mE
24C009/8	Point 44	520553 mN	539625 mE
24C009/9	Point 45	520553 mN	539625 mE
24C010/1	Point 46	520553 mN	539625 mE
24C010/2	Point 47	520553 mN	539625 mE
24C010/3	Point 48	520553 mN	539625 mE
24C010/4	Point 49	520553 mN	539625 mE
24C010/5	Point 50	520553 mN	539625 mE
24C010/6	Point 51	520553 mN	539625 mE
24C010/7	Point 52	520553 mN	539625 mE
24C010/8	Point 53	520553 mN	539625 mE
24C010/9	Point 54	520553 mN	539625 mE
24C011/1	Point 55	520553 mN	539625 mE
24C011/2	Point 56	520553 mN	539625 mE
24C011/3	Point 57	520553 mN	539625 mE
24C011/4	Point 58	520553 mN	539625 mE
24C011/5	Point 59	520553 mN	539625 mE
24C011/6	Point 60	520553 mN	539625 mE
24C011/7	Point 61	520553 mN	539625 mE
24C011/8	Point 62	520553 mN	539625 mE
24C011/9	Point 63	520553 mN	539625 mE
24C012/1	Point 64	520553 mN	539625 mE
24C012/2	Point 65	520553 mN	539625 mE
24C012/3	Point 66	520553 mN	539625 mE
24C012/4	Point 67	520553 mN	539625 mE
24C012/5	Point 68	520553 mN	539625 mE
24C012/6	Point 69	520553 mN	539625 mE
24C012/7	Point 70	520553 mN	539625 mE
24C012/8	Point 71	520553 mN	539625 mE
24C012/9	Point 72	520553 mN	539625 mE
24C013/1	Point 73	520553 mN	539625 mE
24C013/2	Point 74	520553 mN	539625 mE
24C013/3	Point 75	520553 mN	539625 mE
24C013/4	Point 76	520553 mN	539625 mE
24C013/5	Point 77	520553 mN	539625 mE
24C013/6	Point 78	520553 mN	539625 mE
24C013/7	Point 79	520553 mN	539625 mE
24C013/8	Point 80	520553 mN	539625 mE
24C013/9	Point 81	520553 mN	539625 mE
24C014/1	Point 82	520553 mN	539625 mE
24C014/2	Point 83	520553 mN	539625 mE
24C014/3	Point 84	520553 mN	539625 mE
24C014/4	Point 85	520553 mN	539625 mE
24C014/5	Point 86	520553 mN	539625 mE
24C014/6	Point 87	520553 mN	539625 mE
24C014/7	Point 88	520553 mN	539625 mE
24C014/8	Point 89	520553 mN	539625 mE
24C014/9	Point 90	520553 mN	539625 mE
24C015/1	Point 91	520553 mN	539625 mE
24C015/2	Point 92	520553 mN	539625 mE
24C015/3	Point 93	520553 mN	539625 mE
24C015/4	Point 94	520553 mN	539625 mE
24C015/5	Point 95	520553 mN	539625 mE
24C015/6	Point 96	520553 mN	539625 mE
24C015/7	Point 97	520553 mN	539625 mE
24C015/8	Point 98	520553 mN	539625 mE
24C015/9	Point 99	520553 mN	539625 mE
24C016/1	Point 100	520553 mN	539625 mE
24C016/2	Point 101	520553 mN	539625 mE
24C016/3	Point 102	520553 mN	539625 mE
24C016/4	Point 103	520553 mN	539625 mE
24C016/5	Point 104	520553 mN	539625 mE
24C016/6	Point 105	520553 mN	539625 mE
24C016/7	Point 106	520553 mN	539625 mE
24C016/8	Point 107	520553 mN	539625 mE
24C016/9	Point 108	520553 mN	539625 mE
24C017/1	Point 109	520553 mN	539625 mE
24C017/2	Point 110	520553 mN	539625 mE
24C017/3	Point 111	520553 mN	539625 mE
24C017/4	Point 112	520553 mN	539625 mE
24C017/5	Point 113	520553 mN	539625 mE
24C017/6	Point 114	520553 mN	539625 mE
24C017/7	Point 115	520553 mN	539625 mE
24C017/8	Point 116	520553 mN	539625 mE
24C017/9	Point 117	520553 mN	539625 mE
24C018/1	Point 118	520553 mN	539625 mE
24C018/2	Point 119	520553 mN	539625 mE
24C018/3	Point 120	520553 mN	539625 mE
24C018/4	Point 121	520553 mN	539625 mE
24C018/5	Point 122	520553 mN	539625 mE
24C018/6	Point 123	520553 mN	539625 mE
24C018/7	Point 124	520553 mN	5396



NOTES :

1. THE CADASTRAL BOUNDARIES SHOWN ON THIS SHEET ARE APPROXIMATE.
2. LEVELS ARE IN TERMS OF THE GDBD 2009. LEVELS WERE COMPUTED BASED ON CORS STATION TEMB (65.181), MURA (63.822) & UKUR (74.740)
3. CONTOUR INTERVAL IS 1 METER
4. FIELDBOOK NUMBER F 62795

Sheet Number 01 Of 05	
PLOTTING ORIGIN	N 519500
	E 537500

LEGEND						
OLP	Lamp Post	—/—/—	Fence	4.6	Spot Height	
OMH	Square Manhole	-----	Earth Road	(0.4)	Invert	
-	Concrete Drain	—/—/—	Edge Of Forest	----	R.C.B	Reinforced Culvert Box
-	Concrete Road	—/—/—	Edge of Building/Roofline	----		
-	Earth Drain	—/—/—	Sump	----		
□ ST	Septic Tank	—/—/—				

SURVEYED BY	SYARIKAT JURUUKURFADLY	VERIFIED BY	
DRAWN BY	SYARIKAT JURUUKURFADLY		
CHECKED BY	SYARIKAT JURUUKURFADLY		
APPROVED BY	HAJI MAHADI BIN HAJI MOHAMAD TAHIR		
DATE OF SURVEY	FEBRUARY 2024	LICENSED LAND SURVEYOR	HAJI MAHADI BIN HAJI MOHAMAD TAHIR

JURUUKUR
FADLY

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E-MAIL: info@juruukurfadly.com
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NOTES :

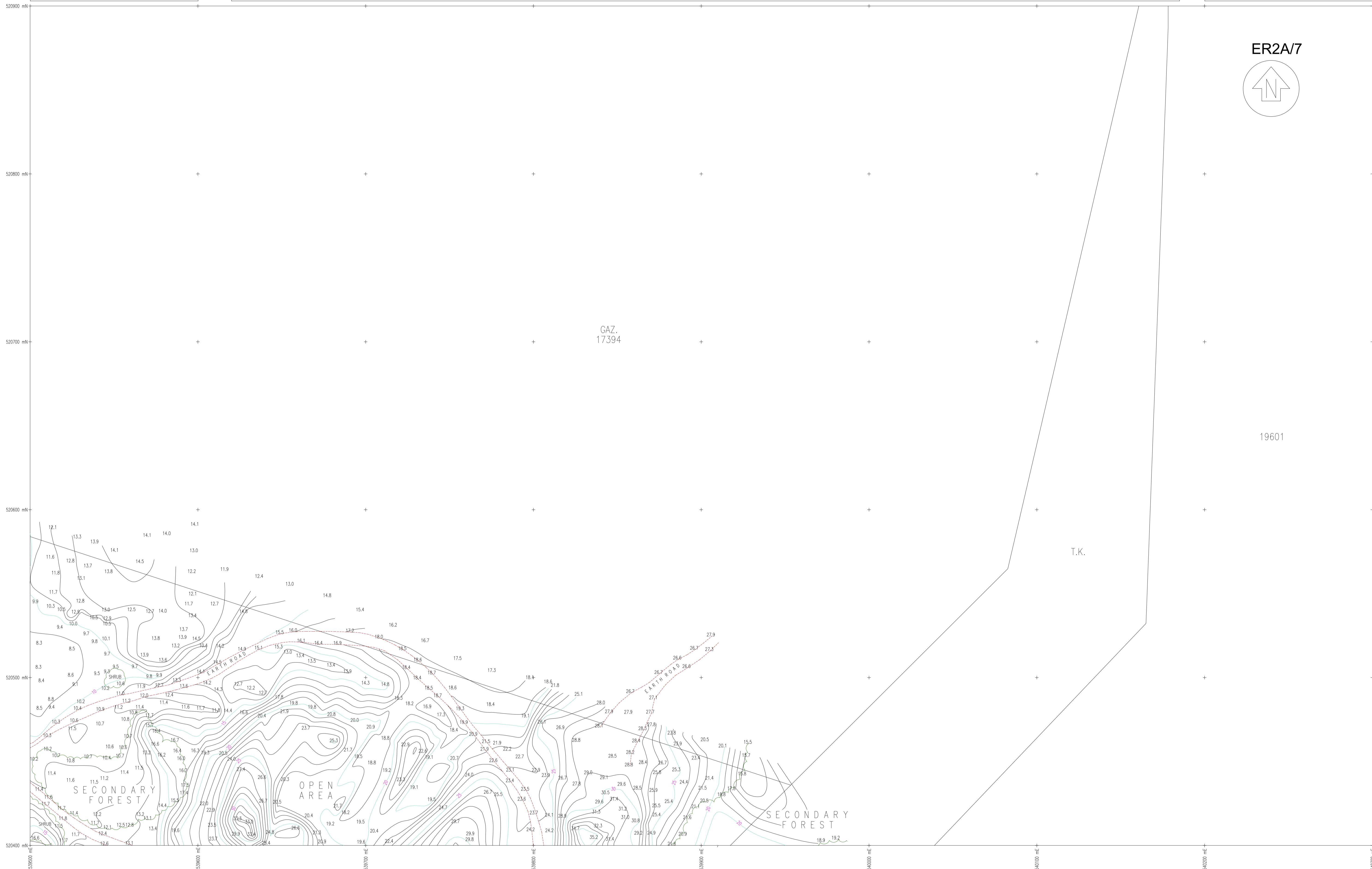
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2. LEVELS ARE IN TERMS OF THE GDBD 2009. LEVELS WERE COMPUTED BASED ON CORS STATION TEMB (65.181), MURA (63.822) & UKUR (74.740)
3. CONTOUR INTERVAL IS 1 METER
4. FIELDBOOK NUMBER F 62795

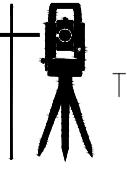
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PLOTTING ORIGIN	N 520400
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DRAWN BY	SYARIKAT JURUUKURFADLY		
CHECKED BY	SYARIKAT JURUUKURFADLY		
APPROVED BY	HAJI MAHADI BIN HAJI MOHAMAD TAHR		
DATE OF SURVEY	FEBRUARY 2024	LICENSED LAND SURVEYOR	HAJI MAHADI BIN HAJI MOHAMAD TAHR

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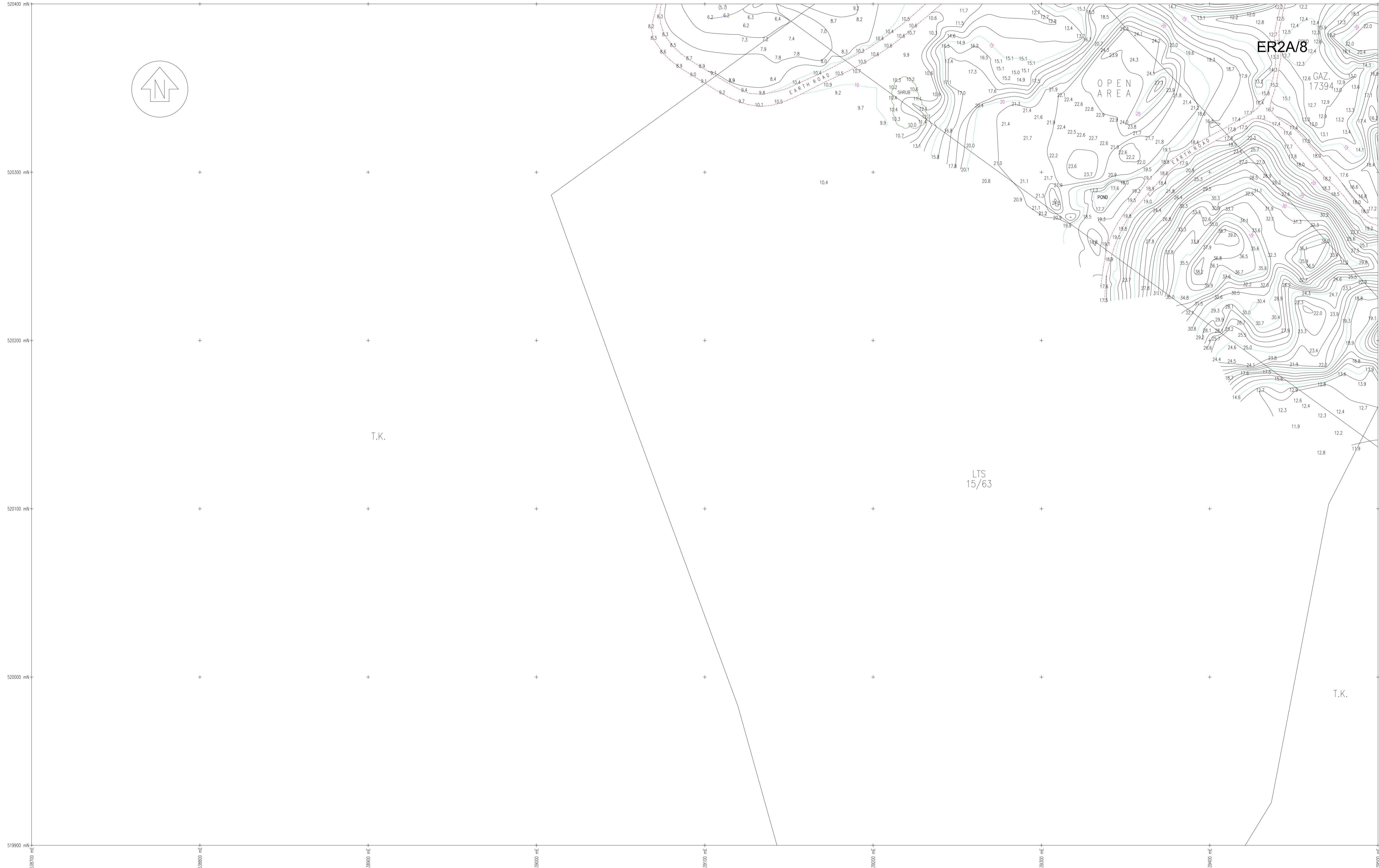
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DRAWN BY	SYARIKAT JURUUKURFADLY		
CHECKED BY	SYARIKAT JURUUKURFADLY		
APPROVED BY	HAJI MAHADI BIN HAJI MOHAMAD TAHIR		
DATE OF SURVEY	FEBRUARY 2024	LICENSED LAND SURVEYOR HAJI MAHADI BIN HAJI MOHAMAD TAHIR	

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Scale 1 : 1,000

JUA23/024/TS/TU - PERMOHONAN PENGUKURAN TOPOGRAFI DAN KAJIAN TANAH DI TAPAK PELUPUSAN SAMPAH SUNGAI PAKU (TAPAK LOT 17394) BAGI RENCANA PROJEK WASTE TO ENERGY

Sheet Number 04 Of 05

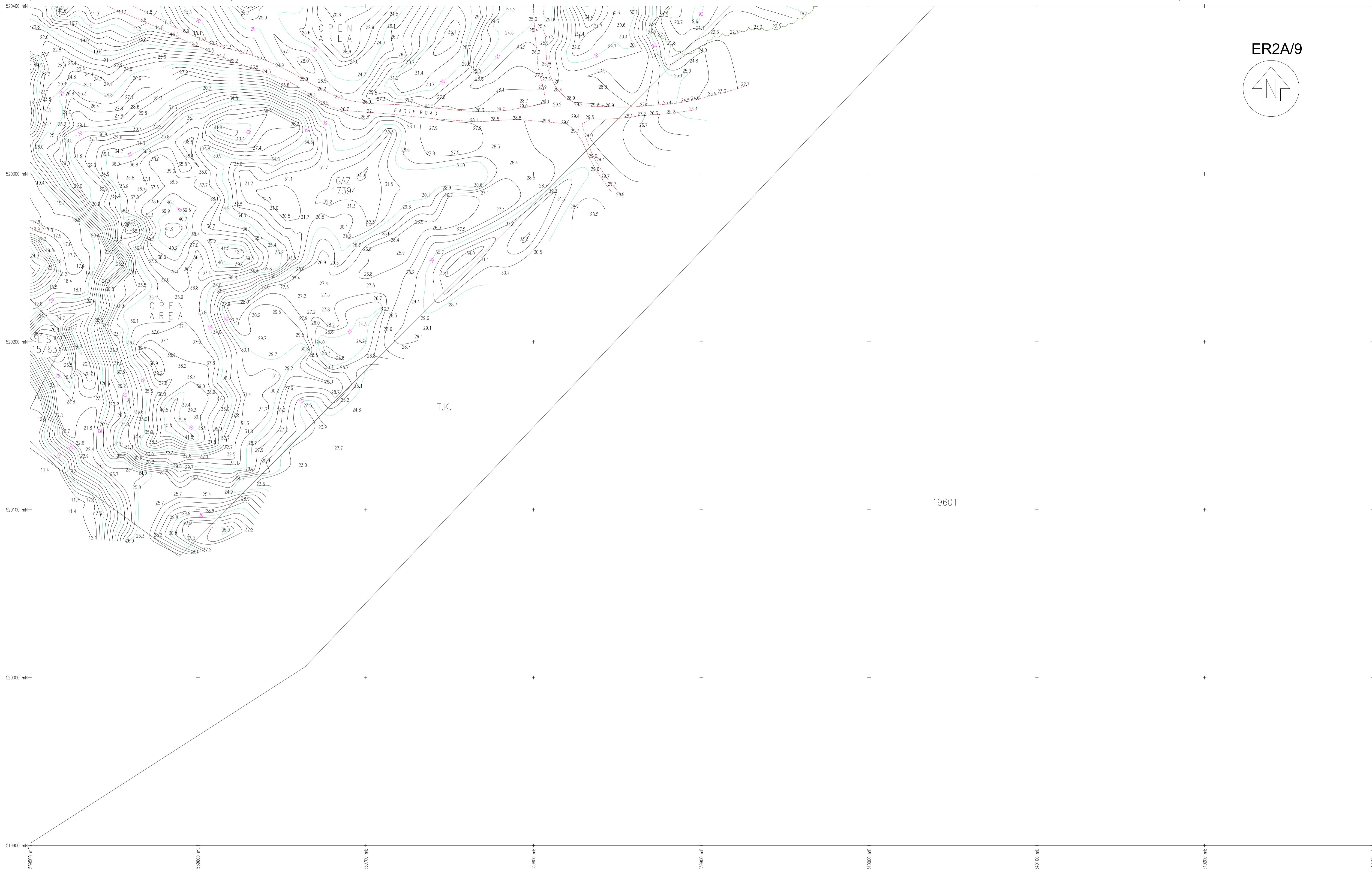


SURVEYED BY	SYARIKAT JURUUKURFADLY	VERIFIED BY	
DRAWN BY	SYARIKAT JURUUKURFADLY	LICENSED LAND SURVEYOR	
CHECKED BY	SYARIKAT JURUUKURFADLY	HAJI MAHADI BIN HAJI MOHAMAD TAHIR	
APPROVED BY			
DATE OF SURVEY	FEBRUARY 2024		

Scale 1 : 1,000

JUA23/024/TS/TU - PERMOHONAN PENGUKURAN TOPOGRAFI DAN KAJIAN TANAH DI TAPAK PELUPUSAN SAMPAH SUNGAI PAKU (TAPAK LOT 17394) BAGI RENCANA PROJEK WASTE TO ENERGY

Sheet Number 05 Of 05



Sheet Number 05 of 05	
PLOTTING ORIGIN	N 519900
	E 539500

LEGEND					
OLP	Lamp Post	- - - - -	Fence	4.6	Spot Height
OMH	Square Manhole	-----	Earth Road	(0.4)	Invert
-	Concrete Drain	---	Edge Of Forest	----	R.C.B
-	Concrete Road	[Hatched]	Edge of Building/Roofline	----	Reinforced Culvert Box
-	Earth Drain	---	Sump	----	
ST	Septic Tank	---			

SURVEYED BY	SYARIKAT JURUUKURFADLY	VERIFIED BY	JURUUKUR FADLY
DRAWN BY	SYARIKAT JURUUKURFADLY		
CHECKED BY	SYARIKAT JURUUKURFADLY		
APPROVED BY	HAJI MAHADI BIN HAJI MOHAMAD TAHR		
DATE OF SURVEY	FEBRUARY 2024	LICENSED LAND SURVEYOR HAJI MAHADI BIN HAJI MOHAMAD TAHR	

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WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 2 – SITE DATA

APPENDIX 2B – SOIL INVESTIGATION REPORTS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 3 – MUNICIPAL SOLID WASTE DATA

APPENDIX 3A – OVERALL WASTE STATISTICS

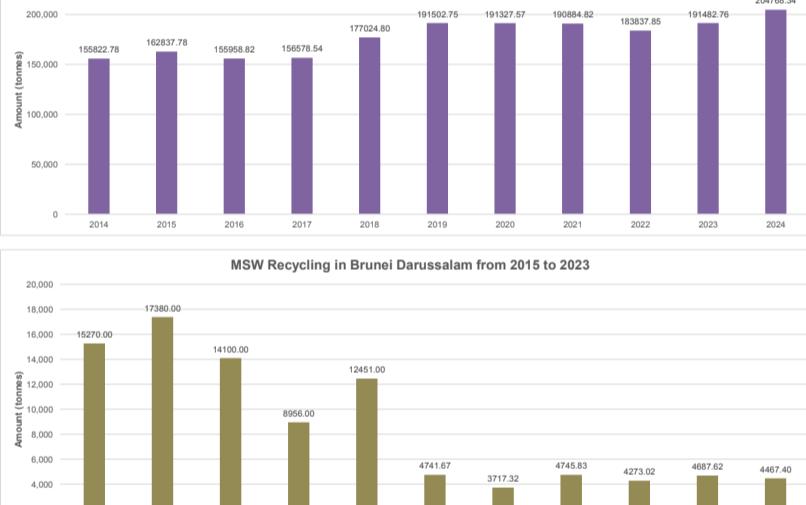
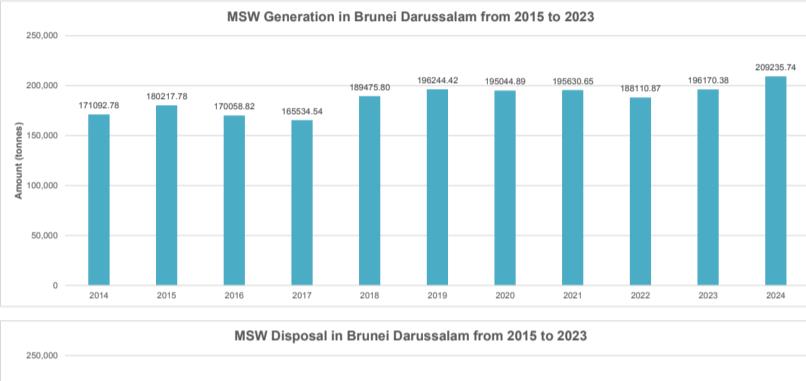
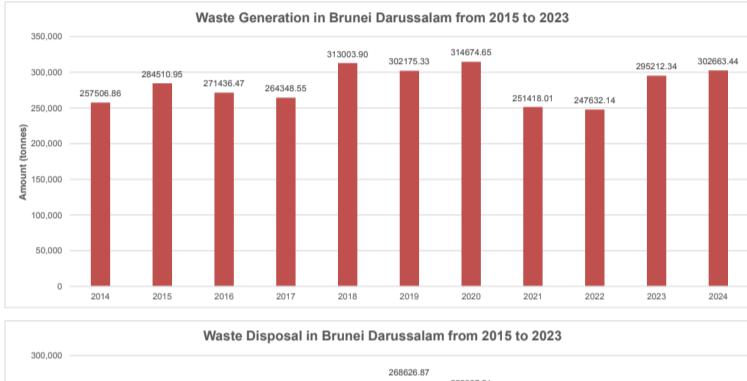
WASTE STATISTICS (AS OF DEC 2024)
OVERALL

Year	Sg Paku Engineered Landfill		K37 Landfill		Rubuda Landfill		Total Waste Disposed of		Recycling		Total Waste Generation	Total MSW Generation	Recycling Rate (%)		Population	MSW Generation (kg/capita/day)	Total Waste Generation (kg/capita/day)
	Total	Total MSW	Total	Total MSW	Total	MSW	Total	Total MSW	Total	MSW	Total	MSW	Total	MSW			
2014	176975.37	147006.30	22147.63	58164.48	30000.00	202123.00	155822.78	55383.88	15270.00	257506.86	171092.78	21.51%	8.92%	407600	1.15	1.73	
2015	180324.24	148013.97	22247.74	59635.00	30000.00	210243.96	156958.62	69193.52	14100.00	271436.47	170558.82	25.49%	8.29%	417256	1.20	1.69	
2016	180344.37	148013.97	18898.58	4944.85	30000.00	202243.96	155958.62	69193.52	14100.00	271436.47	170558.82	25.49%	8.29%	417256	1.12	1.78	
2017	178876.43	148111.79	16623.71	5466.75	30000.00	198200.14	156578.54	66148.41	8956.00	264348.55	165534.54	25.02%	5.41%	429500	1.06	1.69	
2018	209349.14	167852.20	14282.66	5063.20	4109.40	227741.20	177024.80	85262.70	12451.00	313003.90	189475.80	27.24%	6.57%	442400	1.17	1.94	
2019	250358.17	179495.08	14880.10	8619.07	3388.60	268826.87	191502.75	33548.46	4741.67	302175.33	196244.42	11.10%	2.42%	459500	1.17	1.80	
2020	250358.17	179495.08	14880.10	8619.07	3388.60	268826.87	191502.75	33548.46	4741.67	302175.33	196244.42	11.10%	2.42%	459500	1.17	1.80	
2021	253436.04	168445.37	16680.14	13059.45	9380.00	229496.18	190984.82	4745.83	21921.83	251418.01	195630.65	8.72%	2.43%	440715	1.22	1.56	
2022	190158.40	163896.32	15947.68	12930.38	7011.15	213117.23	183837.85	34514.91	4273.02	247632.14	188110.87	13.94%	2.27%	445400	1.16	1.52	
2023	192319.95	168022.47	20139.03	16208.29	7252.00	219710.98	191482.76	75501.36	4687.62	295212.34	196170.38	25.58%	2.39%	455500	1.19	1.80	
2024	200034.67	176840.07	27888.12	20076.77	7851.50	235774.29	204768.34	66889.15	4467.40	302663.44	209257.74	22.10%	2.14%	455500	1.26	1.82	

Notes:
 1) Unless otherwise stated, unit of waste is tonne.
 2) Except for K37 Landfill, Rubuda Landfill and Recycling, all figures are revised as of 30 March 2022. Revision is due to the revised data on Sg Paku Engineered Landfill (SPEL), wherein most of the figures were previously double-counted (between SPEL and SATS).
 3) Population figure for 2024 is based on 2023 population (BDKI 2023) (JPES has not released 2024 population stats)

Year	Targets	
	Recycling Rate (%)	MSW Generation (kG/capita/day)
2014	10	1.40
2015	11	1.38
2016	12	1.36
2017	13	1.34
2018	13	1.34
2019	14	1.32
2020	15	1.30
2021	16	1.28
2022	17	1.26
2023	18	1.24
2024	19	1.22
2025	20	1.20
2026	21	1.18
2027	22	1.16
2028	23	1.14
2029	24	1.12
2030	25	1.10
2031	26	1.08
2032	27	1.06
2033	29	1.02
2034	30	1.00

Note: WC is based on 2019 study



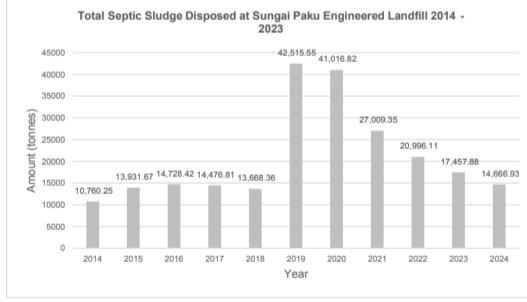
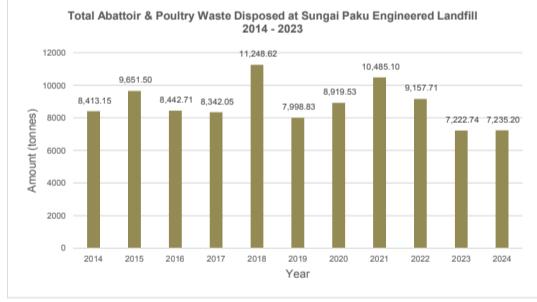
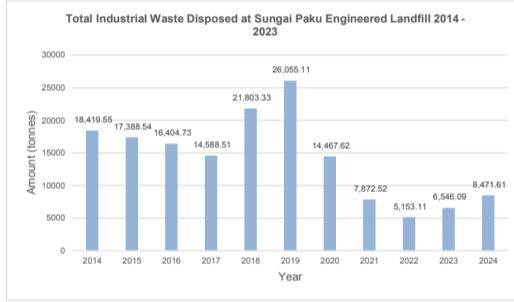
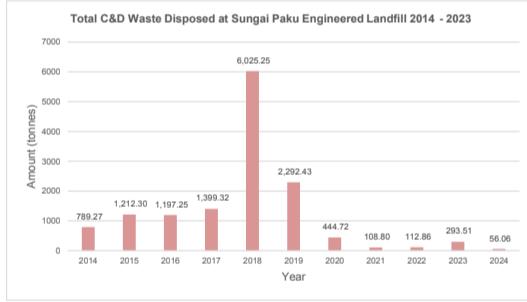
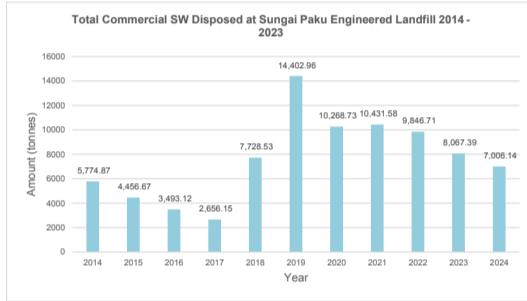
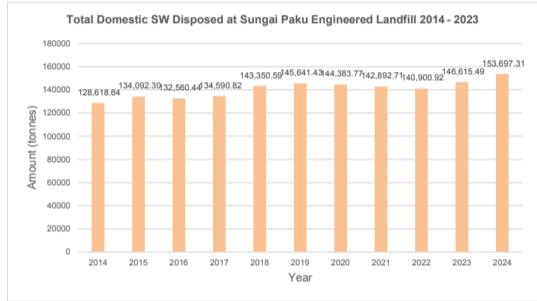
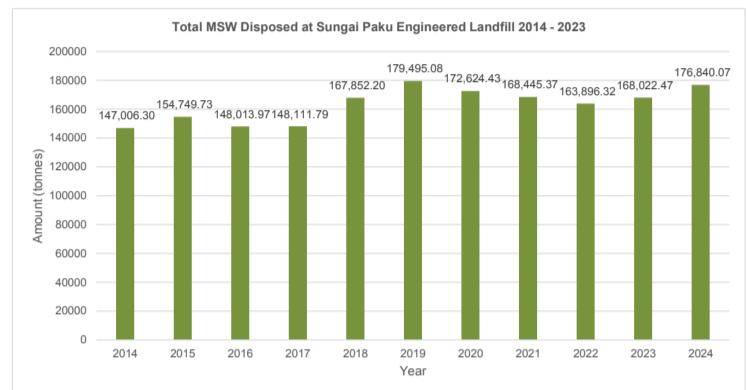
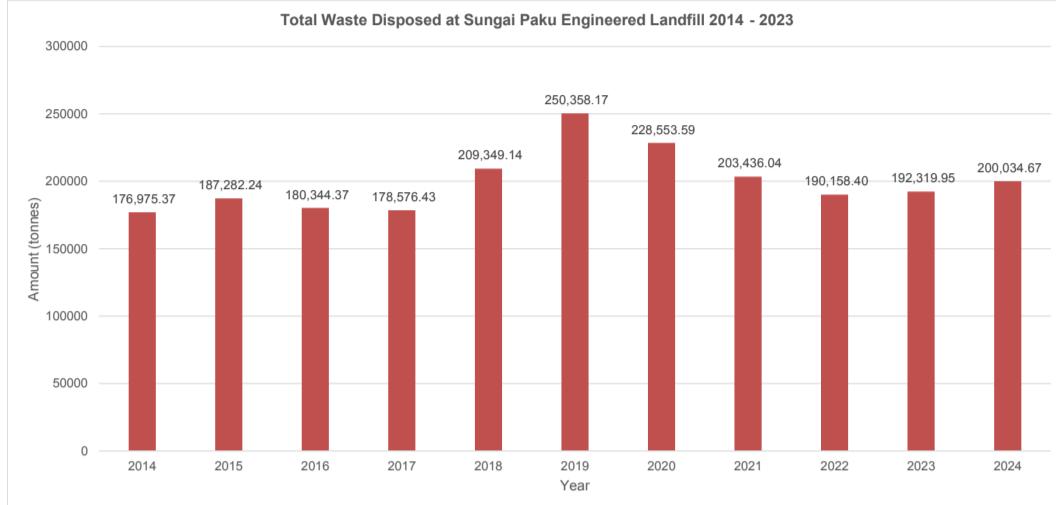
WASTE STATISTICS (AS OF DEC 2024)
SUNGAI PAKU ENGINEERED LANDFILL

Year	Domestic SW	Commercial SW	Green	Bulky	C&D	Industrial SW	Abattoir/Poultry	Sludge	TOTAL	TOTAL MSW	% of Total Waste Disposed
2014	128,618.64	5,774.87	4,069.47	130.17	789.27	18,419.55	8,413.15	10,760.25	176,975.37	147,006.30	88%
2015	134,092.30	4,456.67	6,262.17	287.09	1,212.30	17,388.54	9,651.50	13,931.67	187,282.24	154,749.73	88%
2016	132,560.44	3,493.12	3,197.00	320.70	1,197.25	16,404.73	8,442.71	14,728.42	180,344.37	148,013.97	89%
2017	134,590.82	2,656.15	2,416.99	105.78	1,399.32	14,588.51	8,342.05	14,476.81	178,576.43	148,111.79	90%
2018	143,350.59	7,728.53	4,941.36	583.10	6,025.25	21,803.33	11,248.62	13,668.36	209,349.14	167,852.20	92%
2019	145,641.43	14,402.96	10,121.50	1,330.36	2,292.43	26,055.11	7,998.83	42,515.55	250,356.17	179,495.08	93%
2020	144,383.77	10,268.73	8,693.07	359.33	444.72	14,467.62	8,919.53	41,016.82	228,553.59	172,624.43	89%
2021	142,892.71	10,431.58	4,355.40	280.58	108.80	7,872.52	10,485.10	27,009.35	203,436.04	168,445.37	89%
2022	140,900.92	9,846.71	3,314.23	676.75	112.86	5,153.11	9,157.71	20,996.11	190,158.40	163,896.32	89%
2023	146,615.49	8,067.39	4,597.65	1,519.20	293.51	6,546.09	7,222.74	17,457.88	192,319.95	168,022.47	88%
2024	153,697.31	7,006.14	6,544.20	2,357.22	56.06	8,471.61	7,235.20	14,666.93	200,034.67	176,840.07	85%

Notes:

1) Data as of 31st Dec 2024

2) MSW excludes C&D, industrial solid waste and sludge

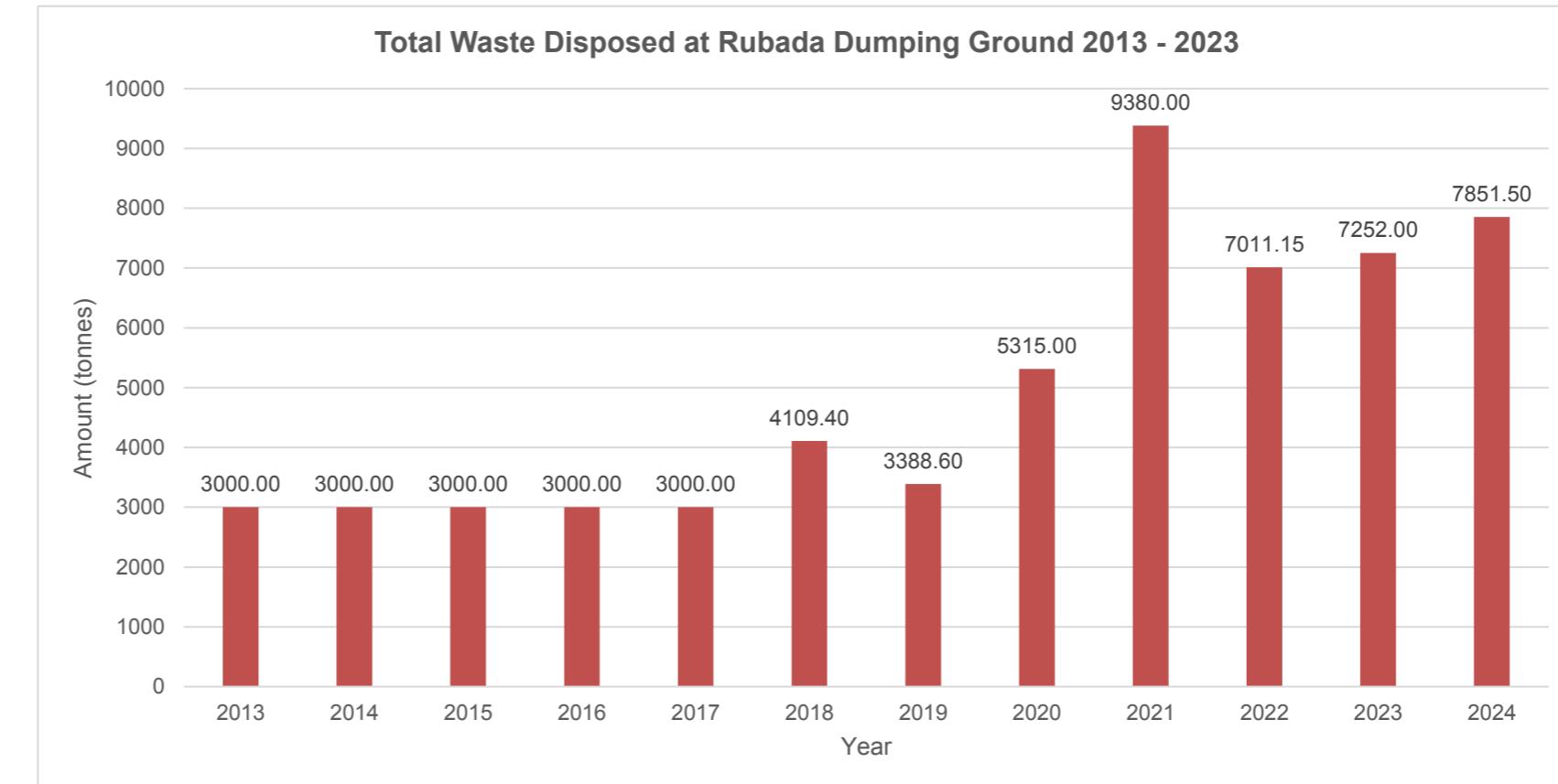


WASTE STATISTICS (AS OF DEC 2024)
RUBADA

Year	Total	Total MSW
2013	3000.00	3000.00
2014	3000.00	3000.00
2015	3000.00	3000.00
2016	3000.00	3000.00
2017	3000.00	3000.00
2018	4109.40	4109.40
2019	3388.60	3388.60
2020	5315.00	5315.00
2021	9380.00	9380.00
2022	7011.15	7011.15
2023	7252.00	7252.00
2024	7851.50	7851.50

Notes:

- 1) Data as of 31st Dec 2024
- 2) All waste disposed are assumed to be MSW

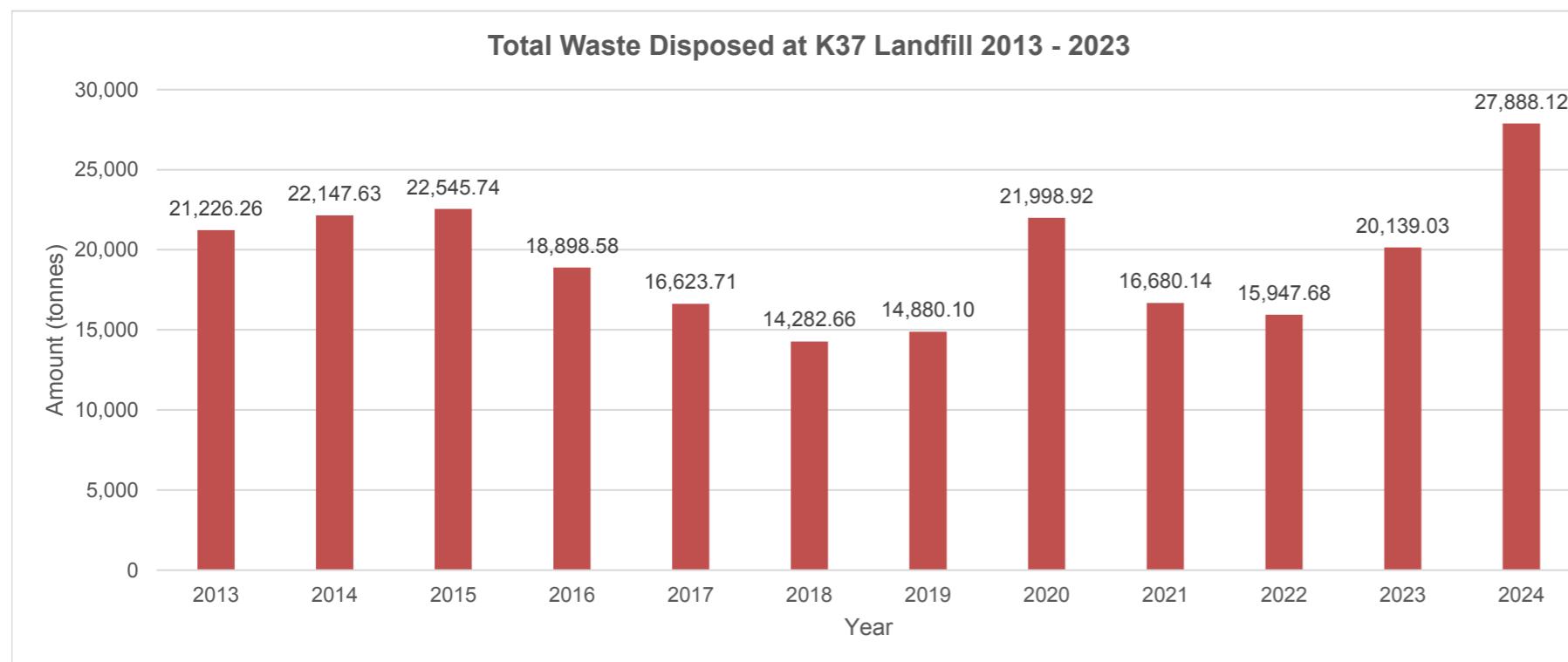


WASTE STATISTICS (AS OF DEC 2024)
K37

Year	Domestic	Garden	Industrial	Asbestos	Hydrocontaminated Soil	Mud Cutting	Solidification (DRUMS)	TOTAL	TOTAL MSW
2013	1,385.89	3,054.89	10,936.61	77.25	4,505.55	1,266.07		21,226.26	4,440.78
2014	1,376.96	4,439.52	12,928.53	14.24	904.30	2,484.08		22,147.63	5,816.48
2015	1,769.41	3,318.64	14,319.61	117.96	201.22	2,818.90		22,545.74	5,088.05
2016	2,216.62	2,728.23	9,566.81	56.49	214.94	4,115.49		18,898.58	4,944.85
2017	2,228.77	3,237.98	8,348.59	34.91	97.60	2,675.86		16,623.71	5,466.75
2018	2,249.33	2,813.87	9,083.75	99.15	18.40	18.16		14,282.66	5,063.20
2019	4,927.73	3,691.34	6,234.15	24.78	2.10	0.00		14,880.10	8,619.07
2020	7475.18	5912.96	8499.87	91.79	19.12	0.00		21,998.92	13,388.14
2021	7,481.00	5,578.45	3,424.29	134.09	62.31	0.00		16,680.14	13,059.45
2022	8,335.88	4,594.50	2,876.66	139.28	1.36	0.00		15,947.68	12,930.38
2023	9,353.11	6,855.18	3,620.27	296.61	13.86	0.00	2.00	20,139.03	16,208.29
2024	10,855.20	9,221.57	7,495.76	270.98	44.61	0.00	2.00	27,888.12	20,076.77

Notes:

- 1) Data as of 31st Dec 2024
- 2) MSW comprises domestic and garden wastes only



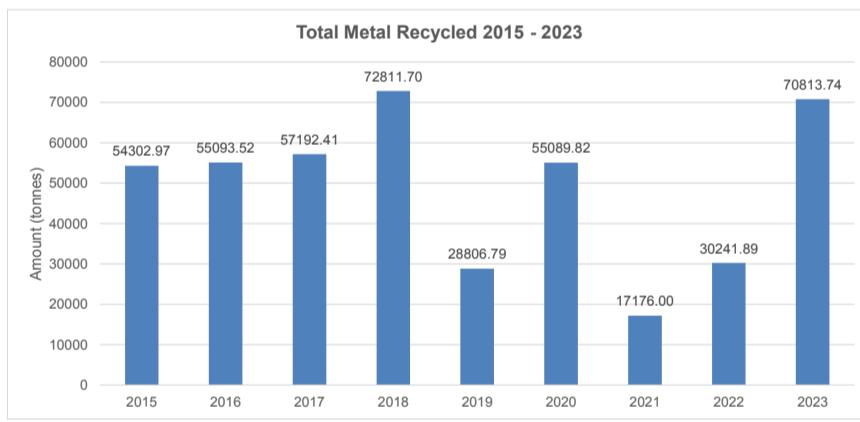
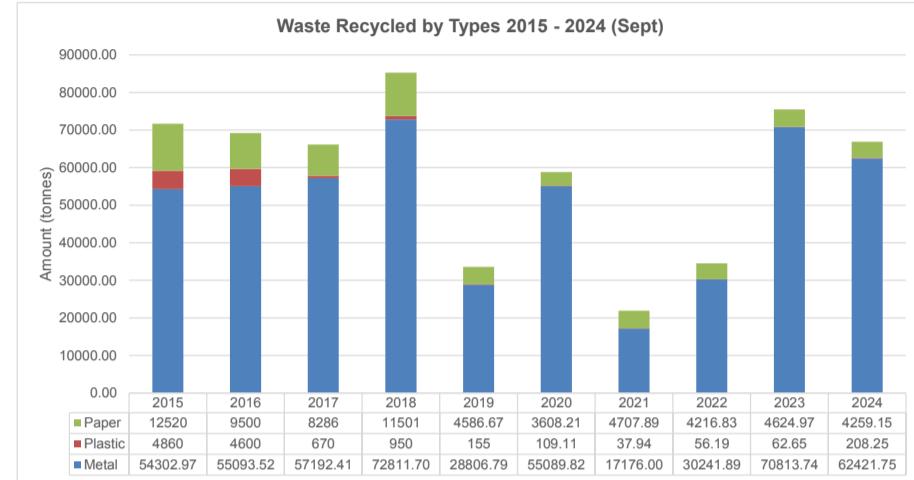
WASTE STATISTICS (AS OF DEC 2024)
RECYCLING

Year	Paper	Plastic	Metal	TOTAL	TOTAL MSW
2010	6800	1900	41871.09	50571.09	8700.00
2011	7500	2200	41919.48	51619.48	9700.00
2012	7600	2500	44014.21	54114.21	10100.00
2013	11100	3350	42524.32	56974.32	14450.00
2014	11450	3820	40113.86	55383.86	15270.00
2015	12520	4860	54302.97	71682.97	17380.00
2016	9500	4600	55093.52	69193.52	14100.00
2017	8286	670	57192.41	66148.41	8956.00
2018	11501	950	72811.70	85262.70	12451.00
2019	4586.67	155	28806.79	33548.46	4741.67
2020	3608.21	109.11	55089.82	56807.14	3717.32
2021	4707.89	37.94	17176.00	21921.83	4745.83
2022	4216.83	56.19	30241.89	34514.91	4273.02
2023	4624.97	62.65	70813.74	75501.36	4687.62
2024	4259.15	208.25	62421.75	66889.15	4467.40

Notes:

1) Data as of 31st Dec 2024

2) MSW comprises paper and plastic only



**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 3 – MUNICIPAL SOLID WASTE DATA

**APPENDIX 3B – EXISTING WASE MANAGEMENT ECO SYSTEM FOR BRUNEI
DARUSSALAM**

WASTE MANAGEMENT OVERVIEW



**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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SECTION 3

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APPENDIX 3 – MUNICIPAL SOLID WASTE DATA

APPENDIX 3C – PREVIOUS SOLID WASTE STUDIES FOR THE SG. PAKU LAND

FILL SITE & BRUNEI DARUSSALAM AND MUNICIPAL SOLID WASTE

SAMPLING DATA

**REPORT OF
WASTE CHARACTERISTIC STUDY (WCS)
MAY 2025**

**SUNGAI PAKU ENGINEERED LANDFILL
(SPEL)**



**ENVIRO IDAMAN (B) SDN BHD
(RC 00008562)**

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PART 1.0 : INTRODUCTION

Effective solid waste management begins with adequate and reliable information of what is in the waste stream originating from the Households, Industries, and Commercial Institutional entities and ending up at the Landfills. This basic information is essential to all aspects of policy and program implementation. The collected information can be used for purposes such as:

- a) Obtaining information to quantify recyclables and to prioritize recovery opportunities.
- b) Establishing a baseline for continued long-term measurement of system performance.
- c) Understanding the differences between waste sub-streams so targeted recycling programs can be designed, implemented, and monitored.
- d) Comparing waste composition and waste diversion accomplishments among jurisdictions with different solid waste policies.
- e) Tools for the Government for formulating effective waste management policies.

PART 2.0 : OBJECTIVES

The purpose of the sampling is to establish a reliable baseline data that can be used in the planning for an Integrated Solid Waste Management of both the collection and disposal of solid waste in Brunei.

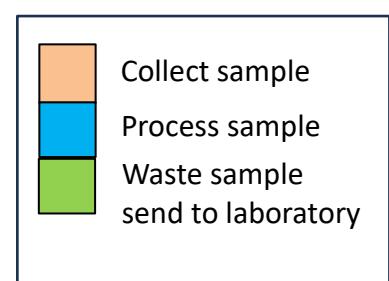
PART 3.0 : SCOPE OF WORK

In general, there are three sources of solid waste categories, first is “As Generated Waste” which is solid waste produce from its source such as house and workplace. Next, is “As Discarded Waste” solid waste collected by waste contractor and solid waste placed at the collection area such as housing area centralised waste collection area. Finally, is “As Disposed Waste” solid waste taken from collection area and transported to solid waste management facilities such as landfill or transfer station. In this study “As Disposed Waste” is selected for study and sampling

The scope of work for this study included sampling of MSW waste coming from district, Bandar Seri Begawan and Muara, Tutong, and Kuala Belait on Tuesday. The sampling is collected on 6th May 2025, proceed on 7th May 2025 and send to laboratory on 8th May 2025. The boom calory test will be done by Chemsains Malaysia Sdn Bhd. This study did not include waste such as construction and demolition, abattoir, sludge and septic in sampling process.

TABLE 1- DATE SELECTED FOR WASTE CHARACTERISTIC STUDY

May 2025																															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	



PART 4.0 : METHODOLOGY

4.1 Waste Composition of the Incoming Waste

A waste composition study was carried out at the Sungai Paku engineered landfill (SPEL) on 7th May 2025, to determine the composition of waste from the various sources. 10 samples were taken from household, industries and commercial and institutional sectors. The samples selected were random from trucks that entered SPEL. It was agreed that the scope of this study was to cover only the waste coming directly from the households, industries and commercial and institutional sectors. This composition study is not included waste from Temburong district.

A random grab sampling was done when a truck is unloaded onto a platform. The waste is then coned and quartered till only about 200 kg remains, as a representative sorting sample. The sorting sample weight for waste composition analysis was based on *MS2505:2012 Guidelines for Sampling of Household Solid Waste - Composition and Characterisation Analysis*. The composition and characterisation analysis that recommends sorting sample weight be a minimum of 200 kg.

The sorting waste sample was then segregated into the waste components by the sorters at the landfill. In the case a composite item is found in the waste, the individual materials were separated and placed into the appropriate storage containers. Sorting continued until the maximum particle size of the remaining waste particles was approximately less than 10 mm. At this point, the remaining material was apportioned into the storage containers corresponding to the waste components represented in the remaining mixture. The truck drivers were interviewed to collect information on the areas the waste load was collected.

4.2 Cone and Quarter Method

- a) Waste trucks entering the site with solid waste collected from household area, industry, and commercial and institution area.
- b) The waste from the trucks was directed to a pre-prepared sampling site and unloaded onto the tip floor.
- c) Bulky items, medical waste or scheduled waste found in the waste was removed from the load.
- d) The remaining material was mixed by mechanical shovel, or manually using rakes or shovels, into a uniform, homogeneous pile approximately 0.8 m high.
- e) The pile was then divided into two equal portions by drawing a straight line through the center of the pile. The pile was further divided by drawing a second line roughly perpendicular to the first.
- f) A pair of opposite quarters was removed, leaving half the original sample.
- g) The steps d) through f) were repeated until the required amount of sorting sample of approximately 200kgs remained.
- h) The sorting sample was then sorted into its type of waste and recorded.

4.3 Gross Calorific Value Method – *ASTM D240*

- a) Approximately 100g gram of sample will be sent to Chemsains Malaysia external laboratory to do **Gross Calorific Value Test based on ASTM D240 method.**

4.4 Number of Manpower

- a) Ten to twelve people.

4.5 Personal Protective Equipment

- a) Safety helmet
- b) Safety shoes
- c) Safety goggles
- d) Glove
- e) Mask

4.6 Apparatus

- a) Weighing scale (1 Unit)
- b) Plastic basket (20 Units)
- c) Shovel (4 Units)
- d) Hoe (1 Unit)
- e) Sieve (size 1 inch) (1 Unit)
- f) Knives (9 Units)

PART 5.0 : WASTE CHARACTERISTIC STUDY TABLE AND DATA

5.1 Selected vehicles on 6th May 2025 for waste characteristic study.

Day: Tuesday Date: 6th May 2025 Weather: Sunny

TABLE 2 – SELECTED VEHICLES RECORD ON 6TH MAY 2025

NO.	VEHICLE NO.	TRANSPORTER TYPE	COMPANY	TIME IN	TIME OUT	AREA	DISTRICT	CATEGORY
1	BAM1391	Roro bin	LIFTCO SDN BHD	7:21	7:42	BANDAR KUALA BELAIT	KUALA BELAIT	Commercial
2	BAQ7290	Manual	AHM AREEBAH SDN BHD	6:58	7:33	KERIAM	TUTONG	Mixed
3	BP1756	Manual	SYKT PEMBINAAN DAUN SDN BHD	7:56	8:22	PANDAN 7	KUALA BELAIT	Commercial
4	BAL7852	Compactor	NORACON SDN BHD	7:59	8:27	KUALA TUTONG	TUTONG	Household
5	BBC8398	Compactor	YUSZAIMA ENT	8:02	8:31	MUMONG	KUALA BELAIT	Household
6	BAJ8438	Trailer	EISB	8:09	8:45	BSB/Muara	BANDAR SERI BEGAWAN	Mixed
7	BAH5704	Open top	EISB	8:11	8:39	BSB/Muara	BANDAR SERI BEGAWAN	Mixed

8	KR4453	Roro bin	NORACON SDN BHD	9:04	9:22	TANJONG MAYA	TUTONG	Commercial
9	BG4284	Compactor	BANDARAN TUTONG	9:28	9:37	BANDAR TUTONG	TUTONG	Institution
10	BG7747	Compactor	BANDARAN KUALA BELAIT	13:39	13:59	BANDAR KUALA BELAIT	KUALA BELAIT	Institution

TABLE 3 – THE TOTAL WEIGHT OF WASTE RECORD 7TH MAY 2025

No	Kilogram (kg)														
	Food waste	Plastic	Paper	Rubber	Wood	Leather	Diaper	Textile	Metal	Glass	Tetra Pak	Garden waste	E-waste	Aerosol	Others
1	7.00	45.10	1.00	0.40	3.60	0.10	4.80	4.20	2.00	4.20	0.40	0.90	3.80	0.80	0.40
2	13.50	3.40	19.20		1.00		7.40	5.20	0.60	3.60	0.20	1.00			2.20
3	12.20	12.70	9.50		1.00		9.00	3.60	1.00	1.80		1.00			
4	22.50	1.40					3.00	2.00	1.60						
5	15.00	3.80						7.80	2.20						
6								2.00							
7								2.80							
8								2.20							
9															
10															
Total	70.20	66.40	29.70	0.40	5.60	0.10	24.20	29.80	7.40	9.60	0.60	2.90	3.80	0.80	2.60
Total weight		254.10													

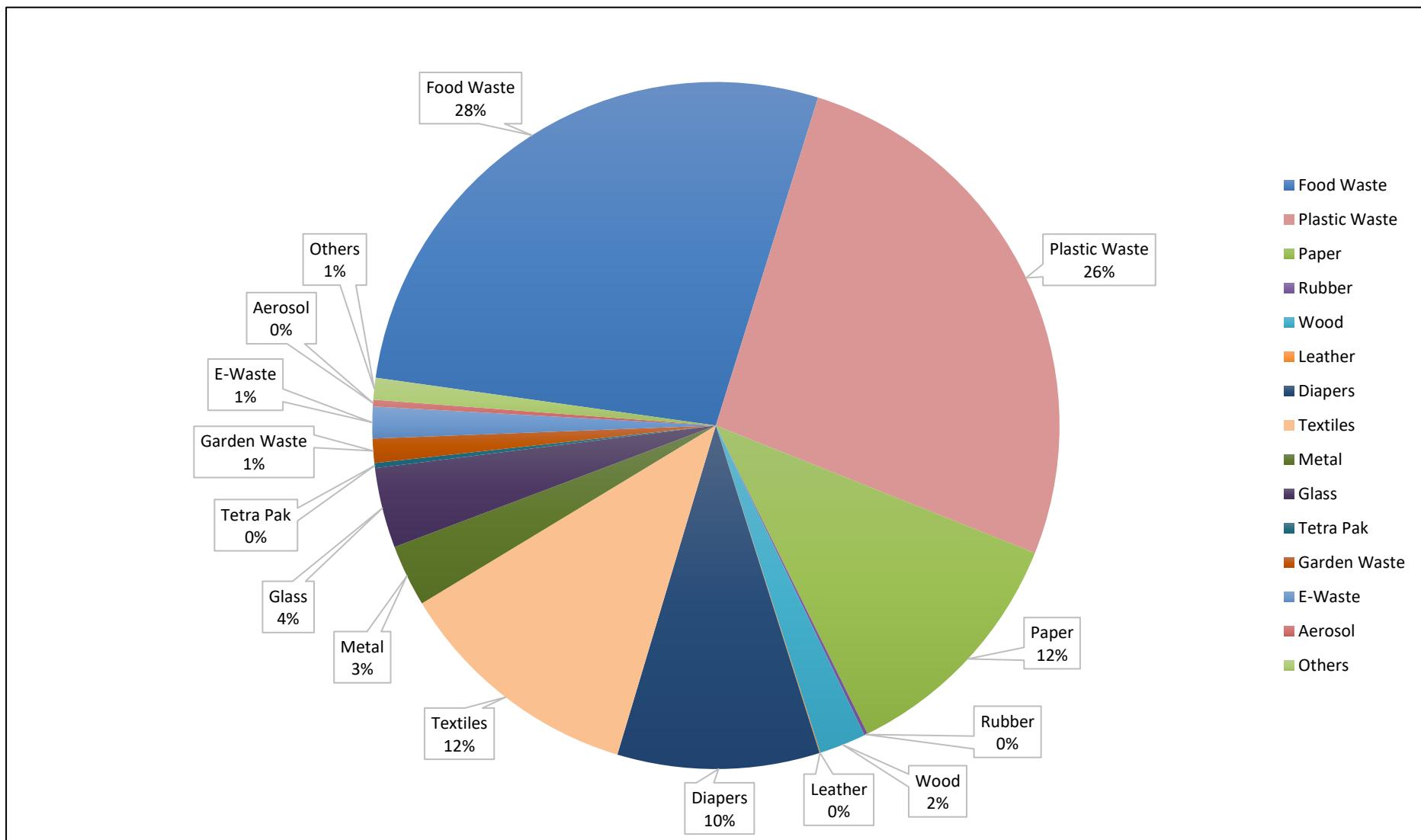
FIGURE 1 – OVERALL AVERAGE COMPOSITION OF WASTE 7TH MAY 2025

TABLE 4 – THE TOTAL WEIGHT OF PLASTIC, PAPER AND METAL WASTE RECORD 7TH MAY 2025

NO	Kilogram (kg)											
	Plastic Waste							Paper			Metal	
	LDPE	HDPE	PET	PVC	PP	PS	OTHERS	Newspaper	Mixed Paper	Cardboard	Ferrous metal	Non-Ferrous
1	4.20	0.40	1.20	0.00	0.80	0.20	0.00	0.80	2.80	3.60	2.00	1.00
2	5.40	1.20	1.40		0.40	0.80		0.20	3.40	1.10	0.60	0.40
3	4.40	1.20	1.40		0.20	0.40			3.40	1.80	1.00	0.80
4	12.10	0.60	2.10			0.80			0.80	1.80	1.60	
5	7.20		1.80			0.60			1.80	1.20		
6	4.60		2.00			1.00			1.20			
7	4.20		1.60						2.80			
8	3.00		1.20						3.00			
Total	45.10	3.40	12.70	0.00	1.40	3.80	0.00	1.00	19.20	9.50	5.20	2.20
Total	66.40							29.70			7.40	

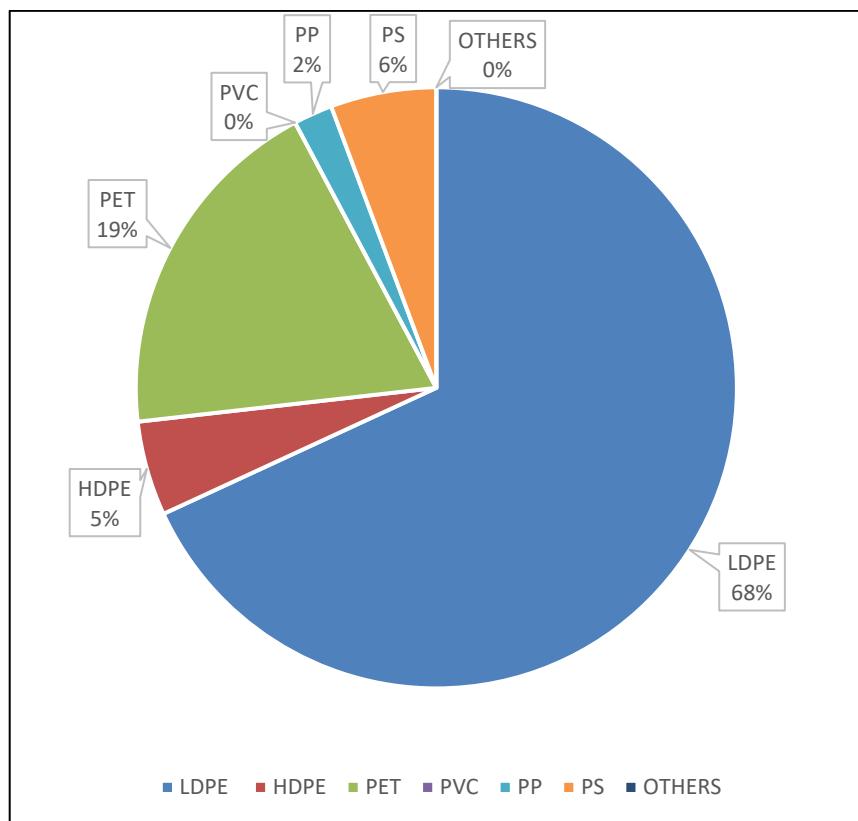
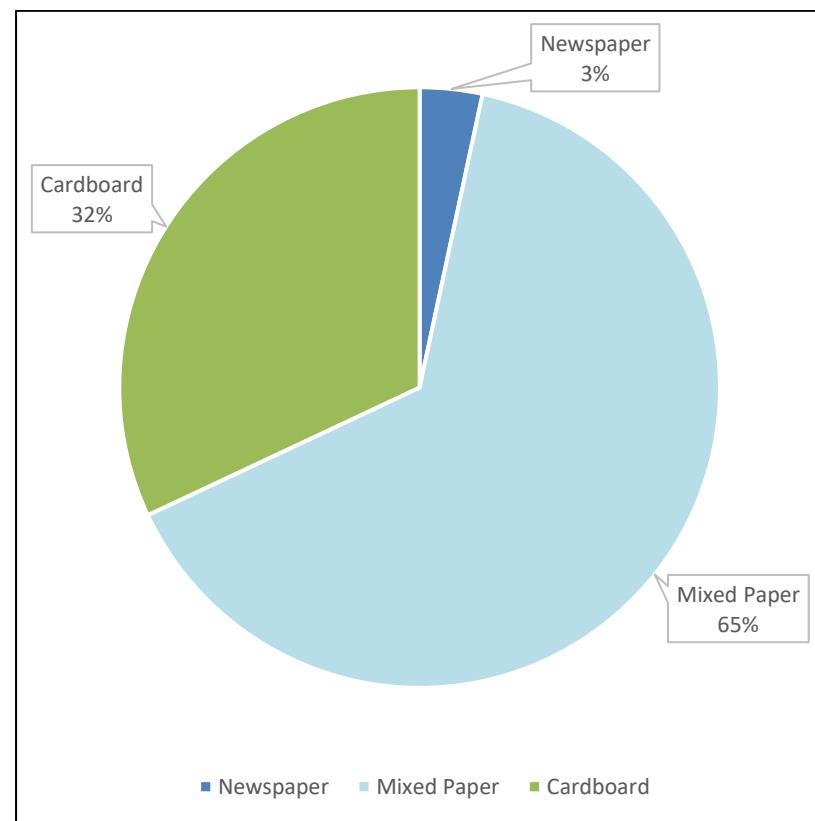
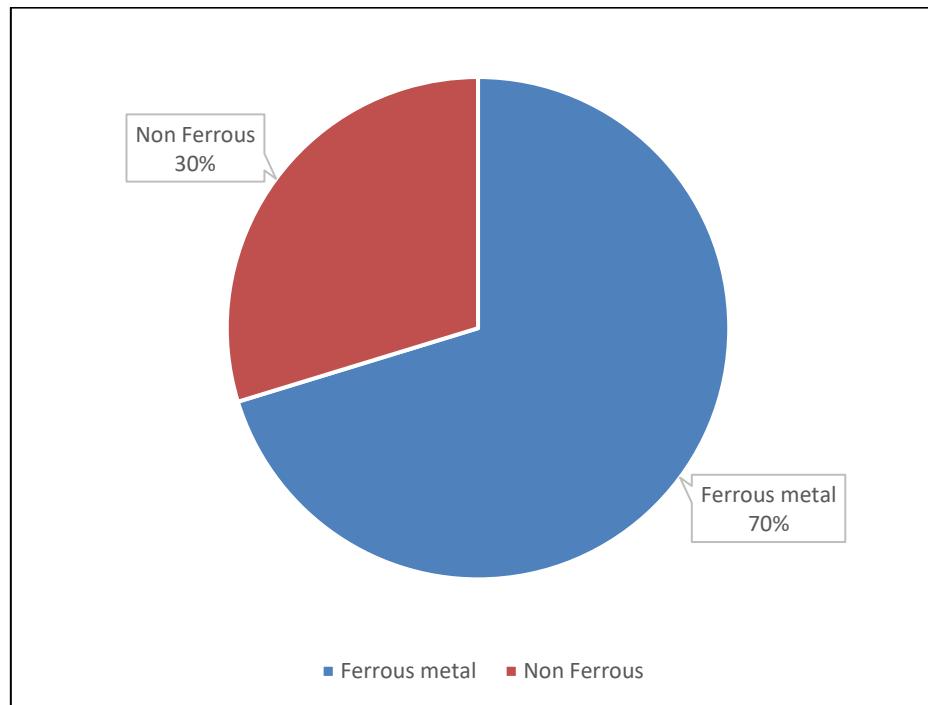
FIGURE 2 – AVERAGE COMPOSITION OF PLASTIC AND PAPER WASTE 7TH MAY 2025**Total Average of Plastics Waste****Total Average of Papers Waste**

Figure 3 – Average composition of plastic and paper waste 7th May 2025

Total Average of Metals Waste



5.2 Gross Calorific Value, Kcal/Kg for plastic, food waste, textiles, diapers and papers.

Table 5 – Gross Calorific Value, Kcal/Kg for plastic, food waste, textiles, diapers and papers



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www.chemsain.com

Test Report

Not for Advertisement Purposes

Customer	: Enviro Idaman (B) Sdn Bhd Sg. Akar Transfer Station, SPG 281, Kg. Belimbing, Jln Subok, Kota Batu, BD 2917	Lab No.	: CK/CL405/2523/25
Attn.	: Mr. Muhammad Anas bin Azam	Type (No.) of Sample	: Municipal Waste (5)
		Date Received	: 22 nd May 2025
		Date of Analysis	: 29 th May 2025
		Date of Report	: 06 th June 2025

Analysis Result:

Lab No.	Sample Description	Gross Calorific Value, Kcal/Kg (Test Method: In House Method based on ASTM D240)
2523 – 1	Plastic (PET, LDPE, HDPE, PS, PP) Sampling Location: Sungai Paku Engineered Landfill, Tutong, Brunei Sampling Date @ Time (Hrs): 07 th May 2025 @ 1400 Hrs	7,380
2523 – 2	Food Waste Sampling Location: Sungai Paku Engineered Landfill, Tutong, Brunei Sampling Date @ Time (Hrs): 07 th May 2025 @ 1400 Hrs	2,675
2523 – 3	Textiles Sampling Location: Sungai Paku Engineered Landfill, Tutong, Brunei Sampling Date @ Time (Hrs): 07 th May 2025 @ 1400 Hrs	4,585
2523 – 4	Diapers Sampling Location: Sungai Paku Engineered Landfill, Tutong, Brunei Sampling Date @ Time (Hrs): 07 th May 2025 @ 1400 Hrs	1,940
2523 – 5	Paper (Cardboard, Mixed Paper, Newspaper) Sampling Location: Sungai Paku Engineered Landfill, Tutong, Brunei Sampling Date @ Time (Hrs): 07 th May 2025 @ 1400 Hrs	3,190

----- End -----

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PART 6.0 : DISCUSSION

Based on “Figure 1 - Overall average composition of waste” It clearly shows food waste is the highest waste produced (28%) with 2675 Kcal/Kg calorific value. Most waste found during study are expired product and leftover food from household, restaurant and marketplace. The second highest is plastic waste (26%) with 7380 Kcal/Kg calorific value. Most of plastic found during study are plastic bag, plastic bottle, and plastic container, plastic bag is the highest waste found as it commonly uses as waste container then, plastic drinking bottle.

Next, is papers waste (12%) with 3190 Kcal/Kg calorific value which is mixed paper more present compare to cardboard. Then, textile (12%) with 4585 Kcal/Kg calorific value which are worn out cloths and recycle grocery bag. Diapers (10%), with 1940 Kcal/Kg calorific value based on our observation, most of it are used by infant compare to an adult diaper.

Next, is glass (4%) waste such as beverage, liquor and sauce bottle. Metal (3%) with ferrous metal is more present than non-ferrous. Most metal waste coming from food industry such as canned food and carbonated drink. Next is wood (2%) most leftover wood from construction or woodwork. Then, E-waste (1%) which are household and kitchen appliances such phone charger and food processor. Last by not least, is garden waste (1%) such as lawn trimming. Others (1%) mostly present are medical waste, such as syringe, urinary catheters and insulin needle. Lastly, waste that present less than (1%) are tetra pak, leathers, rubber and aerosol.

Based on Figure 5, the average of calorific value from this study is approximately 3.954 Mcal/kg (16.54MJ/kg). Compare to others ASEAN country the calorific values are estimated at 5.82–10.11 MJ/kg in Malaysia, 5.163–6.121 MJ/kg in Thailand, 5.52–9.37 MJ/kg in Lao PDR, and 5.163–7.5 MJ/kg in Myanmar.

PART 7.0 : LIMITATION AND CHALLENGES

Every possible effort was taken to ensure that the quality of samples collected for this study was reliable, representative and accurate. Here are some limitations and challenges we are facing during this study.

Non-cooperative from waste transporter. Some of foreigner truck driver has difficulty with communication. They cannot understand Malay or English make it hard to trace the waste category, source and area.

Present of medical waste especially face mask, rubber glove and flu test kits, has increase the bio-hazard exposure to worker especially after Covid-19 pandemic.

PART 8.0 : RECOMMENDATIONS

With this data the government agencies can establish a baseline for continued long-term measurement of Intergraded Waste Management (IWMS) performance and use in formulating effective waste management policies.

PART 9.0 : WASTE COMPOSITION STUDY PHOTOGRAPHS



Grab sampling from waste vehicles



06/05/2025 11:06:46



07/05/2025 09:03:59

Preparation of sorting area



Unpack waste from plastic bag and mixed for cone and quarter method



Sorting big and medium size waste process by the worker



Sieving process for small waste



The individual waste components being weighed after sorting process



Examples of food waste found during the sorting process



Examples of LDPE plastic waste found during the sorting process



Examples of PET plastic waste found during the sorting process



Examples of HDPE plastic waste found during the sorting process



Examples of non-ferrous metal found during the sorting process



Examples of ferrous metal found during the sorting process



Examples of mixed paper found during the sorting process



Examples of cardboard waste found during the sorting process



Examples of wood waste found during the sorting process



Examples of e-waste found during the sorting process



Examples of rubber waste found during the sorting process



Examples of diapers found during the sorting process



Examples of aerosol waste found during the sorting process



Examples of glass waste found during the sorting process



Examples of textile waste found during the sorting process

PART 10.0 : REFERENCES

1. Jabatan Pengurusan Sisa Pepejal Negara Malaysia, 2013, *Survey on SW Composition, Characteristics & Existing Practice of SW Recycling in Malaysia Final Report*, Page 42-43
2. MS2505:2012 Guidelines for Sampling of Household Solid Waste - Composition and Characterisation Analysis.
3. Tun, Maw & Palacky, Petr & Juchelková, Dagmar & Sít'ař, Vladislav. (2020). *Renewable Waste-to-Energy in Southeast Asia: Status, Challenges, Opportunities, and Selection of Waste-to-Energy Technologies*. Page 16.

**REPORT OF WASTE CHARACTERISTIC
STUDY (WCS)**
OCTOBER 2019

**SUNGAI PAKU ENGINEERED LANDFILL
(SPEL)**



ENVIRO IDAMAN (B) SDN BHD
(RC00008562)

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1.0 INTRODUCTION

Effective solid waste management begins with the adequate and reliable information of what is in the waste stream originating from the Households, Industries, and Commercial Institutional entities and ending up at the Landfills. This basic information is essential to all aspects of policy and program implementation. The collected information can be used for purposes such as:

- a) Obtaining information to quantify recyclables and to prioritize recovery opportunities.
- b) Establishing a baseline for continued long-term measurement of system performance.
- c) Understanding the differences between waste sub streams so targeted recycling programs can be designed, implemented, and monitored.
- d) Comparing waste composition and waste diversion accomplishments among jurisdictions with different solid waste policies.
- e) Tools for the Government for formulating effective waste management policies.

2.0 OBJECTIVES

The purpose of the sampling is to establish a reliable baseline data that can be used in the planning for an Integrated Solid Waste Management of both the collection and disposal of solid waste in Brunei.

3.0 SCOPE OF WORK

In general there are three sources of solid waste categories, first is “As Generated Waste” which is solid waste produce from its source such as house and workplace. Next, is “As Discarded Waste” solid waste collected by waste contractor and solid waste placed at the collection area such as housing area centralised waste collection area. Finally, is “As Disposed Waste” solid waste taken from collection area and transported to solid waste management facilities such as landfill or transfer station. In this study “As Disposed Waste” is selected for study and sampling

The scope of work for this study included sampling of MSW waste coming from district, Bandar Seri Begawan and Muara, Tutong, and Kuala Belait on Thursday and Sunday. The sampling on weekday and weekend are as presented in Table 1. This study did not include waste such as construction and demolition, abattoir, sludge and septic in sampling process.

Table 1- Date selected for waste characteristic study

Timeline	October 2019																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Task																															
WCS Week 1 (Thursday, Sunday)																															
WCS Week 2 (Thursday, Sunday)																															
WCS Week 3 (Thursday, Sunday)																															
WCS Week 4 (Thursday, Sunday)																															

■ Thursday

■ Sunday

4.0 METHODOLOGY

4.1. Waste Composition of the Incoming Waste

A waste composition study was carried out at the Sungai Paku Engineered Landfill (SPEL) on October 2019, to determine the composition of waste from the various sources. 10 samples were taken from Household, Industries and Commercial and Institutional sectors. The samples selected were random from trucks that entered SPEL.

It was agreed that the scope of this study was to cover only the waste coming directly from the households, industries and Commercial and Institutional sectors. This composition study was conducted to give a snapshot view of the incoming waste over the 4 weeks period.

A random grab sampling was done when a truck is unloaded onto a platform. The waste is then coned and quartered till only about 200 kg remains, as a representative Sorting Sample. The Sorting Sample weight for waste composition analysis was based on [MS2505:2012](#)

Guidelines for Sampling of Household Solid Waste - Composition and Characterisation Analysis. The Composition and characterisation analysis that recommends Sorting Sample weight be a minimum of 200 kg. The Sorting Waste Sample was then segregated into the waste components by the Sorters at the landfill. In the case a composite item is found in the waste, the individual materials was separated and placed into the appropriate storage containers. Sorting continued until the maximum particle size of the remaining waste particles was approximately less than 10 mm. At this point, the remaining material was apportioned into the storage containers corresponding to the waste components represented in the remaining mixture. The truck drivers were interviewed to collect information on the areas the waste load was collected.

4.2. Cone and Quarter Method

- a) Waste trucks entering the site with solid waste collected from household area, industry, and commercial and institution area.
- b) The waste from the trucks was directed to a pre-prepared sampling site and unloaded onto the tip floor.
- c) Bulky items, medical waste or scheduled waste found in the waste was removed from the load.
- d) The remaining material was mixed by mechanical shovel, or manually using rakes or shovels, into a uniform, homogeneous pile approximately 0.8 m high.
- e) The pile was then divided into two equal portions by drawing a straight line through the center of the pile. The pile was further divided by drawing a second line roughly perpendicular to the first.
- f) A pair of opposite quarters was removed, leaving half the original sample.
- g) The steps d) through f) were repeated until the required amount of sorting sample of approximately 200kgs remained.
- h) The sorting sample was then sorted into its type of waste and recorded.

4.3. Manpower

- a) Ten to twelve people.

4.4. Personal Protective Equipment

- a) Safety helmet
- b) Safety shoes
- c) Safety goggles
- d) Glove
- e) Mask

4.5. Apparatus

- | | |
|------------------------|-----------|
| 1. Weighing scale | (1 Unit) |
| 2. Plastic basket | (13 Unit) |
| 3. Shovel | (2 Unit) |
| 4. Hoe | (1 Unit) |
| 5. Sieve (size 1 inch) | (1 Unit) |
| 6. Knives | (3 Unit) |

5.0 WASTE CHARACTERISTIC STUDY TABLE AND DATA

5.1 The First Week of October 2019

Day: Thursday

Date: 3rd October 2019

Weather: Sunny

Table 2 – Selected vehicles data on 3rd October 2019

No.	Vehicle No.	Transporter Type	Company	Time In	Time Out	Area	District	Category
1	BG4284	COMPACTOR	BANDARAN TUTONG	8:51	9:02	TUTONG	TUTONG	INSTUTITON
2	KR4453	RORO	NORACON	11:15	11:49	BUKIT BERUANG	TUTONG	HOUSEHOLD
3	BAH5703	TRAILER	ENVIRO IDAMAN	13:01	13:28	BRUNEI MUARA	BRUNEI MUARA	MIXED
4	BAW2158	TRAILER	ENVIRO IDAMAN	12:49	13:37	BRUNEI MUARA	BRUNEI MUARA	MIXED
5	BAM1391	RORO	LIFTCO	14:15	14:52	SERIA	BELAIT	COMMERCIAL
6	KR4748	PICKUP	NAPSIAH	14:45	15:29	PENANJONG	TUTONG	HOUSEHOLD
7	BAH5866	PICKUP	PNK	15:02	15:25	KATIMAHAR	BRUNEI MUARA	INDUSTRIAL
8	BAU8361	RORO	SAMPHON	15:23	15:43	MULAUT	BELAIT	INDUSTRIAL
9	BAF6862	PICKUP	DAYANG DANIT	15:46	16:05	PANDAN	BELAIT	INSTUTITON
10	KE9156	PICKUP	NASIR	15:36	16:07	MUMONG	BELAIT	HOUSEHOLD

Table 3 – The weight of waste data 3rd October 2019

NO	Kilogram (kg)										
	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
1	10.7	2.4	1.3	1.6	1.2	0.0	2.9	2.6	1.7	0.7	5.5
2	10.4	2.3	2.0	3.0			3.6	1.7	2.4	0.5	5.6
3	11.5	1.2	1.0	2.4			3.4	0.8	0.9	0.6	13.8
4	15.8	2.7	1.0	1.6			2.5			0.8	5.3
5	19.1		1.9				6.0			0.4	4.3
6	6.9		2.1				2.1			0.3	3.6
7	11.6						4.3				6.8
8	6.0						1.6				7.8
9							2.0				4.0
10							5.6				9.7
Total	92.0	8.6	9.3	8.6	1.2	0.0	33.9	5.1	5.0	3.3	66.4
Total weight		233.4 kg									

Day: Sunday

Date: 6th October 2019

Weather: Sunny

Table 4 – Selected vehicles data on 6th October 2019

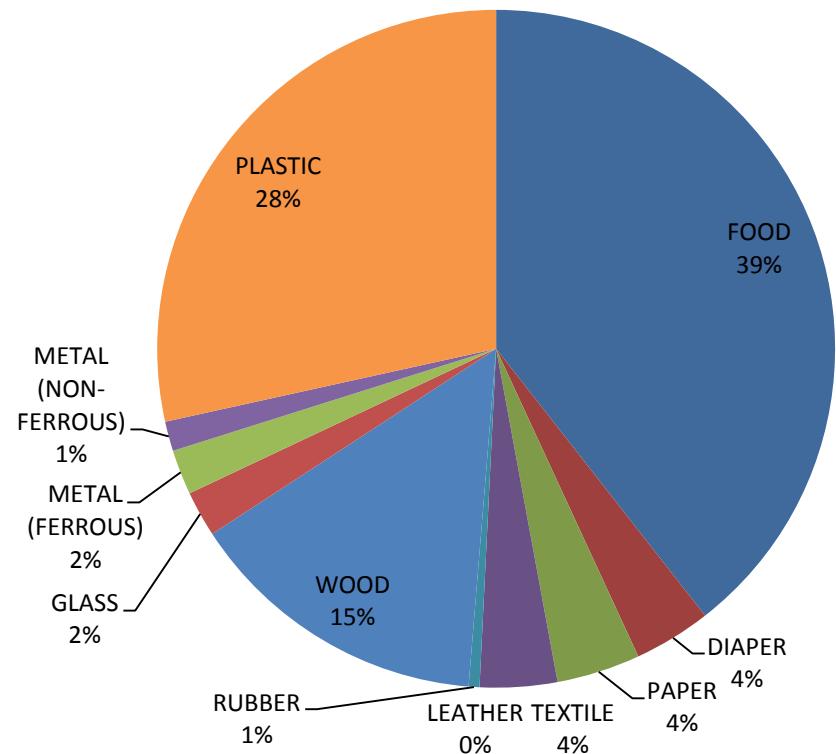
No.	Vehicle No.	Transporter Type	Company	Time In	Time Out	Area	District	Category
1	KR4453	RORO	NORA CON	8:31	8:46	BUKIT BERUANG	TUTONG	HOUSEHOLD
2	BAH1550	TRAILER	ENVIRO IDAMAN	8:32	9:02	BRUNEI MUARA	BRUNEI MUARA	MIXED
3	BP7688	COMPACTOR	ADANAX	8:40	8:55	SG LIANG	BELAIT	COMMERCIAL
4	BAG6929	TRAILER	ENVIRO IDAMAN	9:01	9:42	BRUNEI MUARA	BRUNEI MUARA	MIXED
5	BAU8361	RORO	SAMPHON	10:58	11:15	SERAMBANGUN	TUTONG	HOUSEHOLD
6	KS4078	COMPACTOR	NORA CON	11:06	11:21	SINAUT	TUTONG	HOUSEHOLD
7	BAS9499	MANUAL	HANAFI	13:49	14:19	GADONG	BRUNEI MUARA	COMMERCIAL
8	BAF6255	RORO	DLLC	14:41	15:03	PULAU MUARA	BRUNEI MUARA	INDUSTRIAL
9	BAC3217	MANUAL	MASSUTER A	14:47	15:03	SERIA	BELAIT	INDUSTRIAL
10	KL2274	COMPACTOR	ADANAX	15:38	15:50	BELAIT	BELAIT	COMMERCIAL

Table 5 – The weight of waste data on 6th October 2019

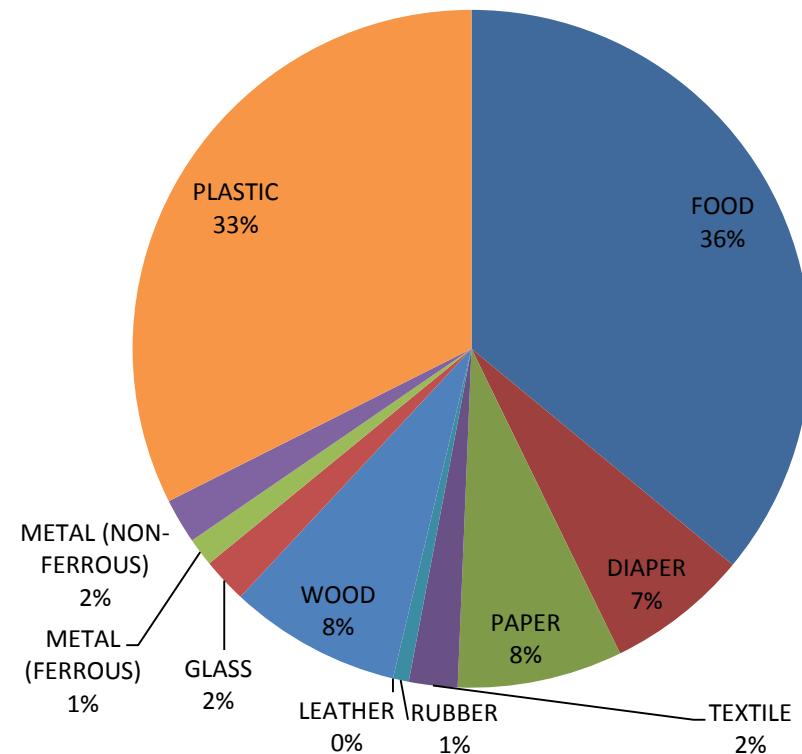
NO	Kilogram (kg)										
	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
1	8.6	10.3	3.4	3.4	0.9	0.0	6.9	2.4	1.9	4.5	9.5
2	8.0	5.8	3.4	2.1	0.9		6.5	2.0	1.3	0.6	12.8
3	10.8		3.1				5.0	0.7			5.1
4	5.7		1.8				1.1				13.6
5	10.5		4.3								6.6
6	6.7		2.7								3.0
7	11.9										3.8
8	10.6										7.5
9	5.0										5.1
10	7.7										10.0
Total	85.5	16.1	18.7	5.5	1.8	0.0	19.5	5.1	3.2	5.1	77.0
Total weight		237.5 kg									

Figure 1 – Composition of waste in percentage on 3rd and 6th October 2019

**Waste Characteristic Study 3rd
October 2019**



**Waste Characteristic Study 6th
October 2019**



5.2 The Second Week of October 2019

Day: Thursday

Date: 10th October 2019

Weather: Sunny

Table 6 – Selected vehicles data on 10th October 2019

No.	Vehicle No.	Transporter Type	Company	Time In	Time Out	Area	District	Category
1	BP7688	COMPACTOR	ADANAX	8:13	8:30	SUNGAI LIANG	BELAIT	COMMERCIAL
2	BG5068	COMPACTOR	BANDARAN SERIA	8:34	8:49	SERIA	BELAIT	INSTUTITON
3	BG4284	COMPACTOR	BANDARAN TUTONG	8:54	9:04	BUKIT BENDERA	TUTONG	INSTUTITON
4	BR6328	TRAILER	ENVIRO IDAMAN	8:56	9:38	BRUNEI MUARA	BRUNEI MUARA	MIXED
5	BAU4123	COMPACTOR	NORACON	9:18	9:36	TANJUNG MAYA	TUTONG	HOUSEHOLD
6	BQ791	RORO	NASIR	9:34	9:54	MUMONG	BELAIT	HOUSEHOLD
7	KH395	PICKUP	SIM BOON	9:42	10:15	SPARK SG LIANG	BELAIT	INDUSTRIAL
8	BAG7366	PICKUP	LIFTCO	10:03	10:25	SERIA	BELAIT	COMMERCIAL
9	BAH5703	RORO	ENVIRO IDAMAN	10:11	11:17	BRUNEI MUARA	BRUNEI MUARA	MIXED
10	BW4178	PICKUP	SIM BOON	10:51	11:21	SPARK SG LIANG	BELAIT	INDUSTRIAL

Table 7 – The weight of waste data on 10th October 2019

NO	Kilogram (kg)										
	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
1	6.1	3.4	2.4	3.0	2.0	0.0	2.9	2.3	2.9	1.2	3.9
2	7.0	3.9	5.4	4.3			4.5		3.5	1.6	8.6
3	6.8		2.4	5.0			6.1		1.1		6.4
4	10.2		2.1	2.2			5.1				8.4
5	4.9		5.4				3.2				5.1
6	9.2		1.2				4.4				8.1
7	8.4		1.8				5.6				4.2
8	10.6		1.6				3.1				8.1
9											7.8
10											5.9
Total	63.2	7.3	22.3	14.5	2.0	0.0	34.9	2.3	7.5	2.8	66.5
Total weight		223.3 kg									

Day: Sunday Date: 13th October 2019 Weather: Sunny

Table 8 – Selected vehicles data on 13th October 2019

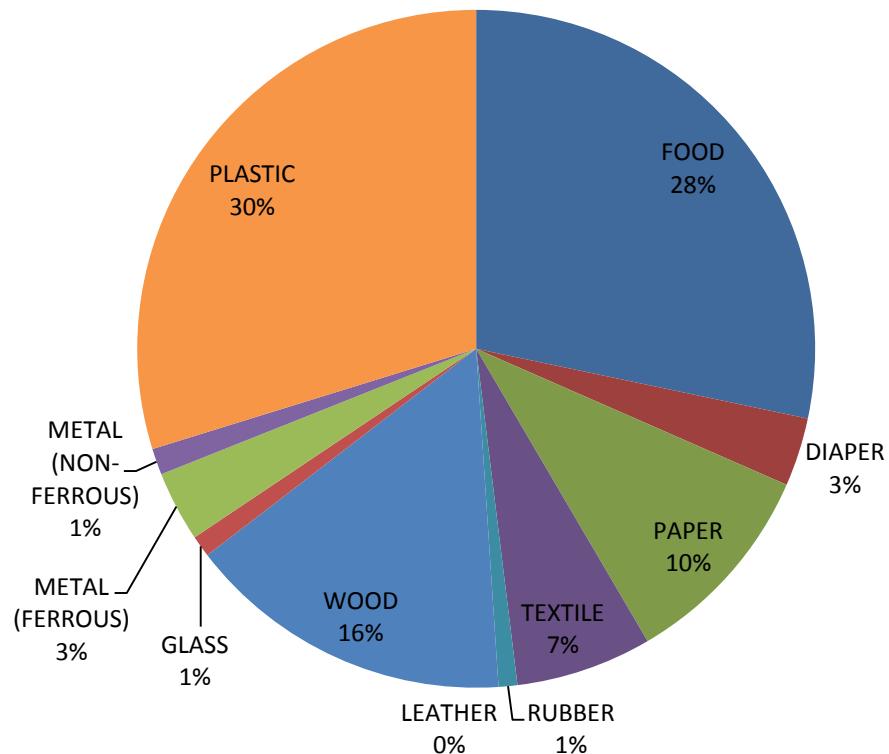
No.	Vehicle No.	Transporter Type	Company	Time In	Time Out	Area	District	Category
1	BG43598	COMPACTOR	BANDARAN SERIA	6:06	6:16	SERIA	BELAIT	INSTUTITON
2	KL2274	RORO	ADANAX	7:50	8:02	SG LIANG	BELAIT	COMMERCIAL
3	BAG6926	TRAILER	ENVIRO IDAMAN	7:54	8:42	BRUNEI MUARA	BRUNEI MUARA	MIXED
4	BQ791	RORO	NASIR	9:11	9:32	MUMONG	BELAIT	HOUSEHOLD
5	BAH2255	RORO	DLCC	9:54	10:09	PULAU MUARA BESAR	BRUNEI MUARA	INDUSTRIAL
6	KR4453	RORO	NORACON	10:13	10:28	BUKIT BERUANG	TUTONG	HOUSEHOLD
7	BAS2580	RORO	DLCC	10:30	11:03	PULAU MUARA BESAR	BRUNEI MUARA	INDUSTRIAL
8	BAH5703	RORO	ENVIRO IDAMAN	10:33	10:53	BRUNEI MUARA	BRUNEI MUARA	MIXED
9	BG6297	PICKUP	JABATAN ELETRIK	10:05	10:26	LUMUT	BELAIT	INSTUTITON
10	BAU8361	RORO	SAMPHON	11:11	11:30	KG MASIN	BRUNEI MUARA	COMMERCIAL

Table 9 – The weight of waste data on 13th October 2019

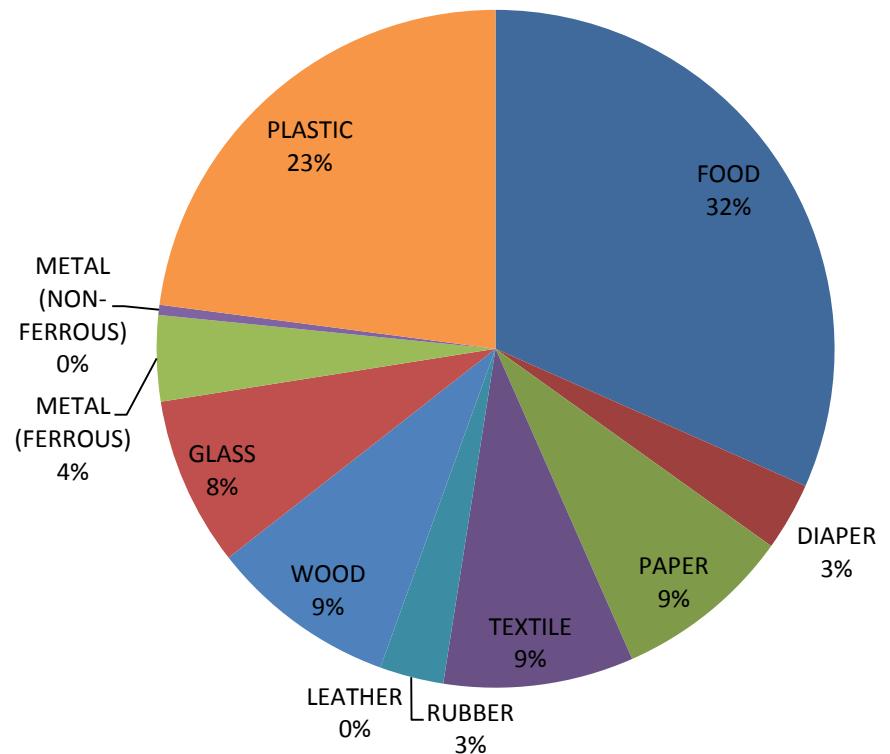
NO	Kilogram (kg)										
	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
0	10.0	8.1	2.0	8.6	3.2	0.0	7.4	8.6	2.7	1.2	10.2
2	9.8		1.0	3.4	2.4		8.2	9.1	3.6		4.6
3	10.1		2.0	8.0	2.0		5.2	2.4	1.8		3.7
4	8.4		5.9	2.6			1.4		2.1		5.6
5	3.4		2.1								5.7
6	9.1		0.6								6.5
7	12.0		2.2								3.7
8	14.0		3.6								10.6
9	2.0		1.8								3.0
10											3.5
Total	78.8	8.1	21.2	22.6	7.6	0.0	22.2	20.1	10.2	1.2	57.1
Total weight		249.1 kg									

Figure 2 - Composition of waste in percentage on 10th and 13th October 2019

**Waste Characteristic Study 10th
October 2019**



**Waste Characteristic Study 13th
October 2019**



5.3 The Third Week of October 2019

Day: Thursday

Date: 17th October 2019

Weather: Sunny

Table 10 – Selected vehicles data on 17th October 2019

No.	Vehicle No.	Transporter Type	Company	Time In	Time Out	Area	District	Category
1	BAW5049	RORO	MALWARENG	6:08	6:33	PULAU MUARA	BRUNEI MUARA	INDUSTRIAL
2	BG5068	COMPACTOR	BANDARAN SERIA	8:42	8:55	PEKAN BELAIT	BELAIT	INSTITUTIONAL ENTITIES
3	BG5072	COMPACTOR	BANDARAN TUTONG	9:02	9:12	PEKAN TUTONG	TUTONG	INSTITUTIONAL ENTITIES
4	BAU3881	RORO	GOH SIT	9:03	9:16	LUMUT	BELAIT	COMMERCIAL
5	BP6275	PICK UP	NASIR	9:43	10:11	LABI	BELAIT	HOUSEHOLD
6	BAF1550	TRAILER	ENVIRO IDAMAN	9:46	10:28	SG. AKAR	BRUNEI MUARA	MIXED
7	BL4343	PICKUP	HASKA	10:05	10:31	JERUDONG	BRUNEI MUARA	COMMERCIAL
8	KH395	PICK UP	SIM BOON	10:05	10:31	SG. LIANG	BELAIT	INDUSTRIAL
9	KF7415	RORO	MCS	10:13	10:33	SERIA	BELAIT	INDUSTRIAL
10	KS4078	COMPACTOR	NORA CON	11:33	11:55	SINAUT	TUTONG	HOUSEHOLD

Table 11 – The weight of waste data 17th October 2019 (kg)

NO	Kilogram (kg)										
	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
0	4.9	0.1	32.3	4.1	1.9	0.0	11.0	3.7	3.1	2.4	1.6
2	5.2			2.4	1.2		1.8	4.5	2.3	3.1	1.3
3	9.8			3.3	2.0		1.9	1.8			0.5
4	10.2						6.1				2.5
5	2.5										
6	3.5										
7	5.6										
8	5.3										
9											
10											
Total	47.0	0.1	32.3	9.8	5.1	0.0	20.8	10.0	5.4	5.5	5.9
Total weight	220.3 kg										

Day: Sunday Date: 20th October 2019 Weather: Sunny

Table 12 – Selected vehicles data on 20th October 2019

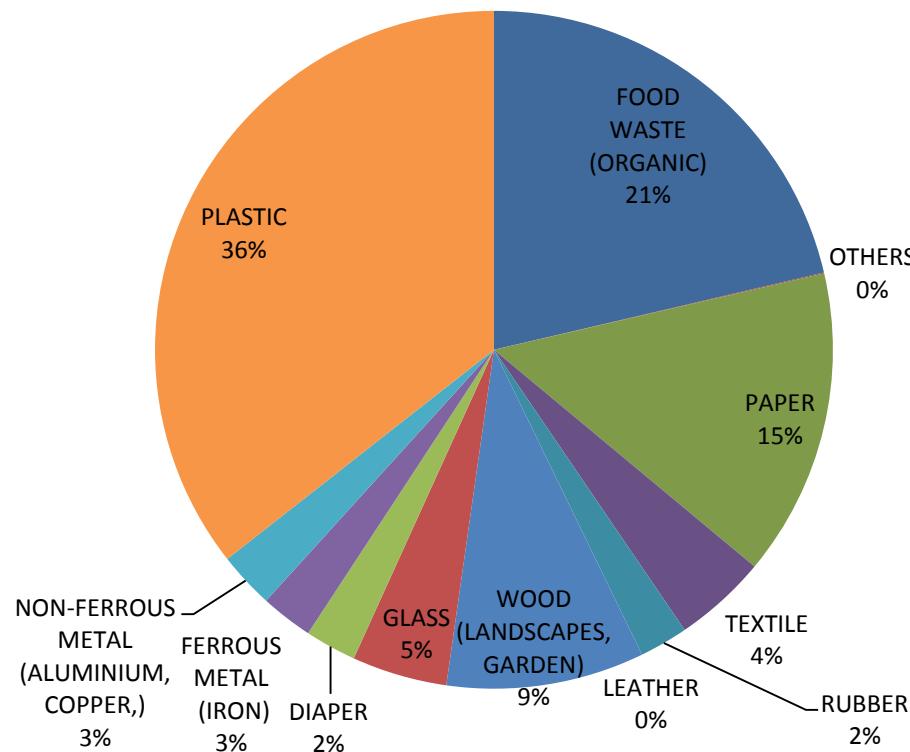
No.	Vehicle No.	Transporter Type	Company	Time In	Time Out	Area	District	Category
1	BAW3045	RORO	MALWARENG	8:27	8:41	PULAU MUARA	BRUNEI MUARA	INDUSTRIAL
2	BP7688	COMPACTOR	ADANAX	8:39	9:21	SG. LIANG	BELAIT	COMMERCIAL
3	BU2943	RORO	NASIR	9:00	9:15	SG. LIANG / AGIS- AGIS	BELAIT	HOUSEHOLDS
4	BS7248	COMPACTOR	MCS	9:08	9:28	SPARK, SG. LIANG	BELAIT	INDUSTRIAL
5	BAH5703	OPEN TOP	ENVIRO IDAMAN	9:25	9:42	SG. AKAR	BRUNEI MUARA	MIXED
6	BAK5739	PICK UP	ADABENA	9:32	9:48	MALAUT	BRUNEI MUARA	COMMERCIAL
7	BS2651	PICK UP	HONGGUAN	9:56	10:26	BANDAR SERI BEGAWAN	BRUNEI MUARA	INDUSTRIAL
8	BAF1550	TRAILER	ENVIRO IDAMAN	10:35	11:12	SG. AKAR	BRUNEI MUARA	MIXED
9	KS4078	COMPACTOR	NORA CON	10:54	11:08	SINAUT	TUTONG	HOUSEHOLDS
10	BAU8361	RORO	SAMPHON	11:30	11:42	KG. MASIN	BRUNEI MUARA	COMMERCIAL

Table 13 – The weight of waste data 20th October 2019

NO	Kilogram (kg)										
	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
0	18.0	0.0	40.1	2.9	1.2	0.0	2.0	4.9	2.5	2.5	1.8
2	6.0			1.1			8.0	2.9	4.5	1.2	1.4
3	9.2						7.0			0.9	1.0
4	9.0						5.2				
5	5.8						5.6				
6	7.2						2.0				
7	9.8						3.2				
8	2.8						1.0				
9	9.8										
10	3.0										
Total	80.6	0.0	40.1	4.0	1.2	0.0	34.0	7.8	7.0	4.6	4.2
Total weight		250.3 kg									

Figure 3 - Composition of waste in percentage on 17th and 20th October 2019

**Waste Characteristic Study 17th
October 2019**



**Waste Characteristic Study 20th
October 2019**

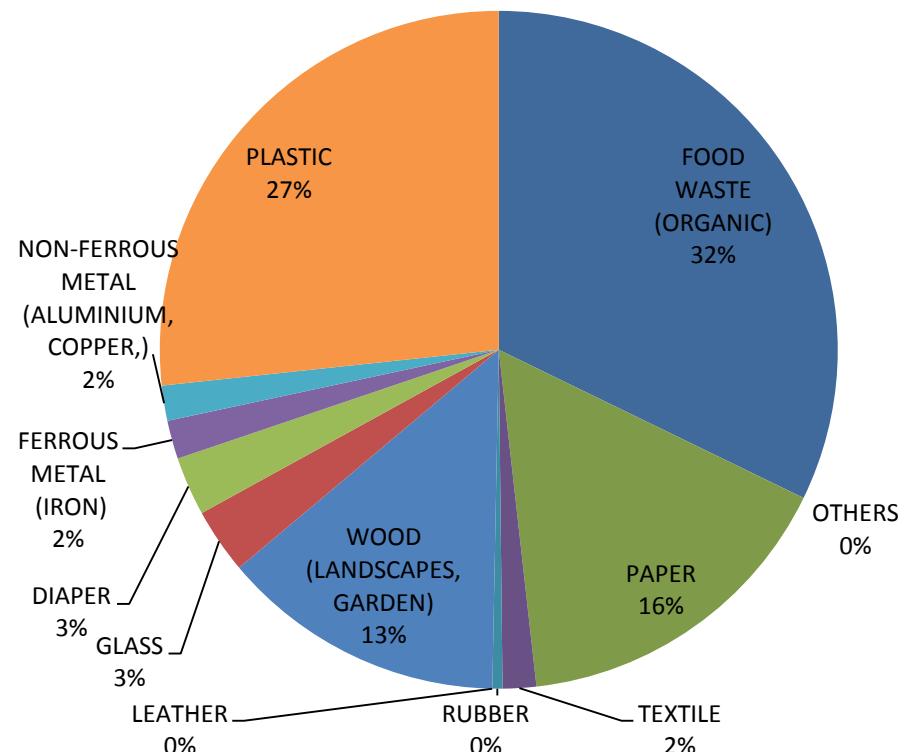
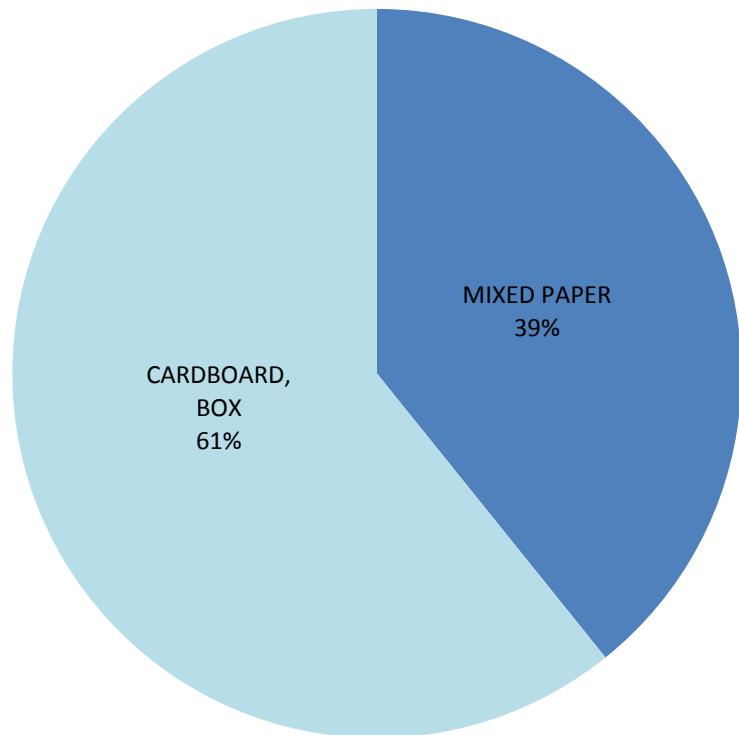


Table 14 - The weight of paper and plastic waste on 17th October 2019

NO	MIXED PAPER	CARDBOARD, BOX	PLASTIC CONTAINER (HDPE,PP)	PLASTIC BOTTLE (PET)	PLASTIC BAG (LDPE)
1	2.0	3.1	2.1	2.1	3.0
2	3.8	2.4	2.6	1.9	5.2
3	3.3	2.8	1.8	2.3	4.2
4	4.3	3.0	1.8	1.8	3.2
5	3.0		1.9	3.1	4.7
6	2.8		2.2	2.2	4.4
7	1.8		3.2	2.2	3.6
8			2.7	1.8	2.9
9				1.5	3.2
10					6.8
Total	21.0	11.3	18.3	18.9	41.2
	32.3			78.4	

Figure 4 - Composition of plastic and paper waste on 17th October 2019

Percentage of paper waste



Percentage of plastic waste

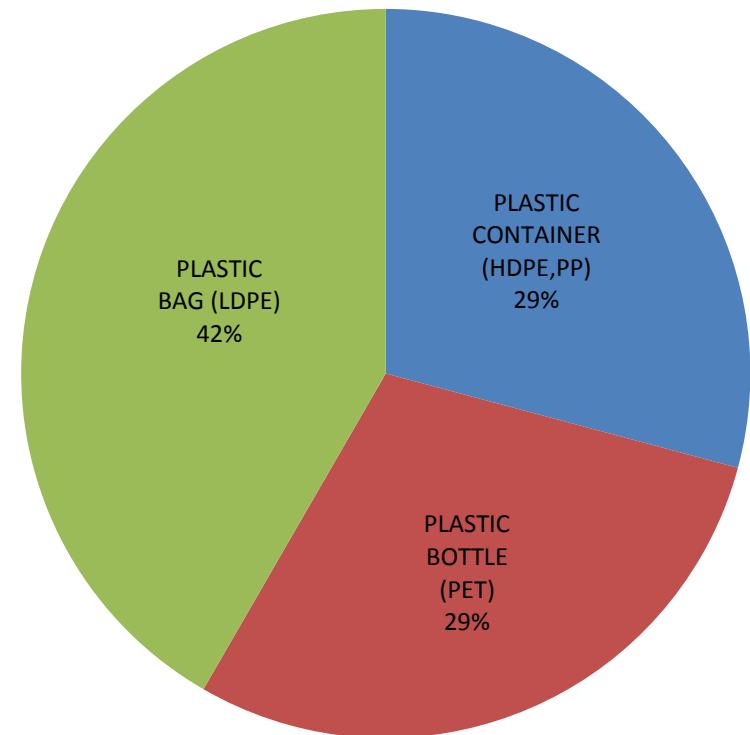
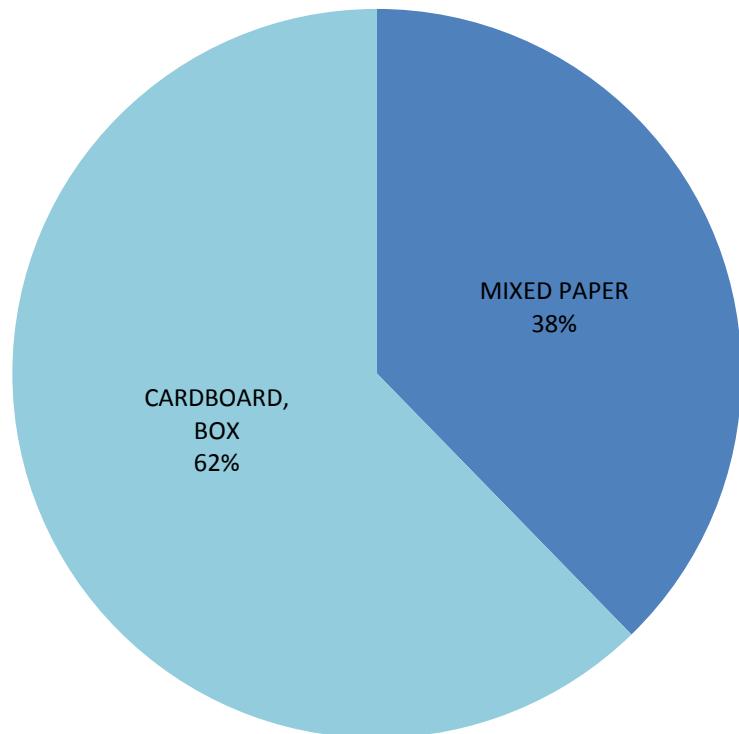


Table 15 - The weight of paper and plastic waste on 20th October 2019

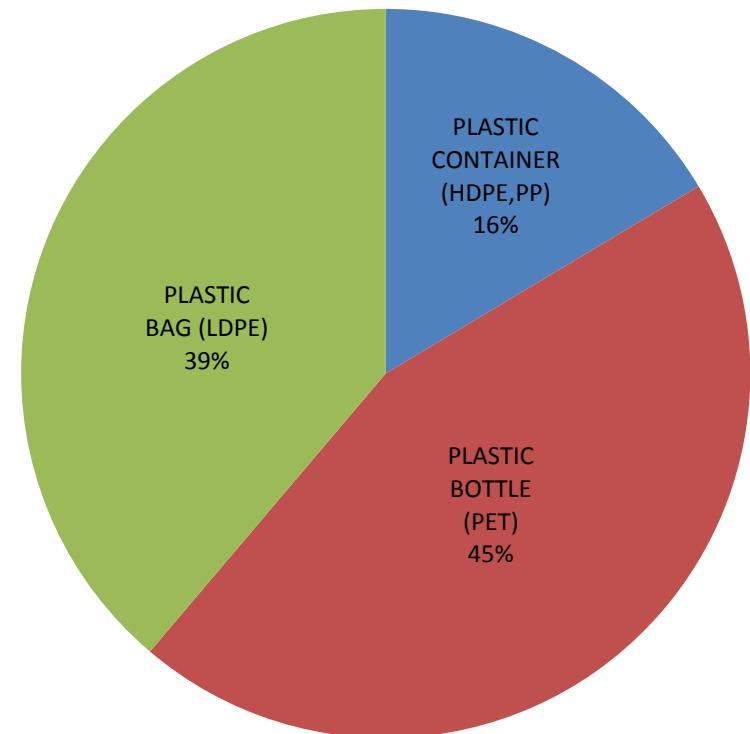
NO	MIXED PAPER	CARDBOARD, BOX	PLASTIC CONTAINER (HDPE,PP)	PLASTIC BOTTLE (PET)	PLASTIC BAG (LDPE)
1	2.3	3.8	1.1	3.0	2.6
2	3.2	2.0	2.0	2.2	4.2
3	2.5	1.8	2.6	1.8	2.9
4	2.9	1.5	1.5	1.9	3.6
5	1.2	1.9	2.2	1.7	5.3
6	2.88	1.8	1.2	1.2	2.2
7	2.5	2.0	1.4	2.2	3.8
8	2.8	2.4		2.2	4.4
9		1.2		2.0	2.2
10		1.5		2.4	3.0
Total	20.2	19.9	12.0	20.6	34.2
	40.1			66.8	

Figure 5 - Composition of plastic and paper waste on 20th October 2019

Percentage of paper waste



Percentage of plastic waste



5.4 The Fourth Week of October 2019

Day: Thursday

Date: 24th October 2019

Weather: Sunny

Table 16 – Selected vehicles data on 24th October 2019

No.	Vehicle No.	Transporter Type	Company	Time In	Time Out	Area	District	Category
1	BG2978	COMPACTOR	BANDARAN KUALA BELAIT	8:17	8:29	PEKAN BELAIT	BELAIT	INSTITUTIONAL
2	KR4453	RORO	NORA CON	8:19	8:33	PENANJONG	TUTONG	HOUSEHOLDS
3	BP7688	COMPACTOR	ADANAX	8:31	8:45	SG. LIANG	BELAIT	COMMERCIAL
4	BR6328	TRAILER	ENVIRO IDAMAN	8:52	9:54	SG. AKAR	BRUNEI MUARA	MIXED
5	BW4718	PICK UP	SIM BOON	9:00	9:43	SG. LIANG	BELAIT	INDUSTRIAL
6	BP6275	PICK UP	NASIR	9:18	9:45	LABI	BELAIT	HOUSEHOLDS
7	BAG7366	PICK UP	LIFTCO	9:36	9:58	SERIA	BELAIT	COMMERCIAL
8	BG4284	COMPACTOR	BANDARAN TUTONG	9:37	9:53	PEKAN TUTONG	TUTONG	INSTITUTIONAL
9	BAH5703	OPEN TOP	ENVIRO IDAMAN	9:50	10:26	SG. AKAR	BRUNEI MUARA	MIXED
10	BAC2598	PICK UP	MEGALIFT	11:02	11:46	GADONG	BRUNEI MUARA	INDUSTRIAL

Table 17 - The weight of waste data 24th October 2019

NO	Kilogram (kg)										
	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
1	6.8	0.0	31.9	7.5	2.8	2.8	6.0	2.2	2.8	1.0	2.0
2	11.0			3.0			7.0	2.0	4.2		1.4
3	7.6			3.0			4.4		3.0		1.4
4	3.8			3.0			2.4		4.0		
5	11.0			1.4							
6	8.0										
7	6.6										
8	7.8										
9	11.4										
10	7.0										
Total	81.0	0.0	31.9	17.9	2.8	2.8	19.8	4.2	14.0	1.0	4.8
Total weight		258.9 kg									

Day: Thursday

Date: 27th October 2019

Weather: Sunny

Table 18 – Selected vehicles data on 27th October 2019

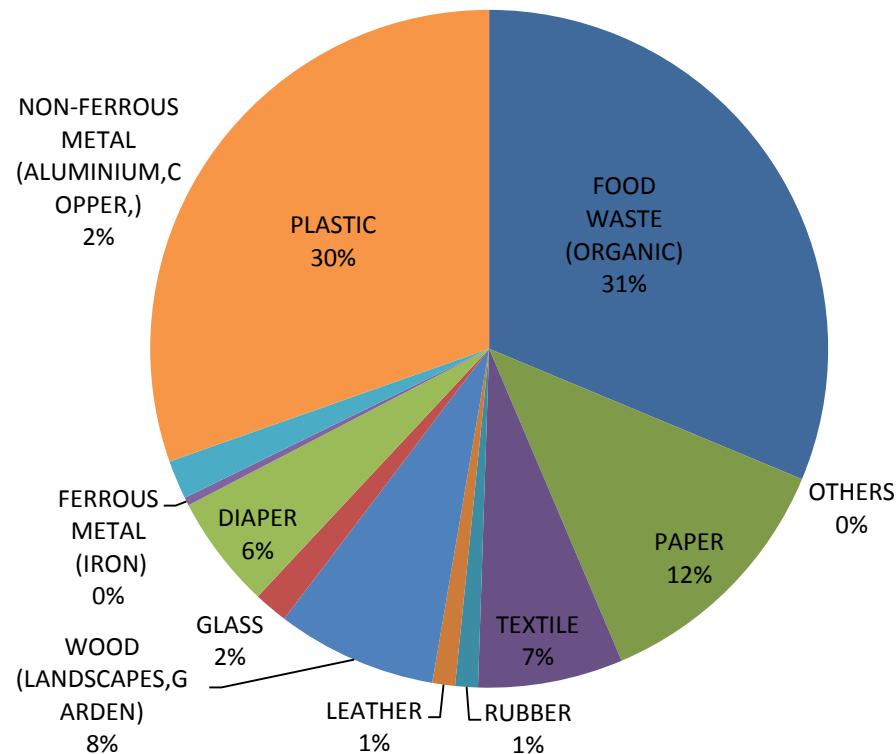
No.	Vehicle No.	Transporter Type	Company	Time In	Time Out	Area	District	Category
1	BG4385	COMPACTOR	BANDARAN KUALA BELAIT	6:02	6:11	PEKAN BELAIT	BELAIT	INSTITUTIONAL ENTITIES
2	BR471	RORO	HJ TALIP	8:16	8:38	PUALA MUARA	BRUNEI MUARA	INDUSTRIAL
3	BS7248	COMPACTOR	MCS	8:53	9:11	TELISAI	TUTONG	COMMERCIAL
4	BU2943	RORO	NASIR	9:01	9:15	LUMUT	BELAIT	HOUSEHOLDS
5	BP7688	COMPACTOR	ADANAX	9:07	9:19	SG. LIANG	BELAIT	COMMERCIAL
6	BAF1585	TRAILER	ENVIRO IDAMAN	9:17	9:48	SG. AKAR	BRUNEI MUARA	MIXED
7	KF7413	RORO	MCS	9:28	9:55	SERASA	BRUNEI MUARA	INDUSTRIAL
8	KS4078	COMPACTOR	NORA CON	9:35	9:56	KUALA TUTONG	TUTONG	HOUSEHOLDS
9	BAU8361	RORO	SAMPHON	14:02	14:16	BENGKURONG MASIN	BRUNEI MUARA	COMMERCIAL
10	BAF1558	TRAILER	ENVIRO IDAMAN	14:35	15:13	SG. AKAR	BRUNEI MUARA	MIXED

Table 19 – The weight of waste data 27th October 2019

NO	Kilogram (kg)										
	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
0	9.8	0.0	20.8	3.8	4.0	4.0	8.8	3.0	3.6	2.4	1.2
2	11.4			2.0		2.8	8.8		6.4	2.0	1.8
3	9.0			1.0			9.0		4.4		0.8
4	11.4						1.0		2.2		
5	16.8										
6	5.6										
7	9.6										
8	10.2										
9											
10											
Total	83.8	0.0	20.8	6.8	4.0	6.8	27.6	3.0	16.6	4.4	3.8
Total weight	246.0 kg										

Figure 6 - Composition of waste on 24th October 2019

Waste Characteristic Study 24th October 2019



Waste Characteristic Study 27th October 2019

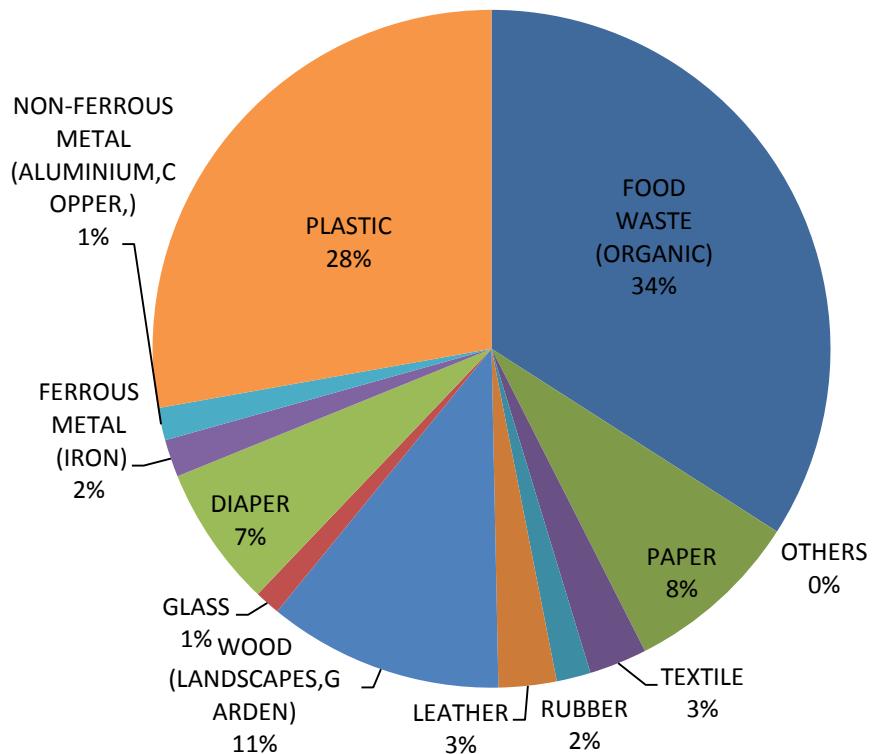
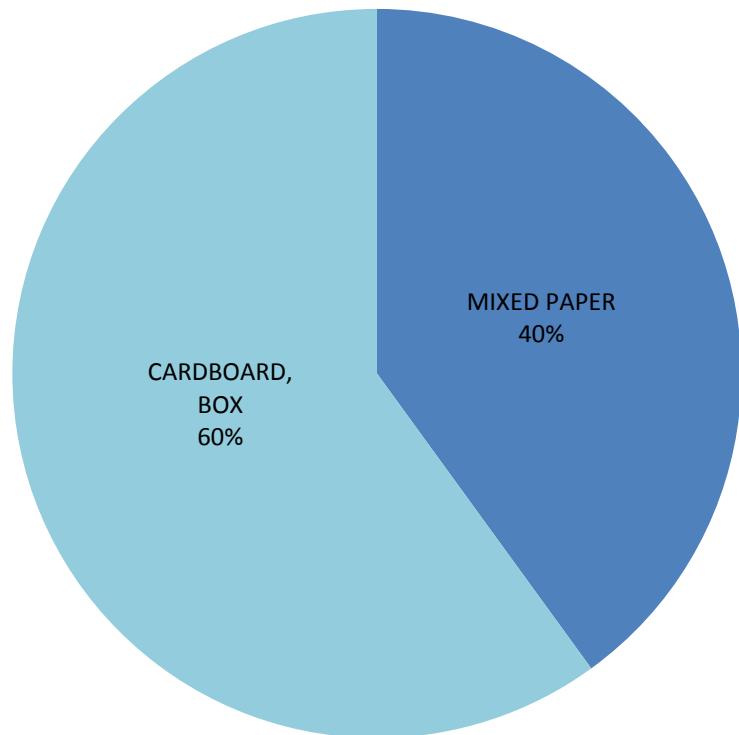


Table 20 – The weight of paper and plastic waste on 24th October 2019

NO	MIXED PAPER	CARDBOARD, BOX	PLASTIC CONTAINER (HDPE,PP)	PLASTIC BOTTLE (PET)	PLASTIC BAG (LDPE)
1	1.0	1.5	2.8	1.2	5.4
2	5.0	2.0	1.2	1.0	4.4
3	2.8	3.8	0.8	4.8	4.5
4	1.0	2.2	2.0	3.0	4.0
5		1.8	1.8	1.2	2.6
6		1.4	2.0	2.4	6.6
7		2.2	1.0	2.0	5.6
8		3.0	1.0		5.2
9		4.2			5.8
10					6.4
Total	9.8	22.1	12.6	15.6	50.5
		31.9		78.7	

Figure 7 - Composition of plastic and paper waste on 24th October 2019

Percentage of paper waste



Percentage of plastic waste

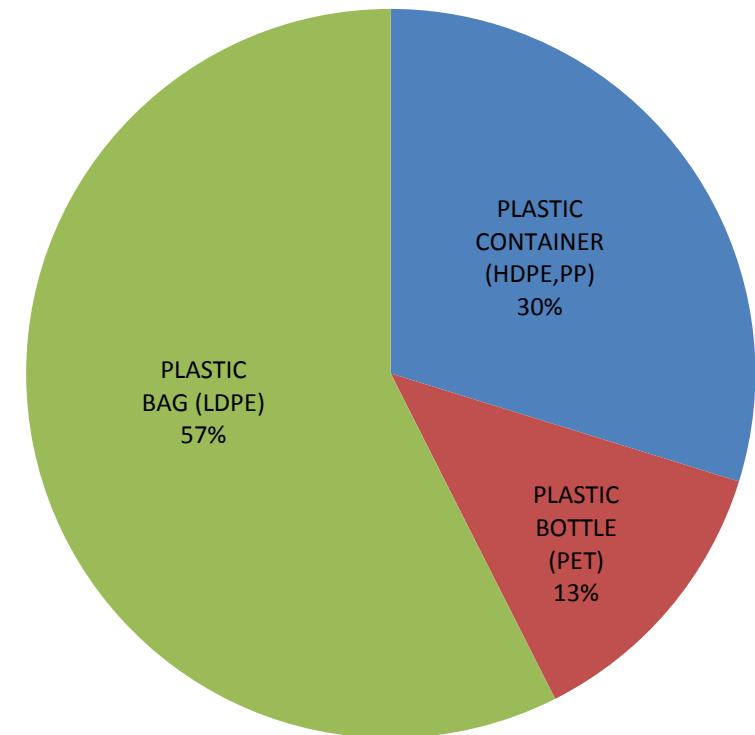
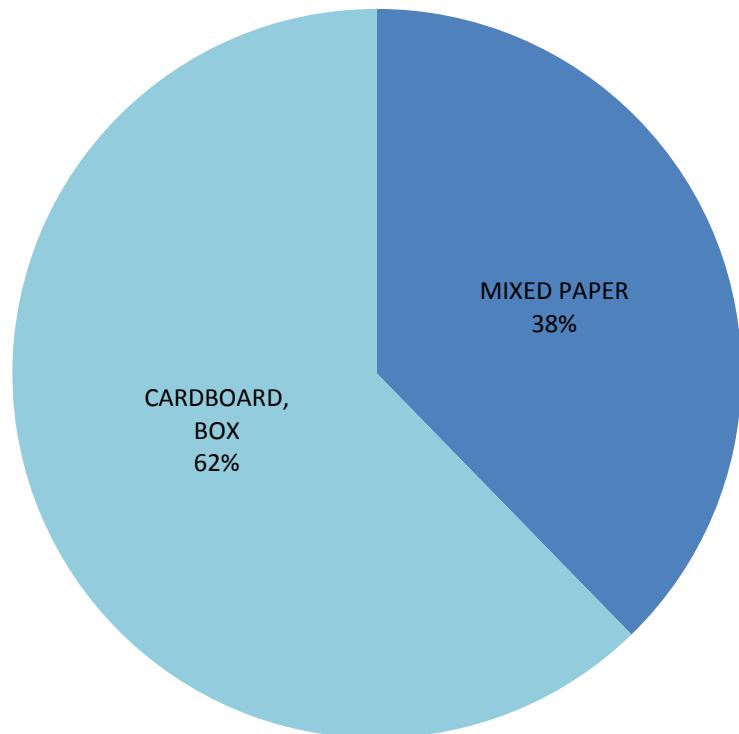


Table 21 – The weight of paper and plastic waste on 27th October 2019

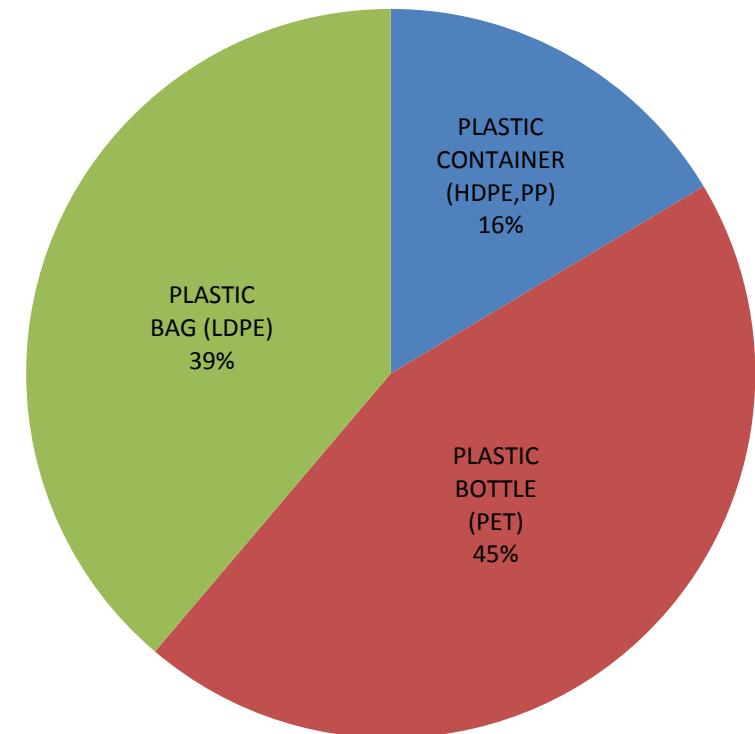
NO	MIXED PAPER	CARDBOARD BOX	PLASTIC CONTAINER (HDPE,PP)	PLASTIC BOTTLE (PET)	PLASTIC BAG (LDPE)
1	0.8	3.8	3.8	2.0	2.4
2	0.6	3.0	2.0	2.0	1.2
3	1.6	3.0	1.4	3.0	1.2
4		2.4	1.6	1.2	6.0
5		3.0	2.4	2.8	2.6
6		2.6	1.4	1.0	3.0
7			2.00	2.0	3.6
8			2.0	2.4	5.0
9				1.2	3.2
10				2.4	3.6
Total	3.0	17.8	16.6	20.0	31.8
		20.8		68.4	

Figure 8 - Composition of plastic and paper waste on 27th October 2019

Percentage of paper waste



Percentage of plastic waste



5.5 Overall average composition of waste from 3rd October to 27th October 2019

Table 22- The total average of waste from 3rd October to 27th October 2019

Date	FOOD WASTE	DIAPER	PAPER	TEXTILE	RUBBER	LEATHER	WOOD	GLASS	METAL (FERROUS)	METAL (NON-FERROUS)	PLASTIC
3 rd October	92.0	8.6	9.3	8.6	1.2	0.0	33.9	5.1	5.0	3.3	66.4
6 th October	85.5	16.1	18.7	5.5	1.8	0.0	19.5	5.1	3.2	5.1	77.0
10 th October	63.2	7.3	22.3	14.5	2.0	0.0	34.9	2.3	7.5	2.8	66.5
13 th October	78.8	8.1	21.2	22.6	7.6	0.0	22.2	20.1	10.2	1.2	57.1
17 th October	47.0	5.4	32.3	9.8	5.1	0.0	20.8	10.0	5.5	5.9	78.4
20 th October	80.6	7.0	40.1	4.0	1.2	0.0	34.0	7.8	4.6	4.2	66.8
24 th October	81.0	14.0	31.9	17.9	2.8	2.8	19.8	4.2	1.0	4.8	78.7
27 th October	83.8	16.6	20.8	6.8	4.0	6.8	27.6	3.0	4.4	3.8	68.4
AVERAGE	76.5	10.4	24.6	11.2	3.2	1.2	26.6	7.2	5.2	3.9	69.9

Figure 9 – Overall average composition of waste 3rd October to 27th October 2019

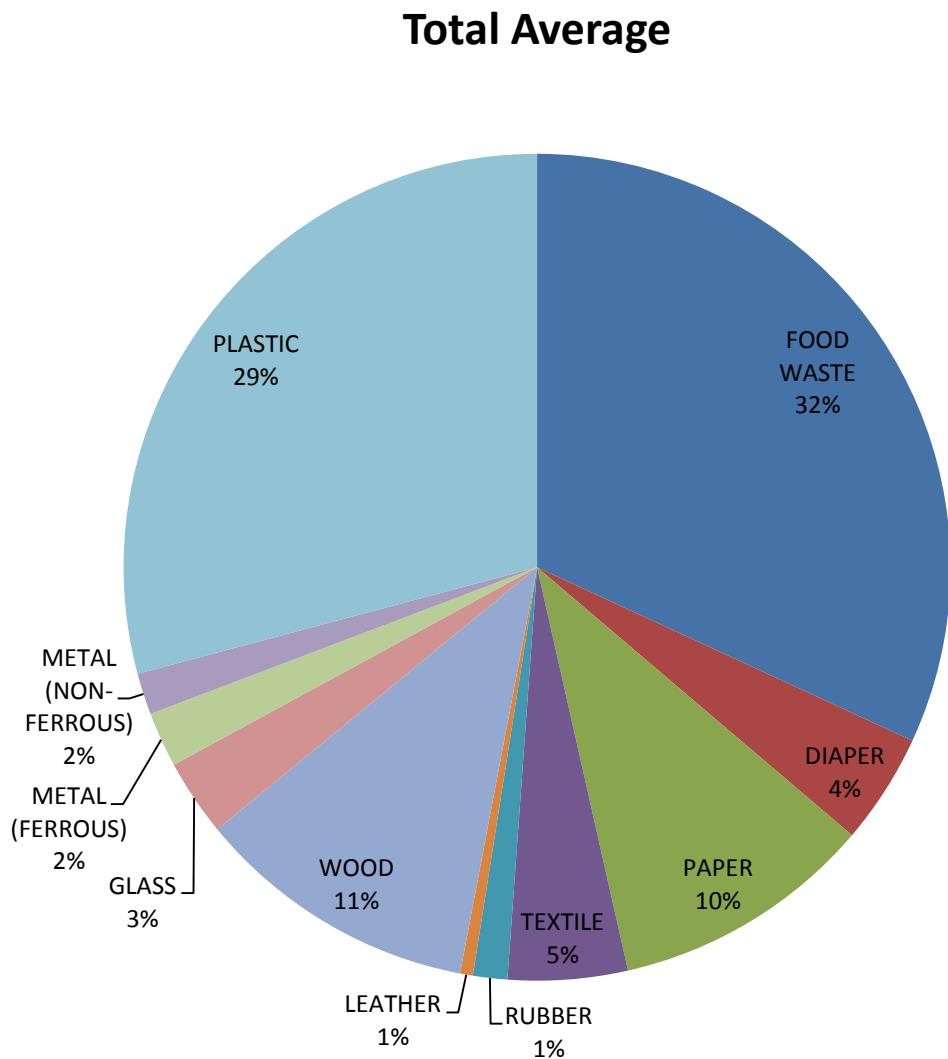
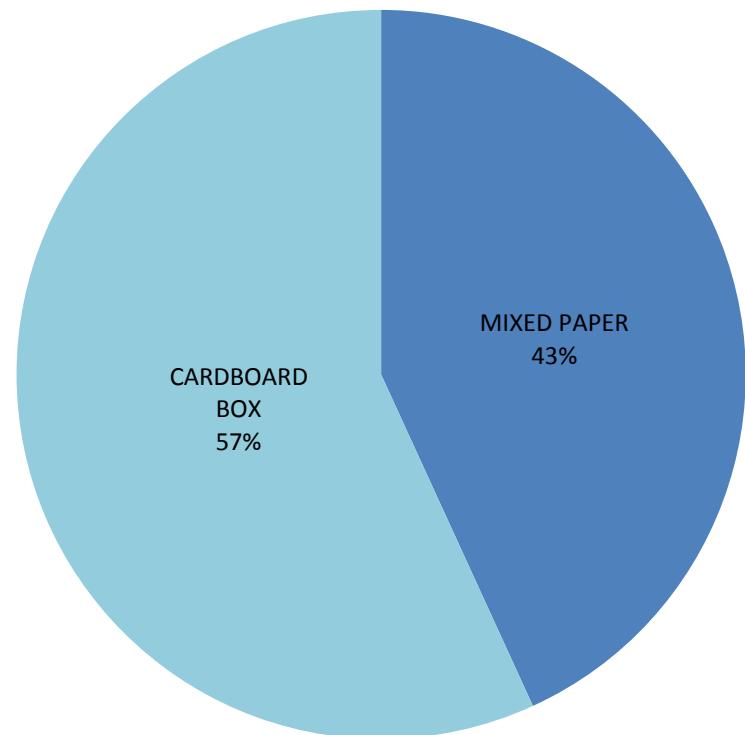
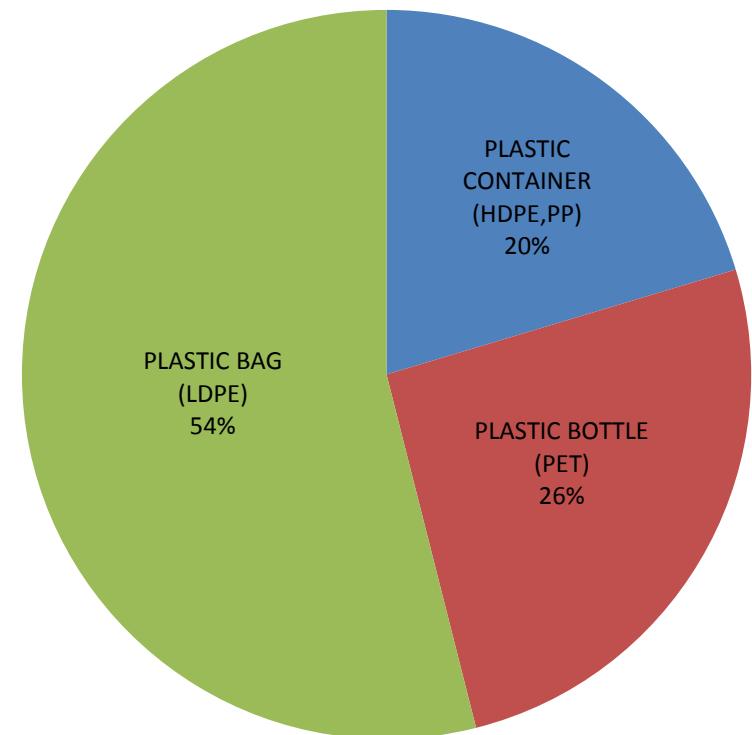


Figure 10 – Overall average composition of paper and plastic waste 17th October to 27th October 2019

Total Average of Paper Waste



Total Average of Plastic Waste



6.0 Discussion

Based on “Figure 9 - Overall average composition of waste” It clearly shows food waste is the highest waste produced (32%). Most these waste are leftover food from household, restaurant and expired product from marketplace. The second highest is plastic waste (29%). Most off plastic found during sorting are plastic bag (mainly black rubbish bags and plain colour plastic bags), plastic bottle, and plastic container. Next, is wood (11%) which consist of pallet, branches, twig and lawn trimming (grass). Then, paper waste (10%) which is cardboard waste is more present during study followed by mixed paper. Based on observation, most of cardboard is coming from industrial and commercial area while mixed paper from household, institution and office.

For textile waste it is (5%) mainly worn out clothing. Next, is glass (3%) waste such as beverage, liquor and sauce bottle. Ferrous metal (2%) and non-ferrous (2%) found in this study are almost equivalent. For ferrous metal waste found are mosquito repellent sprays, food and drink in can. For non-ferrous metal, aluminium food container and carbonate drink container. Last but not least, leather waste (1%) and rubber waste (1%) such as worn out sport wear, slipper and bags. Lastly, Diaper waste (4%) which is almost impossible to recycle.

7.0 Limitation and challenges

Every possible effort was taken to ensure that the quality of samples collected for this study was reliable, representative and accurate. However, there were some uncertainties identified during the course of the study such as unpredictable weather.

This waste characteristic study has done on last quarter of the year which is in rain season. Thus, raining can affect the weight of a waste especially absorbent material like cardboard, paper, cloth and green waste. This can cause unreliable and inaccurate data.

Next, is non-cooperative from waste transporter. Some of foreigner truck driver has difficulty with communication. They cannot understand Malay or English make it hard to trace the waste category, source and area.

8.0 Recommendations

With this data the government agencies can establish a baseline for continued long-term measurement of Intergraded Waste Management (IWMS) performance and use in formulating effective waste management policies.

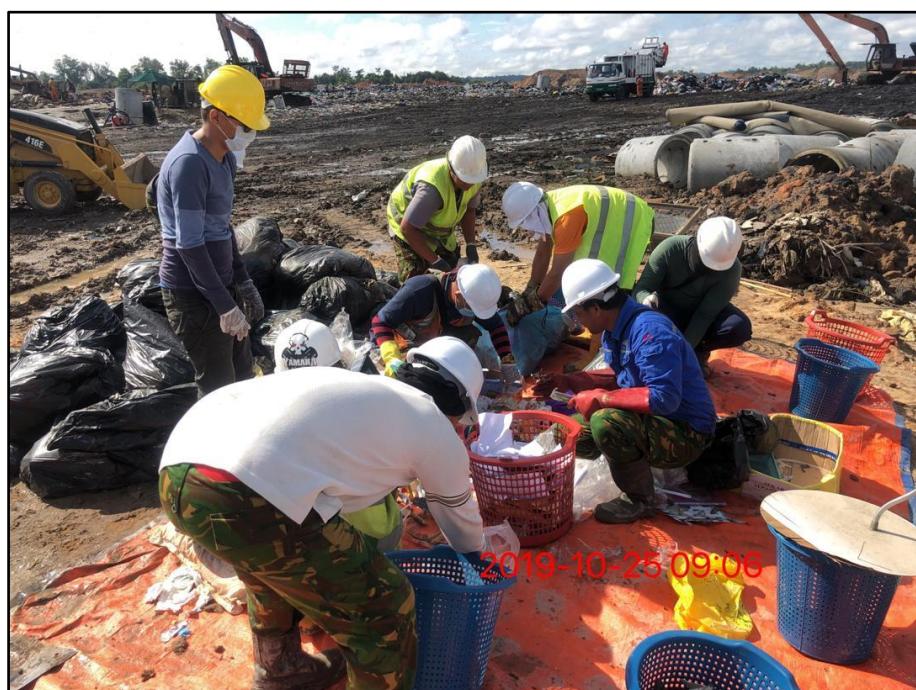
9.0 Waste Composition Study Photographs



Grab sampling from waste vehicles



Preparation of sorting area



Sorting process by the worker



Sieving process for small waste



2019-10-25 09:25

The individual waste components being weighed after sorting process



Examples of aluminium cans found during the sorting process



Examples of Ferrous Metal tins found during the sorting process



Examples of Plastic PET found during the sorting process



Examples of Plastic HDPE/PP found during the sorting process



Examples of coconut shell found during the sorting process



Examples of green waste found during the sorting process



Examples of cardboard found during the sorting process



Examples of paper found during the sorting process



Oct11 2019 9:02am

Examples of food waste found during the sorting process



Oct21 2019 9:15am

Examples of glass found during the sorting process



Examples of textile found during the sorting process



Examples of rubber found during the sorting process



Examples of diapers found during the sorting process

10.0 REFERENCES

1. Jabatan Pengurusan Sisa Pepejal Negara Malaysia, 2013, *Survey On SW Composition, Characteristics & Existing Practice Of SW Recycling In Malaysia Final Report*, Page 42-43
2. MS2505:2012 Guidelines for Sampling of Household Solid Waste - Composition and Characterisation Analysis.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 3 – MUNICIPAL SOLID WASTE DATA

APPENDIX 3D – PROJECTED TOTAL WASTE GROWTH

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT
AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM
JASTRE/BKP/RFP/01/2025**

PROJECTED TOTAL WASTE GROWTH

Year	Year	Popn.	Waste yearly growth(MT)	Waste yearly growth-MSW (MT)	Waste/ day (MT)	MSW/day (MT)
0	2024	455500	235774	209236	646	573
1	2025	460511	238683	211789	654	580
2	2026	465576	241308	214118	661	587
3	2027	470697	243962	216474	668	593
4	2028	475875	246646	218855	676	600
5	2029	481110	249359	221262	683	606
6	2030	486402	252102	223696	691	613
7	2031	491752	254875	226157	698	620
8	2032	497162	257679	228645	706	626
9	2033	502630	260513	231160	714	633
10	2034	508159	263379	233702	722	640
11	2035	513749	266276	236273	730	647
12	2036	519400	269205	238872	738	654
13	2037	525114	272166	241500	746	662
14	2038	530890	275160	244156	754	669
15	2039	536730	278187	246842	762	676
16	2040	542634	281247	249557	771	684
17	2041	548603	284341	252302	779	691
18	2042	554637	287469	255078	788	699
19	2043	560738	290631	257884	796	707
20	2044	566907	293828	260720	805	714
21	2045	573143	297060	263588	814	722
22	2046	579447	300327	266488	823	730
23	2047	585821	303631	269419	832	738
24	2048	592265	306971	272383	841	746
25	2049	598780	310348	275379	850	754
26	2050	605367	313761	278408	860	763
27	2051	612026	317213	281471	869	771
28	2052	618758	320702	284567	879	780

Popn.	Pop. Growth (%)
2024	1.1
2025	
2026	
2027	

Per capita/day (2024)
1.42

Total Waste Generated (MT)	Waste Per Day	Per Capita/ Day
2024	235774	646
2024 (MSW)	209236	573

Note: Total Waste Generated in 2024 is based on total waste disposed and not including recycling waste and is based on data from 3 landfill
 Waste Per Capita/Day is based on Total Waste Disposed in the 3 landfill and not including recycling
 Waste Per Capita/Day (MSW) is based on Total MSW Waste Disposed in the 3 landfill plus MSW generated during recycling
 Waste Yearly growth is based on a constant of 1.42 Per Capita/Day (2024)

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 4 – OTHER RELEVANT INFORMATION FROM STAKEHOLDERS &
AUTHORITIES

APPENDIX 4A – BRUNEI GRID CODE (2ND REVISION) PUBLISHED BY THE
AUTORITI ELEKTRIK NEGARA BRUNEI DARUSSALAM



اُوتوريتی ایلکٹریک نگارا بروني دارالسلام

AUTORITI ELEKTRIK NEGARA BRUNEI DARUSSALAM

BRUNEI DARUSSALAM NATIONAL GRID CODE SECOND REVISION

RECORDS OF REVISIONS

ER4A/2

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01	First	EO17TF	07 March 2019
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1. GENERAL CONDITIONS

1.1. Purpose and Scope of the Code

- 1.1.1. This Code provides the technical, procedures and safety rules which regulate all users of the National Grid.
- 1.1.2. This Code also describes the technical requirements and procedures for users connected to the National Grid to coordinate the planning, maintenance and operation requirements.
- 1.1.3. In those situations, and operational conditions which are possible but difficult to account for in this Code, the TSP will act to preserve the integrity and safety of the National Grid by applying Good Utility Practice.

1.2. To whom this Code applies

- 1.2.1. This Code applies to all parties connected or intends to connect to the National Grid.

1.3. Derogations

- 1.3.1. Any user may request a derogation to one or several requirements of this Code. This shall be filed with the relevant system operator and include:
 - a) An identification of the facility owner, or prospective owner, and a contact person for any communication;
 - b) A description of the apparatus/module or modules for which a derogation is requested;
 - c) A reference to the provisions of this Code from which a derogation is requested and a detailed description of the requested derogation.
- 1.3.2. The grid code review panel shall, in coordination with the relevant TSP and any affected adjacent DSP or DSPs, assess the request for a derogation from a technical, economical and sustainable point of view.
- 1.3.3. The grid code review panel shall confirm to the facility owner or prospective owner whether the request is complete. If the request is deemed incomplete, the facility owner or prospective owner shall submit the additional required information within one month from the receipt of the request for additional information. The request shall be deemed withdrawn were the additional information not to be submitted within the specified time limits.
- 1.3.4. Within six months of receipt of a request for a derogation, the grid code review panel shall forward the request to the Authority along with its corresponding assessment regarding technical, economic and environmental consequences.

- 1.3.5. The Authority shall issue a reasoned decision concerning a request for a derogation. Where the Authority grants a derogation, it shall specify its duration.
- 1.3.6. The Authority may revoke a decision granting a derogation if the circumstances and underlying reasons no longer apply.

1.4. Definitions

- 1.4.1. **Active Power** – The product of voltage and current and the cosine of the phase angle between them, measured in watts, commonly described as 'real power' resulting in net transfer of energy in one direction.
- 1.4.2. **Anti-Islanding** – Capability of detecting the formation of an island, and the ability to disconnect from it.
- 1.4.3. **Apparatus** – Primary equipment electrically connected to the transmission or distribution grid. Examples include lines, cables, switch-gear, transformers, and generators.
- 1.4.4. **Area Control Error** – The instantaneous difference between the actual and scheduled MVA interchange through an interconnector, taking into account the effects of frequency bias and correction for meter error.
- 1.4.5. **Associated User** – When reference is made to a user who does not own the metering installation at a CTP but has a contractual interest in the test result or data flowing from the metering installation, then within the metering requirement the term 'Associated User' is used to differentiate them from the user who owns the metering equipment. For the avoidance of doubt, the Associated User includes a consumer who has such an interest.
- 1.4.6. **Authority** – the Autoriti Elektrik Negara Brunei Darussalam, Ministry of Energy, Negara Brunei Darussalam.
- 1.4.7. **Automatic Generation Control (AGC)** – The system for adjusting the power output of multiple generators at different power stations in response to changes in system load.
- 1.4.8. **Automatic Voltage Regulator (AVR)** – A continuously acting automatic system to control the terminal voltage of a synchronous generating unit by comparing the actual terminal voltage with a reference value and controlling by appropriate means the output of an exciter, depending on the deviations.
- 1.4.9. **Battery Management System (BMS)** – Electronic component connected to a rechargeable battery which maintains its safety and reliability, monitors and evaluates its state, controls its charge and is responsible for the internal cell balancing.

- 1.4.10. **Black Start Capability** – An ability of a generator or power station to re-start from a blackout condition where normal auxiliary power supply is unavailable from the grid.
- 1.4.11. **BS** – British Standard.
- 1.4.12. **Captive Power Generator / Auto Producer** - Generator inside an industrial complex that generates electricity for their own consumption.
- 1.4.13. **Circuit Breaker** – A mechanical switching device which is capable of making and breaking electrical current under normal and adverse conditions. The circuit breaker may be manually operated for switching power or automatically by relays during abnormal conditions.
- 1.4.14. **Code** – This Brunei Darussalam National Grid Code.
- 1.4.15. **Combined-Cycle Power Plant** – A generation facility consisting of one or more gas turbine(s); one or more heat recovery steam generator(s) (HRSG) to convert exhaust heat from the gas turbine(s) into steam to power a steam turbine. Both the gas and steam turbine(s) supply mechanical power to generators to make electrical power.
- 1.4.16. **Competent Person** – A person who has been adequately trained and is deemed to have sufficient technical knowledge and qualifications to enable him/her to discharge their duties in accordance with his/her respective duty schedules and where applicable, to perform work safely on the power system and to appreciate the dangers associated therewith.
- 1.4.17. **Connection** – A physical link between an External Party and the Grid.
- 1.4.18. **Connection Agreement** – An agreement between the TSP and an External Party which describes in details the terms and conditions, financial agreements, and technical aspects not covered by this Code for connection to the grid.
- Other options that describes the terms and conditions with External Parties, whose facilities or equipment are, or are, intended to be connected directly or through the internal electrical system of any other consumer, to the transmission network may be specified in the Connection Agreement. The form of the Connection Agreement may depend upon of the installation to be connected and the voltage level at which it is connected.
- 1.4.19. **Connection Point** – The point on the transmission network where an External Party's system or Apparatus is connected, and typically where the ownership of the assets change unless otherwise described in the Connection Agreement.

- 1.4.20. **Consumer** – A person or entity utilizing electrical power from the Grid.
- 1.4.21. **Critical Customers** - Loads which are (1) essential to health, safety, security and welfare communities such as (but not limited to) hospitals, fire and police stations, telecommunication, data centre, acute care facility, long term care facility, fuel storage, water treatment/pumping stations and other municipal infrastructure; and (2) special customers such as the VVIPs and customers who require electricity for medical purposes.
- 1.4.22. **Custody Transfer Point (CTP)** – the site on the National Grid or a user's grid, which is a metering point, where the custody of the commodity (electricity) has been transferred from one party to another.
- 1.4.23. **Demand** – The demand for both active and reactive electrical power.
- 1.4.24. **DES** – the Department of Electrical Services, Ministry of Energy, Negara Brunei Darussalam.
- 1.4.25. **Distance Protection** – A protection relay scheme, which utilizes the circuit admittance and impedance to compute the distance to a fault and will trip its associated circuit breaker where the computed distance is within its pre-determined zone of protection settings.
- 1.4.26. **Distribution Network** – The portion of the electrical grid operated at voltages of 11,000 V and under.
- 1.4.27. **Distribution Service Provider (DSP)** – The entity holding a distribution license, responsible for the operation, maintenance and planning of a Distribution Network along with its associated plants and Apparatuses for the purpose of providing distribution services, including access to other users of the grid system.
- 1.4.28. **Earthing** – Shall mean the operation of connecting any circuit earth after it has been isolated and tested.
- 1.4.29. **Electricity Storage** - It consists of the conversion of electrical energy into a form of energy which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical energy in a controllable manner.
- 1.4.30. **Electricity Storage Module** - Either a synchronous electricity storage module or a non-synchronous electricity storage module which could also be a part of a power generating module. For the avoidance of doubt, non-controllable electricity storage equipment shall not be considered as an electricity storage module.
- 1.4.31. **Energise** – The closing of isolation devices and circuit breakers which otherwise prevent an Apparatus or facility from becoming 'live', which may or may not include synchronization to the Grid.

- 1.4.32. **Energy Management System (EMS)** – A computerized system at the SCADA control center which monitors and controls the Transmission Grid and dispatches generation to meet the power system demand.
- 1.4.33. **External Generating Facilities** – All generating facilities owned by external corporations.
- 1.4.34. **External Parties** – Entities with Connections to the National Grid, including interconnected external systems, external generation, and loads connected at the Transmission voltage level.
- 1.4.35. **External System** – An electricity system located beyond the limits of the National Grid, which could include the neighboring countries, or that of an External Party in Brunei Darussalam.
- 1.4.36. **Fiscal Metering** – A metering installation at a Connection Point or a CTP or a generator circuit, for fiscal accounting, contractual and/or statistical purpose.
- 1.4.37. **Flicker** – It is occurrence of disturbances in human sight when the illumination of a lighting fixture changes during the time (i.e. the impression of flickering light), as a result of the occurrence of voltage fluctuations caused by the plants belonging to users of the transmission or distribution system.
- 1.4.38. **Forced Outage** – An unplanned interruption of electrical power typically caused by a fault in the system.
- 1.4.39. **Frequency** – The number of alternating current cycles per second, expressed in Hertz.
- 1.4.40. **Frequency Sensitive Mode** - Operating mode of a power-generating module or HVDC system in which the Active Power output changes in response to a change in system frequency, in such a way that it assists with the recovery to target frequency.
- 1.4.41. **Generating Station** – A facility used for the purposes of producing electrical power, which includes all the associated equipment necessary, such as switch- gear, transformers, and auxiliary equipment.
- 1.4.42. **Generator** – Refers to both synchronous generators and asynchronous generators.
- 1.4.43. **Good Utility Practice** – Those practices, methods, and acts engaged in or generally approved by a significant portion of the international electrical utility industry and those acts which, in the exercise of reasonable judgment, could have been expected to accomplish the desired outcome at a reasonable cost consistent with reliability, security, safety, and expediency.
- 1.4.44. **Grid** – The interconnected system of lines, cables, switch-gear, and generation facilities supplying electrical power, which is described and referred to in this Code.

- 1.4.45. **Grid Control Center** – Either of the two grid control centers in Brunei Darussalam: National Control Centre (NCC) under DES purview, or the System Control Centre (SCC) under an IPP purview.
- 1.4.46. **Grounding** – a conducting connection by which an electrical circuit or Equipment is connected to earth or to some conducting body of relatively large extent that serves as ground.
- 1.4.47. **High Voltage** – Voltages exceeding 11,000 Volts.
- 1.4.48. **IEC** – International Electrotechnical Commission.
- 1.4.49. **IPP** – Independent power producer. An entity which owns an electric power generating facility for sale to utilities and end users, but that is not part of a public utility.
- 1.4.50. **Installation** – Any plant, Apparatus, structure, or equipment used for the generation, transmission, supply, or use of electricity.
- 1.4.51. **Interconnector** – One or more transmission circuits used for transmitting power between the National Grid and another grid or external generator.
- 1.4.52. **Islanding** – Situation in which a generator continues to generate power even though the electric power grid is no longer present. The generator is thus isolated from the electric grid forming its own “island”.
- 1.4.53. **Isolator** – Shall mean the Apparatus provided for the purpose of isolating mains and/or Apparatus.
- 1.4.54. **ME** – Ministry of Energy which is the overall governing authority for electrical power in Brunei Darussalam.
- 1.4.55. **Meter** – A device for measuring and recording units of Active Energy and/or Reactive Energy and/or Power and/or demand.
- 1.4.56. **Metering Installation** – A Meter and associated current transformers, voltage transformer, metering protection equipment, including alarms, LV electrical circuitry and associated energy meters, related to the measurement of Active Energy and/or Reactive Energy and/or Active Power and/or reactive power, as the case may be.
- 1.4.57. **Micro-Generator** - Generator with 16 A per phase or less.
- 1.4.58. **National Grid** – referring to the grids in Brunei Darussalam under DES and IPP purview.
- 1.4.59. **Network** – Shall mean a portion of the electrical system operating at a specified voltage.
- 1.4.60. **Non-Controllable Electricity Storage Equipment** - A storage energy unit which active output power cannot be independently controlled. This includes, but not limited to, a Synchronous Flywheel, and a Synchronous Compensation Equipment.

- 1.4.61. **Non-Synchronous Electricity Storage Module** - A module capable of producing electrical energy by converting or re-converting another source of energy such that the frequency of the generated voltage is not inherently in synchronism with the frequency of the system. An electric battery is an example of this.
- 1.4.62. **Operating Agreement** – An agreement made between the relevant TSP and an External Party which gives TSP authority to direct the operations of a facility via the National Control Centre.
- 1.4.63. **Outage** – The removal of equipment from service or unavailability for connection for reasons including both forced and planned outages.
- 1.4.64. **Power-Generating Module** - A synchronous power-generating module, a non-synchronous power-generating module, or a non-synchronous electricity storage unit.
- 1.4.65. **Non-Synchronous Generator** - an electricity generating unit or collection of those which is either non-synchronously connected to the network or connected through an electronics interface. It should also have a single Connection Point / PCC to the distribution or transmission grid. It alternatively called a power park generator.
- 1.4.66. **Point of Common Coupling (PCC)** - point where the generating facility's local electric power system connects to the utilities electric system, such as the electric power revenue meter or at the location of the equipment designated to interrupt, separate or disconnect the connection between the generating facility and the utility.
- 1.4.67. **Power System** – The system comprising the transmission and distribution networks, generation and consumer installations, and external systems connected to the Transmission System.
- 1.4.68. **Primary Frequency Control** – The automatic response of a power-generating unit to a fall or rise in the grid frequency which affects the Active Power output of the unit, in order to restore the frequency back to within target limits. Such response should be fully available within 5 seconds and sustained for up to 30 seconds.
- 1.4.69. **Protective Devices** – Equipment used for the purpose of monitoring system parameters and alarming and/or disconnecting Apparatus during abnormal conditions.
- 1.4.70. **Protection System** – The combination of Protective Devices, which designed to alarm and disconnect elements of the power system during abnormal conditions, in order to prevent those conditions from propagating to a larger part of the network.
- 1.4.71. **PSO** – Power system operator.
- 1.4.72. **Reactive Power** – The product of voltage and current and the sine of the phase angle between them measured in units of Volt-Amperes reactive and standard multiples thereof i.e: 1000 VAr = 1 kVAr; 1000 kVAr = 1 MVAr.

- 1.4.73. **Reliability** – The ability to deliver electrical power within reliability standards and in an adequate and secure manner.
- 1.4.74. **Reserve** – The generation capacity or load reduction capacity that can be called upon to replace scheduled energy supply that has become unavailable as a result of an unexpected outage, or to augment scheduled energy as a result of unexpected demand or other contingencies.
- 1.4.75. **Remote Terminal Unit (RTU)** – A micro-processor based system which gathers analog data from field devices and performs control functions on those devices. Data gathered is channeled via communication channels and equipment to SCADA.
- 1.4.76. **SAIDI** – System Average Interruption Duration Index. A system index of average duration of interruption in the power supply indicated in minutes per total number of customers.
- 1.4.77. **SAIFI** - System Average Interruption Frequency Index. A system index of average frequency of interruptions in power supply indicated as number of interruptions per total number of customers.
- 1.4.78. **SCADA** – Supervisory Control and Data Acquisition; the computerized systems that monitor and control the Grid remotely from the Control Centre.
- 1.4.79. **Secondary Frequency Control** - The automatic response of a power-generating unit to a fall or rise in the grid frequency which affects the Active Power output of the unit, in order to restore the frequency back to within target limits. Such response should be fully available after 30 seconds of the frequency change, taking over the primary frequency control. Moreover, it should be sustained for at least 30 minutes.
- 1.4.80. **Security** – The ability for the power system to withstand sudden disturbances including electrical short-circuits or unanticipated loss of equipment or components.
- 1.4.81. **Spinning Reserve** – The instantaneous generation capacity available to the system operator made up of the difference between the peak output and the running output for those generators currently synchronized to the grid and supplying the load and system losses.
- 1.4.82. **Synchronous Compensation Equipment** - Apparatus which has the function of providing synchronous compensation to the power grid, for example, synchronous condensers.
- 1.4.83. **Synchronous Flywheel** - Part of a synchronously rotating plant for the specific purpose of contributing inertia to the power system.
- 1.4.84. **Synchronous Generator** - indivisible set of installations which can generate electrical energy such that the frequency of the generated voltage, the generator speed and the frequency of network voltage are in a constant ratio and thus in synchronism.

- 1.4.85. **Synthetic Inertia** - ability of a non-synchronous generator or HVDC system to replace the effect of inertia of a synchronous power-generating module to a prescribed level of performance. Synthetic inertia can be provided by an electricity storage unit, an electricity storage module, or even a non-synchronous generator/power park module.
- 1.4.86. **System Earthing** – the intentional connection of neutral point to ground so that the neutral point is earthed, in order that phase to ground voltages under Earth Fault conditions do not rise to high value.
- 1.4.87. **Total Harmonic Voltage Distortion** – The departure of a wave-form from the normal sinusoidal shape that is caused by the addition of one or more harmonics to the fundamental wave form, measured as the square root of the sum of the squares of all the harmonics divided by the fundamental voltage, and expressed as a percentage of the magnitude of the fundamental frequency.
- 1.4.88. **Transmission Network** – The electricity supply network comprising lines, cables, and substations at voltages of above 11 kV.
- 1.4.89. **Transmission Service Provider (TSP)** – The entity holding a transmission License responsible for the operation and maintenance of a transmission network and its associated plant and Apparatus for the purpose of providing transmission services, including access to users of the grid system.
- 1.4.90. **Under-Frequency Relay** – A relay which senses system frequency and initiates alarms or control signals when the measured frequency moves outside limits defined in its preset settings.
- 1.4.91. **Unit Protection** – A protection system which is designed to operate only for a fault condition within a defined zone or particular Apparatus of the power system.

2. TRANSMISSION PLANNING REQUIREMENTS

2.1. Introduction

- 2.1.1. The relevant TSP shall be solely responsible for development of plans for expanding the transmission network as necessary through construction of new and reinforcement of existing transmission system elements, reconfiguration of network topology, adjustment and modernization of protection systems, permanent monitoring and implementation of new technological solutions, necessary to meet the requirements for supplying power in accordance with guidelines and criteria described in this section of the Code. The plan shall take into account forecasted demand increases as well as new load and generation connections.
- 2.1.2. The network shall be designed and planned based on safety, security, reliability, stability, adequacy, efficiency, contributes to a sustainable development and economics of the power system.
- 2.1.3. Changes to the Grid, including large load additions and generator connections must be planned with sufficient lead-time to allow for proper and detailed engineering, design, and construction to be completed in line with Good Utility Practice.

2.2. Operating conditions

Security requirements for the transmission system during normal system operating conditions and contingency situations are defined below:

- 2.2.1. **Normal operating conditions** – are defined as steady-state conditions where all voltage magnitudes on the grid are within prescribed limits, all MVA loading is within the limits of the equipment for all Apparatus, the power system frequency is within the prescribed limits of this Code, and active and reactive power reserves are sufficient to withstand an N-1 contingency without violating operational security limits. Additionally, all network elements required during normal operation are in service.
- 2.2.2. **Single contingency conditions** – are defined as probable contingencies with a single generating unit, transformer, or transmission line/Tower out of service due to a forced or planned outage.
- 2.2.3. **Unlikely contingencies** – are defined as the loss of more than one network element at the same time, the loss of a substation bus-bar, or the loss of a generating unit in addition to other transmission elements at the same time.
- 2.2.4. **Extreme contingencies** – such as loss of multiple elements, loss of an entire power station or substation, or numerous transmission lines at the same time.

2.3. The planning criteria for the transmission system

- 2.3.1. **Under normal conditions** – All equipment shall operate within their rated thermal capacity and voltage limits. Available generating capacity should be available to account for an N-1 contingency without needing to utilize unplanned load shedding. This applies for both active and reactive power reserves.
- 2.3.2. **During single contingency conditions** – All apparatus shall continue to operate within their prescribed thermal and voltage ratings. No power interruptions to any consumers should result from a single transmission contingency. The system shall remain within its voltage limits and stable.
- 2.3.3. **During unlikely contingencies** – The power system shall continue to operate without collapse and without becoming unstable. Intervention by operating staff at the power stations and SCADA will likely be required to adjust power immediately after such events. Switching of the network, increasing generation or manual load shedding may be required.
- 2.3.4. **During extreme contingencies** – The power system shall maintain dynamic stability. Automatic load shedding via under-frequency relays will likely occur, in addition to islanding of the transmission network. Priority of automatic load shedding will be determined by the Director of the TSP or to whom he/she assigns.
- 2.3.5. **Frequency** – The grid frequency is nominally maintained at 50 Hz during normal operation. Grid frequency may temporarily deviate due to large changes in load, the tripping of a generator, or system faults. Limits for these various conditions are as follows:

Normal Operating Conditions:	49.5 Hz to 50.5 Hz
During System Stress:	49.0 Hz to 51.0 Hz
Maximum deviation during faults:	48.75 Hz to 51.25 Hz
Tripping values for generators	51.5 Hz or above and 47.5 Hz or below

- 2.3.6. **Voltage** – Nominal Transmission voltage shall not deviate more than 5% in either direction during steady state conditions. During system stress or following a fault, the voltage may deviate up to 10% for a maximum of 30 minutes.

Unless otherwise agreed by the TSP, the basic insulation level (BIL) for user apparatus shall be as follows:

- a) At 275 kV voltage level, the BIL is 850 kV;
- b) At 132 kV voltage level, the BIL is 550 kV;
- c) At 66 kV voltage level, the BIL is 350 kV.

2.3.7. **Voltage fluctuations and Flicker** – all users are required to minimize the occurrence of voltage fluctuations and flicker on the TSP's networks as measured at the user's Connection Point. The voltage fluctuations and flicker limits are contained in, but not limited to the following documents:

- a) **IEC 6100-3-3:2013+AMD:2017** “Limit of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection”;
- b) **IEC TS 61000-3-5:2009** “Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated current > 75 A”;
- c) **IEC TR 6100-3-7:2008** “Assessment of emission limits for the connection of fluctuating installations to MV, HV and EHV power systems”;
- d) **IEC 61000-3-11:2017** “Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems for equipment with rated current ≤ 75 A and subject to conditional connection”;
- e) **IEC 6100-4-15:2010** “Flicker meter– functional and design specifications”;
- f) **BS EN 50160:2010** Voltage characteristics of electricity supplied by public electricity networks.

2.3.8. **Harmonics** – Harmonics are normally produced by an External Party's apparatus generating waveforms that distort the fundamental 50 Hz wave. Such harmonic generation can damage user apparatus and can result in failure of TSP's or DSP's apparatus. The limit for harmonic levels are specified in, but not limited to the following documents:

- a) **IEC 61000-3-2:2018+AMD1:2020** “Limits for the harmonic current emissions for equipment input current ≤ 16 A”;
- b) **IEC 61000-3-4 (1998-10)** “Limitation of emission of harmonic currents in low voltage power supply systems for equipment with rated current greater than 16 A”;
- c) **IEC 61000-3-6:2008** “Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems”.

3. GENERATOR REQUIREMENTS

3.1. General generator requirements

- 3.1.1. Requirements for generators vary depending on the voltage level to which they are connected, and whether they are synchronous generators or non-synchronous generators.

3.2. Generators connected at less than 6.6 kV (S1 & PE1 types)

- 3.2.1. The power generating facility shall be able to operate continuously and normally when the electricity system's frequency is 47.5-52.0 Hz. The power generating facility must be able to operate for a period of 20 seconds when the electricity system's frequency is below 47.5 Hz. This is summarized in **Table 1.**

Table 1: Frequency operating times for S1 and PE1 generator types

Frequency range	Time period of operation
47-47.5 Hz	Minimum 20 seconds
47.5 Hz- 52 Hz	Unlimited
>52 Hz	No requirement

- 3.2.2. The power generating facility shall be capable of continuing to operate normally when the rate of change of frequency is less than 2.0 Hz/s.
- 3.2.3. The power generating facility shall be able to operate continuously and normally when the electricity system's voltage is 0.9-1.05 pu. Moreover, the power generating facility shall be able to operate for 1.5 s when the system's operating voltage is either 0.85-0.9 pu or 1.05-1.1 pu.
- 3.2.4. If the mains is lost, the generator shall cease to operate in islanded mode within 2 seconds of the formation of an island.
- 3.2.5. (Only S1) The power generating facility owner shall agree on the setting of the synchronization conditions of a synchronous power generating module (S1) with the relevant network operator, if the conditions deviate from what is set out below:
- a) Frequency 49.0-51.0 Hz;
 - b) Voltage 0.90-1.05 pu;
 - c) Phase angle difference <10 degrees;
 - d) Frequency deviation <0.1 Hz;
 - e) Voltage deviation < 0.08 pu;
 - f) In case of a three-phase generator, phase sequence shall be the same on both sides of the circuit breaker to be synchronized.

- 3.2.6. (Only PE1) The power generating facility owner shall agree on the setting of the synchronization conditions of a non-synchronous generating module (PE1) with the relevant network operator, if the conditions deviate from what is set out below:

Voltage	Synchronous GEN	Non-synchronous GEN
< 6.6 kV	S1	PE1
>= 6.6 kV	S2	PE2

- a) Frequency 49-51 Hz;
- b) Voltage 0.90-1.05 pu;
- c) Phase angle difference < 8 degrees;
- d) Frequency deviation <0.05 Hz;
- e) Voltage deviation < 0.02 pu;
- f) Interlocking logics are satisfied.

- 3.2.7. An operational notification procedure for connecting the generator is required. It shall consist of an installation document which shall be submitted to the grid operator. It shall, at least, have the following information:

- a) The location at which the connection is made;
- b) The proposed date of the connection;
- c) The maximum capacity of the installation in kW / kWp;
- d) The type of primary source;
- e) Reference to equipment certificates used for equipment that is in the site installation;
- f) Additional information that may be required by the grid operator for those equipment for which no equipment certificate has been received;
- g) The contact details of the power-generating facility owner and the installer and their signatures.

- 3.2.8. A power generator module may be considered an emerging technology if:

- a) It consists of a commercially available power generator module, and;
- b) The accumulated sales of the technology represent less than the 1% of the annual maximum load of the previous year.

A generator considered as an emerging technology is excluded from all requirements that normally apply for S1 and PE1 as stated in this Code, with the exception of the operational notification procedure requirement in **Section 3.2.7**.

3.3. Generators connected at a voltage equal or larger than 6.6 kV (S2 & PE2)

- 3.3.1. All common requirements for S1 and PE1 apply for S2 and PE2 except the synchronization conditions. Additional requirements for S2 and PE2 are stated below.
- 3.3.2. Frequency range: SE2 and PE2 must remain connected to the grid in the frequency ranges and time periods specified in **Table 2**:

Table 2: Frequency operating times for S2 and PE2 generator types

Frequency range	Time period of operation
47 - 47.5 Hz	Minimum 20 seconds
47.5 - 52 Hz	Unlimited
>52 Hz	No requirements

- 3.3.3. The power generating facility shall be able to operate continuously and normally when the electricity system's voltage is 0.9-1.05 pu. Moreover, the power generating facility shall be able to operate for 60 minutes when the system's operating voltage is 1.05-1.1 pu and the frequency is held between 49-51 Hz.
- 3.3.4. **Limited frequency sensitive mode-over frequency (LFSM-O)** should be implemented in the power generating facility if the availability of primary energy does not impose restrictions. The power generating facility must be capable of reducing its active power production as a linear function of frequency with a droop between 3% and 6%.
- 3.3.5. **Limited frequency sensitive mode-under frequency (LFSM-U)**: The power generating facility must be capable of increasing its active power production as a linear function of frequency when the electricity system's frequency is below 49.5 Hz. Possible LFSM-U range from 3-6%. When the highest regulating level has been achieved, the facility must be able to continue operating at that level.
- 3.3.6. It shall be possible to set the frequency droop control between 3% and 6% in steps of maximum 1%.
- 3.3.7. It shall be possible to set the dead-band of frequency control between 0.0 Hz and 0.05 Hz in steps of a maximum of 0.01 Hz.
- 3.3.8. The generator must be equipped with a bus interface (input port), so that a set-point can be given to the production of active power in order to reduce or increase the active power according to the set-point given from the control center or from an AGC controller. A pulse control is normally used to control both active and reactive power. The duration and magnitude of the pulse should be variable as per instructions from the relevant Grid Control Center. The bus interface must be compatible with but not limited to the **IEC 60870-6** (Elcom, ICCP/TASE.2), **IEC 60870-5-104** or **IEC 61850** protocols.

- 3.3.9. The operator responsible for the operation of the power generating facility must be able to control it remotely or locally. If requested by the grid operator or the grid control centre through AGC controller, the operator of the generating facility shall change the mode or set-point of the power generating facility's active and/or reactive power control within the limits established by the generating facility. The requested change must be achieved 15 minutes after the request is made with a tolerance of +5% of the set-point or at most +1 MW.

3.4. Synchronous generator requirements (S2)

- 3.4.1. S2 generators shall follow all the requirements stated in **Section 3.3** as well as all the requirements in this section (**Section 3.4**). In the event of two requirements dealing with the same topic, the most restrictive requirement shall prevail.
- 3.4.2. All S2 generating units shall be designed such that they can follow the system load.
- 3.4.3. All S2 generating facilities shall be able to perform the following operations during contingencies:
- a) Coming on line;
 - b) Adjusting generating output;
 - c) Remaining in operation and connected to the transmission system;
 - d) Going off-line when the generating unit would contribute to overloading facilities or over-generation conditions.
- 3.4.4. All S2 generating units shall be designed with two-shifting capability for normal daily operations.
- 3.4.5. The generating units shall be designed with the following characteristics:
- a) All S2 generating units shall be frequency sensitive;
 - b) Capable of responding automatically to normal variation in the system frequency +/-0.5 Hz;
 - c) Releasing the spinning reserve in the manner required by the control operator and tested per the verification tests.
- 3.4.6. The speed governor must meet the following minimum requirements:
- a) Capable of being set so that it can operate with governor droops within the range of 3% to 5%;
 - b) The dead-band shall be within the range of +/-0.05 Hz. The governor shall respond to full frequency deviation once system frequency deviation exceeds the dead-band;
 - c) Where a generating unit becomes part of an electrical island isolated from the rest of the system, but still supplying loads in the island, the speed governor must be able to contribute its share to

maintain frequency in the island unless deemed not feasible.

- 3.4.7. For generating units providing contingency reserve, they must be capable of meeting a minimum ramp rate in order to achieve 10% of its Rated MW capacity within 10 minutes, and shall be subjected to verification tests.
- 3.4.8. **Performance Monitoring Facility:** The External Generating Facilities shall provide, install and maintain at its own cost, high-resolution recorder(s) for monitoring and assessment of performance including the speed governor's frequency response of each generating unit. The recorder shall be capable of capturing, but not limited to the following:
- a) Transient and dynamic response of each of the generating unit in terms of real and reactive power output (MW and MVar);
 - b) Voltage and frequency at the generating unit terminal;
 - c) System voltage at the high voltage side of the generating unit's step-up transformer;
 - d) Recorder information shall be made available to TSP operations within 24 hours of request.
- 3.4.9. **Remote Monitoring and AGC:** The External Generating Facilities shall make provision at their facility for remote monitoring of the generating units' output and switch-gear equipment loading and operating conditions, as well as automatic control of generation output from the TSP EMS.
- 3.4.10. **Power System Stabilizer (PSS):** For each generating unit with Rated MW Capacity at or above 60 MW, a PSS shall be incorporated to provide additional damping of power oscillations. Proper operation of the PSS shall be confirmed by test. The preferred input signal for the PSS is accelerating power which can be synthesized from measured electrical power and speed. PSS transducers (i.e., for measuring input signals) shall be linear over their operational range and its time constant shall not exceed 100 milliseconds. The TSP shall make available the system characteristic to External Generating Facilities for tuning of the PSS. The External Generating Facilities shall submit a report incorporating the methodology in deriving the setting of the PSS parameters, as well as the tuning techniques, to PSO for review before implementation on site.
- 3.4.11. **Fault ride through:** The power generating facility shall be able to continue operation during and after disturbances in the power system. It shall be designed in such a way that it can withstand a momentary voltage fluctuation, occurring at the Connection Point, without being disconnected from the grid and without losing its synchronous operation. Momentary pole slipping of a synchronous power generating module is not allowed. The synchronous generator must withstand voltage fluctuations at the Connection Point as shown in **Figure 1**.

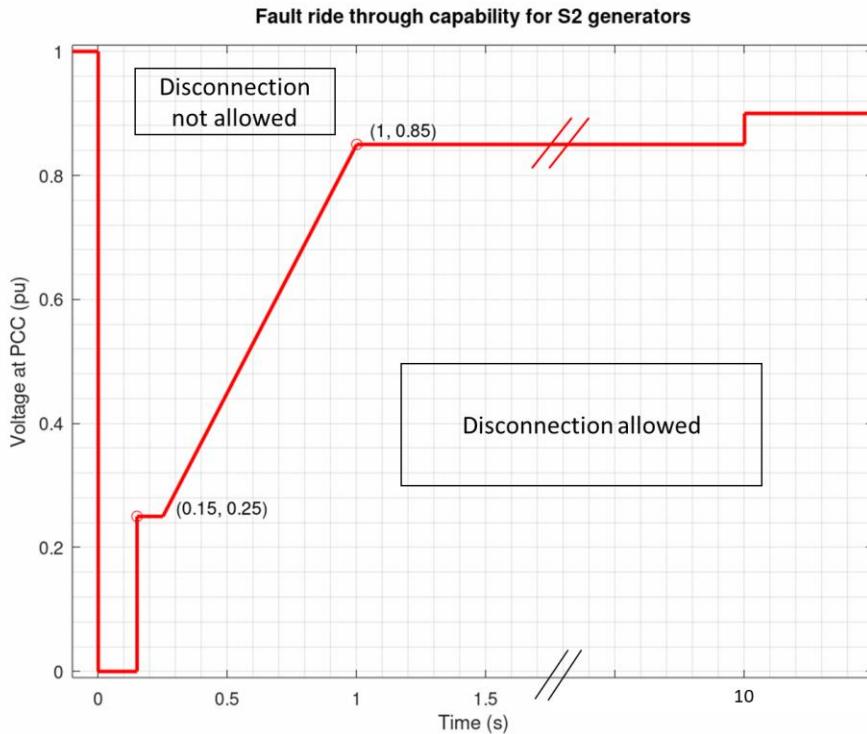


Figure 1 Voltage at the Connection Point of the synchronous generator during a momentary voltage disturbance after which the generator shall continue to operate normally

After a disturbance, the power generating facility shall be able to operate without being disconnected from the grid during momentary variations in voltage amplitude and phase angle caused by potential local or inter-area electromechanical oscillations following a voltage disturbance. The fault-ride-through requirement is applicable to symmetrical faults (3-phase short circuits) and asymmetrical faults (2-phase short circuits and earth short circuits, 1-phase earth short circuits). The fault-ride-through requirement has been specified for the following conditions:

- Before the voltage disturbance, the voltage of the Connection Point of the power generating facility is 1.0 pu;
- Before the voltage disturbance, the power generating facility does not supply reactive power to the Connection Point or take reactive power from the Connection Point;
- Before the voltage disturbance, the AVR of the power generating facility is in operation;
- The short circuit current of the Connection Point is assumed to be at normal/average level before and after the local fault.

- 3.4.12. Effects of external factors such as outdoor temperature or environmental conditions such as haze, forest fires etc., on the short-term overload capacity should be reported.

- 3.4.13. The power generating facility shall be equipped with a turbine controller and associated rotation speed control, with which the active power output and the rate of change of active power can be adjusted. Active power output shall be implemented in such way that it can be changed manually, or by frequency control using the turbine controller and potential power plant controller.
- 3.4.14. It shall be possible to set a dead-band and linear droop for frequency control. At least two modes of operation shall be included: normal state and disturbance
- 3.4.15. The synchronous generator shall be able to operate continuously at a power factor between 0.9 lagging and 0.9 leading at its rated power output, given that grid conditions are within the normal operation range.
- 3.4.16. The power generating facility shall be able to generate and consume reactive power within the operating range limited by its minimum output and rated capacity. Specifically, it shall be able to generate a reactive power amount equivalent to when the generator produces at its rated output power and with a power factor of 0.95, both leading and lagging.
- 3.4.17. The synchronous generator shall have a constant voltage control for the terminal voltage of the generator. It shall not be susceptible to voltage or frequency changes in the grid.
- 3.4.18. It shall be possible to set the set-point of constant voltage control in maximum steps of 0.01 pu in accordance with the limit values specified for the voltage of the generator (continuous operation). The slope of voltage control shall be linear, and it shall be possible to set the slope within a range of 0–8% in steps no greater than 0.5 percentage points. The set-point can be set as positive or negative.
- 3.4.19. Each generating unit should provide suitable AVR equipment compatible with the network for controlling the voltage specified in this Code.
- 3.4.20. The excitation system must be operated only in its constant terminal voltage mode of operation, with any constant reactive power output control mode or constant power factor output control always disabled.
- 3.4.21. The response of the excitation system shall be fast and well damped. For open circuit step response of 5% step change in voltage reference, the Generating unit terminal voltage shall reach 90% of its final value within 1 second and have a maximum Settling Time of 5 seconds. Settling Time is defined as the time taken for the generating unit terminal voltage to settle and stay within an error band of +/-1% of its increment value.
- 3.4.22. Settling time following any disturbance that causes an excitation limiter to operate shall be within 5 seconds.

- 3.4.23. Droop compensation of up to 2/3 of the generating unit's step-up transformer reactance should be provided
- 3.4.24. Excitation limiters shall not interfere with the proper operation of the generating unit
- 3.4.25. **Synchronization:** The power generating facility shall be equipped with the necessary synchronization devices. Only after the relevant network operator has given permission to do so, shall the power generating facility synchronize. Synchronization may take place only under normal continuous operation frequency and voltage ranges. If not agreed otherwise with the relevant network operator, the settings for the synchronization of the power generating facility shall be:
 - a) Frequency: 49-51 Hz;
 - b) Voltage 0.90-1.05 pu;
 - c) Phase angle difference <10 degrees;
 - d) Frequency deviation <0.1 Hz;
 - e) Voltage deviation <0.05 pu;
 - f) Same phase sequences on both sides of the circuit breaker.

3.5. Non-synchronous generator requirements (PE2)

- 3.5.1. PE2 generators shall follow all the requirements stated in **Section 3.3** as well as all the requirements in this section (**Section 3.5**). In the event of two requirements dealing with the same topic, **the most restrictive requirement shall prevail**.
- 3.5.2. **Fault ride through:** The power generating facility shall be able to continue operation during and after disturbances in the power system. It shall be designed in such a way that it can withstand a momentary voltage fluctuation, occurring at the Connection Point, without being disconnected from the grid. The non-synchronous generator must withstand voltage fluctuations at the Connection Point as shown in **Figure 2**. The voltage returns to at least 0.9 pu after 10 s.

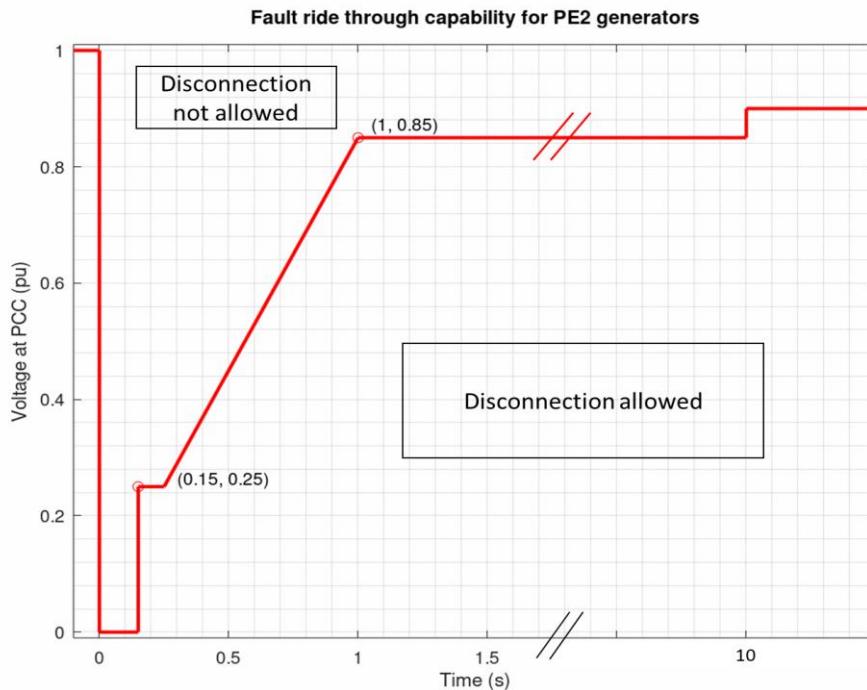


Figure 2 Voltage at the Connection Point of the non-synchronous generator during a momentary voltage disturbance after which the generator shall continue to operate normally

After a disturbance, the power generating facility shall be able to operate without being disconnected from the grid during momentary variations in voltage amplitude and phase angle caused by potential local or inter-area electromechanical oscillations following a voltage disturbance.

The fault-ride-through requirement is applicable to symmetrical faults (3-phase short circuits) and asymmetrical faults (2-phase short circuits and earth short circuits, 1-phase earth short circuits).

The fault-ride-through requirement has been specified for the following conditions:

- Before the voltage disturbance, the voltage of the Connection Point of the power generating facility is 1.0 pu;
- Before the voltage disturbance, the power generating facility does not supply reactive power to the Connection Point or take reactive power from the Connection Point;
- Before the voltage disturbance, the AVR of the power generating facility is in operation;
- The short circuit current of the Connection Point is assumed to be at a normal/average level before and after the local fault.

3.5.3. The non-synchronous generator shall be capable of supplying fast fault current (FFC) either by:

- a) Ensuring the supply of FFC at the Connection Point; or
- b) Providing a FFC at the terminals of the individual units composing the non-synchronous generator.

For full-converter non-synchronous generating units, the following requirement shall be followed regarding the fault current injection:

- a) It shall prioritize the reactive current (I_q);
- b) Its k-factor must be 2.5, and in asymmetrical faults, the positive and negative sequence components must be supplied in the ratio defined by the k-factor;
- c) It shall rise to the target value within 30-50 ms and settle to the target value within 60-80 ms;
- d) It shall be activated as soon as the phase voltage for the generator's Connection Point or its individual units' terminals is less than 0.85 pu;
- e) It shall cease when the aforementioned phase voltage returns to a level higher than 0.9 pu;
- f) Each power generating facility shall be provided as an entity compiled in a single equivalent generator. Moreover, the model shall cover the transformers needed to connect the generator to the power system.

3.5.4. The dependence of the active power output of the power generating facility on external factors, such as solar irradiation or outdoor air temperature, shall be reported as part of the data to be delivered. If the power generating facility consists of several units and the rated capacity is not evenly distributed between the non-synchronous generator units, the rated capacities of individual units shall also be reported as part of the data to be delivered alongside the rated capacity of the entire power generating facility.

3.5.5. Synchronization may take place only under normal continuous operation frequency and voltage ranges. If not agreed otherwise with the relevant network operator, the settings for the synchronization of the power generating facility shall be:

- a) Frequency difference < 0.05 Hz;
- b) Voltage magnitude difference $< 2\%$;
- c) Voltage angle difference < 8 degrees;
- d) Pulse duration < 0.2 s;
- e) The interlocking logics must be satisfied;
- f) Additionally, the inverter shall be capable of synchronizing with the grid automatically.

- 3.5.6. If the mains is lost, the PE2 generator shall cease to operate in islanded mode. Anti-Islanding capabilities shall consist of the detection of at least:
- Under voltage;
 - Over voltage;
 - Under frequency;
 - Over frequency.
- 3.5.7. The connection of the power generating facility to the power system shall not cause a change in excess of 3% in the voltage of the Connection Point of the power generating facility.
- 3.5.8. During a frequency disturbance, when the frequency surpasses 50.5 Hz, the PE2 generator shall reduce its power output as shown in **Figure 3 Frequency disturbance curve for a PE2 generator**.

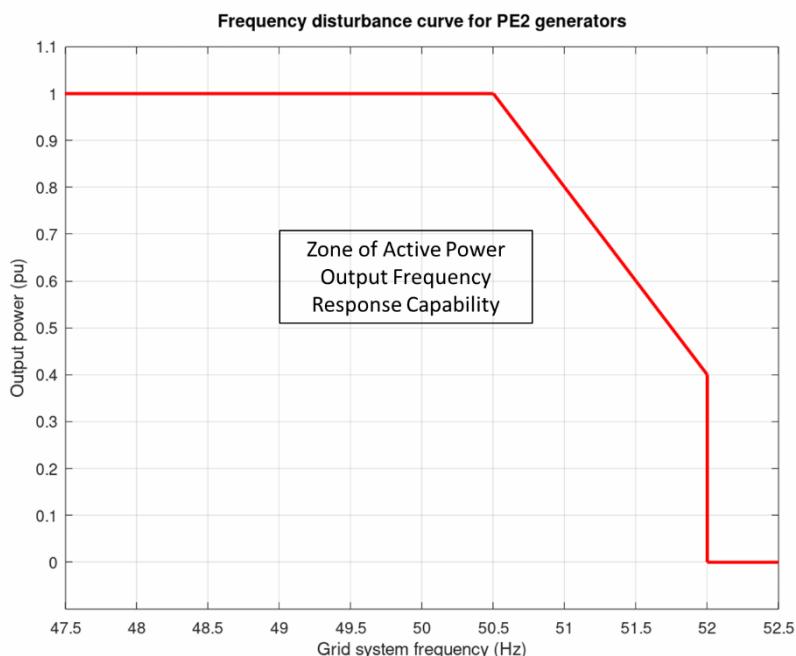


Figure 3 Frequency disturbance curve for a PE2 generator

- 3.5.9. It shall be made available the capability to curtail the upper limit of active power generation to a smaller value than the rated active power capacity of the power generating facility. Similarly, it shall be possible to control the ramp rate.
- 3.5.10. Capability to restrict the rate of change during an increase in active power shall be available in the following cases:
- Where there is a change in the active power limiter set-point or;
 - When there is an increase in the active power generation due to an increase in the primary energy production (e.g. increase in solar radiation).

- 3.5.11. The accuracy of the active power control shall be at least 1 MW, its sensitivity at least 10 mHz, and the response time no more than 2 s. These parameters shall be verified as a part of the commissioning testing, as well as being delivered as part of the power generating facility documentation.
- 3.5.12. The relevant TSP shall have the right to require synthetic inertia during fast frequency deviations. The associated performance parameters regarding the synthetic inertia shall be specified by the TSP.
- 3.5.13. The generator shall be able to generate and consume reactive power as:
- Between 0-0.33 of the ratio Q/Pmax overexcited ($Q>0$) when the voltage at the Connection Point is 0.9-1.0 pu;
 - Between 0-0.33 of the ratio Q/Pmax underexcited ($Q<0$) when the voltage at the Connection Point is 1-1.05 pu.
- 3.5.14. The generator owner shall deliver calculations of the reactive power capacity of the generator at the Connection Point to the relevant network operator. This calculation shall be carried out at:
- Voltage levels: 0.85 (operating for only 10 seconds), 0.9, 1 and 1.1 p.u;
 - Power output: Minimum, $P=P_{\text{max}}/2$ and at rated capacity.
- 3.5.15. The modelling data shall be contrasted with the results obtained from the commissioning testing of the generator.
- 3.5.16. Documentation of the simulation data utilized should be delivered electronically to the grid operator. Such data consist of:
- The components of the power generator and the network to be connected;
 - A block diagram of active power control and frequency control, and its parameters;
 - A block diagram of the reactive power control and voltage control, and its parameters;
 - A block diagram of any other additional functionality that the generator may feature;
 - Instructions for the use and maintenance of the simulation model.

Results of the verification of the modelling data including the commissioning tests results and an account of the differences encountered between the model and the commissioning test.

- 3.5.17. The generator shall have automatic reactive power and voltage control. These shall contain the following three operating modes:
- Constant voltage control;
 - Constant reactive power control;
 - Constant power factor control.
- 3.5.18. The constant voltage control shall allow for set-point steps no greater than 0.01 p.u. The slope of the voltage control shall be linear with a slope between 0.8% in steps no greater than 0.5%.
- 3.5.19. During the constant reactive power control mode, the tolerance for reactive power measurement shall be no greater than +/-0.5 MVar. Furthermore, the control shall achieve its reactive power target value within 10 seconds after a change in the set-point takes place.
- 3.5.20. The constant power factor control shall adjust the reactive power injected or absorbed depending on the active power injected. The range of power factor set-points shall be, at least, between 0.95 lagging to 0.95 leading. The maximum steps between set-points shall not be greater than 0.01. Furthermore, the control shall achieve its power factor target value within 10 seconds after a change in the set-point takes place.
- 3.5.21. A power flow simulation model and fault current simulation shall reproduce, within the voltage and frequency operating range conforming to the specifications, the impact of the power generating facility on the following issues:
- Power flow of the power system, considering potential dependencies, for example, between the production power and the voltage of the Connection Point;
 - The voltage profile of the power system, considering the different modes and constraints of voltage control as well as potential compensation equipment;
 - Fault currents.

3.6. Captive power generators

- 3.6.1. Captive power generators or auto producers are generators inside an industrial complex that generate electricity for their own consumption. There is generally no net export of energy to the connecting grid, however with the prior agreement of the TSP the generator can export electricity to the Grid.
- 3.6.2. With respect to power-generating modules embedded in the networks of industrial sites, power-generating facility owners, system operators of industrial sites and TSP whose network is connected to the network of an industrial site shall have the right to agree on conditions for disconnection of such power-generating modules together with critical loads, which secure production processes, from the relevant system operator's network. The exercise of this right shall be coordinated with the TSP.

- 3.6.3. Except for requirements for LFSM-O, generator requirements relating to the capability to maintain constant active power output or to modulate active power output in **Sections 3.1, 3.2 or 3.4** shall not apply to power-generating modules of facilities for combined heat and power production embedded in the networks of industrial sites, where all of the following criteria are met:
- a) The primary purpose of those facilities is to produce heat for production processes of the industrial site concerned;
 - b) Heat and power generation is inextricably interlinked, that is to say, any change of heat generation results inadvertently in a change of active power generation and vice-versa.
- 3.6.4. Compliance with this specification is not a guarantee that the TSP will permit the connection of the generator at the location and according to the terms specified by the customer. The TSP will act to preserve the integrity and safety of the Distribution system by applying Good Utility Practice, and may specify additional criteria for the connection of the captive power generator.
- 3.6.5. Although generators with phase currents less or equal than 16 A (small scale embedded generators, and micro-generators) shall be required to comply with TSP requirements and National standards related to the supply of electrical equipment, the small-scale embedded generator and micro-generator shall not be permitted to export energy to the Distribution Network. It shall not be possible for small-scale embedded generators and micro-generators to energize the Distribution System in the event of a grid outage.
- 3.6.6. It may be appropriate for the TSP to relax certain conditions for generators intended to be connected in short-term parallel operation to support operations during switchover.
- 3.6.7. The power generated on site by the captive power generator, and any power exported to the Distribution System or Transmission System, shall comply with the power quality specifications in this Code with respect to frequency, voltage, power factor, flicker, and harmonics.
- 3.6.8. The captive power generator is required to provide a monitoring device at the interface with the Distribution System which measures the relevant parameters, and which shall be provided with a facility to disconnect the generator in the event of exceedance of the allowable deviations for these parameters.
- 3.6.9. The power quality at the Point of Connection (POC) is the responsibility of the DSP. Inadequate power quality at the POC may nonetheless lead to the disconnection of the generator.
- 3.6.10. In order to prevent adverse consequences for the Distribution Network in the event of sudden disconnection of the captive power generator's site load, the maximum capacity of the generator shall be limited to the import capacity at the POC.

- 3.6.11. The captive power generator shall apply to the DSP for its connection, at which time the DSP may, at its sole discretion, perform studies to determine the maximum size of the generator, as well as the location and criteria for this connection. The captive power generator shall provide all necessary information related to the generator in the form prescribed by the DSP in order to facilitate this study.
- 3.6.12. During the grid application phase for a new captive power generator, the DSP shall discuss and in some cases specify the interface requirements for the POC, which will include the ability to disconnect the captive power generator upon receipt of a valid control signal from the DSP control centre. This control interface shall, as a minimum, be compliant with IEC 60870-5-101.
- 3.6.13. The DSP shall maintain a formal register of all such captive power generator applications and their respective statuses.
- 3.6.14. the captive power generator shall not regulate voltage at the POC, unless prior authorization from the DSP has been granted.
- 3.6.15. The client shall ensure that the impedance of the generator is correctly specified to account for the permissible fault levels at the POC. The DSP may independently verify this prior to authorizing the connection of the generator.
- 3.6.16. The captive power generator shall be sized such that the tripping while at generating at full capacity shall not lead to the voltage at the POC exceeding the limits specified in this Code.
- 3.6.17. The captive power generator may only synchronise with the Distribution System automatically. Manual synchronisation is not permitted, and it shall not be permissible to disconnect other DSP customers in order to effect such synchronisation.
- 3.6.18. The generator shall automatically disconnect from the grid in a safe and controlled manner in the event of any abnormal conditions. This disconnection shall be effected autonomously by a dedicated controller which complies with relevant applicable specifications.
- 3.6.19. The generator is required to disconnect from the grid in the event of:
- a) Loss of the electric grid;
 - b) Grid voltage or frequency out of bounds as stated in **Sections 3.2 & 3.3**.
- 3.6.20. The generator shall only connect to the grid once synchronisation has been achieved. Disconnection for any cause shall result in a minimum of a 1-minute delay in reconnection to the grid, irrespective of the recovery of the network parameters which triggered the disconnection. Any detection device shall ensure that a minimum of 20 seconds has passed after the normalisation of the supply before attempting reconnection.

3.6.21. The design of the dedicated controller shall be such that the disconnection is fail-safe. That is to say, any failure within the controller or the disconnectors it controls will results in an immediate de-energization of the generator.

3.6.22. The following minimum criteria apply to the disconnectors, whether they be contactors or circuit breakers:

Generator Type	Generator Connection	Disconnect
Single-phase		L, N
Three-phase	Delta	L1, L2, L3
Three-phase	Wye	L1, L2, L3, N

3.6.23. The star point of the generator shall remain connected to earth to avoid any undesirable effects related to circulating currents.

3.6.24. The disconnection switches may be located anywhere between the on-site generator and the Point of Connection. Such disconnection switches shall be provided with a means for the application of a locking device in the isolated position only. It shall not be possible to lock any component controlled by the dedicated controller in the energized position.

3.6.25. These disconnection switches shall have an independent upstream isolator which is rated for the full duty of the generator, and adequately sized for all transient conditions. This isolator shall be lockable in the isolated position, and shall be of break-before-make type. If the DSP has provided a dedicated supply to the captive power generator, the isolator shall be accessible to the DSP, and shall be fitted with appropriate appurtenances for the application of the standard isolation locks used by the DSP.

3.6.26. The captive power generator shall ensure that all generating equipment is appropriately rated for the short circuit capability at the point at which is connected on site. Furthermore, the generator shall be designed to limit its fault contribution within the limits prescribed by the TSP.

3.6.27. Generation connections shall all be of the solidly earthed type. The generator may utilise the earthing connection provided by the DSP only if it is not intended to be operated independently of the Distribution Network. Should this earth connection be utilised, the captive power generator shall be required to follow the DSP's standard for all aspects of the earth connection.

3.6.28. It is permissible to impedance earth the star point of generators which are intended to operate in parallel with the Distribution System. Such impedance shall be selected to limit the effect of harmonic currents. Generators which are intended for operation independently of the Distribution System shall be required to have solidly earthed star points.

- 3.6.29. The generator and its associated electrical distribution on site shall be earthed in accordance with the distribution grid requirements in **Section 5** of this Code. The generator and its electrical installation shall be provided with fault-tolerant residual current detection (RCD) protection, which shall include the detection of DC fault currents on all electrical circuits. Where the generator includes an integral RCD function in accordance with the applicable norms, this shall be deemed to be adequate, however the DSP may request evidence of such a facility, and its certification.
- 3.6.30. Earth fault protection equipment may be required for the connection, the need for which shall be determined by the DSP during their detailed studies for the connection of the generator, and may be installed on either the DSP infrastructure, or within the captive power generator site. Such studies shall include the assessment of conditions that may lead to neutral voltage displacement, and the relevant protection measures to be implemented.
- 3.6.31. The dedicated controller shall be provided with active Loss-of-Mains detection utilising Rate-of-Change-of-Frequency (RoCoF) or similar recognized means of detection for inverter sources, with synchronous generators equipped with at least one additional independent means of LoM detection, such as rate of change of power factor, and reverse reactive or active power flow. Such LoM detection shall be provided with inter-tripping capability, and only active LoM detection may be used, with the dedicated controller applying a signal to the supply in order to detect the presence of the Grid.
- 3.6.32. In the event of an islanding event condition occurring, the generator shall cease the application of voltage to the Grid within 2 second(s).
- 3.6.33. The captive power generator shall affix a suitable warning notice to the point at which the generator is connected to their internal electrical network stipulating the type of generation installed on site, and its point of isolation. The labelling shall be robust, permanent, and shall be of a material that remains legible for the expected lifetime of the installation. Such labelling shall be affixed to all points of isolation within the site that could be energised, inadvertently or otherwise, by the generator.
- 3.6.34. The captive power generator shall inform the DSP of the intention to connect a generator on site, or the presence of any applicable generators on site, in order to ensure that the correct type of bi-directional utility meter is installed. The meter shall record site consumption, however the DSP may at its discretion additionally require the metering of site export, as well as the metering of active and reactive power (four-quadrant metering). The requirement for export metering shall not be taken to imply that a feed-in tariff will apply to such export. All tariff metering shall comply with the Distribution requirements and the metering requirements in this Code.

4. CONNECTION REQUIREMENTS

4.1. Introduction

- 4.1.1. Connections of either External Party generation or other network elements to the transmission grid shall comply with the technical requirements of this Code. Connections shall be made in such a way as to preserve the reliability, stability, and security of the grid.
- 4.1.2. **Technical Criteria for External Parties:** At the Connection Point all External Parties shall meet acceptable technical design and operational criteria. Detailed information relating to a particular connection will be made available by the TSP on request by The External Party. Such information will include, but is not limited to, the following:
- a) Annual/monthly load curve;
 - b) Forecast of peak day demand profile (MW and power factor);
 - c) Sensitivity of the demand to voltage or frequency variations.
- Line forced outage for the network associated with the proposed Connection Point or CTP shall be carried out for all generator connections and large load additions to ensure that their operation will not cause instability in the grid and the telecommunication network details associated with the proposed Connection Point or CTP shall also be considered.
- 4.1.3. All proposed connection requirements shall be mutually agreed upon by all stakeholders and approved by the relevant TSP and the ME.
- 4.1.4. A mutually-agreed upon Connection Agreement shall be drafted for all connections, covering details, terms, and conditions of the proposed connection, required system studies and modeling, as well as financial and ownership agreements not covered by this Code. The Connection Agreement shall also include details of any required network modifications or additions required in order to make the connection.
- 4.1.5. **Connection compliance requirements:** No connections shall be made to the grid without demonstration of compliance with this Code and the relevant Connection Agreements. In addition, analysis and modeling of the grid including the connection shall be performed to prove that the connection does not have adverse effect on the secure, stable, and reliable operation of the grid.
- 4.1.6. **TSP Inspection requirements:** TSP representatives shall inspect all new facilities and apparatus connected to the grid, including witnessing of functional and commissioning tests, to ensure no adverse impact to the grid prior to the energizing of any connections.

4.2. Requirements for Transmission Grid

- 4.2.1. Reactive power reserves shall be procured by the grid operator to maintain the voltage levels within 0.95-1.05 p.u.
- 4.2.2. The grid operator shall determine the maximum short-circuit current at which the rated capability of circuit breakers and other equipment is exceeded. Similarly, the minimum short-circuit current for the correct operation of protection equipment shall be put forward by the grid operator.
- 4.2.3. Information on maximum 3-phase short circuit currents injected to the grid by grid users may be requested, as well as the minimum zero sequence impedance of the user's network at the point of connection.
- 4.2.4. An initial training program for the certification and a rolling program for the continuous training shall be adopted for the TSP's employees in charge of real-time operation of the transmission system. Training for employees in charge of operational planning and those in charge of balancing should also be deployed.
- 4.2.5. The TSP shall establish a contingency list by assessing whether any of those contingencies endangers the operational security of the grid. Each contingency shall be classified as ordinary, exceptional or out-of-range, taking into account their probability of occurrence.
- 4.2.6. The TSP shall assess each contingency from its contingency after running pertinent simulation scenarios and, in case of a resulting in a N-1 situation, the TSP shall activate a remedial action with the aim to restore the normal state, and return to a N-situation.
- 4.2.7. The TSP shall not be required to comply with the N-1 criterion in the following situations:
 - a) During switching sequences;
 - b) During the time period required to prepare and activate remedial actions.
- 4.2.8. **Spinning Reserve requirements:** External Systems shall provide adequate spinning reserve to cater for forecasting errors plus a single incident that causes the loss of the largest amount of power output due to:
 - a) The loss of the largest generation unit;
 - b) The loss of the largest transmission circuit;
 - c) The loss of an interconnection that is exporting energy to Brunei Darussalam.

This is regarded as an N-1 contingency and as such only one incident is planned for in terms of spinning reserve, in addition to any forecasting errors that may occur. This shall allow the Area Control Error to return to zero at least every ten minutes. Extraordinarily, the relevant TSP may require the system to operate under N-2 conditions in certain parts of the system for additional security purposes.

- 4.2.9. The TSP shall perform coordinated operational security analyses a year ahead.
- 4.2.10. The year-ahead operational security analysis shall be conducted at least once a year in order to identify:
- a) Power flows and voltages exceeding operational security limits;
 - b) Violations of stability limits of the transmission system;
 - c) Violations of short-circuit thresholds of the transmission grid.
- 4.2.11. Connecting users shall provide a single line diagram of existing and proposed arrangements to the TSP/ network planner containing the following points:
- a) Busbar layouts;
 - b) Electrical circuitry (lines, cables, transformers, switchgear, etc.);
 - c) Phasing arrangement;
 - d) Switching facilities and interlocking arrangements;
 - e) Operating voltages;
 - f) Numbering and nomenclature.
- 4.2.12. If reactive compensation equipment is connected to the grid, except for power factor corrector equipment associated directly with the user's plant/apparatus, the following information shall be provided:
- a) Type of equipment (For example: fixed or variable);
 - b) Capacitive or inductive rating or its operating range in MVar;
 - c) Details of automatic control logics;
 - d) The point of connection to the grid, both in terms of electrical location and voltage.
- 4.2.13. **Demand transfer capability:** when a load can be supplied from two different supply points, the proportion of demand normally fed from each supply point and the arrangements for transfer, either manual or automatic, for transfer under planned or fault outage conditions shall be provided.
- 4.2.14. A user whose development is under construction in accordance with the relevant Connection Agreement and who wishes to connect to the transmission grid, shall apply in writing to the relevant TSP or DSP with the following information:
- a) Confirmation that the connecting plant/apparatus at the Connection Point will meet the required technical standards;
 - b) A proposed connection date;
 - c) A proposed commissioning schedule, including commissioning test, to be confirmed by the relevant TSP.

- 4.2.15. Within 30 calendar days of notification by a user, in response to **Section 4.2.14**:
- The relevant TSP/DSP shall notify the user whether the conditions in **Section 4.2.14** and the Connection Agreement have been satisfied; and
 - The relevant TSP/DSP shall inform the user that the proposed commissioning schedule has been approved.

4.3. Interconnector requirements

- 4.3.1. The power generation in the country shall be in the basis of self-sufficient policy to cater the country's load demand and power security. Any cross border power import shall have the following prerequisites:
- Cross border power import shall be utilized as a short-term alternative power source or as a back-up power source. For instance, it may be used to cover the shortfall of generation capacity until a new power station is commissioned;
 - It shall be suitable for providing emergency power in case of a power black-out in the grid;
 - Power security and the development of in-country generating capability shall not be compromised by the sales or profits of power import;
 - Cross border power import shall have the potential of providing spinning reserve capacity for the National Grid.
- 4.3.2. External systems shall have adequate infrastructure and system protection in place to ensure stable and secure operation of the integrated systems.
- 4.3.3. External Systems shall have AGC to enable power flow control through the interconnector to within a +/- 5% tolerance.
- 4.3.4. The interconnector shall operate continuously when the voltage level at the interconnector remains within +/- 10% of its rated voltage.
- 4.3.5. The interconnector shall not disconnect due to frequency deviations as long as the frequency remains within 47.5-51.5 Hz, unless otherwise agreed by the TSP(s).
- 4.3.6. Enough spinning reserve shall be catered considering N-1 operation to guarantee safe operation after the loss of an interconnection that is exporting energy to Brunei Darussalam.

- 4.3.7. **Power Factor and Reactive compensation requirements:** External Systems shall have adequate reactive compensation to ensure minimum reactive power flowing through the interconnector.
- Each External party is required to ensure that its installation has satisfactory power factor correction to ensure that, the power factor as measured at the Connection point, meets the TSP's current requirement for that part of the System. Unless otherwise required by the TSP, each External Party should use reasonable endeavors to maintain its average power factor between Unity and 0.9 lagging.
- 4.3.8. **Short increases in load flow requirements:** The interconnector shall have adequate capacity to cater for short increases in flow resulting from the loss of the largest generating unit.
- 4.3.9. Under critical conditions, the TSP may demand that the AC power flow in the interconnector be limited to maintain system security operation in Brunei Darussalam.
- 4.3.10. An interconnection schedule outage shall be put forward in order to plan and guarantee the safe operation of the grid when the interconnection is not operative.
- 4.3.11. The interconnector should remain operating under voltage drops such as the ones stated in the FRT capabilities of generators S2 and PE2 (**Sections 3.4 & 3.5**).
- 4.3.12. Metering for all international interconnectors shall consist of three phase meters of minimum accuracy class 0.2S with +/-0.2% limit of accuracy.
- 4.3.13. **Harmonic content:** The maximum total level of harmonic distortion on the existing and any future System from all sources under both scheduled outage conditions must not exceed:
- a) At 275 kV, a total harmonic distortion of 2% with no individual harmonic greater than 1.5%; and
 - b) At 132 kV or 66 kV, a total harmonic distortion of 2% with no individual harmonic greater than 1.5%.

4.4. Metering requirements

- 4.4.1. Fiscal metering shall be required to measure Active Energy and Active Power and Reactive Energy and Reactive Power at Connection Points. This will comprise both import and export metering when reasonably required by the TSP. These data shall be recorded for every half an hour, and stored 45 days on-site. Operating Metering will be required to measure bidirectional Active and reactive power with power quality measurements.

- 4.4.2. Fiscal Metering shall be installed and maintained to measure the Active Energy transferred to and from the National Grid at the Connection Point for each consumer or External Parties. The Fiscal Metering shall be the primary source of data for billing purpose. The Fiscal Metering shall comprise of a main Meter to measure and record the required data and will also include a Check Meter to validate the readings from the main Meter and as back-up metering at the Connection Point to the National Grid.
- 4.4.3. The Fiscal Metering will be located as close as practical to the Connection Point. Where there is a material difference in location, an adjustment for losses between the Connection Point and the CTP may be calculated and agreed by the relevant TSP and the External Party.
- 4.4.4. The TSP that owns the transmission network equipment for importing and exporting through the CTP will design, supply install test, own, operate and maintain the Fiscal Metering at that CTP.
- If, at a CTP, the TSP does not own the substation or premises where the metering equipment is to be located, then the owner of the substation or premises will provide:
- a) 24-hour access and adequate space for metering and communications equipment;
 - b) Reliable power supplies; and
 - c) CT and VT instrument transformers complying with this metering requirements.
- Any remote communications i.e. fibre optic/Ethernet/3G to the metering equipment and Meters, and connection equipment for remote reading and alarm monitoring will be the responsibility of the TSP.
- Another Party may own the metering if agreed in writing between parties.
- 4.4.5. Installed-meters requirements must meet or exceed the performance and functional requirements described in this Code.
- 4.4.6. Metering equipment including voltage and current transformers shall be tested and certified for calibration and accuracy by a third party appointed by the TSP at applicant's own expenses.
- 4.4.7. Meter accuracy class shall be three phase meters of minimum accuracy class 0.5s with +/-0.5% limit of accuracy. Metering current transformers shall be of minimum accuracy class 0.5S with secondary burden of 30 VA for each circuit. Metering voltage transformers shall be of minimum accuracy class 0.5S with 100 V secondary output and a burden of not less than 100 VA per phase per circuit.
- 4.4.8. The owner of a Fiscal Metering will undertake routine testing of the Meters and of the CTs and VTs every 5 years or whenever there are any significant deviations in the monthly readings. In addition, the owner of a Fiscal Metering installation will undertake calibration testing

upon request by the Associated User. The cost of routine test must be met by the owner of the Metering Installation.

- 4.4.9. Defects or malfunctions of the metering transformers requirements shall be the responsibility of the External Party, when those transformers are installed on their apparatus.
- 4.4.10. Access shall be granted by the External Party to enable the relevant TSP personnel to inspect, take readings, or repair the metering installation.
- 4.4.11. Location of meters and adjustments for losses or unaccounted Energy will be resolved by both parties in the relevant Connection Agreement.
- 4.4.12. **Communication Interface:** Interface between the meter and the external reading device (i.e. P.C., hand held devices, etc.) shall be through an optical port located on the front cover and communication serial ports if any. The port shall preferable be compliant to DLMS/COSEM specification (IEC 62056/EN 13757-1). Details of communication interfaces shall be provided.

4.5. Protection Requirements

- 4.5.1. All External Connections to the National Grid shall meet the minimum requirements for relay protection as described in this section of the Code.
- 4.5.2. All transmission system relay protective devices and schemes shall be suitable for the installation being protected following common Utility Practices.
- 4.5.3. The protective relay systems for the External Generating Facilities' switchgear, transformers and related equipment should be adequate to prevent equipment damage for contingencies occurring both within the generating station and outside the generating station on the transmission system. The External Generating Facilities shall be responsible for the operation & maintenance of each protective relay system within its generating station.
- 4.5.4. **Protective device for interconnector requirements:** Protective devices for Unit Protection of interconnectors at a Third Party's Connection Point shall be the same make and model as the protective devices on the TSP side of the interconnector.
- 4.5.5. Apparatus connected to the External Connection shall have protective devices and circuit breakers which ensure that fault clearance times are as fast as possible, but in no cases shall exceed 120 milliseconds.
- 4.5.6. In the event that a circuit breaker connected to the External System or connection fails to interrupt a fault, breaker fail protection shall operate with a fault clearance time not exceeding 300 milliseconds.
- 4.5.7. Back-up protection including over-current and earth fault protection, shall be installed and properly coordinated with other relaying on both the TSP and the External Party's system.

- 4.5.8. For synchronous generators class S2, loss of excitation and pole-slipping protection requirements shall be installed on each External Generating Unit.
- 4.5.9. **Protective current transformers requirements:** shall be of the applicable accuracy class necessary and compatible with the protection requirements of this Code.
- 4.5.10. **Communication equipment requirements:** those required for the protection relays shall be compatible with the protection relays at both ends of any interconnection with the TSP.
- 4.5.11. All transmission interconnections and lines shall have, as a minimum, current differential protection, sync-check relay, distance protection, and back-up over-current and earth fault protection.

Fault clearance times at the Connection Point and the method of system earthing including, where relevant, the recommended generator neutral earthing configuration, will also be provided to External Parties upon request.

External Parties will be expected to coordinate their protection times according to the clearance times given in **Section 4.5**.
- 4.5.12. **Auto-reclosing for overhead transmission interconnections requirements:** shall be agreed upon between the External Party and the relevant TSP on a case-by-case basis.
- 4.5.13. Interconnectors shall be equipped with under-frequency and over-current protection at both ends. Power Swing and Out-of-Step relays shall be installed at the external connection end of the interconnector. Relay settings shall be reviewed and approved by the Director of the TSP or to whom he/she assigns.
- 4.5.14. Protection relays at both ends of the interconnector shall be capable of monitoring and recording, in high resolution, active and reactive power flow, voltage, frequency, and device statuses.
- 4.5.15. At least once a year, each TSP shall review its protection strategy and concepts and update them where necessary to ensure and maintain operational security.

4.6. Earthing Requirements

- 4.6.1. **Earthing Systems:** All Substation Earthing Systems should have Earth Resistance lower than 1 Ohms for effective discharge of lightning or over voltages to earth. The current carrying paths of an Earthing System should have enough capacity to deal with maximum fault current. Earthing Mat shall be provided below ground level and earth electrodes shall be driven into ground at several points and shall be connected to the Earthing Mat to form an Earthing Mesh. All structures, transformer tanks, breakers, equipment panels shall be connected to this mat by copper strips.

- 4.6.2. **Periodic Checks on Earthing Systems:** Buried elements of the earthing system should be checked for condition at random points as and when necessary but not exceeding a period of two (2) years.

4.7. Communication Requirements

- 4.7.1. External Generation and Systems shall have two independent voice communication links between their Control Center and the TSP SCADA system.
- 4.7.2. External Party must provide telecommunication infrastructure to the point of connection inclusive of the maintenance of the telecommunications infrastructure
- 4.7.3. Communication Links required for Protective Relaying shall be installed and maintained by the External Party and must be compatible with relaying at both ends of the interconnector.

4.8. Maintenance Requirements

- 4.8.1. Interconnectors shall be maintained in accordance with the Maintenance Requirements of this Code.
- 4.8.2. Requests for maintenance outages shall be coordinated and switching, isolating, testing, and earthing shall follow the requirement of the safety section of this Code.
- 4.8.3. The grid operator shall, on a yearly basis, draw up a provisional generator maintenance schedule plan, as well as a transmission maintenance schedule plan for the coming year.

5. REQUIREMENTS FOR DISTRIBUTION GRIDS

5.1. Introduction

- 5.1.1. These requirements contain a set of technical rules that facilitate coordinated planning, design, development and operation of the distribution system. The distribution system corresponds to the portion of the electrical Grid operated at voltage levels of 11 kV and below, and which are operated by a DSP.
- 5.1.2. The design shall meet the requirements in the Electricity Order 2017 Section 17 and as stipulated in the Electrical Installation Requirements.
- 5.1.3. The principles of design, manufacture, testing and installation of distribution equipment, overhead lines and underground cables, including quality requirements, shall conform to applicable statutory obligations and shall comply with relevant Brunei Darussalam standards and IEC publications.
- 5.1.4. The DSP or electricity network company has the right to install and maintain meters within the customer's property along with other equipment which may be required to control the consumption or disconnection of the customer's installation.
- 5.1.5. All existing work at the consumer's facility shall be carried out in accordance with current regulations. Only authorized or registered or licensed electrical workers shall be engaged for the execution of the work, unless otherwise provided by applicable regulations.
- 5.1.6. All work on the consumer's plant must be carried out in accordance with current regulations, and unless otherwise provided by applicable regulations, a registered or licensed electrical worker must perform the work.
- 5.1.7. Connection of the consumer's facility to the network may only be carried out by the DSP.
- 5.1.8. Electrical installation work which entails the need for new or changed connection, or which would result in significant changes to the consumer's consumption of electricity must be notified in writing to the DSP by a registered or licensed electrical worker prior to the commencement of the work.
- 5.1.9. The consumer is responsible for having the right fee-determining fuse carrier and fuse. Changes to the fee-determining fuse carrier or fuse may only take place with the express consent of the DSP.
- 5.1.10. The consumer may not interconnect the DSP's facility with another power source or facility unless otherwise agreed.
- 5.1.11. For safety reasons any unused secondary circuits of current transformers must be shorted. Fuses are not permitted in the secondary circuits of current transformers.

- 5.1.12. Refer to provisions in the Electricity Order 2017 for conditions relating to the DSP's right to interrupt the transmission of electricity due to a breach of contract by the consumer.

5.2. Planning and development

- 5.2.1. Network planning must have a long-term perspective, and a focus on the structure and capacity within a specific network area.
- 5.2.2. The technical solution must meet the requirements for electrical safety, delivery security, quality, environmental considerations, legal requirements, and finances.
- 5.2.3. Development of the Grid System, involving its reinforcement or extension, will arise for a number of reasons including, but not limited to:
- a) Growth in demand for electricity on a system-wide basis;
 - b) the addition of new generating Capacity, modification of existing generating Capacity, or the removal of generation Capacity connected to the Grid System by a user;
 - c) a development on a user's Network already connected to the Grid System;
 - d) the introduction of a new Connection Point or the modification of an existing Connection Point between a user's Network and the Grid System;
 - e) Transient or steady state stability considerations.
- 5.2.4. Grid System developments must be planned with sufficient lead-time to allow any necessary consents to be obtained and detailed engineering, design and construction work to be completed.
- 5.2.5. All cables and devices in a network must be dimensioned to withstand any short-circuit currents and peak currents.

- 5.2.6. Example of planning levels for different levels of redundancy can be seen in **Table 3:**

Table 3: Planning levels for different levels of redundancy

Network	Redundancy	Remarks
Feeding/upstream network	n-1	
Cable network, MV	n-1	Main feeder, ring circuits
Overhead lines Rural network, MV	n-1	Depending on number of customers
Generation, MV	n-0	Static or back-up generator
Large customer	n-1	
Critical customers	n-1	Customers are to implement N-2 redundancy if there is such a requirement and at their own cost
MV/LV substation	n-0 or n-1	Depends on customers reliability requirement

- 5.2.7. The extent of an electricity grid shall be presented on a map or in a grid diagram. The geographical planning is verified with the help of electrical calculations and, if necessary, the geographical planning is adjusted. The following is investigated using the map:
- Network structure;
 - Possibility of reserve supply;
 - Cable lengths;
 - Reliability, faults caused by external circumstances;
 - Adaptation to geographical conditions.
- 5.2.8. When planning networks, existing and future buildings must be taken into account. The facilities must always be planned so that they are easily accessible from a maintenance and service point of view.
- 5.2.9. When planning a new line, it is advisable to follow road edges or other lanes. It often provides some protection for the line, gives less ground impact and simplifies access to the line.

5.3. Reliability and interruption

- 5.3.1. Reliability is described in the simplest way based on interruption length and interruption frequency and is affected by the selected design as well as network structure and degree of automation. The key figures for interruption length are SAIDI and SAIFI.
- 5.3.2. For critical customers, where interruptions may have major consequences, a minimum delivery security should be as stated in **Table 4**:

Table 4: Minimum delivery security for interruptions that may have major consequences in a distribution grid

Load interval [MW]	Maximum downtime [hr]	Corrective Actions
< 2	1	restoration or reserve supply
2 ≤ x < 5	1	Full switching reserve in MV-grid and transformer reserve in feeding station
5 ≤ x < 20	1	Full switching reserve in MV-grid and transformer reserve in feeding station
20 ≤ x < 40	1	Normal supply and reserve from different Busbars in feeding station or different feeding stations

- 5.3.3. The DSP has the right to inspect the consumer's facility. If the DSP detects faults in the consumer's system during connection or inspection, the DSP shall inform the consumer of this, and has the right to immediately disconnect the facility should it determine that such faults present a risk to the DSP network, or the facilities of other consumers connected to the network.
- 5.3.4. The DSP has the right to interrupt the transmission of electricity in order to take measures that are justified for electrical safety reasons or to maintain good operational and delivery security. In no case may the interruption last longer than such measures require.

5.4. Operating conditions

- 5.4.1. The frequency of the DSP's Distribution System shall follow the frequency stated by the planning criteria in **Section 2.3** of this Code.
- 5.4.2. The standard operating voltage at the PCC for 230 V and 400 V shall be +10% and -6%. For other voltages up to 11 kV, the DSP shall strive to maintain the voltage between +/- 10% of the nominal value.

5.5. Magnetic field requirements

- 5.5.1. Magnetic fields need to be taken into account, both near lines and cables as well as within stations in the vicinity of switchgear.
- 5.5.2. As a planning level can be used a certain magnetic field strength at a certain distance from the current-carrying equipment.
- 5.5.3. Care should be taken with the placement of switchgear and transformers in buildings which are used for other activities, such as offices and homes, as magnetic fields are difficult to shield and magnetic phenomena can also give rise to radio noise.

5.6. Protection requirements

- 5.6.1. The protection requirements stated in this section shall be regarded as complementary to the ones stated in **Section 6.4** of this Code.
- 5.6.2. For all generators connected to a distribution grid, the maximum fault clearance time of their protections must be within the limits established by the relevant DSP, taking into account its protection and equipment short circuit rating policies.
- 5.6.3. The protection for generators connected to the distribution grid must protect, at least, against:
 - a) Over voltage;
 - b) Under voltage;
 - c) Over frequency;
 - d) Under frequency;
 - e) Loss of mains.

Other common protections used on generators connected at the distribution grid consist of current differential relays, over-current and earth fault protection, reverse power protection and neutral voltage displacement (NVD) protection. The DSP may require these and other additional protections requirements considering the structure and planning of the distribution grid, size of the generator and the specific point of connection.

- 5.6.4. Auto-reclosing or sequential switching features may be used by the distribution grid and hence additional precaution must be taken when connecting to the distribution grid.
- 5.6.5. Tripping devices can be equipped with remote control to meet requirements for shorter down times. Interruption time per customer is significantly reduced when using a well-functioning remote-controlled network.
- 5.6.6. A common additional function for tripping devices is the reporting of information on voltage, load current, temperature, etc., which can be useful for, among other things, operational monitoring.

5.7. Generation in the distribution grid

- 5.7.1. Generators connected directly to the distribution grid shall follow the Generation requirements stated in **Section 3** of this Code in addition to the requirements under **Section 5.7**
- 5.7.2. Protection requirements regarding generators connected in the distribution grid can be found in **Section 5.6**.
- 5.7.3. It is important that the electricity network company is contacted well in advance before installation of an electricity production plant to investigate whether a possible network reinforcement is required, possible replacement of electricity meters (measurement of both consumption and production) and whether any special requirements are placed on the production plant's installation and design.
- 5.7.4. The DSP is responsible for ensuring that all customers have a delivery quality that meets current standards. For this reason, the DSP must make demands on all customers who risk affecting the electric power quality in the network. Similarly, special requirements are placed on producers regarding the electrical properties of production facilities.
- 5.7.5. A written notification must be made to the relevant DSP for each Connection Point to the electricity network company's network before the work may begin.
- 5.7.6. Before the first connection of the production plant, the plant must be notified and a network agreement must be signed.
- 5.7.7. Protocols on performed functional tests of the electrical protection functions for the finished system must be attached.
- 5.7.8. If an individual earthing is included, measured earthing resistance must also be included.
- 5.7.9. If the design deviates from what is stated in the pre-notification, new information must be submitted for approval by the DSP. Before commissioning, the electricity network company DSP shall be given the opportunity to:
 - a) perform check of connection and measuring device;
 - b) participate in function tests of protection relay system;
 - c) participate in connection.
- 5.7.10. The plant may not be put into operation until after the DSP has given its consent.
- 5.7.11. Upon request, the DSP must provide the value of the network impedance at the Connection Point so that the owner of the production plant, or his electrician, can carry out a correct electrical dimensioning.

- 5.7.12. When designing a new low-voltage network where several production facilities are planned, a calculation of aggregated effects for harmonics and flicker may be carried out. If an existing low-voltage grid with production is to be supplemented with additional production facilities, it is proposed that an electricity quality measurement be also carried out.

5.8. Load flow calculations

- 5.8.1. Load flow analysis is used to verify that all technical requirements are met for the various load / production flows that occur in the network, both during normal operation and reserve operation.
- 5.8.2. For networks without generation, the worst case that occurs at maximum load is analyzed.
- 5.8.3. Empiric formulas can be used to calculate aggregation of loads in low-voltage networks. For larger customers, either maximum power or hourly values can be used instead.
- 5.8.4. If there is generation in the network, two load cases must be analyzed:
- Maximum production and minimum load;
 - Minimum production and maximum load.

5.9. Demand forecast

- 5.9.1. In order for the DSP to operate the DSP's Distribution System efficiently and to ensure maximum System security and System Stability, there is a need for those users specified below to provide loading and generation output information to the DSP.
- 5.9.2. Where Demand data is required from the user, this means the MW Demand of electricity at the DSP point of supply to the user. The DSP may, in certain cases, specify that the Demand data shall include the MVA Demand.
- 5.9.3. The DSP will co-ordinate all Demand forecast information for each Grid Supply Point to meet the requirements of this Code. The DSP will aggregate forecast information provided by users, where appropriate, and provide forecast information to the TSP where the Demand, or change in Demand, is equal to or greater than the Demand Control Notification Level at any DSP Connection Point.

- 5.9.4. The following factors will be taken into account by the DSP and users when conducting Demand forecasts in the Operational Planning Phase:
- a) Historic Demand data and trends;
 - b) Weather forecasts (responsibility for weather correction of user's Demand rests with the user);
 - c) Incidence of major events or activities;
 - d) Embedded Power Generating Module or Embedded Transmission System Schedules;
 - e) Demand transfers;
 - f) Interconnection with adjacent Other Authorized Distributors;
 - g) Demand Control proposed to be operated by Suppliers;
 - h) Any other factor reasonably considered necessary.
- 5.9.5. Where applicable, the design temperature of a cable may differ depending on the use and normal operating conditions. For example, 90°C during normal operation and 130°C during reserve and emergency operation for XLPE cable.

6. OPERATING AND TECHNICAL OBLIGATIONS

6.1. Responsibilities

- 6.1.1. The Grid Control Centre shall be responsible for the secure operation of the transmission (and distribution) network.
- 6.1.2. External Parties shall maintain and operate their installations to ensure that they will not cause any adverse impact to the stability, security, and reliability of the power system.
- 6.1.3. External Parties shall take adequate precautions to ensure no part of the National Grid is energised by their system from another source of supply unless it is requisition in writing as an exceptional arrangement. The switchgear and controls of the External Parties' system shall be so designed as to prevent back- energisation.

6.2. Standards and Standard Operating Procedures

- 6.2.1. All plant and equipment shall be in compliance with the technical requirements of this Code and be designed and constructed in accordance with Good Utility Practice.
- 6.2.2. All plant and equipment shall be capable of operating under normal and contingency situations described in this Code.
- 6.2.3. All installed equipment shall comply with the international standards and codes listed in **Appendix F** of this Code.
- 6.2.4. The TSP and DSP shall develop Standard Operating Procedures (SOP) to ensure secure operation of the grid. Relevant SOP's shall be shared with External Parties.

6.3. Electric and magnetic field requirements

- 6.3.1. Intensity of electric and magnetic fields shall be calculated at the edge of right of way for different line configurations and voltage levels.
- 6.3.2. Safety level with respect to human exposure to electromagnetic field shall also be determined and maintained in accordance with **IEEE C95.1**

6.4. Protection system requirements

- 6.4.1. All external connections shall comply with the protection requirements in **Section 4.5** of this Code and compatible with the National Grid at the interconnector.
- 6.4.2. Protection system shall be properly maintained in accordance with Good Utility Practice, this Code, and relevant Connection Agreements.
- 6.4.3. All External Connections shall operate their installations with all protective devices in service at all times.

6.5. Voltages requirements

- 6.5.1. Connected apparatus shall be designed for use at the appropriate voltage levels which can vary +/-5% from nominal values.
- 6.5.2. Transient voltages due to switching or tripping of apparatus on the transmission system will often temporarily exceed the limits stated above. All connected plant and apparatus shall be designed to survive such events in line with international standards.

6.6. Load Reactive Power requirements

- 6.6.1. Load connections at the transmission or distribution level shall aim at maintaining power factor between 0.9 and 1.

6.7. Harmonics and Power Quality requirements

- 6.7.1. All External Parties shall have equipment installed to suppress harmonics and electrical noise so as not to exceed the levels stated in **Appendix E** of this Code.
- 6.7.2. All External Parties shall have their own stand-by generation facilities if their operations cannot tolerate any failure, temporary interruption, variation, or inconsistency of the connection to the grid.
- 6.7.3. All External Connections shall have their own uninterruptable power supply (UPS), voltage stabilizers, or other means to serve the facility if their operations cannot tolerate any voltage fluctuation or supply distortions.

6.8. Equipment Labeling and Nomenclature requirements

- 6.8.1. All apparatus connected to the transmission Grid shall maintain a uniform system of nomenclature and labeling which matches exactly that found on all operating diagrams. Conventions for nomenclature shall be mutually agreed upon by the connected party and the Director of the TSP or to whom he/she assigns.

6.9. Substation Switchgear Design requirements

- 6.9.1. Connected Transmission switch-gear shall be designed such that no single failure shall cause simultaneous outages of two or more generating units connected to the switch-gear. Substation Switchgear Design shall meet the TSP requirement and specifications.

6.10. Generating Unit Design requirements

- 6.10.1. Generating Units shall comply with the relevant IEC, BS, or other relevant international standards. Connection of generating units shall not cause any unacceptable consequences which jeopardize power system stability, security, and reliability.

- 6.10.2. Short Circuit current contribution at the Connection Point shall be of a magnitude within the limits agreed upon in the Connection Agreement.
- 6.10.3. S2 generating facilities shall be capable of operating with, but not limited to natural gas, liquid fuel or coal. Remote Monitoring and AGC requirements.
- 6.10.4. External Parties shall have RTU's or firewalled TCP/IP interfaces with substation automation systems at their primary substations which allow The TSP SCADA system to monitor and control circuit breakers, isolators, and earthing switches. Measurement of power flow, frequency, voltages, and transformer tap settings shall also be provided through the RTU. Existing interconnections to the DES grid, used for emergency conditions only, are currently exempt from this requirement.
- 6.10.5. For all External Generating Stations, viewing only of their primary substations shall be provided to the National Control Centre (SCADA) system. The mode of interface may be either via direct RTU interface or firewalled TCP/IP connection to the Generating Stations substation automation system. All serial connections shall be redundant. Monitor and control of circuit breakers, isolators, and earthing switches as well as the measurement of power flow (active and reactive), frequency, voltages, and transformer tap position shall also be provided through the RTU.
- 6.10.6. For all Generating Stations, allowance shall be made in the plant control system for connection of the TSP SCADA system for viewing and dispatch functions. This connection is to be made via firewalled redundant TCP/IP interfaces complying with any of the communications standards listed in **Appendix F**, although **IEEE 1815** is preferred. The dispatch logic shall be as agreed with the TSP.
- 6.10.7. Communication equipment required for remote monitoring and control between the connected party and the TSP SCADA system shall be provided by and maintained by the connected party. The design and implementation of all hardware and software shall be approved by the TSP and no equipment shall be connected to the TSP SCADA communications equipment without the written approval of the TSP.
- 6.10.8. Communications protocols as indicated in **Appendix F** shall be implemented as expressly defined in the respective standards, even where such standards allow for extension of the protocols, unless prior approval from the relevant TSP is obtained. Where a protocol is extended or modified without prior written agreement, the TSP reserves the right to deny connection to the TSP SCADA communication systems.
- 6.10.9. Back-up AC power and battery back-up capable of 8-hour operation shall be installed for all communication and control equipment at the External Party's facilities.

6.11. Performance Monitoring requirements

- 6.11.1. All connection to the transmission Grid shall have performance monitoring and transient recorders installed, which shall be capable of monitoring and recording the dynamic performance, including voltage, frequency, and device status, of the equipment during disturbances. Information from these devices shall be provided to the TSP Operations when requested.
- 6.11.2. **An annual report** shall be drawn up by the TSP which shall contain at least the following operational security indicators relevant to operational security:
- a) Number of tripped transmission system elements per year;
 - b) Number of tripped generator facilities per year;
 - c) Energy not supplied per year due to unscheduled disconnection of demand facilities;
 - d) Time duration and number of instances of being in the alert and emergency state;
 - e) Time duration and number of events within which there was a lack of reserves identified;
 - f) Time duration and number of voltage excursions beyond normal transmission voltages (+/- 5%) and system stress voltages (+/- 10%);
 - g) Number of minutes outside the normal operating condition frequency range (49.5-50.5 Hz) and number of minutes outside the maximum frequency deviation during faults (47.5-51.5 Hz);
 - h) Number of local blackouts or system-split separation if applicable.

7. SAFETY, INSPECTION AND MAINTENANCE REQUIREMENTS

7.1. Safety, isolation and earthing

- 7.1.1. **Safety procedure requirements:** All work on External Connections shall take place following safety procedures in line with existing the TSP "Safety Rules and System Operating Regulations" to ensure the safety of personnel and equipment.
- 7.1.2. **Switching program requirements:** All External Parties shall establish and follow strict procedures for switching, isolating, testing, and earthing at all times as described in this Code.
- 7.1.3. **Exchange of Safety Rules and Operations Regulations requirements:** Where work is to take place on either side of the Connection Point between the TSP and External Parties, the TSP's "Safety Rules and System Operations Regulations" shall be followed. Copies of the applicable policies will be shared with External Parties.
- 7.1.4. **Method Statements and Risk Assessments (RAMS) and Job Hazard Analysis (JHA) requirements:** Whenever work is carried out on an interconnector which could impact the security and reliability of the National Grid, the External Party shall create detailed Method Statements and Risk Assessments as well as Job Hazard Analysis to be reviewed and agreed upon by the TSP prior to carrying out the work.
- 7.1.5. **Brunei Workplace Safety and Health Order requirements:** All work carried out on either side of an Interconnector or other apparatus connected to the National Grid shall comply with Brunei's current "Workplace Safety and Health Order".
- 7.1.6. **Only Competent Persons** shall work on an Interconnector or other apparatus belonging to the TSP. Competent Person shall be an electrical personnel who had received the appropriate training and qualified certification required to meet the needs of electrical professionals.
- 7.1.7. **Additional Safety Rules and Operation requirements:** Switching, Isolation, Testing, and Earthing of all high-voltage apparatus connected to the National Grid shall be carried out in accordance with the TSP's "Safety Rules and System Operating Regulations".
- 7.1.8. **Additional requirements for work on apparatus connected to the National Grid:** Work on any lines, cables or apparatus connected to the National Grid shall be carried out in strict compliance with the "Permit to Work" system and the TSP's "Safety Rules and System Operating Regulations", as applicable
- 7.1.9. **Isolation requirements:** Requests for isolating equipment, which is connected to the National Grid shall be made to the National Control Centre for prior approval.

- 7.1.10. **Additional requirements for work:** All work taking place inside or near substations or apparatus connected to the National Grid shall be supervised by persons deemed as Persons-in-Charge (PIC's) by the relevant TSP.
- 7.1.11. **Contractors of External Parties requirements:** All contractors working on External Parties installations connected to the National Grid must have considerable and sufficient experience in carrying out such works and must be overseen by a recognized Person- in-Charge.

7.2. Inspection and Maintenance

- 7.2.1. **Facilities connected to the transmission system:** External Parties are individually responsible for the maintenance of their equipment and components within their facilities and to ensure that all equipment complies with applicable standards and requirements set forth in this Code, as well as in relevant Connection Agreements and Operation Agreements. The equipment must be regularly tested and maintained according to the standard test as prepared by the External Parties and approved by the TSP.
- 7.2.2. **Competent Person requirements:** External Parties shall inspect, test, monitor, and maintain their facilities carried out by Competent Person(s) that meet the prescribed requirements in terms of qualified personnel and equipment for performance of works or TSP recognized competent persons who have been adequately trained to carry out the work as well as to protect both themselves and the public.
- 7.2.3. **Defect rectification:** External Parties shall rectify any defects discovered during routine inspection, testing, and monitoring within a reasonable period of time or within specific periods of time described in the relevant Connection or Operating Agreements with the TSP.
- 7.2.4. **Maintenance process requirements:** External Parties shall have a systematic maintenance process, including inspection and testing intervals, logging of defects and tracking to ensure that necessary repairs or follow-up activities are carried out.
- 7.2.5. **Spare part requirements:** External Parties shall ensure that they carry an inventory of strategic spare parts for timely replacement of faulty parts of generation facilities and apparatus connected to the transmission network.
- 7.2.6. **Maintenance record requirements:** External Parties shall maintain records of all inspections, testing, monitoring, and maintenance activities for a period of six years.

A.1. Demand Data Requirements for Planning Purposes

A.1.1. External Parties wishing to connect loads to the transmission network shall provide the following information to the TSP with respect to demand of the installation:

- a) Location of the development;
- b) Anticipated maximum active and reactive power demand;
- c) Projected demand growth over the life of the development;
- d) Type of loads;
- e) Typical daily load pattern;
- f) Typical annual maximum demand pattern.

A.2. Particular Load Information for loads exceeding 1 MW

A.2.1. Each connected party whose load includes motors of fluctuating loads or voltage sensitive load, which has the potential to have an adverse impact on the operation of the power system, shall provide the TSP the following information:

- a) The capacity, starting current and supply voltage of all large motors;
- b) The capacity, anticipated load fluctuation and supply voltage of any large plant at the facility;
- c) The capacity and supply voltage of voltage sensitive plant or equipment causing harmonics and phase imbalance;
- d) Protective devices for the installation;
- e) Detailed data with respect to the proposed Connection Point.

A.2.2. Details should be provided on any individual loads which have characteristics differing from the typical range of loads in domestic, commercial or industrial fields. In particular, details on arc furnaces, rolling mills, traction installations etc. that are liable to cause flicker problems to other consumers.

APPENDIX B. GENERATING UNIT REQUIREMENTS

B.1. Preliminary Generating Unit Data for thermal units

To be submitted for consideration of connection to the transmission system. External Generating Facilities seeking connection to the transmission system shall provide the following information described in this Appendix:

B.1.1. General

- a) Name of the Generating facility;
- b) Total generation capacity (MW & MVA);
- c) Description and configuration of the facility, including the types and quantities of the generation;
- d) Maximum available output for each generator;
- e) Minimum stable load for each generator;
- f) Short circuit current contribution for each generator unit;
- g) Schedule for commissioning each phase of the facility;
- h) Total power required for auxiliary equipment;
- i) Internal load intended to be supplied by proposed generation facility.

B.1.2. Generating Unit performance parameters

- a) Name of the generator unit;
- b) Unit Number;
- c) Manufacturer;
- d) Rated terminal voltage;
- e) Rated MVA capacity;
- f) Rated power factor:
 - i. Over-excited (lagging) _____;
 - ii. Under-excited (leading) _____;
- g) Short-circuit ratio at rated voltage and current _____;
- h) Direct axis short-circuits time constants:
 - i. Transient ($T'd$) _____;
 - ii. Sub-transient ($T''d'$) _____;
- i) Direct axis open-circuit time constants:
 - i. Transient ($T'do$) _____;
 - ii. Sub-transient ($T''do$) _____;
- j) Quadrature axis open-circuit time constants:
 - i. Transient ($T'qo$) _____;
 - ii. Sub-transient ($T''qo$) _____;
- k) Direct Axis synchronous reactance (X_d):
 - i. Unsaturated _____ %;

- l) Direct axis transient reactance ($X'd$):
 i. Unsaturated _____ %;
 ii. Saturated _____ %;
- m) Quadrature axis unsaturated reactance:
 i. Synchronous (Xq) _____ %;
 ii. Transient ($X'q$) _____ %;
 iii. Sub-transient ($X''q'$) _____ %;
- n) Potier reactance (X_p) _____ %;
- o) Leakage reactance (X_1) _____ %;
- p) Negative phase sequence reactance (X_2). _____ %;
- q) Zero phase sequence reactance (X_0). _____ %;
- r) Armature winding short-circuit Time constant (T_a). _____ Seconds;
- s) Main field current at no load and rated voltage _____ Amps;
- t) Main field current at full load, rated voltage and rated power factor over-excited _____ Amps;
- u) Resistance of main field windings at operating temperature of. ____ °C _____ Ohms;
- v) Machine damping factor (K_D)_____;
- w) "Turbine + Generating Unit" Inertia Constant (H) for S2 ____ MW x s/MVA;
- x) Saturation curves:
 i. To indicate the corresponding field current values at 1.0 pu and 1.2 pu of terminal voltage on the air-gap and open circuit curves;
 ii. V-curve;
 iii. Reactive capability curve;
 iv. Factory test reports and field test result, if any.

B.1.3. Generation Step-up transformers

- a) Rated MVA Capacity _____ MVA;
- b) Rated voltage:
 i. Primary _____ kV;
 ii. Secondary _____ kV;
- c) Nominal voltage ratio _____;
- d) Positive Sequence impedance at:
 i. Maximum tap _____ %;
 ii. Minimum tap _____ %;
 iii. Nominal tap _____ %;
- e) Zero sequence impedance _____ %;
- f) Tap changer range _____ +/- %;
- g) Tap changer step size _____ %;

- h) Tap changer type on load / off load;
- i) Winding connection vector group _____;
- j) Magnetizing curve;
- k) Earthing Resistor (if any):
 - i. Primary side _____;
 - ii. Secondary side _____.

B.1.4. Excitation Systems

- a) Voltage regulator model name;
- b) Functional description and block diagram showing transfer function of individual element of the excitation system and the AVR;
- c) The setting and block diagram showing transfer function of individual element of the minimum and maximum excitation limiters.
- d) The setting of limiters is to be plotted in the Generating Unit Reactive Capability Curve;
- e) Exciter saturation curve data, if applicable and available;
- f) Commissioning tests and other field tests.

B.1.5. Power System Stabilizers (PSS)

- a) Functional description and block diagram showing transfer function of individual element of the PSS;
- b) Report on methodology in deriving the PSS setting, including simulation results and tuning procedures;
- c) Commissioning tests and other field tests.

B.1.6. Steam Turbine Unit Data

- a) Rated MW capacity;
- b) Power fraction for High Pressure (HP), Intermediate Pressure (IP), and Low Pressure (LP) turbines;
- c) Control design – functional description and block diagram showing transfer function of individual element of the governor/turbine/boiler;
- d) Test data and reports:
 - i. Control and intercept valve curves:
 - Position vs. signal;
 - Valve opening vs. signal;
 - Closing / opening speed tests;
 - ii. Load rejection tests;
 - iii. Load step response tests;
 - iv. Frequency response tests;
 - v. Change in steam turbine unit output for sudden change in gas turbine unit output, including gas turbine unit outage (for combined-cycle units).

- e) Generator boiler control strategy, including:
 - i. Whether constant or variable pressure;
 - ii. If constant pressure, boiler follows, turbine follows, or coordinated control;
 - iii. If coordinated control, frequency and pressure biases;
 - iv. If variable pressure, pressure and control valve position as a function of load levels;
- f) Control strategy following outages of one or more gas turbines (for combined-cycle);
- g) Steam unit power vs. exhaust temperature, air flow, and power of gas turbine units (for combined-cycle units).

B.1.7. Gas Turbine Units

- a) Rated MW capacity;
- b) Performance data and curves;
 - i. Power vs. fuel consumption;
 - ii. Exhaust Temperature vs. fuel consumption;
 - iii. Power vs. ambient temperature;
 - iv. Power vs. speed;
 - v. Inlet guide vane effects.
- c) Control design – functional description and block diagram showing transfer function of individual element of gas turbine units (including effect of ambient temperature) in PSSE format;
- d) Test data and reports:
 - i. Load rejection tests;
 - ii. Frequency response tests.

B.1.8. Generating Unit Protection

- a) Loss of excitation relays:
 - i. CT ratios;
 - ii. VT ratios;
 - iii. Settings.
- b) Under-frequency relays settings;
- c) Over-frequency relay settings;
- d) Other relay settings such as under-voltage protection for auxiliary equipment.

All data to be provided shall be in per unit magnitudes with MVA base specified. Generating unit and generation unit's step-up transformer data shall be provided in rated MVA Capacity base.

B.2. Preliminary Generating Unit Data for PV based non-synchronous generators

To be submitted for consideration of Connection to the transmission or distribution system. External Generating Facilities seeking Connection to the transmission system shall provide the following information described in this Appendix:

B.2.1. General

- a) Name of the Generating facility;
- b) Total generation capacity (MW & MVA);
- c) Description and configuration of the facility, including the types and quantities of the generation including PV inverters and, if applicable, any connected storage unit;
- d) Maximum available output for each generator;
- e) Minimum stable load for each generator;
- f) Short circuit current contribution for each generator unit;
- g) Schedule for commissioning each phase of the facility;
- h) Total power required for auxiliary equipment;
- i) Internal load intended to be supplied by proposed generation facility.

B.2.2. DC converter parameters

- a) DC converter type (i.e. current or voltage source);
- b) Number of poles and pole arrangement;
- c) Rated DC voltage/pole (kV);
- d) Nominal secondary (converter-side) voltage(s) (kV);
- e) Winding and earthing arrangements;
- f) Positive phase sequence reactance at minimum, maximum and nominal tap;
- g) Positive phase sequence resistance at minimum, maximum and nominal tap;
- h) Zero phase sequence reactance;
- i) Tap-changer range in %;
- j) Number of tap-changer steps.

B.2.3. DC network parameters

- a) Rated voltage per pole;
- b) Rated DC current per pole;
- c) Single line diagram of the complete DC network;
- d) Details of the complete DC network, including resistances, inductances and capacitances of all DC cables or lines;
- e) Details of any DC reactors, DC capacitors and/or DC side filters in the network;

B.2.4. AC filter reactive compensation equipment parameters (if applicable)

- a) Total number of AC filter banks;
- b) Type of equipment (fixed/variable);
- c) Single line diagram of filter arrangement and connections;
- d) Reactive power rating for each AC filter at rated voltage;
- e) Performance chart illustrating reactive power capability of the DC converter, as a function of MW transfer, with all filters and compensation devices connected to the DC converter station online;
- f) Synthetic inertia if any.

B.2.5. Generating facility flexibility performance

- a) Nominal and maximum (emergency) loading rate with the DC converter in rectifier mode;
- b) Nominal and maximum (emergency) loading rate with the DC converter in inverter mode;
- c) Maximum recovery time to 90% of pre-fault loading following an AC system fault/ voltage dip;
- d) Maximum recovery time to 90% of pre-fault loading following a transient DC network fault.

B.2.6. For power storage units (if any), regarding functions in the BMS

- a) Metering and monitoring;
- b) Safety protections;
- c) Data communication and performance;
- d) BMS data communication.

B.2.7. Generation Step-up transformers

- a) Rated MVA Capacity _____ MVA;
- b) Rated voltage:
 - i. Primary _____ kV;
 - ii. Secondary _____ kV;
- c) Nominal voltage ratio _____;
- d) Positive Sequence impedance at:
 - i. Maximum tap _____ %;
 - ii. Minimum tap _____ %;
 - iii. Nominal tap _____ %;
- e) Zero sequence impedance _____ %;
- f) Tap changer range _____ +/- %;
- g) Tap changer step size _____ %;
- h) Tap changer type on load / off load;
- i) Winding connection vector group _____;

- j) Magnetizing curve;
- k) Earthing Resistor (if any);
 - i. Primary side _____;
 - ii. Secondary side _____.

B.2.8. Generating Unit Protection

- a) Under-frequency relays settings;
- b) Over-frequency relay settings;
- c) Other relay settings such as under-voltage or over-voltage.

B.3. Preliminary Data for electricity storage units

To be submitted for consideration of Connection to the transmission or distribution system. Electricity storage units seeking Connection to the transmission system shall provide the following information described in this Appendix:

B.3.1. Power Storage Unit

- a) Rated output power at nominal voltage;
- b) Energy;
- c) Type;
- d) Allowable charging capacity;
- e) Discharging capacity;
- f) Round-trip AC energy efficiency (including auxiliaries) at nominal system voltage;
- g) Cycle life;
- h) Any technical prospective scenario leading to limitations on the above performance characteristics.

B.4. Black Start generating Unit Capability Data for S2 generators

- a) Name & Location of Black Start generating unit;
- b) Type of generating unit: Diesel/Gas;
- c) Unit Number;
- d) Manufacturer;
- e) Model;
- f) Rated Terminal Voltage: _____ kV;
- g) Rated MVA capacity: _____ MVA;
- h) Rated Power Factor:
 - i. Over-excited (leading);
 - ii. Under-excited (lagging);
- i) Time from Notification given to synchronization: _____ Hours;

- j) Start-up curve (from Synchronization to Minimum Stable Load);
 - i. Time from minimum stable load to full load: _____ Hours;
 - ii. Maximum ramp rate: _____ MW/min;
- k) Capability curve:
 - i. Reactive power capability Curve;
 - ii. Factory Test reports and field tests results;
- l) Black start capability test report shall include the following:
 - i. Detailed single-line diagram of the station and switch-board, Auxiliaries, Emergency diesel generating units and Black-start generating units connected;
 - ii. Detailed test procedures, from initial isolation from the Transmission system, start-up of Black-start generating unit(s) until synchronization to the system;
 - iii. Records of key timing, load (active and reactive) profile, voltage profile of black-start generating unit(s) during run-up of auxiliary equipment.

B.5. Commissioning Tests for S1 and S2 generators

Where applicable, the following tests shall be included prior to commissioning External Generating Facilities without causing adverse impact to the National Grid and subject to approval by the TSP (S2 generators) and the DSP (S1 generators):

- a) Excitation tests;
- b) Load Rejection tests;
- c) Load Swing tests;
- d) On load trip tests;
- e) Combustion tests;
- f) Performance tests;
- g) Load Runback tests;
- h) HP/LP heater tests;
- i) Power system stabilizer tests only S2 generators;
- j) Vacuum loss Runback tests;
- k) Governor Valve linearization tests;
- l) Boiler feed-pump Runback tests;
- m) FDF Runback tests;
- n) Cold/Warm/Hot Start Tests;
- o) Automatic generation control tests;
- p) Spinning reserve capability tests.

B.6. Commissioning Tests for PE2 and PE1

Where applicable, the following tests shall be included prior to commissioning External Generating Facilities without causing adverse impact to the National Grid and subject to approval by the TSP (PE2 generators) and the DSP (PE1 generators):

- a. Limited frequency sensitive mode- over frequency (LFSM-O): The test shall be carried out by simulating frequency steps and ramps big enough to trigger at least 10 per cent of rated capacity change;
- b. Limited frequency sensitive mode- under frequency (LFSM-U): The test shall be carried out by simulating frequency steps and ramps big enough to trigger at least 10 per cent of rated capacity change with a starting point of no more than 80% on rated capacity;
- c. Frequency sensitive mode: The steady-state parameters of regulations, such as droop and dead-band and dynamic parameters, including robustness through frequency step change response and large, fast frequency deviations shall be verified;
- d. Rate of change: The test should be performed with two different rate of changes, namely $0.1*P_{max}/min$ and $1.0*P_{max}/min$. The power output should be gradually decreased to its minimum and, thereafter, be gradually increased to its maximum. The same test should be performed first increasing to its maximum and later decreased to its minimum;
- e. Constant voltage control: The test shall be performed by setting the slope of the voltage control to 2%, and the voltage control set-point changed to 1.00 pu, 1.01 pu, 1.00 pu, 0.99 pu, 1.00 pu, 1.02 pu, 1.00 pu, 0.98 pu and 1.00 pu. Afterwards, repeat the same voltage control set-points with a slope of voltage control set at 4%;
- f. Constant reactive power control: The test shall consist of changes in the reactive power output control setpoint in steps of, for example, 1 MVar;
- g. Constant power factor control: The test shall consist of changes in the power factor control set-point in steps of, for example, 0.01.
- h. Reactive power capacity test and restriction of active power: The test shall be performed at maximum inductive and minimum capacitive reactive power, whilst generating at three different active power output: at 60% of rated capacity for:
 - At 60% of rated capacity for 30 minutes;
 - At 30-50% of rated capacity for 30 minutes;
 - At 10-20% of rated capacity for 60 minutes.
- i. Starting and stopping: The test shall demonstrate that starting and stopping of the generator does not introduce quality deviations in the network to which it is connected;
- j. Fault-ride-through capability: The procedure of the fault-ride-through capability shall be either determined by the network operator on a case-by-case basis, or if such procedure is not performed as per agreement with the network operator, a demonstration via simulation calculations and continuous monitoring of the facility when in operation may be alternatively conducted.

APPENDIX C. TEST REQUIREMENTS FOR EXTERNAL PARTIES

C.1. Obligations

All External Parties shall conduct tests on the plant and apparatus intended to be connected to the transmission grid in accordance with the following requirements.

C.2. New Electrical Plant

- C.2.1.** All new electrical plant to be connected or re-connected to the power system shall be fully tested at site in accordance with applicable IEC, BS, or international standards.
- C.2.2.** The test methodologies and procedures for any off-load pre-commissioning or on-load commission tests pertaining to electrical plant shall be in accordance with the applicable standards and Good Utility Practice.
- C.2.3.** Where commissioning tests have the possibility of affecting the secure, stable, and reliable operation of the power system, the TSP may elect to witness such tests being performed.
- C.2.4.** Only qualified and competent persons are permitted to perform the system tests.
- C.2.5.** Reports of all tests conducted shall be made available to the TSP.
- C.2.6.** The TSP may stop, delay, or cancel any system test if it is determined that performance of the test could adversely affect the stability, security, and reliability of the power system.

APPENDIX D. OPERATING AND TECHNICAL REQUIREMENTS FOR EXTERNAL PARTIES

D.1. General Conditions for generation facilities

- D.1.1.** Scheduling and testing for all external generation will be determined through the applicable Connection Agreements.
- D.1.2.** External Generators shall operate their installations with all of the protective devices in service at all times.
- D.1.3.** External Thermal Generating Facilities shall submit validated parameters and models which include:
 - a) Generating unit;
 - b) Excitation system, including excitation limiters;
 - c) Power system stabilizer;
 - d) Governor / turbine / prime mover;
 - e) Boiler controls.

External PV Non-Synchronous Generating Facilities shall submit validated parameters and models which include, at least:

- a) Equivalent model of the Generating unit, including any electronic power interface;
- b) Storage energy unit if any;
- c) Power control parameters.

External Electricity Storage Facilities shall submit validated parameters and models which include, at least:

- a) Equivalent model of the electricity storage units;
- b) Model of the electronic power interface;
- c) Power control parameters.

The parameters and models shall be validated via site tests for all generating and electricity storage units. The test methods shall be designed to cover both linear and non-linear responses of the generating units. The parameters and models are considered validated when the computer simulation results match the site test results. Simulation and site test results shall be overlaid on the same plots using the same scales.

Upon completion of site tests, the External Generating facility shall submit all completed tests results and models to the TSP.

- D.1.4.** The design and operation of any connected installation shall not cause adverse impact on the integrity of the transmission system.

D.2. Quality Assurance Conditions

D.2.1. Voltage Fluctuation: External Parties shall ensure that the operation of their installations shall not cause voltage fluctuations at the PCC to exceed 3% of the nominal voltage for step changes.

The planning limits for voltage fluctuations caused by an External Party's connection shall be in accordance with the requirements set out in Engineering Recommendation of P28 of the UK.

D.2.2. Harmonics: The owner of an installation shall ensure that starting surges or harmonics generated at their facilities must not cause the maximum total harmonic voltage distortion at the PCC to exceed 2.0%, and no individual odd harmonic greater than 1.5% and no individual even harmonic greater than 1.0%.

D.2.3. Phase imbalance: Planned outages for operation of installations shall not cause the maximum negative phase sequence component of the phase voltage to exceed 1.0%.

D.2.4. Communication Equipment at External Generating Facilities: External Generating facilities shall maintain and operate communication links from their control room to the TSP's SCADA system as described in this Code. These lines should be used for system operational use only. Communication links required for protective relaying schemes shall be installed and maintained by the External Party. These links shall be in service at all times which the plant is synchronized to the Grid.

External Transmission substations shall have a land-line voice communication link between the substation and the TSP's SCADA system.

D.3. High-resolution Recorder and Performance Monitoring

D.3.1. High-resolution recorders shall be installed on External generating facilities and shall be suitable for both dynamic and transient recording. The minimum sampling rate shall be 50 Hz and 1 kHz for dynamic and transient recording, respectively. Basic signals to be monitored and recorded include the following:

- a) For Thermal Generating Units:
 - Active power (MW);
 - Reactive power (MVar);
 - Bus frequency;
 - Power system stabilizer output;
 - AGC pulses;
 - Load Limiter Position (for steam units);
 - MV Demand Control Signal (for steam units);
 - Ambient and exhaust temperatures;
 - Fuel demand signals and fuel flow;
 - Generating Unit terminal voltage (High and low side);
 - Generating Unit Field Voltage;
 - Generating Unit Field Current.

- b) For PV Non-Synchronous Generating Units:
 - Active power (MW);
 - Reactive power (MVAr);
 - Bus frequency;
 - Terminal voltage at both sides of the converter.
- c) For Electricity Storage Units:
 - Active power for charging and discharging purposes (MW);
 - Reactive power for charging and discharging purposes (MVAr);
 - Bus frequency;
 - Terminal voltage at both sides of the converter;
 - State of charge of every storage unit;
 - Internal temperature of every storage unit (electric battery).
- d) For Interconnectors:
 - Active power (MW) and reactive power (MVAr) flow for each interconnector;
 - Substation bus voltage and frequency;
 - Circuit breaker and protection device status.

D.3.2. Recorder Specifications

- a) Sampling rate – Min 50 Hz to 1 kHz;
- b) Resolution:
 - Analog signals: 12 bits or 0.025% of full scale;
 - Frequency: +/- 5 mHz.
- c) Trigger type:
 - Maximum frequency / voltage;
 - Minimum frequency / voltage;
 - Rate of rising or falling of frequency / voltage.
- d) Pre-trigger length:
 - 30 second minimum for dynamic recording;
 - 0.5 second minimum for transient recording.
- e) Event Storage capacity of 400 events minimum;
- f) Event length:
 - Minimum 15 minutes for dynamic recording;
 - Minimum 5 seconds for transient recording.
- g) Event Data Format:
 - ASCII;
 - Spreadsheet;
 - IEEE Comtrade.

h) Time Stamping:

- A Global Position Satellite (GPS) clock shall be provided for time synchronization and shall have a minimum resolution of 1 millisecond.

i) Software:

- The software of the recorder shall have at least the capability to compute R.M.S. Values for voltage, current, Active power, and reactive power and power factor.

APPENDIX E. EMS MONITORING AND TELEMETRY INTERFACE REQUIREMENTS

Technical requirements for telemetry interfaces between External Parties and the National Control Centre will be determined in future updates to this Code due to implementation of the EMS to the existing SCADA system.

APPENDIX F. TECHNICAL STANDARDS

The equipment shall be designed, manufactured and tested generally in accordance with the latest revision of the following standards except where specifically directed otherwise:

F.1. Standards for switch-gear

IEC 62271-200	High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52kV
IEC 62271-1	High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear
IEC 62271-100	High-voltage switchgear and controlgear – Part 100: Alternating-current circuit breakers
BS EN 62271-100	High-voltage switchgear and controlgear Part 100: Alternating current circuit breakers
IEC 62271-102	High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches
BS EN 62271-106	High-voltage switchgear and controlgear – Alternating current contactors, contactor-based controllers and motor-starters
BS 159	Specification for High-voltage Busbars and Busbar Connections
IEC 61869-2	Instrument Transformers – Part 2: Additional requirements for current transformers
BS EN 61869-5	Instrument transformers – Additional requirement for capacitor voltage transformers
BS EN 61869-2	Instrument Transformers – Additional requirements for current transformers
IEC 61869-5	Instrument Transformers – Part 5: Additional requirements for capacitor voltage transformers
IEC 61869-3	Instrument Transformers – Part 3: Additional requirements for inductive voltage transformers
IEC 61869-1	Instrument Transformers – Part 1: General requirements
BS EN 61869-3	Instrument transformers – Additional requirements for inductive voltage transformers
IEC 60273	Characteristic of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V
IEC 60660	Insulators – Tests on indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to but not including 300 kV
IEC 60137	Insulated bushings for alternating voltages above 1000 V
BS EN 60137:2017	Insulated bushings for alternating voltages above 1000 V
IEC 60255	Measuring relays and protection equipment
BS EN 61810	Electromechanical elementary relays
BS 89	Specification for direct acting indicating electrical measuring instruments and their accessories
BS 7430	Code of practice for protective earthing of electrical installations

BS 5000-99	Rotating electrical machines of particular types or for particular applications Part 99: Machines for Miscellaneous Applications
BS EN IEC 60034-3	Rotating Electrical Machines Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines and for synchronous compensators
BS EN 50347	General purpose three-phase induction motors having standard dimensions and outputs. Frame numbers 56 to 315 and flange numbers 65 to 740
BS EN IEC 60947-4-1	Low-voltage switchgear and controlgear contactors and motor-starters. Electromechanical contactors and motor-starters.
IEC 60332-1	Tests on electric cables under fire conditions Part 1: Test on a single vertical insulated wire or cable
BS 6231	Electric Cables. Single core PVC insulated flexible cables of rated voltage 600/1000 V for switchgear and controlgear wiring
IEC 61233	High-voltage alternating current circuit-breakers – Inductive load switching
IEC 60099-4	Surge arrestors – Part 4: Metal oxide surge arresters without gaps for a.c.systems
IEC 60376	Specification of technical grade Sulphur hexafluoride (SF6) and complementary gases to be used in its mixtures for use in electrical equipment
BS EN IEC 60480	Specifications for the re-use of Sulphur hexafluoride (SF6) and its mixtures in electrical equipment
IEC 62271-203	High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 KV
BS EN 60060-1	High-voltage test techniques – General definitions and test requirements
ANSI/IEEE C37.09	Test Procedures for AC high-voltage circuit breakers with rated maximum voltage above 1000 V
IEC 62271-209	Cable connections for gas-insulated enclosed switchgear (>52kV)
IEC 60502	Power cables with extruded insulation and their accessories for rated voltage from 1 kV ($U_m = 1.2 \text{ kV}$) up to 30 kV ($U_m = 36 \text{ kV}$) – All Parts
IEC 60529	Degrees of protection provided by enclosures (IP Code)
CENELEC EN 50052	High-voltage switchgear and controlgear. Gas-filled cast aluminium alloy enclosures
CENELEC EN 50064	High-voltage switchgear and controlgear – Gas-filled wrought aluminium and aluminium alloy enclosures
CENELEC EN 50068	High-voltage switchgear and controlgear – Gas-filled wrought steel enclosures
CENELEC EN 50069	High-voltage switchgear and controlgear – Gas-filled welded composite enclosures of cast and wrought aluminium alloys
IEC 61672-1	Electroacoustics - Sound level meters – Part 1: Specifications

F.2. Standards for transformers

IEC 60076	Power Transformers
IEC 60076-4	Power transformers – Part 4: Guide to the lightning impulse and switching impulse testing - Power transformers and reactors
IEC 60076-7	Power transformers – Part 7: Loading guide for mineral-oil-immersed power transformers
BS EN 60076-1	Power transformers - General
BS 148	Recycled mineral insulating oil for transformers and switchgear. Specification
BS EN 60422	Mineral insulating oils in electrical equipment. Supervision and maintenance guidance
BS EN 60214-1	Tap-changers – Performance requirements and test methods
IEC 60060	High-voltage test technique – All Parts
BS EN 60060-1	High-voltage test techniques – General definitions and test requirements
IEC 61672-1	Electroacoustics – Sound level meters – Part 1: Specifications
IEC 61672-2	Electroacoustics – Sound level meters – Part 2: Pattern evaluation tests
IEC 60076-10	Power transformers – Part 10: Determination of sound levels
IEEE C57.32-2015	Requirements, Terminology, and Test Procedures for Neutral Grounding Devices

F.3. Standards for synchronous generators

IEC 60034-3	Rotating electrical machines – Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines and for synchronous compensators
IEC 60034-4	Rotating electrical machines – Part 4: Methods for determining synchronous machine quantities from tests
BS 5000-99	Rotating electrical machines of particular types or for particular applications - Machines for miscellaneous applications
IEC 88528-11	Reciprocating internal combustion engine driven alternating current generating sets – Part 11: Rotary uninterruptible power systems – Performance requirements and test methods

F.4. Standards for non-synchronous generators

IEC 62477-1	Safety requirements for power electronic converter systems and equipment – Part 1: General
IEC 62477-2	Safety requirements for power electronic converter systems and equipment – Part 2: Power electronic converters from 1000 V AC or 1500 V DC up to 36 kV AC or 54 kV DC
IEC 62909-1	Bi-directional grid connected power converters – Part 1: General requirements
IEC 62909-2	Bi-directional grid-connected power converters – Part 2: Interface of GCPC and distributed energy resources

IEC 61724	Photovoltaic system performance monitoring – Guidelines for measurement, data exchange and analysis
IEC 61727	Photovoltaic (PV) systems – Characteristics of the utility interface
IEC 62446	Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance
IEC 60904	Photovoltaic devices – All Parts
IEC 62109	Safety of power converters for use in photovoltaic power systems
IEC 62116	Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures
IEC 61427-2	Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 2: On-grid applications
IEC 62670	Photovoltaic concentrators (CPV) – Performance testing
IEC 62108	Concentrator photovoltaic (CPV) modules and assemblies – Design qualification and type approval
IEC 60146-2	Semiconductor converters – Part 2: Self-commutated semiconductor converters including direct d.c. converters
IEC TS 62578	Power electronics systems and equipment - Operation conditions and characteristics of active infeed converters (AIC) applications including design recommendations for their emission values below 150 kHz
IEC 61400	Wind energy generation systems
IEC 62040	Uninterruptible power supply (UPS)
IEC 62310	Static transfer systems (STS)

F.5. Standards for cables

IEC 60228	Conductors of insulated cables
IEC 60502	Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1.2\text{kV}$) up to 30 kV ($U_m = 36\text{ kV}$) – All Parts
IEC 60811	Common test methods for insulating and sheathing materials of electric cables
IEC 60885	Electric and optical fibre cables - Test methods for non-metallic materials
IEC 60230	Impulse tests on cables and their accessories
IEC 60287	Electric cables - Calculation of the current rating
IEC 60141-1	Tests on oil-filled and gas-pressure cables and their accessories – Part 1: Oil-filled, paper or polypropylene paper laminate insulated, metal-sheathed cables and accessories for alternating voltages up to and including 500 kV
IEC 60840	Power cables with extruded insulation and their accessories for rated voltages above 30 kV ($U_m = 36\text{ kV}$) up to 150 kV ($U_m = 170\text{ kV}$) - Tests methods and requirements

IEC 60502	Power cables with extruded insulation and their accessories for rated voltage from 1 kV ($U_m = 1.2 \text{ kV}$) up to 30 kV ($U_m = 36 \text{ kV}$)
IEC 60529	Degrees of protection provided by enclosures (IP Code)
ISO 7-2	Pipe threads where pressure-tight joints are made on threads – Part 2: Verification by means of limit gauges
ASTM B187	Standard specification for copper, bus bar, rod and shapes and general purpose rod, bar, and shapes
ASTM B3	Standard specification for soft or annealed copper wire

F.6. Standards for meters and metering transformers

BS EN 50160:2010	Voltage characteristics of electricity supplied by public electricity networks
BS EN 62053-24	Electricity metering equipment (a.c.). Particular requirements - Static meters for reactive energy at fundamental frequency (classes 0,5 S, 1 S and 1)
BS EN 62056-21	Electricity metering. Data exchange for meter reading, tariff and load control – Direct local data exchange
BS EN 62052-11	Electricity metering equipment. General requirements, tests and test conditions - Metering equipment
BS EN 62053-11	Electricity metering equipment (a.c.), Particular requirements. Electromechanical meters for active energy (classes 0.5, 1 and 2)
BS EN 62053-21	Electricity metering equipment (a.c.). Particular requirements - Static meters for active energy (classes 1 and 2)
BS EN 62053-22	Electricity metering equipment (a.c.). Particular requirements - Static meters for active energy (classes 0.2 S and 0.5 S)
BS EN 62053-23	Electricity metering equipment (a.c.). Particular requirements - Static meters for reactive energy (classes 2 and 3)
IEC 62053-11	Electricity metering equipment (a.c.) - Particular requirements – Part 11: Electromechanical meters for active energy (classes 0.5, 1 and 2)
IEC 62052-11	Electricity metering equipment - General requirements, tests and test conditions – Part 11: Metering equipment
IEC 62053-21	Electricity metering equipment - Particular requirements – Part 21: Static meters for AC active energy (classes 0,5, 1 and 2)
IEC 62053-23	Electricity metering equipment - Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3)
IEC 61869-2	Instrument transformers – Part 2: Additional requirement for current transformers
IEC 61869-5	Instrument transformers – Part 5: Additional requirements for capacitor voltage transformers
IEC 61869-3	Instrument transformers – Part 3: Additional requirements for inductive voltage transformers
IEC 61869-1	Instrument transformers – Part 1: General requirements
IEC 61000-3-2	Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for the harmonic current emissions (equipment input current $\leq 16 \text{ A}$ per phase)

IEC 61000-3-3	Electromagnetic compatibility (EMC) – Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply system, for equipment with rated current <= 16 A per phase and not subject to conditional connection
IEC 61000-3-4	Electromagnetic compatibility (EMC) – Part 3-4: Limits - Limitation of emission of harmonic currents in low voltage power supply systems for equipment with rated current greater than 16 A.
IEC TS 61000-3-5	Electromagnetic compatibility (EMC) – Part 3-5: Limits - Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated >75 A
IEC 61000-3-6	Electromagnetic compatibility (EMC) – Part 3-6: Limits - Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems
IEC TR 61000-3-7	Electromagnetic compatibility (EMC) – Part 3-7: Limits - Assessment of emission limits for the connection of fluctuating installations to MV, HV and EHV power systems
IEC 61000-3-11	Electromagnetic compatibility (EMC) – Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current <=75 A and subject to conditional connection
IEC 61000-4-15	Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques - Flickermeter – Functional and design specifications
IEC 62056-21	Electricity metering - Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange
IEC 62052-11	Electricity metering equipment – General requirements, tests and test conditions – Part 11: Metering equipment
IEC 62053-11	Electricity metering equipment (a.c.) – Particular requirements - Part 11: Electromechanical meters for active energy (classes 0.5, 1 and 2)
IEC 62053-21	Electricity metering equipment – Particular requirements - Part 21: Static meters for AC active energy (classes 0.5, 1 and 2)
IEC 62053-22	Electricity metering equipment – Particular requirements – Part 22: Static meters for AC active energy (classes 0.1S, 0.2S and 0.5S)
IEC 62053-23	Electricity metering equipment – Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3)
IEC 62053-24	Electricity metering equipment – Particular requirements – Part 24: Static meters for fundamental component reactive energy (classes 0.5S, 1S, 1, 2 and 3)

F.7. Standards for serial communications

IEEE 1815	Standard for Electric Power Systems Communications - Distributed Network Protocol (DNP3)
IEC 61850	Communications network and systems for power utility automation
IEC 60870-5-104	Telecontrol equipment and systems – Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles
IEC 60870-6	Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations

F.8. Standards for electromagnetic fields

IEEE C95.1	Standard for safety levels with respect to human exposure to electric, magnetic and electromagnetic fields, 0 Hz to 300 GHz
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If the specifications conflict in any way with one, or more of the above standards, the specifications shall have precedence and shall govern.

Where the number of the IEC or BS Standard is not specifically stated above, the IEC or BS Standard which is most appropriate to the class of equipment, material or work specified by the Contractor shall be used.

SECTION 3

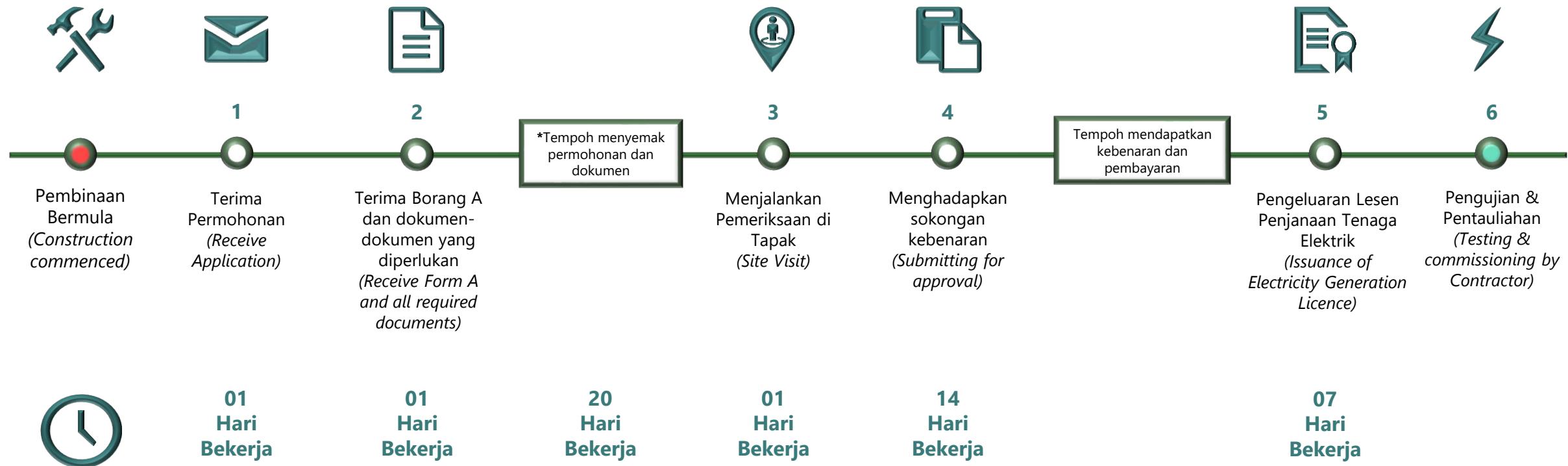
PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

**APPENDIX 4 – OTHER RELEVANT INFORMATION FROM STAKEHOLDERS &
AUTHORITIES**

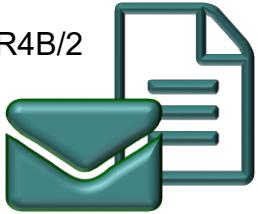
**APPENDIX 4B – LICENSING PROCESS FOR ELECTRICITY GENERATION
ACTIVITY BY THE AUTORITI ELEKTRIK NEGARA BRUNEI DARUSSALAM**

PROSES PERLESENAN AKTIVITI PENJANAAN TENAGA ELEKTRIK

LICENSING PROCESS FOR ELECTRICITY GENERATION ACTIVITY



*Tertakluk kepada kelengkapan dokumen yang dihadapkan



DOKUMEN-DOKUMEN YANG PERLU DIHADAPKAN

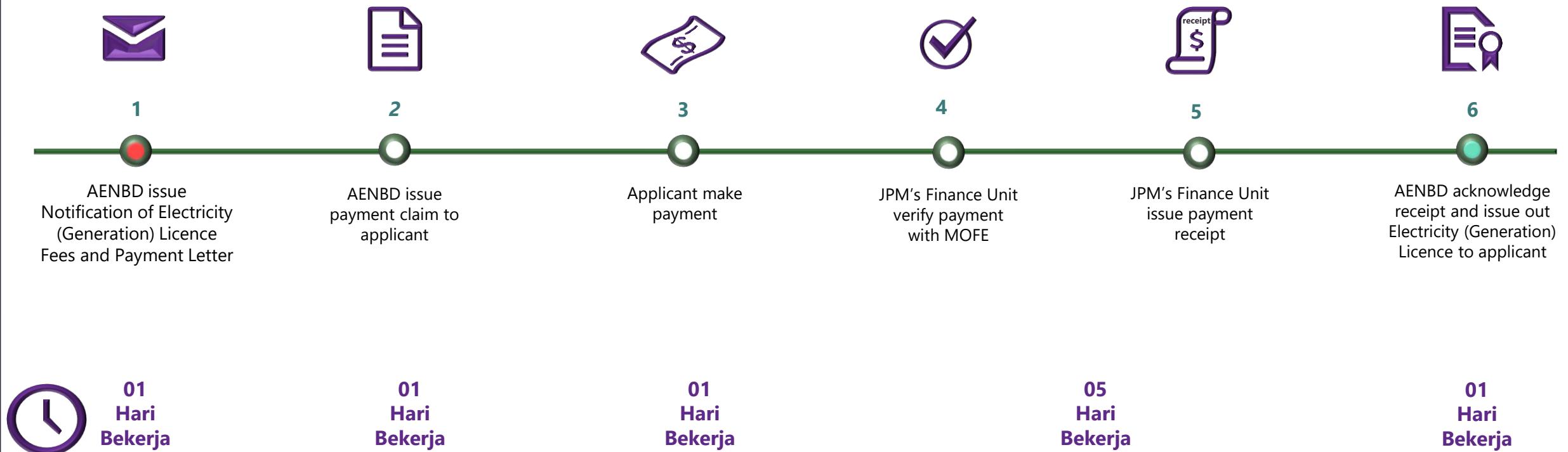
DOCUMENTS TO BE SUBMITTED

No	*DOCUMENTS
1	Application Letter
2	Completed Form A Includes information of the company, shareholders, nature of business, focal person, list of generating units and other information
3	Business Plan Includes the company's profile, mission, vision, objectives, current organization structure, manpower statistics (% local & expats, no. of staffs, etc.), list of key performance indicators (i.e. company's scorecard), 5 years power development plan or equivalent and any related documents
4	As Built Electrical Single Line Drawing Drawings related to electrical system/network. Final drawings to be submitted once available
5	Power Plant System Operating Philosophy or equivalent Power plant operation (normal condition), details of generating units, load dispatch, spinning reserve margin, capacity and any other related documents
6	Contingency During Emergency Emergency system restoration, system outages, emergency system restoration, manpower planning and any other related documents
7	Emergency Response Procedure For different types of incidents/scenarios related to power
8	HSE Management Plan Documented policies, plan, ISO and any other related documents
9	People Competency (for Electrical) Technical authority framework, electrical competency framework or equivalent related to power
10	Other Related Documents (if applicable) Occupational Permit (OP) from ABCi, approval from DEPR on Environmental Impact Assessment (EIA) and any other related documents

*Submission shall be in both physical and soft copy

PROSES PEMBAYARAN LESEN PENJANAAN TENAGA ELEKTRIK

PAYMENT PROCESS FOR ELECTRICITY GENERATION LICENCE



FORM A**1. Details of Company****1.1. Registered Business Name**

For a public (*Berhad*) or private company (*Sendirian Berhad*) - name must be as contained in the *Certificate of Incorporation* issued by the Registrar of Companies. If partnership or sole proprietor – name must be as contained in **Forms 16 & 17** issued by the Registrar of Business Names.

1.2. Registry of Company & Business Name (ROCBN) No.:**1.3. Address**

Registered office address and Mailing address

1.4. Nature of Organisation

Describe the nature (private or public entity, and if listed details of public listing), its corporate shareholding structure, composition of the board of directors and the management team (Organisation Structure). Please attached relevant documents such as organisation structure, etc.

2. Details of Focal Persons**2.1. Focal Person (1st)**

Name			
Position		Fax No.	
Contact No	(O)	(M)	
Email			

2.2. Focal Person (2nd)

Name			
Position		Fax No.	
Contact No	(O)	(M)	
Email			

3. Details of Organization's CEO / CE / Directors (or Senior Management)

Name			
Position		Fax No.	
Contact No	(O)	(M)	
Email			

4. Additional Information
4.1. Name of Generating Facilities

Please state also all plant type example Coal, Gas, Diesel etc.

4.2. Addresses of the Generating Facilities

Please state the locations of all facilities or plant.

**4.3. Total Installed Capacity
(nameplate) (MW)**

For each generating facilities including the overall total

**4.4(a) Thermal
Efficiency (%)**

For each generating facilities including the total average

**4.4(b) Electrical
Efficiency(%)**

For each generating facilities including the total average

4.5. Number of Generating Units in each Generating Facilities

Please list down all the Generating Units (GTGs, STGs, Diesel Generators, etc) in Appendix 1 attached.

4.6. Generating Facilities connected to the national grid?

If yes, please attached copy of the power purchase agreement (or similar) with the power utility.

Yes No, state reason: _____

4.7(a) Primary Source of Fuel for each Generating Facilities?

Please attached copy of the fuel supply agreement/approval.

4.7(b) Secondary Source of Fuel for each Generating Facilities?

Please attached copy of the fuel supply agreement/approval.

4.8. HSE Management System available?

If yes, please attached the relevant HSE management system plan, approved Environment Impact Assessment (EIA), emergency response plan, & etc.

Yes No, state reason: _____

5. Declaration

I declare that:

- a) to the best of my knowledge and belief, all the details provided in this form including all the information or document(s) supplied with this form are true and complete;
- b) I have read and agree to comply to the Electricity Act Chapter 223 and its legislations, for which knowingly or recklessly making a false, incomplete or misleading statement in support of this form may lead to the grant of the licence being refused or revoked and may result in criminal proceedings being instituted under Section 54 of the Electricity Act Chapter 223.

Name:	
Position:	
Contact:	
Date:	<hr/> [Signature & Stamp]

Appendix 1

List of generating unit(s) owned/operated by the Applicant.

Note: If more than 1 unit, then add on the full list using this as a template for an attachment to this application.

Please attached clear photos of the generating unit(s) nameplate.

Generating Unit(s)

No	Generator Unit Identifier	Model & Manufacturer	Serial Number	Installed Capacity (Nameplate) (MW)
1				
2				
3				

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

**APPENDIX 4 – OTHER RELEVANT INFORMATION FROM STAKEHOLDERS &
AUTHORITIES**

APPENDIX 4C – PROPOSED RAW WATER INTAKE LOCATION

Proposed Raw water intake location

ER4C/1



Legend:

Proposed Water intake from Sg Danau 1

Proposed Water intake from Sg Pepakan 2

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

**APPENDIX 4 – OTHER RELEVANT INFORMATION FROM STAKEHOLDERS &
AUTHORITIES**

**APPENDIX 4D – CONFIDENTIAL DRAFT OF ENVIRONMENTAL PROTECTION
AND MANAGEMENT ACT (AMENDMENT) ORDER, 2025**

CONSTITUTION OF BRUNEI DARUSSALAM
(Order made under Article 83(3))

ENVIRONMENTAL PROTECTION AND MANAGEMENT ACT (AMENDMENT)
ORDER, 2025

ARRANGEMENT OF SECTIONS

Section

1. Citation and commencement
2. Amendment of long title of Chapter 240
3. Amendment of section 3
4. Insertion of new Part 3A
5. Insertion of new sections 21A and 21B
6. Addition of new Schedule 3

CONSTITUTION OF BRUNEI DARUSSALAM

(Order made under Article 83(3))

ENVIRONMENTAL PROTECTION AND MANAGEMENT ACT (AMENDMENT) ORDER, 2025

In exercise of the power conferred by Article 83(3) of the Constitution of Brunei Darussalam, His Majesty the Sultan and Yang Di-Pertuan hereby makes the following Order –

Citation and commencement

1. This Order may be cited as the Environmental Protection and Management Act (Amendment) Order, 2025 and shall commence on 5th June 2025.

Amendment of long title of Chapter 240

2. The long title of the Environmental Protection and Management Act, in this Order referred to as the Act, is amended by inserting “, and to regulate the control and management of waste,” immediately before “and” in the second line.

Amendment of section 3

3. Section 3 of the Act is amended by inserting the following new definitions in the appropriate alphabetical order –

“air pollution” means the emission of any air pollutant into the air;

“collection point” means a position at any premises, whether located inside or outside the premises for waste to be stored before collection, whether in receptacles or not and such position has direct and unhindered access for collection by waste collection vehicles and is located so as not to cause obstruction or nuisance to any person;

“collection service” means a service where the waste is collected from collection points and delivered to a waste disposal facility;

“disposal” means the disposal of any waste by any means, including destruction, decomposing, incineration, treatment or making it re-usable or recyclable;

“hazardous industrial waste” means any waste specified in Schedule 3;

“industrial waste” means any waste generated from industrial premises and activities which is not a hazardous industrial waste;

“licensee” means any waste collector licensee or waste disposal licensee that is licensed under this Act;

“nuisance” means any act, omission or thing occasioning or likely to occasion injury, annoyance, offence, harm, danger or damage to the sense of sight, smell or hearing, or which is or is likely to be injurious or dangerous to health or property;

“receptacle” means a bin or container for the storing of waste prior to collection;

“waste” means any substance or object that is –

- (a) proposed to be disposed of;
- (b) disposed of; or
- (c) required by any written law to be disposed of;

“waste collection vehicle” means any vehicle used for the collection of waste;

“waste collector” means any person who collects, removes or transports waste;

“waste collector licensee” means any waste collector who is licensed under section 10D;

“waste disposal facility” includes a recycling facility, a refuse disposal ground, any place used for the deposit of waste, an incinerator or any plant, machinery or apparatus used for the processing or treatment of waste;

“waste disposal licensee” means any person who is licensed under section 10F to construct, establish, maintain or operate any waste disposal facility;

“waste generator” means any person who generates waste.”.

Insertion of new Part 3A

4. The Act is amended by inserting the following new Part immediately before Part 4 –

“PART 3A CONTROL AND MANAGEMENT OF WASTE

Division 1

Waste Generator, Waste Collector etc.

Authority may apply systems for collection and removal of waste

10A. (1) The Authority may at any time apply to all premises within any area that it may determine any system which it thinks fit for the collection and removal of waste of every description from those premises.

(2) In any area to which a system for the collection and removal of waste is applied under subsection (1) –

(a) no person other than a waste collector licensee whose specified area in its license includes premises in the area may collect or remove any waste; and

(b) every waste generator of any premises that the Authority may designate in the area shall use the service of collecting and removing waste provided by a waste collector licensee whose specified area in its license includes those designated premises.

(3) Any person who fails to comply with subsection (2) is guilty of an offence.

Prohibition against unauthorised depositing, treatment etc. of waste

10B. (1) A person shall not deposit, separate, store, keep, collect, transfer, transport, treat or dispose of, or cause to be or permit to be deposited, separated, stored, kept, collected, transferred, transported, treated or disposed of, any waste except in accordance with this Act.

(2) Any person shall take all reasonable measures to prevent unauthorised disposal of waste on his premises.

Duties of waste generator

10C. (1) It shall be the duty of a waste generator to –

- (a) subscribe to the service of collecting and removing waste provided by a waste collector licensee;
- (b) ensure that waste receptacles are provided in which waste may be temporarily deposited and placed in proper and convenient locations within their premises and in any other places that the Authority thinks fit;
- (c) ensure that waste receptacles are maintained in a good condition and replaced when necessary;
- (d) ensure that there is no spillage, release of waste or noxious liquid, or other offensive matter of any kind during the storage of the waste;
- (e) ensure that waste receptacles for waste are provided with a secure lid and kept closed;
- (f) ensure that waste receptacles have sufficient capacity to prevent overflowing; and

- (g) ensure that no burying of waste within the waste generator's premises or in any public place.
- (2) Any waste generator who fails to comply with subsection (1) is guilty of an offence.

Licensing of persons carrying on service of collecting, removing or transporting of waste

- 10D.** (1) A person shall not carry on the service of collecting, removing or transporting waste of any description without a waste collector licence granted by the Authority under this section.
- (2) The Authority may grant a licence authorising any person to carry on the service of collecting, removing or transporting waste of any description.
- (3) The Authority may designate any person who has been granted a licence under this section as a waste collector licensee.
- (4) Any waste collector licensee who collects, removes or transports waste of any description shall ensure that the waste or liquid from the waste is not dropped, scattered or spilled onto any public place.
- (5) Any person who fails to comply with subsection (1) is guilty of an offence and liable on conviction to a fine not exceeding \$20,000, imprisonment for a term not exceeding 2 years or both.

Waste disposal facility

- 10E.** (1) The Authority may –
- (a) provide, acquire, construct and maintain any waste disposal facility for the deposit, disposal and treatment of waste of any description as it may consider necessary; and

(b) make available the facility to any person on payment of any fees or charges as may be prescribed.

(2) The Authority may –

(a) refuse to accept any waste brought to any waste disposal facility without giving any reason; or

(b) accept waste of any description on any condition that it may consider necessary.

No waste disposal facility to be operated without licence

10F. (1) A person shall not operate any waste disposal facility without a waste disposal licence granted by the Authority under this section.

(2) The Authority may grant a licence authorising any person to operate any waste disposal facility.

(3) The Authority may designate any person who has been granted a licence under this section as a waste disposal licensee.

(4) Any waste disposal licensee using, working or operating a waste disposal facility shall use, work or operate the waste disposal facility in any manner that the Authority may require.

(5) Any person who fails to comply with subsection (1) is guilty of an offence and liable on conviction to a fine not exceeding \$50,000, imprisonment for a term not exceeding 12 months or both, and in the case of a second or subsequent conviction, to a fine not exceeding \$100,000, imprisonment for a term not exceeding 12 months or both.

*Division 2**Licence***Application for licence**

- 10G.** (1) An application for a licence under section 10D or 10F shall be –
- (a) made to the Authority in such form and manner as the Authority may determine;
 - (b) accompanied by the prescribed fee.
- (2) In considering any application under subsection (1), the Authority may require the applicant to –
- (a) furnish such additional documents or information; and
 - (b) satisfy such other matters as the Authority may determine.
- (3) In considering an application received under subsection (1), the Authority may –
- (a) grant a licence, with or without conditions; or
 - (b) refuse to grant a licence.
- (4) A licence shall not be renewable as of right and an application to renew shall be treated as an application for a licence.
- (5) A licensee shall not be entitled to any refund of any fee paid in respect of any licence.

Licence not transferable

10H. A licensee shall not transfer his licence to, or permit his licence to be used by, another person.

Grant etc. of licence

10I. (1) Subject to subsection (4), the grant of any licence issued, or to be issued under this Act, shall be in the absolute discretion of the Authority.

(2) Any licence granted shall be valid for a period of 3 years from the date of issue, unless suspended or revoked.

(3) The Authority may suspend or revoke a licence granted to any person on proof to its satisfaction of an offence against this Act or other misconduct by such person.

(4) Any person who is aggrieved by the refusal of the Authority to grant a licence or by a decision of the Authority to suspend or revoke a licence may, within 14 days of the date of receipt of the notice of such refusal, suspension or revocation, appeal in writing to the Minister whose decision is final.

Changes in particulars of licence

10J. Whenever any change is made or occurs to the name or address of the licensed place, the licensee shall within 30 days of such change –

- (a) furnish to the Authority a statement in writing specifying the nature and date of the change; and
- (b) surrender the licence to the Authority,

and the Authority shall, as soon as practicable, issue a new licence to the licensee.

Replacement of lost or defaced licence

10K. (1) Where it is proved to the satisfaction of the Authority that a licence has been lost, destroyed or so mutilated or defaced as to be illegible, the Authority may, on receipt of an application from the licensee and accompanied by the prescribed fee, issue a replacement licence to the licensee, and the replacement licence so issued shall have the same effect as the original.

(2) If at any time after the issue of a replacement licence the original licence is found, the licensee shall return the original licence to the Authority.”.

Insertion of new sections 21A and 21B

5. The Act is amended by inserting the following two new sections immediately after section 21 –

“Power to direct for waste to be separated

21A. (1) The Authority may give written directions as it considers fit to any person for the purpose of ensuring the compliance with this Act, on the separation, handling and storage of any waste in the possession of such person.

(2) Any person who fails to comply with the direction under subsection (1) is guilty of an offence and liable on conviction to a fine not exceeding \$1,000.

Notice requiring removal of waste

21B. (1) If, in the opinion of the Authority, any waste stored in any waste disposal facility threatens or is likely to threaten –

- (a) the health of any person; or
- (b) to cause pollution to the environment,

the Authority may, by written notice, require the licensee to dispose, at the licensee's own cost and within the period specified in the notice, such waste at a waste disposal facility specified in the notice.

(2) The Authority may, by written notice, require the licensee to furnish, within the period specified in the notice, evidence that the licensee has complied with the notice under subsection (1).”

Addition of new Schedule 3

6. The Act is amended by adding the following new Schedule –

“SCHEDULE 3

(section 3)

LIST OF HAZARDOUS INDUSTRIAL WASTES

HIW 1 METAL AND METAL-BEARING WASTES

- | | |
|---------|--|
| HIW 101 | Waste containing arsenic or its compound |
| HIW 102 | Waste lead acid batteries, whole or crushed |
| HIW 103 | Waste batteries containing cadmium and nickel or mercury or lithium |
| HIW 104 | Dust, slag, dross or ash containing arsenic, mercury, lead, cadmium, chromium, nickel, copper, vanadium, beryllium, antimony, tellurium, thallium or selenium excluding slag from iron and steel factory |
| HIW 105 | Galvanic sludge |
| HIW 106 | Residues from recovery of acid pickling liquor |
| HIW 107 | Slag from copper processing for further processing or refining containing arsenic, lead or cadmium |
| HIW 108 | Leaching residues from zin processing, dust and sludges form |
| HIW 109 | Waste containing mercury or its compound |

HIW 110 Waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl

HIW 2 WASTES CONTAINING PRINCIPALLY INORGANIC CONSTITUENTS WHICH MAY CONTAIN METALS AND ORGANIC MATERIALS

- HIW 201 Asbestos wastes in sludge, dust or fibre forms
- HIW 202 Waste catalysts
- HIW 203 Immobilised scheduled wastes, including chemically fixed, encapsulated, solidified or stabilised sludges
- HIW 204 Sludges containing one or several metals, including chromium, copper, nickel, zinc, lead, cadmium, aluminium, tin, vanadium and beryllium
- HIW 205 Waste gypsum arising from chemical industry or power plant
- HIW 206 Spent inorganic acids
- HIW 207 Sludges containing fluoride

HIW 3 WASTES CONTAINING PRINCIPALLY ORGANIC CONSTITUENTS WHICH MAY CONTAIN METALS AND INORGANIC MATERIALS

- HIW 301 Spent organic acids with pH less or equal to 2 which are corrosive or hazardous
- HIW 302 Flux waste containing mixture of organic acids, solvents or compounds of ammonium chloride
- HIW 303 Adhesive or glue waste containing organic solvents, excluding solid polymeric materials
- HIW 304 Press cake from pre-treatment of glycerol soap lye
- HIW 305 Spent lubricating oil
- HIW 306 Spent hydraulic oil
- HIW 307 Spent mineral oil-water emulsion
- HIW 308 Oil tanker sludges
- HIW 309 Oil-water mixture such as ballast water
- HIW 310 Sludge from mineral oil storage tank
- HIW 311 Waste oil or oily sludge
- HIW 312 Oily residue from automotive workshop, service station, oil or grease interceptor

- HW 313 Oil contaminated earth from re-refining of used lubricating oil
- HW 314 Oil or sludge from oil refinery plant maintenance operation
- HW 315 Tar or tarry residues from oil refinery or petrochemical plant
- HW 316 Acid sludge
- HW 317 Spent organometallic compounds, including tetraethyl lead, tetramethyl lead and organotin compounds
- HW 318 Waste, substances and articles containing or contaminated with Polychlorinated Biphenyls (PCB) or Polychlorinated Triphenyls (PCT)
- HW 319 Waste of phenols or phenol compounds, including chlorophenol in the form of liquids or sludges
- HW 320 Waste containing formaldehyde
- HW 321 Rubber or latex wastes or sludge containing organic solvents or heavy metals
- HW 322 Waste of non-halogenated organic solvents
- HW 323 Waste of halogenated organic solvents
- HW 324 Waste of halogenated or unhalogenated non-aqueous distillation residues arising from organic solvents recovery process
- HW 325 Uncured resin waste containing organic solvents or heavy metals, including epoxy resin and phenolic resin

HIW 326 Waste organic phosphorus compound

HIW 327 Waste of thermal fluids (heat transfer) such as ethylene glycol

**HIW 4 WASTES WHICH MAY CONTAIN EITHER IN ORGANIC
 OR ORGANIC CONSTITUENTS**

HIW 401 Spent alkalis containing heavy metals

HIW 402 Spent alkalis with pH more or equal to 11.5 which are corrosive or hazardous

HIW 403 Discarded drugs containing psychotropic substances or containing substances that are toxic, harmful, carcinogenic, mutagenic or teratogenic

HIW 404 Pathogenic wastes, clinical wastes or quarantined materials

HIW 405 Waste arising from the preparation and production of pharmaceutical product

HIW 406 Clinker, slag and ashes from scheduled wastes incinerator

HIW 407 Waste containing dioxins or furans

HIW 408 Contaminated soil, debris or matter resulting from cleaning-up of a spill of chemical, mineral oil or scheduled wastes

HIW 409 Disposed containers, bags or equipment contaminated with chemicals or pesticides, mineral oil or scheduled wastes

- HW 410 Rags, plastics, papers or filters contaminated with scheduled wastes
- HW 411 Spent activated carbon excluding carbon from the treatment of potable water and processes of the food industry and vitamin production
- HW 412 Sludges containing cyanide
- HW 413 Spent salt containing cyanide
- HW 414 Spent aqueous alkaline solution containing cyanide
- HW 415 Spent quenching oils containing cyanides
- HW 416 Sludge of inks, paints, pigments, lacquer, dye or varnish
- HW 417 Waste of inks, paints, pigments, lacquer, dye or varnish
- HW 418 Discarded or off-specification inks, paints, pigments, lacquer, dye or varnish products containing organic solvent
- HW 419 Spent di-isocyanates and residues of isocyanate compounds, excluding solid polymeric material from foam manufacturing process
- HW 420 Leachate from scheduled waste landfill
- HW 421 A mixture of scheduled wastes
- HW 422 A mixture of scheduled and non-scheduled wastes

- HIW 423 Spent processing solution, discarded photographic chemicals or discarded photographic wastes
- HIW 424 Spent oxidising agent
- HIW 425 Wastes from the production, formulation, trade or use of pesticides, herbicides or biocides
- HIW 426 Off-specification products from the production, formulation, trade or use of pesticides, herbicides or biocides
- HIW 427 Mineral sludges, including calcium hydroxide sludges, phosphating sludges, calcium sulphite sludges and carbonates sludges
- HIW 428 Wastes from wood preserving operation using inorganic salts containing-copper, chromium or arsenic or fluoride compounds or using compound containing chlorinated phenol or creosote
- HIW 429 Chemicals that are discarded or off specification
- HIW 430 Obsolete laboratory chemicals
- HIW 431 Waste from manufacturing or processing or use of explosives
- HIW 432 Waste containing, consisting of or contaminated with, peroxides
- HIW 5 OTHER WASTES**
- HIW 501 Any residue from treatment or recovery of scheduled wastes.”.

Made this day of Hijriah corresponding
to the day of 2025 at Our Istana Nurul Iman,
Bandar Seri Begawan, Brunei Darussalam.

**HIS MAJESTY
THE SULTAN AND YANG DI-PERTUAN,
BRUNEI DARUSSALAM.**

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 4 – OTHER RELEVANT INFORMATION FROM STAKEHOLDERS &
AUTHORITIES

APPENDIX 4E – CONFIDENTIAL DRAFT OF CODE OF PRACTICE FOR
POLLUTION CONTROL 2025

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Part One: General

1 Scope

The Code of Practice for Pollution Control (CoP) is a guidance document supporting PART 7, Section 32 of the Environmental Protection and Management Act, Chapter 240. Working alongside the country's economic development agenda and aspiration in achieving an improved quality of life as per Objective 2 of Wawasan Brunei 2035, this Code of Practice serves as an important guide to all stakeholders to ensure that the environment is clean, safe, healthy and productive.

This code stipulates pollution control requirements and good environmental practices to safeguard clean air, land, water, and a quality living environment. Best industry practices are also provided for the management of hazardous substances as well as guidance on remediation of contaminated land.

1.1 Environmental Requirement Framework

National legislations, standards and/or guidelines for pollution control are regulated under the Environmental Protection and Management Order, 2016. The general duties of person and environmental requirements are specified within the following sections of the Order, i.e.:

- Part III, Sections 7 to 10, and
- the Regulations made thereunder in Part VIII, Section 41.

Other relevant legislations, standards and/or guidelines that are indispensable for the application of this code include but not limited to the following:

- Hazardous Waste (Control of Export, Import and Transit) Order 2013
- Prevention of Pollution of the Sea Order 2005
- Brunei National Oil Spill Contingency Plan (NOSCOP)
- Workplace Safety & Health Order 2009
- Decommissioning and Restoration Guidelines for Onshore and Offshore Facilities

The latest edition of the referenced documents (including any amendments) shall apply.

1.2 Sustainability as Guiding Principle

- 1.2.1 To reduce environmental pressure from wastes, Prescribed Activity Owners are encouraged to demonstrate that sustainable construction methods are used, resource recovery and reuse is in place and opportunities for a circular economy approach are adopted.
- 1.2.2 In line with global pursuits towards combating climate change, it is advised, where practicable for Prescribed Activity Owners to demonstrate that greenhouse gases and the water footprint are being monitored with the objective to reduce emissions and discharges over time.
- 1.2.3 Where applicable and practicable, Prescribed Activity Owners is encouraged to incorporate elements of Nature Positivity into its design and operation of the Prescribed Activity. This includes

not only limiting the loss of biodiversity but to seek avenues to enhance biodiversity within project design, planning and operation.

1.3 Limitations and Exclusions

This CoP acts as a **guidance** document for Prescribed Activity Owners and/or Prescribed Site Occupiers outlining their obligations, best management practices and/or best available techniques to conduct their operations while safeguarding the environment. The guidelines outlined in this document shall, however, be considered with the following caveats:

- 1) Legislations and national laws must be adhered to and take precedence in any event of conflict and/or contradiction between this code and legislation.
- 2) Standards, limits, and/or criteria as provided in this CoP and its ANNEXes shall act as 'starting point' guidelines which may be subject to change, updates and/or further refinements resulting from the permitting / EIA stage.
- 3) This CoP predominantly provides guidance on environmental management and protection. Health and safety provisions are excluded from this CoP, all project proponents are required to refer to relevant national health and safety regulations (i.e. Workplace Safety and Health Order 2009 and the Regulations made thereunder).

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2 Environmental Assessment and Permitting Process

The key stages of the environmental assessment and permitting process are shown in Figure 1. Further details for each stage of work are provided below. All stakeholders, new developments/projects as well as those existing, are required to go through this process to identify and perform their respective environmental obligations.

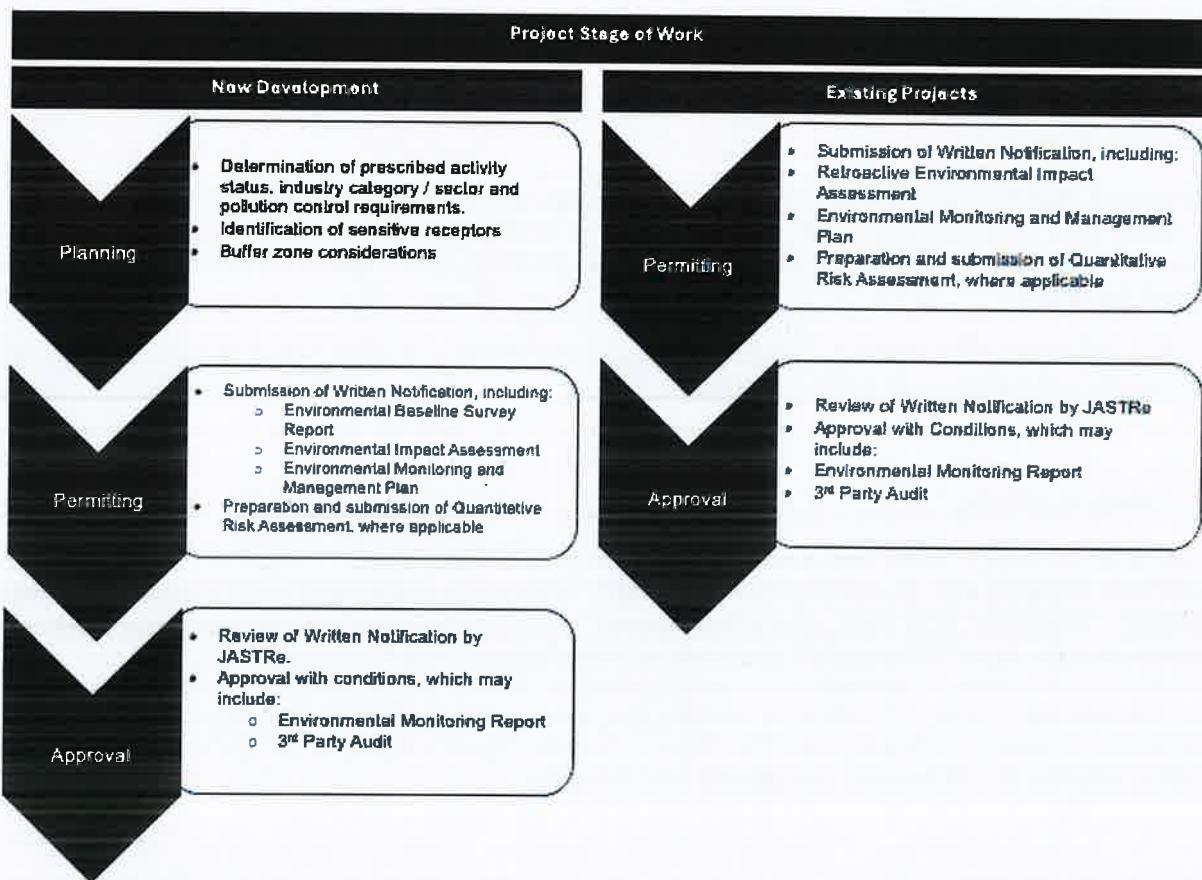


Figure 1 Key stages of Environmental Permitting and Approval Process in Brunei

- 1) **Planning Stage** – all Project proponents are required to conduct a:
 - a) Screening Exercise: To screen whether the proposed Project is classified as a Prescribed Activity under Schedule 1 of the Environmental Protection and Management Act, Chapter 240. For a Prescribed Activity, this includes defining the industry category and adherence to the pollution control requirements outlined in this CoP.
 - b) Site Suitability Evaluation: This includes an evaluation of the suitability of the proposed site(s) in relation to industrial zones and buffers requirements outlined in this CoP.
- 2) **Permitting Stage**
 - a) Submission of Written Notification: This submission shall be accompanied by details as per required in Schedule 2 of the Environmental Protection and Management Act, Chapter 240, including, but not limited to, an Environmental Impact Assessment or Retroactive Environmental Impact Assessment to assess project related impacts from construction, operational and/or decommissioning phases, to the environment and an Environmental Management and Monitoring Plan that outlines the planned monitoring and management framework that will be executed during the lifecycle phase (e.g., construction and operational phases) of the Prescribed Activity.

3) Approval Stage

- a) Based upon results from the Written Notification review process, if the Written Notification submissions have met the requirements of Schedule 2 of the Environmental Protection and Management Act, Chapter 240, Prescribed Activity will be approved with conditions which may include additional prescribed requirements for quarterly Environmental Monitoring Report submission and/or third-party auditing.

2.1 Industry Categories

2.1.1 Low Risk Sector

Prescribed Activity or Works resulting in minimal or insignificant social and environmental impacts that can be readily controlled, managed, and mitigated. A typical example of such an activity is a business operation or activity that does not include any emissions to the atmosphere, water bodies and/or storage of hazardous material or waste.

For low-risk sector, EIA shall be carried out and should fulfill at a minimum Best Management Practices and Abatement measures in pollution control.

2.1.2 Medium Risk Sector

Prescribed Activity or Works that results in, or has the potential to, cause relatively complex or significant impacts that are generally site-specific, largely reversible, and readily addressed through mitigation measures and BMP. Potential adverse environmental impacts on human populations or environmentally important areas are less adverse than those of High-Risk transactions.

For medium-risk sector, EIA shall be carried out and should fulfill Best Management Practices and Abatement measures in pollution control, relevant Industry Specific Pollution Control Measures as well as conduct appropriate monitoring, compliance and reporting.

2.1.3 High Risk Sector

Prescribed Activity or Works with significant adverse environmental and social impacts which extend beyond a specific site and may be irreversible (such as loss of a sensitive habitat), affect vulnerable communities or ethnic groups, involve involuntary displacement and resettlement, or affect significant cultural heritage sites. Prescribed Activities under this sector often consist of multiple, complex, or significant installations, processes or structures that will most certainly result in a variety of individual and / or interacting impacts that cannot be sufficiently mitigated with standard BMP.

For high-risk sector, EIA shall be carried out and should fulfill Best Management Practices and Abatement measures in pollution control, relevant Industry Specific Pollution Control Measures as well as conduct appropriate monitoring, compliance and reporting.

2.2 Judicious Siting & Buffer Zones

General Principles

- 2.2.1 The following *Site Suitability Principal Criteria* shall be considered when assessing site suitability:
- a) Land-use of proposed Works is not in conflict with that designated in gazetted land-use plans.
 - b) Land-use of proposed Works is generally compatible with surrounding land-use that is designated in gazetted land-use plans.
 - c) The proposed site considers adequate provisions for buffer zone or setbacks to sensitive receptors.
 - d) Where relevant, the impact of added pollutant load on the surrounding environment and its capacity to receive it should be considered without compromising national environmental targets or goals.
 - e) Where relevant, consider the use of Best Available Technology and pollution prevention and control measures.
- 2.2.2 Industrial zoning and buffers are prescribed based on their scale of pollution or potential environmental impacts towards primarily human (residential) receptors. Site buffers in relation to existing waterbodies (e.g., river, sea, etc.), environment and ecology are important considerations. As general guidance for development of all industrial buildings in Brunei, please refer to Garis Panduan dan Piawai Perancangan Bagi Kemajuan Industri 2010 by the Department of Town and Country Planning. For development within industrial land under DARE's jurisdiction, please refer to DARE Industrial Zoning using Brunei Darussalam Standard Industry Classification (BDSIC) 2011 in ANNEX A.
- 2.2.3 For Non-Prescribed Activity or Works, the project siting, zoning and buffer provisions must be carried out during project planning stage via internal scoping based upon criteria as set out in Clause 2.2.1 and the prescribed buffer zones factored in.
- 2.2.4 For Prescribed Activity, the adequacy of the prescribed site buffer shall be assessed and the final buffer provisions to be declared in the Environmental Impact Assessment (EIA) and where relevant, Quantitative Risk Assessments (QRA).
- 2.2.5 All relevant permits must be attained prior to building works. This includes among others, Planning Permission from the Department of Town and Country Planning and Building Approval obtained from ABCi.

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3 Definitions and Abbreviation

For the purposes of this code, the following definitions apply:

Air Pollutants

Includes dust, fumes, mist, smoke or other particulate matter, vapor, gas, odorous substances, or any combination thereof, that may have polluting properties.

Ambient Air

Outdoor air in the troposphere.

Atmospheric Emission

The release of air pollutants into ambient air which includes diffuse emissions.

Authority

Authority appointed under Section 4(1) of the Environmental Protection and Management Act, Chapter 240.

BCCO

Brunei Climate Change Office

Best Available Techniques (BAT)

Advanced and proven techniques for the prevention and control of industrial emissions and the wider environmental impact caused by industrial installations, which are developed at a scale that enables implementation under economically and technically viable conditions.

Best Management Practices (BMP)

Most often analogous with and/or encompassed within the concept of BAT, Best Management Practices refer to the accepted body of science-based environmental management approaches or measures that allow a related Prescribed Activity Owner to best meet required standards or achieve the desired objectives.

Circular Economy

Recovering resources at the end of a product's life and channelling them back into production so that all forms of waste are reused.

Combustion Plants

Any equipment, e.g., boiler, turbine, generator or engine which burns fuel to generate heat, energy, power or electricity.

Contaminated

Having been made impure by exposure to or addition of harmful or polluting substance(s).

Controlled Watercourse

A watercourse from which potable water supplied by the Public Works Department (PWD) or relevant authority is obtained but excluding a watercourse from which water is pumped into a main of the abovementioned relevant authority.

DARe

Darussalam Enterprise

EIA

Environmental Impact Assessment

Fuel Burning Equipment

Any furnace, boiler and/or any other apparatus used in the process of burning any combustible material.

Greenhouse Gases

Gases in the atmosphere that trap heat, such as carbon dioxide and methane.

Hazardous Industrial Wastes

Any waste falling within the categories of waste listed in the Order or regulations on waste management. This includes used/discharged/off shelf life/ off-spec chemical and hazardous substances, including wastes from industrial processes.

Hazardous Substances

a) Any natural or artificial substance including any raw material, whether in a solid, semi-solid or liquid form, or in the form of gas or vapor, or in a mixture of at least two of these substances.

b) Any living organism,

intended for any environmental protection, conservation, and control activity, which can cause pollution or detrimental effect to the environment, as the case may be.

IFC

International Finance Corporation

Industrial Area

A designated area as approved or gazetted by the local Authority for the purpose of siting industrial, manufacturing or processing plants, factories or facilities.

Industrial Effluent

Any liquid, either with or without particles of matter in suspension therein, that outflow or discharges from any process or activities of an industrial building or process facility or manufacturing plant.

Mixed Development Area

A designated area as approved or gazetted by the local Authority for the purpose of permitting business, commercial, trading or similar activities, together with residential uses.

Mixing Zone

A mixing zone is a regulatory designated area in the receiving water where the effluent from a point source discharge undergoes initial dilution in the receiving water.

MPABD

Maritime and Port Authority of Brunei Darussalam.

Nature Positivity

Activities that enhance the resilience of our planet and societies to halt and reverse nature loss.

Noise Sensitive Area or Zone

Schools, hospitals and nursing homes, places of worship, religious buildings, courts of law and ecological sensitive areas.

Open Burning

Any fire, combustion or smouldering that occurs in any place which results in the direct emission of any air pollutants into the ambient air.

Prescribed Activity

Any activity set out in Schedule 1 of the Environmental Protection and Management Order, 2016.

Prescribed Activity Owner

Any person who intends to carry out the prescribed activity as set out in Schedule 1 of the Environmental Protection and Management Act, Chapter 240. This includes the project design, pre-construction, construction, operational, decommissioning and restoration, or any other phase of that activity.

Public Sewer

Pipe system to convey fluids by gravity, usually foul water but can be surface or combined, constructed by the Government on any land including private property at its expense or acquired from the Government.

Residential Area

A designated area as approved or gazetted by the local Authority for the purpose of human dwellings and residence.

Sanitary Wastewater

The effluents discharged from domestic sewage, food service and laundry facilities.

Sewage Treatment Plant

A plant setup of any combination of physical, biological and chemical process units such as screens, grit and grease chambers, balancing tanks, primary sedimentation tanks, bio reactors, secondary clarifiers, disinfection, flow measurement devices, sludge treatment and tertiary treatment etc., to remove contaminants from sewage to produce effluent that is suitable for discharge to watercourse / water bodies (complying with local disposal requirements).

SHENA

Safety, Health and Environment National Authority

Stack

A chimney, vertical pipe, channel, duct system or similar structure designed to move out exhaust (e.g., flue-gas, smoke) or through which combustion product gases or smoke are exhausted to the ambient air.

Stormwater

Rainwater or surface water includes any surface runoff and flows resulting from precipitation, drainage, or other sources (i.e., excluding sewage).

Sustainable Construction

Using recyclable and renewable materials in building projects and minimizing energy consumption and waste production.

Uncontrolled Watercourse

Includes a reservoir, lake, river, stream, canal, drain, spring or well or a part of the sea abutting on the foreshore and any other natural, artificial or sub-surface body of water.

Water Footprint

The amount of freshwater utilised in the production of goods and products.

WHO

World Health Organisation

Works

Includes any activity, whether commercial or not, that may have an impact on the environment

Written Notification

A written report as set out in Schedule 2 of the Environmental Protection and Management Act, Chapter 240.

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Part Two: Pollution Control Requirements

Industrial activities and other anthropogenic developments should be designed, constructed, and operated with appropriate pollution control measures to prevent and minimise any adverse pollution impact on the surrounding environment.

4 Water Pollution

a) General Principles

Water is a vulnerable and valuable resource with economic value. It is therefore important to safeguard this natural resource through application of sufficient precautionary measures and BMP to prevent water pollution.

b) Application

4.2.1 Applicable to any premises or activities which discharge untreated industrial effluent or processed wastewater from any premises or activities, including from utility operations, sanitary wastewater or stormwater to the environment onto or into any soil, or any inland waters or marine waters unless specified.

c) General Duties

4.2.2 All types of wastewater discharge to the environment shall comply with applicable national regulations and requirements.

4.2.3 Complying with industrial effluent limits may not necessarily result in compliance with ambient water quality and therefore, relevant ambient water quality criteria in Annex D, shall be applied and adhered to.

4.2.4 Pursuant to Sections 1.1 and 4.2.3, assessment to comply with permissible effluent limits shall be conducted with application of scientific methods and mathematical models, with considerations of:

- a) ANNEX C
- b) Potential impact to the receiving waterbody from a discharge source taking into consideration such aspects as existing water quality, proximity of potentially affected communities, ecological receptors, other intakes and outfalls as well as prevailing hydrodynamic conditions

4.2.5 Pursuant to Section 4.2.4, permissible effluent discharge criteria shall be defined during the permitting and approval stage, including but not limited to:

- a) Mixing zone, established through quantitative modelling
- b) Net pollution load
- c) Monitoring regime

4.2.6 No person shall conduct any work, construction, or upgrading, or make any change resulting in a new source of discharge of industrial effluent, without prior consent from the relevant Authority.

4.2.7 Best Management Practices shall be applied to manage and control water pollution. Where feasible, application of Best Available Techniques as listed in ANNEX B should also be considered.

d) Industrial Effluent

- 4.2.8 All industrial effluents shall be treated to allowable limits before discharge into watercourse as shown in ANNEX C. For medium and high-risk Prescribed Activities, the discharge limits specified in the respective BMP/BAT documents listed in ANNEX B are also applicable.
- 4.2.9 Where required, industries shall develop, construct, install, operate, and maintain a suitably sized wastewater treatment plant to treat the effluent to comply with the allowable limits before discharge.

e) Sanitary Wastewater

- 4.2.10 All sanitary wastewaters shall be discharged through properly constructed sewers into the public sewer per Design Manual and Guidelines for Sewerage 2013 or its latest version.
- 4.2.11 If no public sewers are available, sufficient provisions must be made to dispose of sewage by treatment such that it renders the effluent sufficiently innocuous to be discharged into a stream or drain which is flowing and not stagnant to allow for dilution, or to be allowed to percolate into the soil.

f) Stormwater

- 4.2.12 Stormwater runoff at low risk of becoming contaminated is permitted to be channeled for direct discharge into a watercourse but not into the public sewer.
- 4.2.13 Stormwater runoff at high risk of becoming contaminated from process areas or facilities shall be collected and treated properly before discharge into any watercourse.

g) Best Management Practices & Abatement Measures

- 4.2.14 BMP for control of water pollution shall be applied by all industry sectors, including low, medium, and high-risk sectors.
- 4.2.15 General Environmental, Health & Safety Guidelines for Wastewater and Ambient Water Quality as provided by the International Finance Corporation (World Bank) listed in ANNEX B are applicable. The latest version of the guideline shall be applied/adhered to unless otherwise instructed by the Authority.
- 4.2.16 Examples of benchmarked General Abatement Measures for controlling water pollution are provided in Table 1 and shall, as recommended in above-mentioned guidelines, be adopted where applicable. Adoption of alternative control options is allowed provided they comply with national standards and requirements.

Table 1 **Example of Abatement Measures for Water Pollution Control** (referenced from IFC EHS Guidelines for Wastewater and Ambient Water Quality, Apr 2007)

Pollutant/Parameter	Control Options / Principle	Common End of Pipe Control Technology
pH	Chemical, Equalization	Acid/Base addition, Flow equalization
Oil and Grease / TPH	Phase separation	Dissolved Air Floatation, oil water separator, grease trap
TSS - Settleable	Settling, Size Exclusion	Sedimentation basin, clarifier, centrifuge, screens
TSS - Non-Settleable	Floatation, Filtration - traditional and tangential	Dissolved air floatation, Multimedia filter, sand filter, fabric filter, ultrafiltration, microfiltration

Pollutant/Parameter	Control Options / Principle	Common End of Pipe Control Technology
Hi - BOD (> 2 Kg/m ³)	Biological - Anaerobic	Suspended growth, attached growth, hybrid
Lo - BOD (< 2 Kg/m ³)	Biological - Aerobic, Facultative	Suspended growth, attached growth, hybrid
COD - Non-Biodegradable	Oxidation, Adsorption, Size Exclusion	Chemical oxidation, Thermal oxidation, Activated Carbon, Membranes
Metals - Particulate and Soluble	Coagulation, flocculation, precipitation, size exclusion	Flash mix with settling, filtration - traditional and tangential
Inorganics / Non-metals	Coagulation, flocculation, precipitation, size exclusion, Oxidation, Adsorption	Flash mix with settling, filtration - traditional and tangential, Chemical oxidation, Thermal oxidation, Activated Carbon, Reverse Osmosis, Evaporation
Nutrients	Biological Nutrient Removal, Chemical, Physical, Adsorption	Aerobic/Anoxic biological treatment, chemical hydrolysis and air stripping, chlorination, ion exchange
Temperature	Evaporative Cooling	Surface Aerators, Flow Equalization
Pathogens	Disinfection, Sterilization	Chlorine, Ozone, Peroxide, UV, Thermal

4.2.17 The type and level of effluent treatment shall consider the following:

- a) Intended use of the receiving water body (e.g., as a source of drinking water, recreation, or other).
- b) Presence of sensitive receptors (e.g., endangered species or habitats, recreational areas, fish farms and other water dependent activities that have a precedence in the area).

h) Industry Specific Pollution Control Measures

- 4.2.18 For medium to high-risk Prescribed Activities, additional BAT/BMP may be required to control water pollution.
- 4.2.19 Relevant BAT/BMP to control the water pollution discharges shall be applied in the planning, design, operation, and decommissioning of the Prescribed Activities i.e., examples of which for Prescribed Activities are provided in ANNEX B.
- 4.2.20 Key pollutants of concern that require precautionary control measures and regular monitoring are provided within the relevant BAT/BMP document listed in ANNEX B and shall be adhered to unless otherwise instructed by the relevant Authority.

i) Effluent Monitoring, Compliance & Reporting

- 4.2.21 Responsible operators of all industry sectors shall ensure that monitoring, compliance, and reporting systems are set up and working in a proper and efficient manner (Figure 2).
- 4.2.22 In-situ analysis of all effluents must be conducted and monitored using appropriate calibrated monitoring equipment and in accordance with national or international recognized methods (e.g., ISO, ASTM and EN).
- 4.2.23 Ex-situ (Laboratory) analysis of water samples must be conducted by an accredited laboratory.
- 4.2.24 Industrial effluent monitoring should consider any time-dependent variations such as batch or continuous discharge.
- 4.2.25 The frequency of monitoring shall be proportionate with the intensity of operation and effluent discharge in relation to demonstrated impacts to the environment.
- 4.2.26 For the purpose of submission, all monitoring data should be quality assured and compiled in a coherent manner.
- 4.2.27 Periodic and/or continuous monitoring data should be submitted to the Authority on a timely basis through an Environmental Monitoring Report (EMR) (ANNEX L).

j) Water Quality Monitoring, Compliance & Reporting

- 4.2.28 Medium and High-Risk Prescribed Activity Owners shall carry out water quality monitoring at the point of discharge and / or at the boundary of mixing zone and / or at the nearest sensitive receptor as determined during the permitting and approval process.
- 4.2.29 Monitoring parameters shall cover the primary pollutants regulated by the relevant Water Quality Guideline as set out in ANNEX D unless specified otherwise by the relevant Authority.
- 4.2.30 The frequency of monitoring shall be proportionate with the intensity of operation and in relation to demonstrated impacts to the environment.
- 4.2.31 Monitoring location(s) should be established based on the results of scientific methods and mathematical models to estimate potential impact to the receiving waterbody from a discharge source taking into consideration such aspects as the location of potentially affected communities, ecological receptors, other intakes and outfalls as well as prevailing hydrodynamic conditions.

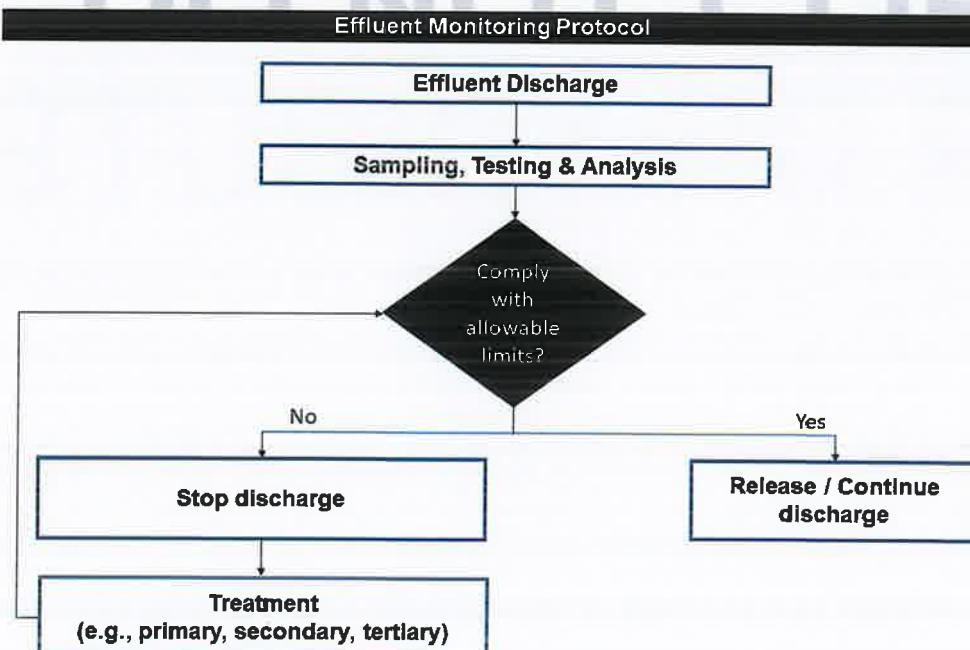


Figure 2 Effluent Monitoring Protocol

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5 Air Pollution

a) General Principles

According to the World Health Organization, air pollution is one of the largest environmental health risk communities face and is therefore an important topic that needs to be addressed and regulated nationally as well as internationally.

b) Application

- 5.2.1 Applicable to any trade, industry, process or fuel burning equipment that emit air pollutants into ambient air.

c) General Duties

- 5.2.2 All atmospheric emissions shall comply with applicable national requirements and regulations. For Prescribed Activities, this includes:

- a) the allowable limits as specified in ANNEX E
- b) ambient air quality standards and guidelines as specified in ANNEX F

- 5.2.3 At facility level, impacts to air quality shall be estimated through semi-quantitative (e.g., expert judgement coupled with descriptive statistics) or quantitative (e.g., mathematical modelling) assessments with the use of baseline air quality assessments in accordance with the expected magnitude (particularly for High-risk Sectors).

- 5.2.4 In the event of any incident, accident or failure, the Prescribed Activity Owners are required to:

- a) inform the Authority immediately.
- b) take necessary measures or any complementary measures as may be required by the Authority to limit the environmental consequences and/or to ensure that compliance is restored.

- 5.2.5 Best management practices under Section 5f) should be applied, where applicable, to prevent or reduce emissions into ambient air.

d) Stack Height Consideration

- 5.2.6 Stack height for all point sources of emissions shall be designed accordingly to avoid excessive ground level concentrations and to ensure reasonable diffusion to minimize impacts. The design stack height shall:

- a) Not be lower than 3 m above roof level of all factory buildings in the vicinity or 15 m measured from ground level, whichever is higher.
- b) For High-risk Sector industries or those with multiple stacks, individual stack heights should be computed through modelling.

e) Open Burning

- 5.2.7 Open burning of materials including waste, refuse, debris, construction waste, tyres, metal, plastics, paper, cardboards, green waste in or at any place is prohibited.

- 5.2.8 Open burning is generally prohibited except for the following:

- a) permissible activities without permit listed under ANNEX G, and

b) activities that are granted permit by the Authority.

5.2.9 For more information on the open burning guidelines, please refer to ANNEX H.

f) Best Management Practices & Abatement Measures

5.2.10 Best Management Practices for control of air pollution shall be applied by all industry sectors. This includes the following strategy principles:

- a) Use of Best Available Techniques (BAT)
- b) Consideration of the efficient use of resource / energy / fuel
- c) Cap pollution load in municipal or ecological sensitive areas

5.2.11 General Environmental, Health & Safety Guidelines for Air Emissions and Ambient Air Quality as provided by the International Finance Corporation (World Bank) listed in ANNEX B are applicable. The latest version of the guideline shall be applied/adhered to unless otherwise instructed by the Authority.

5.2.12 General Abatement Measures to control air pollution shall be adopted where applicable i.e., see summary of examples provided in Table 2. Adoption of alternative control options is allowed provided they comply with local standards and requirements.

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Table 2 Example of Abatement Measures for Air Pollution Control

Pollutant/Parameter	Principal Source and Issue	General Prevention & Control Options
Particulate Matter (PM)	<ul style="list-style-type: none"> Abrasive processes Handling of drift sensitive products. Combustion of solid fossil fuels. 	<ul style="list-style-type: none"> Collect dust through air extraction and ventilation systems by: <ul style="list-style-type: none"> Fabric Filters, Electrostatic Precipitator (ESP) Cyclone Wet Scrubber
Sulphur Dioxide (SO ₂)	<ul style="list-style-type: none"> Combustion of sulphureous fuels such as oil, coal, biomass By-product from some chemical processes. 	<ul style="list-style-type: none"> Fuel Switching Sorbent Injection Dry or Wet Flue Gas Desulfurization
Oxides of Nitrogen (NO _x)	<ul style="list-style-type: none"> Combustion of fuel. 	<ul style="list-style-type: none"> Low-excess-air firing Staged Combustion Flue Gas Recirculation Water/Steam Injection Low-NO_x Burners Flue Gas Treatment Selective Catalytic Reduction (SCR) or Selective Non-Catalytic Reduction (SNCR)
Fugitive VOCs	<ul style="list-style-type: none"> Equipment Leaks from Pumps, Compressors, Pressure Relief Devices, Valves, Connectors, Open-ended Lines, Sampling Connections, etc. 	<ul style="list-style-type: none"> Seal-less design Closed-vent system Dual mechanical seal with barrier fluid maintained at a higher pressure than the pumped fluid or compressed gas Rupture disk assembly Weld together Blind, cap, plug, or second valve Closed-loop sampling Implementing a leak detection and repair (LDAR) program that controls fugitive emissions by regularly monitoring to detect leaks, and implementing repairs within a pre-defined time period.
	<ul style="list-style-type: none"> Volatile organic liquids in process vessels and storage tanks Loading of volatile* organic liquids into road tankers, barges and seagoing vessels 	<ul style="list-style-type: none"> Substitution of less volatile substances, such as aqueous solvents. Collection of vapors through air extractors and subsequent treatment of gas stream by removing VOCs with control devices such as condensers or activated carbon absorption. Collection of vapors through air extractors and subsequent treatment with destructive control devices such as Catalytic Incinerators, Thermal Incinerators or Enclosed Oxidizing Flares (vapour treatment). Use of floating roofs on storage tanks to reduce the opportunity for volatilization by eliminating the headspace present in conventional storage tanks. Vapour balancing for loading into road tankers Vapour treatment for loading into barges and seagoing vessels
Fugitive PM	<ul style="list-style-type: none"> Unpaved roads 	<ul style="list-style-type: none"> Wet Suppression – watering with/without 'ecofriendly' chemicals e.g., for crust formation or as wetting agent

Pollutant/Parameter	Principal Source and Issue	General Prevention & Control Options
		<ul style="list-style-type: none"> • Wind speed reduction e.g., by wind screens or vegetation • Speed Reduction • Traffic Reduction • Paving (Asphalt / Concrete) • Covering with Gravel, Slag, or Paver • Vacuum Sweeping of paved areas • Water Flushing/Broom Sweeping of paved areas
	• Transport and open storage of solid materials, and from exposed soil surfaces	<ul style="list-style-type: none"> • Use of dust control methods, such as covers, water suppression, or increased moisture content for open materials storage piles, or controls, including air extraction and treatment through baghouse or cyclone for material handling sources, such as conveyors and bins.

* Volatile: liquid with a vapour pressure of 1 kPa (10 mbar) or more at a temperature of 293.15 K (20°C) or at operating conditions.

g) Industry Specific Pollution Control Measures

- 5.2.13 For Medium and High-risk Prescribed Activities, additional BAT/BMP may be required to control air emissions.
- 5.2.14 Relevant BAT/BMP for the control of atmospheric emissions shall be applied in the planning, design, operation, and decommissioning of the Prescribed Activities i.e., examples of which for Prescribed Activities are provided in ANNEX B.
- 5.2.15 Key pollutants of concern that require precautionary control measures and regular monitoring are provided within the relevant BAT/BMP document listed in ANNEX B and shall be adhered to unless otherwise instructed by the relevant Authority.

h) Air Emission Monitoring, Compliance & Reporting

- 5.2.16 All atmospheric emissions must comply with applicable emission standards. Compliance shall be verified by monitoring.
- 5.2.17 For emission monitoring, the monitoring parameters shall reflect the pollutants of concern associated with project processes.
- 5.2.18 In-stack continuous emission monitoring system (CEMS) requirements should follow relevant BAT reference documents (ANNEX B).
- 5.2.19 All monitoring, sampling and analysis must be carried out using calibrated equipment and in accordance with national or international recognized methods (e.g., ISO, ASTM and EN) by trained professionals and/or registered companies with relevant authorities.
- 5.2.20 The frequency of monitoring shall be proportionate with the intensity of operation and in relation to demonstrated impacts to the environment.
- 5.2.21 For the purpose of submission, all monitoring data should be quality assured and compiled in a coherent manner.
- 5.2.22 Periodic and/or continuous monitoring data shall be submitted to the Authority on at a minimum quarterly basis or as specified in the approved Written Notification submission through the Environmental Monitoring Report (EMR) (ANNEX L).

i) **Air Quality Monitoring, Compliance & Reporting**

- 5.2.23 Ambient air quality monitoring may be required by the Authority. Monitoring may consist of off-site or fence line monitoring either by the Medium and High-risk Prescribed Activity Owner, the Authority, or by collaboration between both.
- 5.2.24 All monitoring and analysis must be carried out using calibrated equipment and in accordance with national or international recognized methods (e.g., ISO, ASTM and EN) by trained professionals and/or registered companies with the relevant authorities.
- 5.2.25 Monitoring parameters shall cover the primary pollutants regulated by WHO Ambient Air Quality Guideline as set out in ANNEX F unless specified otherwise by the relevant authorities.
- 5.2.26 The frequency of monitoring shall be proportionate with the intensity of operation and in relation to demonstrated impacts to the environment.
- 5.2.27 Monitoring location should be established based on the results of scientific methods and mathematical models to estimate potential impact to ambient air quality from an emission source taking into consideration such aspects as the location of potentially affected communities and prevailing wind directions.

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6 Noise Pollution

a) General Principles

According to World Health Organization, environmental noise is an important public health issue, featuring among the top environmental risks to health and negative impacts on well-being. It is therefore important to provide control measures for protecting human health from exposure to environmental noise.

b) Application

- 6.2.1 Noise disturbance shall mean any sound which:
 - a) exceeds the existing ambient equivalent A-weighted sound level (L_{Aeq})¹ by 3 dB; or
 - b) exceeds the sound level limits as prescribed in ANNEX I.

- 6.2.2 All noise emissions shall comply with applicable national regulations and requirements. For Prescribed Activities, this includes:
 - a) the allowable limits as specified in ANNEX I.
 - b) In situations where the existing/ambient sound levels are higher than prescribed limits, noise impacts should not result in a maximum increase in background levels of 3 dB at the nearest receptor.

- 6.2.3 At facility level, noise impacts shall be estimated through semi-quantitative (e.g., expert judgement coupled with descriptive statistics) or quantitative (e.g., mathematical modelling) assessments in consideration of baseline/ambient sound levels in accordance with the expected magnitude (particularly for High-risk Sectors).

- 6.2.4 BMP (under Section 6d) should be applied, where applicable, to manage and control noise pollution. Where feasible, application of BAT (under Section 6e) should also be considered.

- 6.2.5 In the event of any incident, accident or failure, the Prescribed Activity Owners are required to:
 - a) inform the Authority immediately.
 - b) take necessary measures or any complementary measures as may be required by the Authority to limit the environmental consequences and/or to ensure that compliance is restored.

d) Best Management Practices & Abatement Measures

- 6.2.6 Best Management Practices for control of noise pollution should be applied by all industry sectors, including low, medium, and high-risk sectors. This includes the following strategic principles:
 - a) Reducing noise emission and exposure through proper assessment and planning;

¹ Equivalent Continuous Sound Pressure Level, or L_{eq}/L_{Aeq}, is the constant noise level that would result in the same total sound energy being produced over a given period

- b) Coordinate approaches to control noise sources through use of noise abatement measures;
 - c) Informing and involving communities potentially affected by a change in noise exposure.
- 6.2.7 General Abatement Measures to control noise pollution provided in Table 3 should be adopted where applicable, with priority to reduce at source and of transmission path. Adoption of alternative control options is allowed provided they comply with national standards and requirements.

Table 3 Example of Abatement Measures for Noise Pollution Control

Reduction at Source	Transmission Path	Receiver
e.g., Consideration of buffer zones or siting facilities away from community areas, road/railway alignment, reducing speed limit, plant design, traffic restrictions and management, selecting equipment with lower sound power levels, etc.	e.g., Use of enclosures, noise barriers or silencers, etc.	e.g., Sound insulation of windows or doors, building orientation, etc.

e) Industry Specific Pollution Control Measures

- 6.2.8 Operational industrial noise sources are typical across most industrial sectors / Prescribed Activities. Therefore, best management practices (Section 6d) and best available technologies (ANNEX B) should be referred to.
- 6.2.9 For construction and transportation noise sources, relevant BAT/BMP noise abatement should be applied in the planning, design, operation, and decommissioning activities i.e., examples of which for Prescribed Activities are provided in ANNEX B.
- 6.2.10 For construction noise sources, public notice of potentially affected communities should be issued prior to the activities.

f) Monitoring, Compliance & Reporting

- 6.2.11 Measurements to include:
- a) Ambient sound pressure levels at a receiver location and/or at the premise boundary of noise source. This should be done prior to project development and in absence of other noise sources to establish background ambient noise levels.
 - b) Sound pressure levels at a receiver location and/or the premise boundary of noise source to assess compliance to noise limits or for verifying operational phase noise levels.
 - c) Sound pressure levels of each noise source as may be required to evaluate the contribution of each source.
- 6.2.12 Monitoring and measurements must be carried out using appropriate calibrated sound level meters / equipment and in accordance with national or international recognized methods (e.g.,

ISO, ASTM and EN) by trained professionals and/or registered companies with relevant authorities.]

- 6.2.13 Monitoring periods need to be sufficient for statistical analysis, with monitors capable of logging data continuously over the designated period of time, or as appropriate.
- 6.2.14 The frequency of monitoring shall be commensurate with the intensity of operation and in relation to demonstrated impacts to the environment.
- 6.2.15 For the purpose of submission, all monitoring data should be quality assured and compiled in a coherent manner.
- 6.2.16 Periodic and/or continuous monitoring data should be submitted to the Authority on a timely basis through the Environmental Monitoring Report (EMR) (ANNEX L).

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7 Hazardous Substances

a) General Principles

- 7.2.1 Hazardous substances and their control and management measures referred to in this Code of Practice **exclude** those regulated under the Poisons Act. For matters related to the management of pesticides, healthcare or medical substances and waste, Prescribed Activity Owners are to refer to the relevant authorities.
- 7.2.2 The prescribed list of hazardous substances can be referred to in ANNEX J.

b) Application

- 7.2.3 Applicable to all Prescribed Activity Owners and any party that is involved in the generation, storage, consignment and transport, collection, use and/or processing of hazardous substances.

c) General Duties

- 7.2.4 All Prescribed Activity Owners responsible for hazardous substances shall adhere to what was approved under its Written Notification particularly for handling, storage, and transport of hazardous substances.
- 7.2.5 The appropriate permits, i.e., to seek and apply proper permits from the relevant authorities before import, export, possession for any use of hazardous substances and must be conducted by Prescribed Activity Owners.
- 7.2.6 In the event of any incident, accident or failure, the Prescribed Activity Owners are required to:
- inform the Authority immediately.
 - take necessary measures or any complementary measures as may be required by the Authority to limit the environmental consequences and/or to ensure that compliance is restored.

d) Best Management Practices & Abatement Measures: Acquisition, Storage and Labelling

- 7.2.7 Acquisition of hazardous substances should be according to projected need and should not be more than the necessary to avoid excess wastage.
- 7.2.8 All hazardous substances must be stored in containers with appropriate hazard labelling that conform with classification and labelling of hazardous substances standard as prescribed by the relevant authority.
- 7.2.9 Safety Data Sheets (SDS) must be provided by the manufacturers, made available on-site and follow well-established standards, i.e., United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS).
- 7.2.10 The designation of storage areas for hazardous substances must meet national industry specific design measures prescribed by the relevant authority. Where no national industry specific design measures exist, hazardous substance storage areas must comply with international industry specific design measures, examples of which are provided in ANNEX B.

e) Best Management Practices & Abatement Measures: Handling

- 7.2.11 Anyone responsible in handling hazardous substance must undergo training courses and certification on safety requirements, first aid, firefighting and precautionary measures, including prevention of accidental release or spillage, and procedures to follow in case of accidental release

or spillage and must be approved by the as per current requirements before they are allowed to collect, handle and transport hazardous substances.

f) Best Management Practices & Abatement Measures: Transport

- 7.2.12 Vehicles used for transporting hazardous substances must be in accordance to the applicable guidelines and standards set by the relevant authorities. The vehicles must be compatible or suitable for the characteristics and nature of the hazardous substances being transferred and must always be equipped with the appropriate safety and precautionary equipment.
- 7.2.13 The vehicles must be equipped with secondary containment, drip trays, or other overflow and drip containment measures at connection points or other possible overflow points.
- 7.2.14 Safety and precautionary equipment should be worn and/or equipped during the transport or collection of hazardous substance.

g) Industry Specific Pollution Control Measures

- 7.2.15 Relevant BATs for the management of hazardous substances shall be applied in the planning, design, operation, and decommissioning of the Prescribed Activities i.e., examples of which for Prescribed Activities are provided in ANNEX B.

h) Monitoring, Compliance & Reporting (under Normal Operating Conditions)

- 7.2.16 Management of hazardous substances including the inventory on the acquisition, storage, use and disposal of hazardous substances must be reported to the Authority at a minimum quarterly basis or as specified in the approved Written Notification through the submission of the Environmental Monitoring Report (EMR) (ANNEX L).
- 7.2.17 All Prescribed Activity Owners must conduct regular inspection of safety features or hazard control measures and logbook of inspections. As and when required, reports of such inspection shall be provided-to the Authority.
- 7.2.18 All Prescribed Activity Owner must keep and maintain records containing any information on hazardous substance and retain those records for a period of 5 years after the record is made.
- 7.2.19 In the event of a spillage, sites for monitoring points must consider key human and environmental receptors such as rivers, waterways, and other water bodies.
- 7.2.20 In an event of accidental discharge or spillage, Prescribed Activity Owners must immediately inform the relevant authorities.

i) Handling, Storage, and Transfer of Hazardous Substances in the Marine Environment

- 7.2.21 For hazardous substances handling, storage, transfer, pollution management and related matters that occur within the marine environment, reference shall be made to the relevant Order and regulations including, but not limited to, the following:
 - a) Prevention of Pollution of the Sea Order 2005.
 - b) Prevention of Pollution of the Sea (Garbage) Regulations 2008.
 - c) Prevention of Pollution of the Sea (Oil) Regulations 2008.
 - d) Prevention of Pollution of the Sea (Noxious Liquid Substance in Bulk) Regulations 2008.
 - e) Oil Spill Management for Oil Companies: Brunei National Oil Spill Contingency Plan (NOSCOP).

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8 Hazardous Industrial Wastes

a) General Principles

- 8.2.1 For guidance and compliance on the storage, handling, treatment and disposal of hazardous industrial wastes, the relevant regulations pertaining to management of hazardous industrial wastes, including those made thereunder the Environmental Protection and Management Act, Chapter 240 shall be referred and adhered to. The prescribed list of hazardous industrial wastes can be referred to in ANNEX K.
- 8.2.2 Other general waste which are otherwise not classified as hazardous industrial wastes are excluded from this CoP and shall refer to the relevant regulations pertaining to waste management made thereunder the Environmental Protection and Management Act, Chapter 240 for compliance.

b) Application

- 8.2.3 Applicable to all Prescribed Activity Owners and any party that is involved in the import, export, generation, storage, consignment and transport, collection, processing, recycling, recovery, treatment and/or disposal of the prescribed hazardous industrial wastes.

c) General Duties

- 8.2.4 All Prescribed Activity Owners for hazardous industrial waste shall adhere to what was approved under its Written Notification particularly for handling, storage, transport and disposal of hazardous industrial waste.
- 8.2.5 All activities related to the import, export and transit of hazardous industrial waste that are subject to the Basel Convention shall adhere to the Hazardous Waste (Control of Export, Import and Transit) Order, 2013.
- 8.2.6 All Prescribed Activity Owners responsible for hazardous industrial waste should be trained and possess accredited license(s) to operate. The attainment of licensing is subject to the Authority's purview.
- 8.2.7 In the event of any incident, accident or failure, the Prescribed Activity Owners are required to:
- inform the Authority immediately.
 - take necessary measures or any complementary measures as may be required by the Authority to limit the environmental consequences and/or to ensure that compliance is restored.

d) Best Management Practices & Abatement Measures: Acquisition, Storage and Labelling

- 8.2.8 All hazardous industrial wastes must be assigned with the correct codes per the List of Hazardous Industrial Wastes in ANNEX K.
- 8.2.9 Safety Data Sheets (SDS) must be provided by the manufacturers, made available on-site and follow well-established standards, i.e., United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS).
- 8.2.10 Hazardous industrial wastes must not be stored for more than 180 days, with a capped, agreed upon maximum storage capacity or as per instructed by the Authority.
- 8.2.11 Where no national industry specific design measures exist, storage of hazardous industrial waste must comply with international industry specific design measures, examples of which are provided in ANNEX B.

e) Best Management Practices & Abatement Measures: Handling

- 8.2.12 Hazardous industrial waste collectors and transporters must undergo training courses and certification on safety requirements, first aid, firefighting and precaution measures, [including prevention of accidental release or spillage, and procedures to follow in case of accidental release or spillage,] and must be approved by the relevant authorities as per current requirements before they are allowed to collect, handle and dispose hazardous industrial wastes.

f) Best Management Practices & Abatement Measures: Transport

- 8.2.13 Vehicles used for transporting hazardous substances must be in accordance to the applicable guidelines and standards set by the relevant authorities. The vehicles must be compatible or suitable for the characteristics and nature of the hazardous substances being transferred and must always be equipped with the appropriate safety and precautionary equipment.
- 8.2.14 The vehicles must be equipped with secondary containment, drip trays, or other overflow and drip containment measures at connection points or other possible overflow points.
- 8.2.15 Safety and precautionary equipment should be worn and/or equipped during the transport or collection of hazardous industrial waste.

g) Industry Specific Pollution Control Measures

- 8.2.16 Relevant BATs for the management of hazardous industrial wastes shall be applied in the planning, design, operation, and decommissioning of the Prescribed Activities i.e., examples of which for Prescribed Activities are provided in ANNEX B.

h) Monitoring, Compliance & Reporting (under Normal Operating Conditions)

- 8.2.17 Management of hazardous industrial waste including the inventory on the generation, storage and disposal of hazardous industrial waste must be reported to the Authority at a minimum quarterly

basis or as specified in the approved Written Notification through the submission of the Environmental Monitoring Report (EMR) (ANNEX L).

- 8.2.18 All Prescribed Activity Owners must conduct regular inspection of safety features or hazard control measures and logbook of inspections. As and when required, reports of such inspection shall be provided to the Authority.
- 8.2.19 All Prescribed Activity Owner must keep and maintain records containing any information on hazardous industrial wastes and retain those records for a period of 5 years after the record is made.
- 8.2.20 In the event of a spillage, sites for monitoring points must consider key human and environmental receptors such as rivers, waterways, and other water bodies.
- 8.2.21 In an event of accidental discharge or spillage, Prescribed Activity Owners must immediately inform the relevant authorities.

i) Disposal Management Procedures

Disposal management procedures shall include, but not limited to those outlined below.

- 8.2.22 Hazardous industrial wastes that have been notified and inventoried with the Authority must be disposed of within 180 days, provided there is no risk to storage during that period.
- 8.2.23 Transfer to a hazardous industrial waste disposal facility must be accompanied by a consignment note as approved or recognised by the Authority to ensure waste quantities as per inventory are accounted for. To ensure consistent safe delivery and acceptance by the receiver, one copy of the note signed by the receiver should be kept by the generator, the transporter and the receiver itself; and provided to the Authority.
- 8.2.24 Hazardous industrial waste shall be disposed to a licensed or approved hazardous industrial waste disposal and treatment facility.
- 8.2.25 The hazardous industrial waste disposal and treatment facility may only receive hazardous industrial waste for which it has been approved/licensed to process.

j) Emergency Response and Remediation of Contaminated Sites

- 8.2.26 Prescribed Activity owner(s) must prepare an Emergency Response Plan (ERP) that is clear and visible to all employees within the facility. The components of the ERP should include (but not limited to):
 - a) Identification of possible emergency situations
 - b) Notification of flow chart
 - c) Emergency detection, evaluation, and classification
 - d) Responsibilities of personnel in an emergency
 - e) Emergency awareness
 - f) Impact zone maps
 - g) Communication and coordination protocols with relevant authorities

- 8.2.27 A response team consisting of relevant agencies should be pre-determined to be called for in the event of an emergency that is beyond the capability of the Prescribed Activity Owner to manage (i.e., requires additional resources, large spillages into public property, etc).
- 8.2.28 Contamination by organic wastes may be remediated on site if they can be biodegraded. If the contamination is by heavy metals, contaminated areas must be excavated or removed and disposed of at a secure landfill.
- 8.2.29 For a hazardous substance or hazardous industrial waste spillage from trucks or other transportation means, if the soil or area cannot be removed, immediate washing and neutralization at the site is required, and any remnants of the neutralizing agent is to be wiped off using industrial rags.
- 8.2.30 Only trained personnel should be involved in the remediation works of hazardous substances.

k) Handling, Storage, and Transfer of Hazardous Industrial Wastes in the Marine Environment

- 8.2.31 For hazardous industrial waste handling, storage, transfer, pollution management and related matters that occur within the marine environment, reference shall be made to the relevant Order and regulations including but not limited to the following:
 - a) Prevention of Pollution of the Sea Order 2005.
 - b) Prevention of Pollution of the Sea (Garbage) Regulations 2008.
 - c) Prevention of Pollution of the Sea (Oil) Regulations 2008.
 - d) Prevention of Pollution of the Sea (Noxious Liquid Substance in Bulk) Regulations 2008.
 - e) Oil Spill Management for Oil Companies: Brunei National Oil Spill Contingency Plan (NOSCOP).
- 8.2.32 To control potential intrusion or spread of invasive species from ballast discharge that could be hazardous to the environment and human life, the UN Convention on the Law of the Sea (Article 196), IMO: International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004, International Maritime Organization's 2011 Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species, and The International Convention for the Prevention of Pollution from Ships (MARPOL) should be adhered to.

ANNEX A

(normative)

DARe Industrial Zoning using Brunei Darussalam Standard Industry Classification (BDSIC) 2011

Ref.	Zone	Site in Relation to Residential, Educational, or IB Zone				Site Adjacent to Aerial Road			Site Adjacent to River, Lake, or Sea			All Sites					
		Min. Site Buffer	Min. Building Setback	Max. Height Limit within 40m from Zone Boundary	Min. Building Setback	Max. Height Limit within 40m from Aerial Road	Min. Building Setback	Max. Height Limit within 40m from Waterway	Min. Building Setback from Road Boundary to	Min. Building Setback from Non-Road Boundary	Min. Awning Setback from Road Boundary	Min. Awning Setback from Non-Road Boundary	Max. Height Limit	Max. FAR or Plot Ratio			
IB	(IB) Industrial Business Zone The purpose of the Industrial Business zone is to provide areas for specialized light industrial firms to locate in a campus-like setting, normally located on the periphery of industrial areas and adjacent to aerial or major collector roadways. In general, this zone is designed for firms that will help achieve economic diversification objectives and that typically have a large number of employees per hectare. The activities of such firms do not generate offensive external impacts and usually do not tolerate substantial noise, pollution, or vibration from surrounding uses. The zone is designed to provide sites for offices that provide a scientific and educational research function or directly serve manufacturing uses or other industrial or commercial enterprises (and not the general public). Provision is also made for small and medium-scale industrial uses within the context of business parks that will maintain the campus-like setting. On a limited basis, complementary uses are permitted, such as restaurants that primarily serve employees in the immediate area and possibly the greater community.	0m	6m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	6m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	6m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	0-9m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	6m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	0m	3m	12m	2.0		
IL	(IL) Light Industrial Zone The primary purpose of this Zone is to provide for high quality, light industrial developments that operate in such a manner that no nuisance factor is created or apparent outside an enclosed building. Limited outdoor activities (loading, service, storage, etc.) that are accessory to a principal Use may occur providing the scale of such activities does not unduly conflict with the primary purpose of this Zone or dominate the Use of the site. This Zone is intended for sites located on, or in proximity to, aerial or collector roadways within an industrial area; or wherever required to implement the objectives of a Plan or Use study. <i>Light type industries or activities are characterized by:</i> <ul style="list-style-type: none">• None or very low pollution potential for air pollution, noise, vibration, odour, fire or explosion;• Does not involve the use hazardous raw materials or production of hazardous products;• Use of renewable or low greenhouse gas emission sources of energy;• Generate no or very low amounts of wastewater with potential to contribute to water pollution;• Generate mostly non-hazardous solid waste and no significant amount of scheduled wastes; or• Industries are small scale and mostly compatible with each other.	8m	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	8m	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	8m	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	8m	9m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	6m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	4.5m	3m	14m	2.0		

Ref.	Zone	Site in Relation to Residential, Educational, or IB Zone			Site Adjacent to Arterial Road			Site Adjacent to River, Lake, or Sea			All Sites					
		Min. Site Buffer	Min. Building Setback	Max. Height Limit within 40m from Zone Boundary	Min. Building Setback	Max. Height Limit within 40m from Arterial Road	Min. Building Setback	Max. Height Limit within 40m from Waterway	Min. Building Setback from Road Boundary to Office	Min. Building Setback from Non-Road Boundary to Factory	Min. Building Setback from Non-Road Boundary	Min. Awning Setback from Non-Road Boundary	Min. Awning Setback from Non-Road Boundary	Max. Height Limit	Max. FAR or Plot Ratio	
IM	(IM) Medium Industrial Zone The purpose of this Zone is to provide for manufacturing, processing, assembly, distribution, service and repair Uses that carry out a portion of their operation outdoors or require outdoor storage areas. Any nuisance associated with such Uses should not generally extend beyond the boundaries of the Site. This Zone should normally be applied on the interior of Industrial areas adjacent to collector and local industrial public roadways such that Uses are separated from any adjacent residential areas by a high quality Industrial, IB or Commercial Zone. <i>Medium type industries or activities are characterized by:</i> <ul style="list-style-type: none">• Moderate pollution potential and risk due to fire, explosion, and/or hazardous chemicals;• Moderate air pollution potential (including odour) from low levels of residual air pollutants;• Moderate potential for emission of greenhouse gases and/or ozone depleting substances;• Moderate noise and/or vibration with no significant residual impact;• Generate significant quantities of wastewater containing low levels of residual pollutants; or• Generate scheduled wastes which are mostly readily treated or managed within prescribed facilities.	250m	N/A	N/A	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	9m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	6m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	4.5m	3m	18m	2.0	
IH	(IH) Heavy Industrial Zone The purpose of this Zone is to provide for Industrial Uses that, due to their appearance, noise, odour, risk of toxic emissions, or fire and explosion hazards are incompatible with residential, commercial, and other land Uses. This Zone should normally be located on the interior of industrial or agricultural areas, such that it does not interfere with the safety, use, amenity or enjoyment of any surrounding zones. <i>Heavy type industries or activities are characterized by:</i> <ul style="list-style-type: none">• High pollution potential and risk due to fire, explosion, radiation, and/or highly hazardous chemicals;• High air pollution potential (including odour) from residual pollutants in air emissions (fugitive and source emissions);• High potential for emission of greenhouse gases and/or ozone depleting substances;• Generate excessive noise and/or vibration exceeding safe limits;• Generate large quantities of wastewater containing significant levels of residual contaminants;• Use large quantities of raw material(s) with potential to cause significant fugitive emissions during handling, transfer and storage; or• Generate significant amounts of scheduled wastes some of which are difficult to treat or managed.	500m	N/A	N/A	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	9m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	6m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	4.5m	3m	20m	2.0	
IHS	(IHS) Special Heavy Industrial Zone The purpose of this Zone is to provide for Industrial Uses that, due to their appearance, noise, odour, risk of toxic emissions, or fire and explosion hazards are incompatible with other land Uses. This Zone should normally be located away from communities or within agricultural areas, such that it does not interfere with the safety, use, amenity or enjoyment of any surrounding zones. <i>High risk industries characterized by:</i> <ul style="list-style-type: none">• Very high risk due to fire, explosion, radiation, and highly hazardous chemicals;• Raw material used in production or products may include those classified as 'highly hazardous';• Emit significant levels of residual particulate and/or gaseous air pollutants; Discharge very large quantities wastewater containing significant levels of residual contaminants; or• Generate large quantities of scheduled wastes some of which are very difficult to treat.	1,000m	N/A	N/A	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	12m	9m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	20m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	6m No loading, storage, trash collection, outdoor service or display area shall be permitted within a Setback	4.5m	3m	25m	2.0	

ANNEX B

(normative)

Best Management Practices & Best Available Techniques for Prescribed Activities

NOTE – Refer to the respective Guidance Documents for the current recommended practices:

- Environmental, Health and Safety (EHS) Guidelines published by the International Finance Corporation (IFC)
- Best Available Techniques (BAT) Reference Document (BREF) published by the European Commission

No	Schedule 1: Prescribed Activities	EHS Guideline International Finance Corporation (IFC)	BREF BAT European Commission
		 Scan for further details on IFC EHS Guidelines	 Scan for further details on EU BREF
1	Agricultural and Farming	Perennial Crop Production	Intensive Rearing of Poultry or Pigs
		Annual Crop Production	
		Poultry Production	
		Mammalian Livestock Production	
2	Aviation	Airlines	Not Available
		Airports	
3	Drainage and Irrigation	Perennial Crop Production	Not Available
		Annual Crop Production	
4	Fisheries	Aquaculture	Not Available
5	Forestry	Board and Particle-based Products	Production of Wood-based Panels
		Forest Harvesting Operations	
		Pulp and Paper Mills	Production of Pulp, Paper and Board
		Sawmilling and Wood-based Products	
6	Hazardous Substance	Hazardous Materials Management	Refining of Mineral Oil and Gas
		Onshore Oil and Gas Development	Management of Waste from Extractive Industries
		Offshore Oil and Gas Development	
		Liquefied Natural Gas (LNG) Facilities	
		Retail Petroleum Networks	

No	Schedule 1: Prescribed Activities		EHS Guideline International Finance Corporation (IFC)	BREF BAT European Commission
			Gas Distribution Systems	
			Crude Oil and Petroleum Product Terminals	
			Natural Gas Processing	
7	Industry	Abrasive Blasting Works	Construction Materials Extraction	Surface Treatment Using Organic Solvents including Wood Preservation
		Asphalt	Petroleum Refining	Refining of Mineral Oil and Gas
			Toll Roads	
		Cement	Cement and Lime Manufacturing	Production of Cement, Lime and Magnesium Oxide
		Ceramic	Ceramic Tile and Sanitary Ware Manufacturing	Ceramic Manufacturing Industry
			Glass Manufacturing	Manufacture of Glass
		Chemical	-	Common Waste Gas Management and Treatment Systems in the Chemical Sector
			Large Volume Petroleum-based Organic Chemicals Manufacturing	Production of Large Volume Organic Chemicals Production of Polymers
			Large Volume Inorganic Compounds Manufacturing and Coal Tar Distillation	Large Volume Inorganic Chemicals – Solids and Others Industry
			Nitrogenous Fertilizer Manufacturing	Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers
			Phosphate Fertilizer Manufacturing	
			Pesticides Formulation, Manufacturing and Packaging	Manufacture of Organic Fine Chemicals
			Pharmaceuticals and Biotechnology Manufacturing	
			Oleochemicals Manufacturing	
		Charcoal	Coal Processing	Large Combustion Plants
		Concrete	Cement and Lime Manufacturing	Production of Cement, Lime and Magnesium Oxide
		Crushing, Grinding and Milling	Mining	Management of Waste from Extractive Industries
			Construction Materials Extraction	
			Integrated Steel Mills	Iron and Steel Production
		Ferrous and Non-Ferrous Metal	Base Metal Smelting and Refining	
				Smelters and Foundries Industry Ferrous Metals Processing
		Food Preparation	Fish Processing	Food, Drink and Milk
			Poultry Processing	
			Dairy Processing	Slaughterhouses and Animal By-products Industries
			Meat Processing	

No	Schedule 1: Prescribed Activities	EHS Guideline International Finance Corporation (IFC)	BREF BAT European Commission
	Gas Works	Coal Processing	Refining of Mineral Oil and Gas
		Natural Gas Processing	
		Petroleum Refining	
		Liquefied Natural Gas (LNG) Facilities	Large Combustion Plants
		Offshore Oil and Gas Development	
		Onshore Oil and Gas Development	
	Iron and Steel	Foundries	Iron and Steel Production
		Integrated Steel Mills	
	Petrochemicals	Petroleum Refining	Refining of Mineral Oil and Gas
		Liquefied Natural Gas (LNG) Facilities	
		Offshore Oil and Gas Development	
		Onshore Oil and Gas Development	Surface Treatment of Metals and Plastics
		Metal, Plastic, Rubber Products Manufacturing	
		Petroleum-based Polymers Manufacturing	
		Large Volume Petroleum-based Organic Chemicals Manufacturing	
	Pulp and Paper Production	Pulp and Paper Mills	Production of Pulp, Paper and Board
	Pulping Works	Pulp and Paper Mills	Production of Pulp, Paper and Board
	Scrap Metal Works	Metal, Plastic, Rubber Products Manufacturing	Surface Treatment of Metals and Plastics
	Shipyards	Ports, Harbors and Terminals	Not Available
		Shipping	
	Vehicle	Shipping	Not Available
		Airlines	
		Metal, Plastic, Rubber Products Manufacturing	
8	Infrastructure	Airlines	Not Available
		Airports	
		Crude Oil and Petroleum Product Terminals	
		Gas Distribution Systems	
		Health Care Facilities	
		Ports, Harbors and Terminals	
		Railways	
		Retail Petroleum Networks	
		Shipping	
		Telecommunications	
		Toll Roads	
		Tourism and Hospitality Development	
		Waste Management Facilities	

No	Schedule 1: Prescribed Activities	EHS Guideline International Finance Corporation (IFC)	BREF BAT European Commission
		Water and Sanitation	
9	Land Reclamation	Ports, Harbors and Terminals	Not Available
10	Marine	Offshore Oil and Gas Development	Not Available
		Ports, Harbors and Terminals	
		Shipping	
11	Mining	Mining	Management of Waste from Extractive Industries
12	Ports	Ports, Harbors and Terminals	Not Available
		Shipping	
13	Power Generation and Transmission	Coal Processing	Large Combustion Plants
		Natural Gas Processing	
		Electric Power Transmission and Distribution	
		Geothermal Power Generation	
		Thermal Power	
		Wind Energy	
14	Quarries	Construction Materials Extraction	Management of Waste from Extractive Industries
15	Resort and Recreational Development	Tourism and Hospitality Development	Not Available
16	Steam Boilers	Geothermal Power Generation	Large Combustion Plants
		Thermal Power	
17	Transportation	Airlines	Not Available
		Airports	
		Crude Oil and Petroleum Product Terminals	
		Gas Distribution Systems	
		Ports, Harbors and Terminals	
		Railways	
		Retail Petroleum Networks	
		Shipping	
		Toll Roads	
18	Waste Treatment and Disposal	Waste Management Facilities	Waste Treatment
			Waste Incineration
19	Water Supply	Water and Sanitation	Food, Drink and Milk

ANNEX C

(normative)

Allowable limits for industrial effluent discharged into a public sewer/watercourse/controlled watercourse.

NOTE –Refer to the respective Regulations for the current allowable limits.

These parameters lists are not exhaustive. Additional parameters may be included subject to JASTRe's consideration.

Parameter	Unit		Controlled Watercourse			Uncontrolled Watercourse			Public Sewer	
			DHI	PCG	SG	DHI	PCG	SG	DHI	PCG
Temperature	°C	40	40	45		40	40	45	45	45
pH	-	6.0 – 9.0	6.9 - 9.0	6.0 – 9.0		6.0 – 9.0	6.9 - 9.0	6.0 – 9.0	6.0 – 9.0	6.0 – 9.0
Total Dissolved Solids (TDS)	mg/l	-	2000	1000			2500; 3000	NIL	3000	
Biological Oxygen Demand (BOD)	mg/l	20	20	20	40		20; 50	50	200	2000
Chemical Oxygen Demand (COD)	mg/l	60	150	60	100		150; 200	100	600	4000
Total Suspended Solids (TSS)	mg/l	30	30	30	50		30	50	400	1000
Oil and Grease	mg/l	1	2	1	5		5; 5	10	20	50
Arsenic	mg/l	0.01	0.1	0.01	0.1		0.5	0.1	1	1
Aluminium	mg/l	5	5	NIL	5		5; 10	NIL	2	2
Barium	mg/l	1	2	1	2		5; 10	2	10	10
Boron	mg/l	0.5	NIL	0.5			NIL	5	5	5
Cadmium	mg/l	0.003	0.05	0.003	0.02		0.1; 0.1	0.1	0.1	0.1
Chloride	mg/l	-	500	250	-		750; 2000	NIL	1000	1000
Chlorine (Free)	mg/l	0.5	0.5	NIL	1		0.5; 1	NIL	0.5	0.5
Chromium (Total) – new	mg/l	0.05	NIL	0.05	1		NIL	1	5	NIL
Chromium – 3	mg/l	0.2	0.5	0.05	1		1; 2	1	2	1
Chromium – 6	mg/l	0.05	0.1	0.05	0.05		0.2; 0.2	1	1	1
Copper	mg/l	0.1	0.5	0.1	0.1		0.5; 0.1	0.1	5	5
Cyanide (Total)	mg/l	0.05	0.1	0.1	0.1		0.2; 0.2	0.1	2	2
Fluoride	mg/l	-	1.5	NIL	-		2; 3	NIL	10	10

Hydrocarbons	mg/l	-	5	NIL	-	5; 10	NIL	20	20
Iron	mg/l	1	1	1	5	5; 5	10	20	20
Lead	mg/l	0.1	0.1	0.1	0.1	0.5; 1	0.1	5	5
Manganese	mg/l	0.2	1	0.5	1	5; 5	5	10	10
Mercury	mg/l	0.001	0.005	0.001	0.005	0.005; 0.005	0.05	0.1	0.1
Nickel	mg/l	0.1	0.2	0.1	1	0.5; 1	1	5	5
Ammoniacal Nitrogen	mg/l	5	5	NIL	20	50; 50	NIL	50	50
Nitrate	mg/l	10	10	20	30	20; 30	NIL	-	NIL
Nitrite	mg/l	0.5	0.5	NIL	2	1; 2	NIL	-	NIL
Nitrogen (Total)	mg/l	15	15	NIL	50	50; 50	NIL	-	NIL
Phenols	mg/l	-	0.1	NIL	-	0.5; 0.5	0.2	0.5	20
Phosphorous	mg/l	-	30	NIL	-	30; 30	NIL	10	10
Selenium	mg/l	0.01	0.05	0.01	0.1	0.1; 0.1	0.5	2	2
Sulphate	mg/l	-	200	200	-	400; 500	NIL	1000	1000
Sulphides	mg/l	0.2	0.5	NIL	0.2	1	1	1	5
Synthetic Detergents	mg/l	-	1	5	-	1; 2	15	20	20
Tin	mg/l	-	NIL	5	-	NIL	NIL	10	10
Zinc	mg/l	0.5	1	0.5	1	2; 5	1	10	10

The industrial effluent discharged into any watercourse shall not contain any of the following substances:

- (1) radioactive material
- (2) any pesticide or equivalent
- (3) garbage, excrement or animal waste, or solid matter.
- (4) petroleum or other inflammable solvents
- (5) a substance that either by itself or in combination or by reaction with other waste may give rise to any gas, or substance which is or is likely to be a hazard to human life, a public nuisance, or injurious.

ANNEX D

(normative)

Ambient Water Quality Standards

NOTE – Refer to the respective Regulations for the current allowable limits.

1) ASEAN Marine Water Quality Criteria (2008)

For Aquatic Life Protection	
Parameters	Criteria Values
Ammonia (NH ₃ -N)	70 µg/L
Cadmium (Cd)	10 µg/L
Chromium (VI) (Cr (VI))	50 µg/L
Copper (Cu)	8 µg/L
Temperature	Increase not more than 2° C above the maximum ambient temperature
Cyanide (CN-)	7 µg/L
Dissolved oxygen (DO)	4 mg/L
Lead (Pb)	8.5 µg/L
Mercury (Hg)	0.16 µg/L
Nitrate (NO ₃ -N)	60 µg/L
Nitrite (NO ₂ -N)	55 µg/L
Oil and grease	0.14 mg/L
Total phenol	0.12 mg/L
Phosphate (PO ₄ ³⁻ -P)	15 µg/L (Coastal) 45 µg/L (Estuarine)
Tributyltin (TBT)	10 ng/L
Total suspended solids (TSS)	Permissible 10% maximum increase over seasonal average concentration
Bacteria (to be included for Human Health Protection, i.e., Coastal Water Quality for Recreational Activities)	100 faecal coliform/100 mL 35 enterococci/100 mL

2) Riverine Water Quality
(extract from National Water Quality Standards for Malaysia, 2016)

Water Classes and Uses

Class	Uses
Class I	Conservation of natural environment. Water Supply I – Practically no treatment necessary. Fishery I – Very sensitive aquatic species.
Class IIA Class IIB	Water Supply II – Conventional treatment required. Fishery II – Sensitive aquatic species. Recreational use with body contact.
Class III	Water Supply III – Extensive treatment required. Fishery III – Common, of economic value and tolerant species; livestock drinking.
Class IV	Irrigation
Class V	None of the above.

Water Quality Index Classification

Parameter	Unit	CLASS				
		I	II	III	IV	V
Ammoniacal Nitrogen	mg/l	< 0.1	0.1 – 0.3	0.3 – 0.9	0.9 – 2.7	> 2.7
Biochemical Oxygen Demand	mg/l	< 1	1 – 3	3 – 6	6 – 12	> 12
Chemical Oxygen Demand	mg/l	< 10	10 – 25	25 – 50	50 – 100	> 100
Dissolved Oxygen	mg/l	> 7	5 – 7	3 – 5	1 – 3	< 1
pH	-	> 7	6 – 7	5 – 6	< 5	> 5
Total Suspended Solid	mg/l	< 25	25 – 50	50 – 150	150 – 300	> 300
Water Quality Index (WQI)		< 92.7	76.5 – 92.7	51.9 – 76.5	31.0 – 51.9	< 31.0

Water Quality Classification Based on Water Quality Index

Sub Index & Water Quality Index	INDEX RANGE		
	Clean	Slightly Polluted	Polluted
Biochemical Oxygen Demand (BOD)	91 - 100	80 - 90	0 - 79
Ammoniacal Nitrogen (NH -N) 3	92 - 100	71 - 91	0 - 70
Suspended Solids (SS)	76 - 100	70 - 75	0 - 69
Water Quality Index (WQI)	81 - 100	60 - 80	0 - 59

Parameters	Unit	Class				
		I	IIA/IIIB	III*	IV	V
Aluminium (Al)	mg/l	▲	-	(0.06)	0.5	▲
Arsenic (As)	mg/l		0.05	0.4 (0.05)	0.1	
Barium (Ba)	mg/l		1	-	-	
Cadmium (Cd)	mg/l		0.01	0.01* (0.001)	0.01	
Chromium (IV) (Cr (IV))	mg/l		0.05	1.4 (0.05)	0.1	
Chromium (III) (Cr (III))	mg/l		-	2.5	-	
Copper (Cu)	mg/l		0.02	-	0.2	
Hardness	mg/l		250	-	-	
Calcium (Ca)	mg/l		-	-	-	
Magnesium (Mg)	mg/l	-	-	-	-	
Sodium (Na)	mg/l	-	-	-	3 SAR	
Potassium (K)	mg/l		-	-	-	
Iron (Fe)	mg/l		1	1	1 (Leaf) 5 (Others)	L
Lead (Pb)	mg/l		0.05	0.02* (0.01)	5	E
Manganese (Mn)	mg/l	N	0.1	0.1	0.2	V
Mercury (Hg)	mg/l	A	0.001	0.004 (0.0001)	0.002	E
Nickel (Ni)	mg/l	T	0.05	0.9*	0.2	L
Selenium (Se)	mg/l	U	0.01	0.25 (0.04)	0.02	S
Silver (Ag)	mg/l	R	0.05	0.0002	-	
Tin (Sn)	mg/l	A	-	0.004	-	A
Uranium (U)	mg/l	L	-	-	-	B
Zinc (Zn)	mg/l		5	0.4*	2	O
Boron (B)	mg/l	L	1	(3.4)	0.8	V
Chlorine (Cl)	mg/l	E	200	-	80	E
Chlorine (Cl ₂)	mg/l	V	-	(0.02)	-	
Copernicium (CN)	mg/l	E	0.02	0.06 (0.02)	-	IV
Fluorine (F)	mg/l	L	1.5	10	1	
Nitrogen Dioxide (NO ₂)	mg/l	S	0.4	0.4 (0.03)	-	
Nitrogen Oxide (NO ₃)	mg/l		7	-	5	
Potassium (P)	mg/l	O	0.2	0.1	-	
Silica (Si)	mg/l	R	50	-	-	
Sulfate (SO ₄)	mg/l		250	-	-	
Sulfur (S)	mg/l	A	0.05	(0.001)	-	
Carbon Monoxide (CO)	mg/l	B	-	-	-	
Gross-α	Bq/l	S	0.1	-	-	
Gross-β	Bq/l	E	1	-	-	
Radium-226 (Ra-226)	Bq/l	N	< 0.1	-	-	
Strontium-90 (Sr-90)	Bq/l	T	< 1	-	-	▼

Carbon Chloroform Extract (CCE)	µg/l		500	-	-	
MBAS/BAS	µg/l		500	5000 (200)	-	
O & G (Mineral)	µg/l		40; N	N	-	
O & G (Emulsified Edible)	µg/l		7000; N	N	-	
Polychlorinated biphenyls (PCB)	µg/l		0.1	6 (0.05)	-	
Phenol	µg/l		10	-	-	
Aldrin/Dieldrin	µg/l		0.02	0.2 (0.01)	-	
Benzene hexachloride (BHC)	µg/l		2	9 (0.1)	-	
Chlordane	µg/l		0.08	2 (0.02)	-	
Dichlorophenyltrichloroethane (t-DDT)	µg/l		0.1	(1)	-	
Endosulfan	µg/l		10	-	-	
Heptachlor/Epoxyde	µg/l		0.05	0.9 (0.06)	-	
Lindane	µg/l		2	3 (0.4)	-	
2,4-Dichlorophenoxyacetic (2,4-D)	µg/l		70	450	-	
2, 4, 5-Trichlorophenoxyacetic acir (2,4,5-T)	µg/l		10	160	-	
2-(2,4, 5-Trichlorophenoxy)propionic acid (2,4,5-TP)	µg/l		4	850	-	
Paraquat	µg/l		10	1800	-	

Notes:

* At hardness 50 mg/l CaCO₃

Maximum (unbracketed) and 24-hour average (bracketed) concentrations

N Free from visible film sheen, discolouration and deposits

Parameters	Unit	Class					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/l	0.1	0.3	0.3	0.9	2.7	>2.7
Biochemical Oxygen Demand (BOD)	mg/l	1	3	3	6	12	>12
Chemical Oxygen Demand (COD)	mg/l	10	25	25	50	100	>100
Dissolved Oxygen (DO)	mg/l	7	5 - 7	5 - 7	3 - 5	<3	<1
pH	-	6.5 - 8.5	6 - 9	6 - 9	5 - 9	5 - 9	-
Colour	TCU	15	150	150	-	-	-
Electrical Conductivity	µS/cm	1000	1000	-	-	6000	-
Floatables	-	N	N	N	-	-	-
Odour	-	N	N	N	-	-	-
Salinity	%	0.5	1	-	-	2	-
Taste	-	N	N	N	-	-	-
Total Dissolved Solid (TDS)	mg/l	500	1000	-	-	4000	-
Total Suspended Solid (TSS)	mg/l	25	50	50	150	300	300
Temperature	°C	-	Normal + 2 °C	-	Normal + 2 °C	-	-
Turbidity	NTU	5	50	50	-	-	-
Faecal Coliform**	count/100 ml	10	100	400	5000 (20000) ^a	5000 (20000) ^a	-
Total Coliform	count/100 ml	100	5000	5000	50000	50000	>50000

Notes:

N No visible floatable materials or debris, no objectional odour or no objectional taste

* Related parameters, only one recommended for use

** Geometric mean

a Maximum not to be exceeded

ANNEX E

(normative)

Atmospheric Emission Allowable Limits

NOTE – Refer to the respective Regulations for the current allowable limits.

1) Combustion Plants in all sizes/capacity

Pollutants	Emission Standards (mg/Nm ³)*
Particulate matter (PM)	50**
Sulfur dioxide (SO ₂)	500**
Nitrogen oxides (NO _x)	400
Carbon monoxide (CO)	250

* Concentration in mg/Nm³ at 273 K, 101.3 kPa, dry, 3% O₂ for gaseous/liquid fuels, 6% for solid fuels

** These emission standards are not applicable for natural gas

- 2) Standards for Air Emissions (Follow Singapore's Environmental Protection and Management (Air Impurities) Regulations) 1 July 2015**

ANNEX F

(normative)

Ambient Air Quality Standards

NOTE – Refer to the respective Regulations for the current allowable limits.

1) Ambient Air Quality Standards

- a) Where available, the **Brunei Darussalam Air Quality Target (BDAQT)** by 2035 should be adhered to.
- b) In the absence of a national guideline value, the **WHO Air Quality Guideline (AQG) of 2005** should be referred to as the ceiling value.
- c) The **WHO Air Quality Guideline (AQG) of 2021** be referred to as long-term target values to be attained where feasible at the judgement of the Authority.

Pollutants	Averaging time	Units	Brunei	WHO	
			BDAQT by 2035	2005 AQG level	2021 AQG level
Public Health					
PM ₁₀	Annual	µg/m ³	-	20	15
	24-hour		50	50	45 ^a
PM _{2.5}	Annual	µg/m ³	-	10	5
	24-hour		37.5	25	15 ^a
Sulphur Dioxide	24-hour	µg/m ³	50	20	40 ^{a,c}
	10-minute		-	500	500
Nitrogen Dioxide	Annual	µg/m ³	-	40	10
	24-hour		-	-	25 ^a
	1-hour		100	200	200
Ozone	Peak Season	µg/m ³	-	-	60 ^b
	8-hour		100	100	100 ^a
Carbon monoxide	24-hour	mg/m ³	-	-	4 ^a
	8-hour		10	10	
	1-hour		30	35	
Terrestrial Vegetation					
Sulphur Dioxide	Annual	µg/m ³	-	20	
Nitrogen oxides	Annual	µg/m ³	-	30	

^a 99th percentile (i.e., 3-4 exceedance days per year)

^b Average of daily maximum 8-hour mean O₃ concentration in the six consecutive months with the highest six-month running-average O₃ concentration.

^c The 24-hour mean of 40 µg/m³ for SO₂ is understood to correspond to an annual mean of 10 µg/m³.

Note: Annual and peak season is long-term exposure, while 24-hour and 8-hour is short-term exposure.

ANNEX G
(normative)

Permissible Open Burning Activities Without Permit

- 1) The burning of any deceased plant and noxious plant and agricultural purposes relating to the diseased plant and noxious;
- 2) The burning of carcasses of infected animal, bird and related material;
- 3) The burning of carcasses;
- 4) Camp fire;
- 5) In-situ burning of oil spill as per NOSCOP;
- 6) Training activities conducted by the Fire and Rescue Department;
- 7) The burning of flammable gases where the industrial flare is properly operated;
- 8) Outdoor cooking such as barbecue (BBQ);
- 9) The burning of any articles as part of religious rites or worshipping activities;
- 10) The burning of fireworks for cultural purposes;
- 11) Cremation.
- 12) Wastes that are consented for disposal by burning under the Financial Regulations.

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ANNEX H

(normative)

Open Burning Guidelines



**DEPARTMENT OF ENVIRONMENT, PARKS AND RECREATION
MINISTRY OF DEVELOPMENT
NEGARA BRUNEI DARUSSALAM**

OPEN BURNING GUIDELINES

This guideline is subjected to the approval granted by the Department of Environment, Parks and Recreation.

- 1) Inform the Brunei Fire and Rescue Department of the date and time before burning.
- 2) Burning must be carried out only when **GOOD** air quality was is recorded under 50 PSI level. Burning is not allowed when the air quality was is recorded above 50 PSI level. (Air quality data can be obtained from the Department's website at www.env.gov.bn).
- 3) Burning shall take place only between **10.00 am and 4.00 pm**.
- 4) The use of rubber materials such as tyre as a fire starter is **PROHIBITED**.
- 5) Forest cutting, branches and wood must be in dry condition prior to burning.
- 6) Each wood branch to be burned should be divided into several piles (**about 20 feet apart from each other**).
- 7) Only **two (2) pile burning activities** is allowed for a day (according suitability of burning emission).
- 8) Burning must be carried out away from main road (at least 1 km from main road side) to avoid compromising visibility of road users.
- 9) Monitoring and planning need to be done to ensure the burning is not spreading to nearby areas.
- 10) If burning is causing impacts that may affect the welfare and comfort of the public, it shall be stopped immediately.

ANNEX I
(normative)

Recommended Boundary Noise Levels

NOTE – Refer to the respective Regulations for the current allowable limits.

Type of Affected Premises	Maximum permitted noise level (reckoned as the equivalent continuous noise level) in decibels (dBA)					
	over specified period	over 5 minutes	over specified period	over 5 minutes	over specified period	over 5 minutes
	7am – 7pm		7pm – 11pm		11pm – 7am	
Noise Sensitive Premises	60	65	55	60	50	55
Residential Premises	65	70	60	65	55	60
Commercial Premises	70	75	65	70	60	65
Industrial Premises	-	75	-	70	-	65

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ANNEX J

(normative)

List of Hazardous Substances

1) Hazardous Substances

Substance	Exclusions
1,2-dibromoethane (EDB)	
Acetic acid	Substances containing not more than 80%, weight in weight, of acetic acid; Preparations and solutions for photographic use.
Acetic Anhydride	
Acetochlor	
Acetyl bromide	
Alachor	
Allyl isothiocyanate	
Alkali metal bifluorides; Ammonium bifluoride; Potassium fluoride; Sodium fluoride; Potassium silicofluoride; Sodium silicofluoride; Silicofluoric acid	Preparations containing not more than 0.3%, weight in weight, of potassium fluoride in radiator protectors; Preparations containing not more than 0.96%, weight in weight, of potassium fluoride in photographic chemicals; Substances containing not more than 3%, weight in weight, of sodium fluoride or sodium silicofluoride as a preservative; Substances containing sodium fluoride intended for the treatment of human ailments.
Amitraz	
Ammonia	Preparations and solutions of ammonia containing not more than 10%, weight in weight, of ammonia; Refrigeration equipment; Photographic and plan developers; Hair colour dyes; Perm lotions; Smelling bottles.
Ammonium chlorate	
Anionic surface active agents	Preparations containing anionic surface active agents which are at least 90% biodegradable under a test carried out in accordance with that part of the OECD method which is referred to as "Confirmatory Test Procedure" in European Communities Council Directive No. 73/405/EEC (C) or other equivalent test methods acceptable to the Director-General.
Antimony pentachloride	Polishes.
Antimony trihydride	

Substance	Exclusions
Arsenical substances, the following: Arsenic acid Arsenic sulphide Arsenic trichloride Arsine Calcium arsenite Copper arsenate Copper arsenite Lead arsenate Organic compounds of arsenic Oxides of arsenic Potassium arsenite Sodium arsenate Sodium arsenite Sodium thioarsenate	Pyrites ores or sulphuric acid containing arsenical poisons as natural impurities; Animal feeding stuffs containing not more than 0.005%, weight in weight, of 4-hydroxy-3-nitrophenyl-arsonic acid and not containing any other arsenical poison; Animal feeding stuffs containing not more than 0.01%, weight in weight, of arsanilic acid and not containing any other arsenical poison; Animal feeding stuffs containing not more than 0.0375%, weight in weight, of carbarsone and not containing any other arsenical poison.
Asbestos in the form of crocidolite, actinolite, anthophyllite, amosite, tremolite, chrysotile and amphiboles and products containing these forms of asbestos	Asbestos in the form of chrysotile in any vehicle brake or clutch lining installed in any vehicle registered before 1 April 1995.
Atrazine	
Benzidine; its salts	
Bis(chloromethyl)ether	
Boric acid; Sodium borate	Boric acid or sodium borate in medicinal preparations, cosmetics, toilet preparations and substances being preparations intended for human consumption; Preparations containing boric acid or sodium borate or a combination of both where water or solvent is not the only other part of the composition.
Boron tribromide	
Boron trichloride	
Boron trifluoride	
Bromine; Bromine solutions	
Cadmium and its compounds in controlled EEE	Controlled EEE containing cadmium not exceeding 0.01% maximum concentration value by weight of homogeneous material in controlled EEE; Cadmium and its compounds in electrical contact; Cadmium in filter glass or glass used for reflectance standards; Cadmium in printing ink for the application of enamel on glass; Cadmium alloy as electrical or mechanical solder joint to electrical conductor located directly on voice coil in transducer used in high-powered loudspeaker with sound pressure level of 100 dB (A) or more; Cadmium and cadmium oxide in thick film paste used on aluminium bonded beryllium oxide.
Cadmium-containing silver brazing alloy	
Captafol	
Carbamates	Benomyl; Carbendazim; Chlorpropham; Propham; Thiophanate-methyl; Preparations containing not more than 1%, weight in weight, of propoxur and not containing any other carbamate; Preparations containing not more than 1%, weight in weight, of methomyl and not containing any other carbamate.

Substance	Exclusions
Carbon monoxide	Gas mixtures containing carbon monoxide weighing less than 1 metric tonne; Gas mixtures containing carbon monoxide as by-products from combustion activities.
Carbon tetrafluoride	
Chlorinated hydrocarbons, the following: Aldrin Benzene hexachloride (BHC) Bromocyclen Camphechlor Chlorbenside Chlorbicyclen Chlordane Chlordecone Chlordimeform Chlorfenethol Chlorfenson Chlorfensulphide Chlorobenzilate Chloropropylate Dicophane (DDT) pp'-DDT Dicofol Dieldrin Endosulfan Endrin Fenazaflor Fenson Fluorbenzide Gamma benzene hexachloride (Gamma-BHC), also known as lindane HCH (mixed isomers) HEOD [1,2,3,4,10,10-hexachloro-6, 7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4 (exo): 5,8 (endo)-dimethano naphthalene] HHDN [1,2,3,4,10,10-hexachloro-1, 4,4a,5,8,8a-hexahydro-1,4 (exo): 5,8 (endo)-dimethano naphthalene] Heptachlor Hexachloroethane Isobenzan Isodrin Kelevan Methoxychlor [1,1,1-trichloro-2, 2-di-(p-methoxyphenyl) ethane] Mirex Polychlorinated butadienes Tetrachlorodiphenylethane [TDE; 1, 1-dichloro-2,2-bis (p-chlorophenyl) ethane] Tetradifon Tetasul Toxaphene Allied chlorinated hydrocarbon compounds used as pesticides (insecticides, acaricides, etc.)	Paper impregnated with not more than 0.3%, weight in weight, of benzene hexachloride or gamma-BHC provided it is labelled with directions that no food, wrapped or unwrapped, or food utensils are to be placed on the treated paper, and that it is not to be used where food is prepared or served.
Chlorine	Chlorine used for chlorination of water in swimming pools.
Chlorine trifluoride	
Chlorobenzenes, the following: Monochlorobenzene Meta-dichlorobenzene Ortho-dichlorobenzene Trichlorobenzene Tetrachlorobenzene Pentachlorobenzene Hexachlorobenzene	
Chlorophenols, the following: Monochlorophenol Dichlorophenol Trichlorophenol Tetrachlorophenol Pentachlorophenol and its salts and esters	Substances containing not more than 1%, weight in weight, of chlorophenols.

Substance	Exclusions
Chlorophenoxyacids; their salts, esters, amines, which include but are not limited to — 2,4,5-T and its salts and esters	
Chloropicrin	
Chlorosilanes, the following: Hexachlorodisilane Phenyltrichlorosilane Tetrachlorosilane	
Chlorosulphonic acid	
Chromic acid	Substances containing not more than 9%, weight in weight, of chromic acid; Photographic solutions containing chromic acid in individual containers containing not more than 15 kilograms each of such solutions and of aggregate weight of not more than 500 kilograms of such solutions.
Cyanides	Ferrocyanides; Ferricyanides; Acetonitrile; Acrylonitrile; Butyronitrile; 2-Dimethylaminoacetonitrile; Isobutyronitrile; Methacrylonitrile; Propionitrile.
Diborane	
Dibromochloropropane	
Diethyl sulphate	
Dinitro-ortho-cresol (DNOC) and its salts (such as ammonium salt, potassium salt and sodium salt)	
Dinosam; its compounds with a metal or a base	
Dinoseb and its salts and esters, which includes but is not limited to — Binapacyl	
Dinoterb	
Diquat; its salts	
Drazoxolon; its salts	Dressings on seeds.
Dustable powder formulations containing a combination of — benomyl at or above 7 per cent, carbofuran at above 10 per cent, thiram at or above 15 per cent	
Endothal; its salts	
Epichlorohydrin	
Ethyl mercaptan	Substances containing less than 1%, weight in weight, of ethyl mercaptan.
Ethylene dichloride	
Ethylene imine	
Ethylene oxide	Mixtures of inert gases and ethylene oxide comprising not more than 12%, weight in weight, of ethylene oxide contained in cylinders of water capacity less than 47 litres and for aggregate of not more than 3 of such cylinders.
Ferric chloride	
Fipronil	Formulated products containing Fipronil approved for household use and belonging to Table 5 of the WHO Recommended Classification of Pesticides by Hazard.
Fluorine	

Substance	Exclusions
Fluoroacetamide	
Formaldehyde	Substances containing not more than 5%, weight in weight, of formaldehyde; Photographic glazing or hardening solutions.
Formic acid	Substances containing not more than 5%, weight in weight, of formic acid.
Germane	
Hexabromocyclododecane(HBCD)	
Hexavalent chromium in controlled EEE	Controlled EEE containing hexavalent chromium not exceeding 0.1% maximum concentration value by weight of homogeneous material in controlled EEE; Hexavalent chromium as anticorrosion agent, not exceeding 0.75% by weight, in the cooling solution of carbon steel cooling system in absorption refrigerator.
Hexazinone	
Hydrazine anhydrous; Hydrazine aqueous solutions	
Hydrochloricacid	Substances containing not more than 9%, weight in weight, of hydrochloric acid.
Hydrofluoricacid	Preparations or solutions containing not more than 2%, weight in weight, of hydrofluoric acid.
Hydrofluorocarbons, the following, including any mixture containing those hydrofluorocarbons: 1,1,1,2,2,3,4,5,5,5-decafluoropentane 1,1,1,2,2,3-hexafluoropropane 1,1,1,2,3,3,3-heptafluoropropane 1,1,1,2,3,3-hexafluoropropane 1,1,1,2-tetrafluoroethane 1,1,1,3,3,3-hexafluoropropane 1,1,1,3,3-pentafluorobutane 1,1,1,3,3-pentafluoropropene 1,1,1-trifluoroethane 1,1,2,2,3-pentafluoropropane 1,1,2,2-tetrafluoroethane 1,1,2-trifluoroethane 1,1-difluoroethane 1,2-difluoroethane Difluoromethane Fluoromethane(methylfluoride) Pentafluoroethane Trifluoromethane	Any manufactured product containing any substance mentioned in the opposite column, not being a container containing the substance.
Hydrogen chloride	
Hydrogen cyanide; Hydrocyanic acid	Preparations of wild cherry; In reagent kits supplied for medical or veterinary purposes, substances containing less than the equivalent of 0.1%, weight in weight, of hydrocyanic acid.
Hydrogen fluoride	
Hydrogen selenide	
Isocyanates	Polyisocyanates containing less than 0.7%, weight in weight, of free monomeric diisocyanates; Pre-polymerised isocyanates in polyurethane paints and lacquers; Hardeners and bonding agents for immediate use in adhesives.

Substance	Exclusions
Lead and its compounds in controlled EEE	<p>Controlled EEE containing lead not exceeding 0.1% maximum concentration value by weight of homogeneous material in controlled EEE;</p> <p>Lead in glass of cathode ray tube;</p> <p>Lead, not exceeding 0.2% by weight, in glass of fluorescent tube;</p> <p>Lead, not exceeding 0.35% by weight, as an alloying element in steel for machining purposes or galvanised steel;</p> <p>Lead, not exceeding 0.4% by weight, as an alloying element in aluminium; Lead, not exceeding 4% by weight, in copper alloy;</p> <p>Lead in high melting temperature type solder (that is, lead-based alloy containing 85% by weight or more lead);</p> <p>Electrical and electronic component containing lead in — (a) glass or ceramic (other than dielectric ceramic in capacitor); or (b) glass or ceramic matrix compound;</p> <p>Lead in dielectric ceramic in capacitor for rated voltage of 125 VAC, 250 V DC or higher;</p> <p>Lead in bearing shell or bush for refrigerant-containing compressor for heating, ventilation, air conditioning or refrigeration application;</p> <p>Lead in white glass for optical application;</p> <p>Lead in filter glass or glass used for reflectance standards;</p> <p>Lead in printing ink for the application of enamel on glass;</p> <p>Lead in solder for — (a) completing viable electrical connection between semiconductor die and carrier within integrated circuit flip chip package; (b) soldering to machined-through hole discoidal or planar array ceramic multilayer capacitor; or (c) soldering thin copper wire (with diameter not exceeding 100 µm) in power transformer;</p> <p>Lead in soldering materials in mercury-free flat fluorescent lamp;</p> <p>Lead oxide in surface conduction electron emitter display used in structural element;</p> <p>Lead bound in crystal glass;</p> <p>Lead in cermet-based trimmer potentiometer element;</p> <p>Lead in plating layer of high-voltage diode on base of zinc borate glass body.</p>
Lead compounds in paint	<p>Paint in which the total lead does not exceed 0.009% by weight of the paint;</p> <p>Paint in which the total lead exceeds 0.009% by weight of the paint, and which is — (a) copper-based anti-fouling paint or zinc-based anti-corrosion paint; (b) imported into or manufactured in Singapore, other than solely for export; and (c) in a container that is labelled in accordance with Part III of this Schedule.</p>
Mercury	<p>Controlled EEE containing mercury not exceeding 0.1% maximum concentration value by weight of homogeneous material in controlled EEE;</p>
Mercury and its compounds in controlled EEE	<p>Cold cathode fluorescent lamp or external electrode fluorescent lamp, used for purposes other than general lighting, that — (a) is not more than 500 mm long and contains not more than 3.5 mg of mercury; (b) is more than 500 mm long but not more than 1500 mm long and contains not more than 5 mg of mercury; or (c) is more than 1500 mm long and contains not more than 13 mg of mercury.</p>
Mercury compounds including inorganic mercury compounds, alkyl mercury compounds,	

Substance	Exclusions
alkyloxyalkyl and aryl mercury compounds, and other organic compounds of mercury	
Mercury and its compounds in batteries	Batteries (including those in button form) containing not more than 0.0005% by weight of mercury per cell.
Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps used for electronic displays	Cold cathode fluorescent lamps or external electrode fluorescent lamps used for electronic displays, that — (a) are not more than 500 mm long and contain not more than 3.5 mg of mercury per lamp; (b) are more than 500 mm long but not more than 1500 mm long and contain not more than 5 mg of mercury per lamp; or (c) are more than 1500 mm long and contain not more than 13 mg of mercury per lamp.
Mercury in fluorescent lamps (primarily for general lighting purposes)	Compact fluorescent lamps containing mercury not exceeding 5 mg per lamp; Triband phosphor linear fluorescent lamps of less than 60 W per lamp containing mercury not exceeding 5 mg per lamp; Circular fluorescent lamps and other linear fluorescent lamps containing mercury not exceeding 10 mg per lamp.
Mercury in high pressure mercury vapour lamps (primarily for general lighting purposes)	
Mercury in switches and relays	Very high accuracy capacitance and loss measurement bridges and high frequency radio frequency switches and relays in monitoring and control instruments containing mercury not exceeding 20 mg per bridge, switch or relay.
Mercury in the following non-electronic measuring devices: Barometers Hygrometers Manometers Thermometers Sphygmomanometers	Non-electronic measuring devices installed in large-scale equipment or those used for high precision measurement, where no suitable mercury-free alternative is available.
Metanil yellow (sodium salt of metanilylazo-diphenylamine)	Dye-indicators used in laboratories.
Methyl chloride	
Methyl mercaptan	Substances containing less than 1%, weight in weight, of methyl mercaptan.
Monomethyltetrachloro diphenyl methane	
Monomethyl-dichloro-diphenyl methane	
Monomethyl-dibromodiphenyl methane	
Neonicotinoid compounds used as pesticides, the following: Imidacloprid	Formulated products containing Imidacloprid approved for household use and belonging to Table 5 of the WHO Recommended Classification of Pesticides by Hazard.
Niclofolan	
Nicotine sulphate	
Nitric acid	Substances containing not more than 9%, weight in weight, of nitric acid.
Nitric oxide	
Nitrobenzene	Substances containing less than 0.1%, weight in weight, of nitrobenzene; Soaps containing less than 1%, weight in weight, of nitrobenzene; Polishes and cleansing agents.
Nitrogen trifluoride	
Oleum	
Orange II [sodium salt of p-(2-hydroxy-1-naphthylazo) benzenesulphonic acid]	Dye-indicators used in laboratories.
Organic peroxides	Car putties; Substances and preparations containing not more than 3%, weight in weight, of organic peroxides; Solutions of not more than 60%, weight in weight, of methyl ethyl ketone peroxides and total aggregate weight of less than 50 kilograms of such solutions.

Substance	Exclusions
Organic-tin compounds, the following: Compounds of fentin Cyhexatin Tributyl tin compounds	
(a) Chlorofluorocarbons, the following: Chloroheptafluoropropane Chloropentafluoroethane Chlorotrifluoromethane Dichlorodifluoromethane Dichlorohexafluoropropane Dichlorotetrafluoroethane Heptachlorofluoropropane Hexachlorodifluoropropane Pentachlorofluoroethane Pentachlorotrifluoropropane Tetrachlorodifluoroethane Tetrachlorotetrafluoropropane Trichlorofluoromethane Trichloropentafluoropropane Trichlorotrifluoroethane	Products containing any ozone depleting substance other than the following products: (a) in the case of chlorofluorocarbons — (i) air conditioners in vehicles registered on or after 1 January 1995 or intended for such vehicles; (ii) equipment for domestic or commercial refrigeration or air conditioning installed on or after 1 January 1993, or heat pump equipment, which contains any chlorofluorocarbon substance as a refrigerant or in any insulating material of such equipment; (iii) refrigerators that have a compressor rating which exceeds one horsepower; (iv) non-pharmaceutical aerosol products; (v) insulation boards, panels or pipe covers; (vi) polystyrene sheets or finished products;
(b) Halons, the following: Bromochlorodifluoromethane Bromochloromethane Bromotrifluoromethane Dibromotetrafluoroethane	(b) in the case of Halons, portable fire extinguishers; and (c) in the case of bromotrifluoromethane, fire protection systems with building plans approved after 17 June 1991 and installed after 31 December 1991.
(c) Hydrochlorofluorocarbons, the following: 1,1-dichloro-1-fluoro-ethane 1,1-dichloro-2,2,3,3-pentafluoropropane 1,3-dichloro-1,2,2,3,3-pentafluoropropane 1-chloro-1,1-difluoro-ethane Chlorodifluoroethane Chlorodifluoromethane Chlorodifluoropropane Chlorofluoroethane Chlorofluoromethane Chlorofluoropropane Chlorohexafluoropropane Chloropentafluoropropane Chlorotetrafluoroethane Chlorotetrafluoropropane Chlorotrifluoroethane Chlorotrifluoropropane Dichlorodifluoroethane Dichlorodifluoropropane Dichlorofluoroethane Dichlorofluoromethane Dichlorofluoropropane Dichloropentafluoropropane Dichlorotetrafluoropropane Dichlorotrifluoroethane Dichlorotrifluoropropane Hexachlorofluoropropane Pentachlorodifluoropropane Pentachlorofluoropropane Tetrachlorodifluoropropane Tetrachlorofluoroethane Tetrachlorofluoropropane Tetrachlorotrifluoropropane Trichlorodifluoroethane Trichlorodifluoropropane Trichlorofluoroethane Trichlorofluoropropane Trichlorotetrafluoropropane Trichlorotrifluoropropane	

Substance	Exclusions
(d) Hydrobromofluorocarbons, the following: Bromodifluoroethane Bromodifluoromethane Bromodifluoropropane Bromofluoroethane Bromofluoromethane Bromofluoropropane Bromohexafluoropropane Bromopentafluoropropane Bromotetrafluoroethane Bromotetrafluoropropane Bromotrifluoroethane Bromotrifluoropropane Dibromodifluoroethane Dibromodifluoropropane Dibromofluoroethane Dibromofluoromethane Dibromofluoropropane Dibromopentafluoropropane Dibromotetrafluoropropane Dibromotrifluoroethane Dibromotrifluoropropane Hexabromofluoropropane Pentabromodifluoropropane Pentabromofluoropropane Tetrabromodifluoropropane Tetrabromofluoroethane Tetrabromofluoropropane Tetrabromotrifluoropropane Tribromodifluoroethane Tribromodifluoropropane Tribromofluoroethane Tribromofluoropropane Tribromotetrafluoropropane Tribromotrifluoropropane	
(e) Carbontetrachloride (f) 1,1,1-trichloroethane(methylchloroform) (g) Methylbromide	
Paraquat; its salts	Preparation in pellet form containing not more than 5%, weight in weight, of salts of paraquat ion.
Pentadecafluoroctanoic acid (PFOA); its salts and related compounds	
Perchloromethyl mercaptan	Substances containing less than 1%, weight in weight, of perchloromethyl mercaptan.
Perfluorohexane sulfonic acid (PFHxS); its salts and related compounds	
Perfluorooctane sulfonic acid (PFOS)	
Phenols, the following: Catechol Cresol Hydroquinone Octylphenol Phenol Resorcinol Polychlorinated biphenyl (PCB)	Preparations containing less than 1%, weight in weight, of phenols; Phenols which are intended for the treatment of human ailments and other medical purposes; Soaps for washing; Tar (coal or wood), crude or refined; Photographic solutions containing hydroquinone in individual containers containing not more than 15 kilograms each of such solutions and of aggregate weight of not more than 500 kilograms of such solutions.
Phosgene	
Phosphides	
Phosphine	
Phosphoric acid	Substances containing not more than 50%, weight in weight, of phosphoric acid.

Substance	Exclusions
Phosphorus compounds used as pesticides (insecticides, acaricides, etc.), which includes but is not limited to: Chlorpyriphos Methamidophos Methyl-parathion Monocrotophos Parathion Phosphamidon Trichlorfon	Acephate; Bromophos; Iodofenphos; Malathion; Pirimiphos-methyl; Temephos; Tetrachlorvinphos; Preparations containing not more than 0.5%, weight in weight, of chlorpyrifos and not containing any other phosphorus compound; Preparations containing not more than 0.5%, weight in weight, of dichlorvos and not containing any other phosphorus compound; Materials impregnated with dichlorvos and not containing any other phosphorus compound for slow release; Preparations containing not more than 1%, weight in weight, of azamethiphos and not containing any other phosphorus compound.
Phosphorus oxybromide	
Phosphorus oxychloride	
Phosphorus pentabromide	
Phosphorus pentachloride	
Phosphorus pentafluoride	
Phosphorus trichloride	
Polybrominated biphenyls	
Polybrominated biphenyls in controlled EEE	Controlled EEE containing polybrominated biphenyls not exceeding 0.1% maximum concentration value by weight of homogeneous material in controlled EEE.
Polybrominated diphenyl ethers (PBDEs)	
Polybrominated diphenyl ethers in controlled EEE	Controlled EEE containing polybrominated diphenyl ethers not exceeding 0.1% maximum concentration value by weight of homogeneous material in controlled EEE.
Polychlorinated biphenyls	
Polychlorinated naphthalenes	
Polychlorinated terphenyls	
Potassium hydroxide	Substances containing not more than 17%, weight in weight, of potassium hydroxide; Accumulators; Batteries.
Prochloraz	
Pyrethroid compounds used as pesticides, the following: Fenvalerate Lambda-cyhalothrin	Formulated products containing Fenvalerate approved for household use and belonging to Table 5 of the WHO Recommended Classification of Pesticides by Hazard
Short-chain chlorinated paraffins (chain lengths at least C10 but not exceeding C13)	
Sodium azide	Air bag devices in motor vehicles.
Sodium hydroxide	Substances containing not more than 17%, weight in weight, of sodium hydroxide; Made-up formulated preparations either liquid or solid for biochemical tests.
Sulphur in diesel intended for use in Singapore as fuel for industrial plants	Sulphur in diesel in which the sulphur content is 0.001% or less by weight.
Sulphur in petrol intended for use in Singapore as fuel for industrial plants	Sulphur in petrol in which the sulphur content is 0.005% or less by weight.
Sulphur tetrafluoride	

Substance	Exclusions
Sulphur trioxide	
Sulphuric acid	Substances containing not more than 9%, weight in weight, of sulphuric acid; Accumulators; Batteries; Fire extinguishers; Photographic developers containing not more than 20%, weight in weight, of sulphuric acid.
Sulphuryl chloride	
Sulphuryl fluoride	
Tetraethyl lead, tetramethyl lead and similar lead containing compounds	
Thallium; its salts	
Titanium tetrachloride	
Tris (2, 3-dibromo-1-propyl) phosphate	
Tungsten hexafluoride	

2) General Exemptions (from the list of hazardous substances under 1) above.)

Adhesives other than those containing any of the following substances as defined under 1) above:
 Pentadecafluoroctanoic acid (PFOA) and its salts and related compounds, Perfluorohexane sulfonic acid (PFHxS) and its salts and related compounds, polychlorinated naphthalenes or short-chain chlorinated paraffins;

Anti-fouling compositions other than —

- (a) those containing tributyl tin compounds; and
- (b) anti-fouling paints containing lead compounds;

Builders' materials other than those containing asbestos as defined above;

Ceramics;

Distempers;

Electrical valves;

Enamels;

Explosives;

Fillers other than those containing any of the following substances as defined under 1) above:

Pentadecafluoroctanoic acid (PFOA) and its salts and related compounds or Perfluorohexane sulfonic acid (PFHxS) and its salts and related compounds;

Fireworks;

Glazes other than those containing any of the following substances as defined under 1) above:

Pentadecafluoroctanoic acid (PFOA) and its salts and related compounds or Perfluorohexane sulfonic acid (PFHxS) and its salts and related compounds;

Glue;

Inks;

Lacquer solvents;

Loading materials;

Lubricants other than those containing any of the following substances as defined under 1) above:
polychlorinated naphthalenes or short-chain chlorinated paraffins;

Matches;

Motor fuels other than diesel oil and petrol;

Paints other than those containing any of the following substances as defined under 1) above: asbestos,
lead compounds, mercury compounds, Pentadecafluoroctanoic acid (PFOA) and its salts and related
compounds, Perfluorohexane sulfonic acid (PFHxS) and its salts and related compounds,
polychlorinated naphthalenes, or short-chain chlorinated paraffins;

Pharmaceutical aerosols;

Photographic paper;

Pigments other than those containing tributyl tin compounds as defined under 1) above;

Plastics other than those containing any of the following substances as defined under 1) above:
polychlorinated naphthalenes or short-chain chlorinated paraffins;

Propellants other than those containing ozone depleting substances;

Rubber;

Varnishes other than those containing any of the following substances as defined under 1) above:
Pentadecafluoroctanoic acid (PFOA) and its salts and related compounds or Perfluorohexane sulfonic
acid (PFHxS) and its salts and related compounds;

Vascular plants and their seeds.

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ANNEX K

(normative)

List of Hazardous Industrial Wastes

HIW 1 METAL AND METAL-BEARING SUBSTANCES

- HIW 101 Substances containing arsenic or its compounds
- HIW 102 Substances from lead acid batteries, whole or crushed
- HIW 103 Waste batteries containing cadmium and nickel or mercury or lithium
- HIW 104 Dust, slag, dross or ash containing arsenic, mercury, lead, cadmium, chromium, nickel, copper, vanadium, beryllium, antimony, tellurium, thallium or selenium excluding slag from iron and steel factory
- HIW 105 Galvanic sludges
- HIW 106 Residues from recovery of acid pickling liquor
- HIW 107 Slag from copper processing for further processing or refining containing arsenic, lead or cadmium
- HIW 108 Leaching residues from zinc processing in dust and sludges form
- HIW 109 Substances containing mercury or its compounds
- HIW 110 Wastes from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl.

HIW 2 SUBSTANCES CONTAINING PRINCIPALLY INORGANIC CONSTITUENTS WHICH MAY CONTAIN METALS AND ORGANIC MATERIALS

- HIW 201 Asbestos containing substances in sludge, dust or fibre forms
- HIW 202 Spent catalysts
- HIW 203 Immobilized hazardous wastes including chemically fixed, encapsulated, solidified or stabilized sludges
- HIW 204 Sludges or substances containing one or several metals including chromium, copper, nickel, zinc, lead, cadmium, aluminium, tin, vanadium and beryllium
- HIW 205 Waste gypsum arising from chemical industry or power plant
- HIW 206 Spent or discarded inorganic acids
- HIW 207 Sludges containing fluoride

HIW 3 SUBSTANCES CONTAINING PRINCIPALLY ORGANIC CONSTITUENTS WHICH MAY CONTAIN METALS AND INORGANIC MATERIALS

- HIW 301 Spent or discarded organic acids with pH less or equal to 2 which are corrosive or hazardous
- HIW 302 Flux substances containing mixture of organic acids, solvents or compounds of ammonium chloride

- HIW 303 Adhesive or glue waste containing organic solvents excluding solid polymeric materials
- HIW 304 Press cake from pre-treatment of glycerol soap lye
- HIW 305 Spent or discarded lubricating oil
- HIW 306 Spent or discarded hydraulic oil
- HIW 307 Spent mineral oil-water emulsion
- HIW 308 Oil tanker sludges
- HIW 309 Oil-water mixture such as ballast water
- HIW 310 Sludge from mineral oil storage tank
- HIW 311 Waste oil or oily sludge
- HIW 312 Oily residue from automotive workshop, service station, oil or grease interceptor
- HIW 313 Oil contaminated earth from re-refining of used lubricating oil
- HIW 314 Oil or sludge from oil refinery plant maintenance operation
- HIW 315 Tar or tarry residues from oil refinery or petrochemical plant
- HIW 316 Acid sludge
- HIW 317 Spent organometallic compounds including tetraethyl lead, tetramethyl lead and organotin compounds
- HIW 318 Waste, substances and articles containing or contaminated with Polychlorinated Biphenyls (PCB) or Polychlorinated Triphenyls (PCT)
- HIW 319 Waste of phenols or phenol compounds including chlorophenol in the form of liquids or sludges
- HIW 320 Spent or discarded substances containing formaldehyde
- HIW 321 Rubber or latex wastes or sludge containing organic solvents or heavy metals
- HIW 322 Wastes of non-halogenated organic solvents
- HIW 323 Wastes of halogenated organic solvents
- HIW 324 Waste of halogenated or unhalogenated non-aqueous distillation residues arising from organic solvents recovery process
- HIW 325 Uncured resin substances containing organic solvents or heavy metals including epoxy resin and phenolic resin
- HIW 326 Waste organic phosphorus compounds
- HIW 327 Waste or discarded of thermal fluids (heat transfer) such as ethylene glycol
- HIW 4 SUBSTANCES WHICH MAY CONTAIN EITHER INORGANIC OR ORGANIC CONSTITUENTS**
- HIW 401 Spent alkalis containing heavy metals
- HIW 402 Spent alkalis with pH more or equal to 11.5 which are corrosive or hazardous
- HIW 403 Discarded drugs containing psychotropic substances or containing substances that are toxic, harmful, carcinogenic, mutagenic or teratogenic

- HIW 404 Pathogenic wastes, clinical wastes or quarantined materials
- HIW 405 Wastes arising from the preparation and production of pharmaceutical product
- HIW 406 Clinker, slag and ashes from scheduled wastes incinerator
- HIW 407 Substances containing dioxins or furans
- HIW 408 Contaminated soil, debris or matter resulting from cleaning-up of a spill of chemical, mineral oil or scheduled wastes
- HIW 409 Disposed containers, bags or equipment contaminated with chemicals or pesticides, mineral oil or scheduled wastes
- HIW 410 Rags, plastics, papers or filters contaminated with hazardous substances
- HIW 411 Spent activated carbon excluding carbon from the treatment of potable water and processes of the food industry and vitamin production
- HIW 412 Sludges containing cyanide
- HIW 413 Spent salt containing cyanide
- HIW 414 Spent aqueous alkaline solution containing cyanide
- HIW 415 Spent quenching oils containing cyanides
- HIW 416 Sludge of inks, paints, pigments, lacquer, dye or varnish
- HIW 417 Waste of inks, paints, pigments, lacquer, dye or varnish
- HIW 418 Discarded or off-specification inks, paints, pigments, lacquer, dye or varnish products containing organic solvent
- HIW 419 Spent di-isocyanates and residues of isocyanate compounds excluding solid polymeric material from foam manufacturing process
- HIW 420 Leachate from hazardous waste landfill
- HIW 421 A mixture of hazardous substances
- HIW 422 A mixture of hazardous and non-hazardous substances
- HIW 423 Spent processing solution, discarded photographic chemicals or discarded photographic wastes
- HIW 424 Spent or discarded oxidizing agent
- HIW 425 Wastes or discarded chemicals from the production, formulation, trade or use of pesticides, herbicides or biocides
- HIW 426 Off-specification products and chemicals from the production, formulation, trade or use of pesticides, herbicides or biocides
- HIW 427 Mineral sludges, including calcium hydroxide sludges, phosphating sludges, calcium sulphite sludges and carbonates sludges
- HIW 428 Wastes from wood preserving operation using inorganic salts containing-copper, chromium or arsenic or fluoride compounds or using compound containing chlorinated phenol or creosote
- HIW 429 Hazardous chemicals that are discarded or off specification
- HIW 430 Obsolete laboratory chemicals

HIW 431 Waste from manufacturing or processing or use of explosives

HIW 432 Waste containing, consisting of or contaminated with, peroxides

HIW 5 OTHER SUBSTANCES

HIW 501 Any residues from treatment or recovery of scheduled wastes

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ANNEX L

(informative)

Environmental Monitoring Report Format

جاتن عالم سکیتر تامن دان ریکریاسی
DEPARTMENT OF ENVIRONMENT, PARKS AND RECREATION
MINISTRY OF DEVELOPMENT | BRUNEI DARUSSALAM

ENVIRONMENTAL MONITORING REPORT FORMAT

NO.	SECTION	SUBSECTION	REMARKS
1	Cover Page	-	To provide information as follows: 1. Written Notification Approval Reference number 2. Company logo, name and contact information 3. Project title 4. Report number 5. Quarter #/year with reporting period. e.g. Quarter 1/2021 (January 2021 - March 2021) 6. Date finalised and submitted 7. Prepared and checked by
2	Table of Contents	-	To provide information as follows: 1. Sections and subsections 2. Page numbers accordingly
	i. List of Abbreviations	-	-
	ii. List of Figures	-	-
	iii. List of Tables	-	-
3	Executive summary	-	To provide brief summary for each section of the report including the findings of the report.
4	1. Introduction	1.1. Company background information	To include information based on what has been provided in the Written Notification and Environmental Monitoring Plan (EMMP).
		1.2. Project background and location	To include: 1. Information on <u>prescribed activities</u> declared in the Written Notification and the Environmental Management and Monitoring Plan (EMMP) submitted as per required in the Environmental Protection and Management Act, Chapter 240. 2. Detailed-labelled map of project location.
		1.3. Aspect/Pollution source monitored	Aspect/pollution source to be monitored (such as trade effluent discharge and emission) stated in the Environmental Management and Monitoring Plan (EMMP) shall be <u>mentioned</u> and <u>committed</u> in the report.

(Tabular form)

		1.4. Third party information (if applicable)	To provide brief information of the third parties involved in the sampling and analysis (if any). To include: 1) Company's information and contact details 2) Location of laboratory 3) Samplings that they performed monitoring report.
		1.5. Monitoring objective(s)/aim(s)	To state clear objectives/aims to be assessed/reviewed of results in the context of objectives.
5	2. Methodology	To explain clearly the methods and procedure and include the following:	
		2.1. Sampling methods and period	To provide <u>methods</u> , types of equipment, date of samples taken and frequency of sampling. <i>(Tabular)</i>
		2.2. Types of parameters	To include list of physical, chemical and relevant parameters for each aspect/pollution source e.g., parameters being monitored for trade effluent. <i>(Tabular)</i>
6	3. Results and Interpretation of monitoring	2.3. Location/Site of sampling	To provide a detailed, clear map of location where the samplings are acquired, discharge/emission points, sources and environmental receptors.
		Subsections entail the list of aspect/pollution source being reported, e.g.: 3.1. Leachate discharge analysis 3.2. Surface water quality analysis 3.3. Ambient air quality analysis 3.4 Noise monitoring data and etc.	Under each subsection, present the results data with clear labelling of figures or tables. Current results must be presented in text and/or figures with correct units and compared with the recommended values of best practice standards i.e. BPCG and IFC. Any exceedances must be highlighted. To provide a <u>precise and concise</u> interpretation of the results in the last column or in a paragraph under each figure or table which consists of justification <u>for any exceeding values</u> only as the mitigation procedures/corrective measures carried out. <i>(Tabular)</i>
7	4. Conclusion		To provide explanation whether the objectives mentioned previously have been achieved after obtaining the results. To include: 1) Summary of compliance and non-compliance of the parameters of pollution sources. 2) Summary of the effectiveness of the mitigation plan proposed (if any).

8	5. Appendices /Annexes	Headings for Appendix/Annex, example: <u>Annex 1</u> Third-party laboratory summary report <u>Annex 2</u> Waste collection receipt <u>Annex 3</u> Certificate of Equipment Accreditation/Certification	Insert any relevant data that are too detailed to be included in the result and discussion of the main report. Proper labelling of the appendices /annexes for easy understanding. Any abbreviations used in the shared information should be explained in the "List of Abbreviations" section as well. Insert schedules or certification of calibration.
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**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3

PART 2 – APPENDICES TO EMPLOYER’S REQUIREMENTS

APPENDIX 5A – SCHEDULE OF CURRENT APPROVALS AND PERMISSIONS

OBTAINED BY THE EMPLOYER

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 3 – EMPLOYER'S REQUIREMENTS

PART 2 – APPENDICES TO EMPLOYER'S REQUIREMENTS

**APPENDIX 5A – SCHEDULE OF CURRENT APPROVALS AND PERMISSIONS
OBTAINED BY THE EMPLOYER**

The Employer has undertaken to obtain the approvals, permits, and consents listed in this section from the relevant authorities prior to or during the execution of the Works. The Contractor shall, as and when required, provide necessary input, technical information, documentation, and other reasonable assistance to support the Employer in obtaining and/or maintaining the below listed approvals.

Except for the approvals explicitly listed herein, all other approvals, permits, consents, licenses, or authorizations required for the execution, completion, pre-commissioning, commissioning, start-up, ownership, operation, maintenance and subsequent transfer of the Works or decommissioning (as appropriate based on the selection of the option by the Employer) shall be the sole responsibility of the Contractor. The Contractor shall ensure timely identification, application, and acquisition of such approvals in compliance with applicable laws and regulations, and any cost and consequences of delay arising from the failure to do so shall be borne by the Contractor.

LIST OF CURRENT APPROVALS AND PERMISSION OBTAINED (OR TO BE OBTAINED) BY THE EMPLOYER

Ref.	Approval Description	Department / Authority Concerned	Target Approval
1	Boundary realignment for expansion of the current gazette land as shown in Appendix 1A – B940-01	Survey Department for Cadastral approvals and new boundary stones	Prior to signing of Contract Agreement

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WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4
TENDERER'S TECHNICAL PROPOSAL

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4
PART 1A – LETTER OF TENDER
(TENDER ‘A’ BASE TENDER)

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

**LETTER OF TENDER
(TENDER ‘A’ – BASE TENDER)**

(To be submitted in Letterhead paper of the Tenderer)

Date:

Chairman of Tender Committee
Mini Tender Board,
Ministry of Development,
Ground Floor, Ministry of Development Building,
Old Airport, Berakas, Bandar Seri Begawan, BS3510,
Negara Brunei Darussalam.

**Tender Name: REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND
TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**
JASTRE/BKP/RFP/01/2025

1. We, _____, have examined all Parts and Components (Contract Agreement, General Conditions, Particular Conditions, Contract Data, Employer's Requirements, General and Particular Specifications and Schedules) of the abovementioned Tender Documents "**Request for Proposal to Invest, Design, Build, Own, Operate and Transfer Waste to Energy Plant at Lot 17394, Kg. Sg. Paku, Tutong, Negara Brunei Darussalam (JASTRE/BKP/RFP/01/2025)**" as well as Addenda Number _____ (if applicable) for the above-named Tender. We have examined, understood and checked these documents and have ascertained that they contain no errors (or) other defects. We have had access to Site, and have carried out our own inspection and examination of Site and have conducted our own enquiries in order to satisfy ourselves as to the nature and condition of Site.

2. We accordingly offer to execute and complete the Works and remedy any defects therein so that they are fit for the purposes defined in the Contract, to operate and maintain the facility under for the Operation Service Period, to handback to the Employer at the end of the Operation Service Period and in conformity with the terms and conditions contained in the Contract and Power Purchase Agreement for:
 - a. the cumulative amount of tipping fees over the Operation Service Period as set out in Section 5, Part 6A [Schedule of Tipping Fees], being the amount of, Brunei Dollars: _____

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

(B\$ _____); and

- b. a Monthly Energy Base Price for Energy Payment under the Power Purchase Agreement (PPA) for the entire Operation Service Period at a rate of **Brunei Dollars Five Cents per kWh (B\$0.05 / kWh)**.
3. We agree to abide by this Tender until **Three Hundred Sixty-Five (365) days** after the closing date of this Tender and it shall remain binding upon us and may be accepted at any time before that date. We acknowledge that the General Conditions of Contract, Particular Conditions Part A – Contract Data and Part B - Special Conditions including its Contract Agreement form part of this letter of Tender.
4. The Employer and its authorised representative may contact the following person(s) on behalf of the Tenderer for further information.

(Note 1: The tenderer shall give the name, title, full address, telephone and fax numbers and email contact of appropriate personnel)

5. This Tender is made in the full understanding that:
 - (a) Employer reserves the right to reject or accept any Tender, and to annul the entire Tender process, and reject all Tender, at any time prior to award of Contract;
 - (b) Employer is not bound to accept the lowest or any Tender received;
 - (c) Employer will not be liable for any actions nor be under any obligation to inform the tenderer of the reasons for such actions; and
6. If this offer is accepted, we undertake (*as a condition precedent to the commencement of any works under this Contract*) to deposit with the Employer the insurance policies required by the Conditions of Contract and cash or an unconditional demand bond from a Preferred Performance Security Provider equal to **five percent (5%)** of the Contract Sum as a Performance Security.
7. We undertake, if our Tender is accepted, to complete the Design-Build Period within _____ [not later than **forty-eight (48) months**] from the Commencement Date of the Contract.
8. Unless and until a formal Contract Agreement is prepared and executed, this Letter of Tender together with your written acceptance thereof shall constitute a binding contract between us.
9. We confirm that in signing this letter, we, the Tenderer, accept the terms of the Tender Documents and that all costs incurred by the Tenderer in preparing and submitting this Tender will be borne by the Tenderer.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

Signature of Tenderer

Signature _____ in the capacity of _____

duly authorise to sign Tenders for and on behalf of _____

Address: _____

Date: _____

Signature of the Witness

Signature _____ in the capacity of _____

Address: _____

Date: _____

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4
PART 1B – LETTER OF TENDER
(TENDER ‘B’ ALTERNATIVE TENDER)

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

LETTER OF TENDER

(TENDER ‘B’ – ALTERNATIVE TENDER)

(To be submitted in Letterhead paper of the Tenderer)

Date:

Chairman of Tender Committee
Mini Tender Board,
Ministry of Development,
Ground Floor, Ministry of Development Building,
Old Airport, Berakas, Bandar Seri Begawan, BS3510,
Negara Brunei Darussalam.

**Tender Name: REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND
TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**
JASTRE/BKP/RFP/01/2025

1. We, _____, have examined all Parts and Components (Contract Agreement, General Conditions, Particular Conditions, Contract Data, Employer's Requirements, General and Particular Specifications and Schedules) of the abovementioned Tender Documents "**Request for Proposal to Invest, Design, Build, Own, Operate and Transfer Waste to Energy Plant at Lot 17394, Kg. Sg. Paku, Tutong, Negara Brunei Darussalam (JASTRE/BKP/RFP/01/2025)**" as well as Addenda Number _____ (if applicable) for the above-named Tender. We have examined, understood and checked these documents and have ascertained that they contain no errors (or) other defects. We have had access to Site, and have carried out our own inspection and examination of Site and have conducted our own enquiries in order to satisfy ourselves as to the nature and condition of Site.

2. We accordingly offer to execute and complete the Works and remedy any defects therein so that they are fit for the purposes defined in the Contract, to operate and maintain the facility under for the Operation Service Period, to handback to the Employer at the end of the Operation Service Period and in conformity with the terms and conditions contained in the Contract and Power Purchase Agreement for:
 - a. the cumulative amount of tipping fees over the Operation Service Period as set out in Section 5, Part 6B [Schedule of Tipping Fees], being the amount of, Brunei Dollars: _____

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

(B\$ _____); and

b. a Monthly Energy Base Price for Energy Payment under the Power Purchase Agreement (PPA) for the entire Operation Service Period at a rate of _____ per kWh (B\$ _____ / kWh).

3. We agree to abide by this Tender until **Three Hundred Sixty Five (365) days** and it shall remain binding upon us and may be accepted at any time before that date. We acknowledge that the General Conditions of Contract, Particular Conditions Part A – Contract Data and Part B - Special Conditions including its Contract Agreement form part of this letter of Tender.
4. The Employer and its authorised representative may contact the following person(s) on behalf of the Tenderer for further information.

(Note 1: The tenderer shall give the name, title, full address, telephone and fax numbers and email contact of appropriate personnel)

5. This Tender is made in the full understanding that:
 - (a) Employer reserves the right to reject or accept any Tender, and to annul the entire Tender process, and reject all Tender, at any time prior to award of Contract;
 - (b) Employer is not bound to accept the lowest or any Tender received;
 - (c) Employer will not be liable for any actions nor be under any obligation to inform the tenderer of the reasons for such actions; and
6. If this offer is accepted, we undertake (*as a condition precedent to the commencement of any works under this Contract*) to deposit with the Employer the insurance policies required by the Conditions of Contract and cash or an unconditional demand bond from a Preferred Performance Security Provider equal to **five percent (5%)** of the Contract Sum as a Performance Security.
7. We undertake, if our Tender is accepted, to complete the Design-Build Period within _____ [not later than **forty-eight (48) months**] from the Commencement Date of the Contract.
8. Unless and until a formal Contract Agreement is prepared and executed, this Letter of Tender together with your written acceptance thereof shall constitute a binding contract between us.
9. We confirm that in signing this letter, we, the Tenderer, accept the terms of the Tender Documents and that all costs incurred by the Tenderer in preparing and submitting this Tender will be borne by the Tenderer.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

Signature of Tenderer

Signature _____ in the capacity of _____

duly authorise to sign Tenders for and on behalf of _____

Address: _____

Date: _____

Signature of the Witness

Signature _____ in the capacity of _____

Address: _____

Date: _____

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4
PART 2 – APPENDICES TO LETTER OF TENDER
INTRODUCTIONS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

PART 2 – APPENDICES TO LETTER OF TENDER

The Tenderer is requested to complete all the following Appendices and is advised that failure to do so may result in its Tender being liable for rejection.

In the event of award of the Contract, the Tenderer is advised that the Employer, at its sole discretion, may utilise any of these Tender Appendices to form part of the Contract Document.

The Tenderer shall refer to the relevant sections of the Tender in order to comply with all the Requirements of the Employer while preparing these Appendices.

Please refer to Part 3 of Appendix 1 – Submission Checklist under Section 1 – Tender Instructions for the submission checklist and submission requirements of these Appendices.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 1 – DETAILS OF TENDERER

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 1 – DETAILS OF TENDERER

The Tenderer must have a valid registration with the relevant authorities in the Country of the Tenderer's operation. Copies of the certificate of incorporation of the company in the Country of operation complete with details of owners and shareholders must be submitted with this Appendix.

Nationality and residency information is to be provided for all shareholders and directors (shareholders holding more than a 10% interest) of tenderers that are corporations carrying on business as contractors.

Details of any parent company and their associated holdings in the Tenderer's company shall be clearly stated.

In the event of a joint venture, the above information shall be submitted for all members of the joint venture.

In addition, following details shall be submitted regarding the joint venture:

- a. Details of Joint Venture whether it is an existing or a proposed formation
- b. In the event of a future formation, anticipated timeline to form a Joint Venture Company from the date of Award Notification after Tender
- c. Memorandum of Understanding to form Joint Venture
- d. Draft Joint Venture Agreement with terms including but not limited to equity share, management responsibilities, nominated lead for the Joint Venture, roles and responsibilities of the Joint Venture partners, confirmation to be jointly and severally bound for liabilities etc.

The term Joint Venture Company refers to: -

- a. Joint equity participation between local company(s) or local company(s) and international partner(s);
- b. Actively managed by both parties
- c. Registered under the Companies Act (Cap 39) in Brunei Darussalam

Joint Venture shall have a lead member. The lead member shall be capable of carrying out works of this nature. All members of the Joint Venture shall be bound jointly and severally if selected.

Tenderer must have previous proven and demonstrated track record in designing, building and operating waste to energy projects (within the last ten (10) years). The Tenderer who in the case of a consortium / joint venture, shall be the lead member of the consortium / joint venture, shall have an average annual turnover of B\$ 25,000,000.00 (Brunei Dollars Twenty-Five Million) for the past five (5) years of which any two consecutive years shall have a minimum of B\$ 40,000,000.00 (Brunei Dollars Forty Million) annual turnover.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 1 – DETAILS OF TENDERER (Cont'd)

DETAILS OF TENDERER

A1-1 Page ____ of ____

FORM A1-1			
Tenderer Name:			
Scope of Works Undertaken: <i>(Write a summary of scope of works to be undertaken directly in relation to Section 3, Part 1 – Employer's Requirements - Scope of Works & Specification and where applicable supplement with attachments to elaborate the details of scope of works to be undertaken)</i>			
In operation since (please attach certificate of registration with registrar of companies or Certificate of Incorporation)*:			
Contact Person for this Tender:		Telephone:	
Address:			
Telephone:		Facsimile:	
Email:		Website:	
Total No. of Staff:		Total No. of Technical Staff:	
Total No. of Administrative Staff:		Total No. of Other Staff:	
Paid-up Capital (B\$):		Authorised Capital(B\$):	
Parent Company Name:		Parent Company Holdings / Share %:	
Parent Company's Country of Incorporation:		Parent Company Operation since:	
Details of Owners / Directors / Share-holders			
No.	Name	Citizenship / Resident	Position
1			
2			
3			
4			
5			

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER
APPENDIX 2 – DETAILS OF SUB-CONTRACTORS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 2 – DETAILS OF SUB-CONTRACTORS

The Tenderer must submit details of the members of the proposed team with this appendix which shall include sub-contractors / domestic sub-contractors. The Tenderer must submit an original letter of support from each of the sub-contractors which should clearly state the scope of works undertaken by the respective sub-contractors. Submission must include an overall organization chart indicating the team members' company name and their role in the project.

The Tenderer shall also submit all the information, registration certificates in their Country of operations including details of the directors and shareholders, etc. as part of the tender submission under this Appendix.

The Tenderer shall also include details of the local sub-contractors who shall be responsible for all the logistics and other related support required to import, safely transport, store in the appropriate safe storage and subsequently deliver to the Project Worksite on time to meet the planned schedule for installation of all equipment packages.

For the purposes of the construction, the Tenderer shall propose following minimum contractors as domestic sub-contractors (or otherwise as member of Joint Venture / Consortium): -

- i. Building and Civil Works Contractor – must have a valid registration with the Ministry of Development with a minimum of Class VI Contractor with minimum categories of KA01 and B01 and have relevant past experience;
- ii. Mechanical & Electrical Works Contractor - must have a valid registration with the Ministry of Development with a minimum of Class V and/or above with minimum categories E01, E02, E03, E05, M01, M03 and KPME05 and have relevant past experience;

The Tenderer shall demonstrate in their submission as part of this Appendix on the % of the total Tendered Amount expended locally for the local supply chain per annum for both the Design-Build Period and Operation Service Period to demonstrate the involvement of local businesses.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 2 – DETAILS OF SUB-CONTRACTORS (Cont'd)

DETAILS OF PROJECT TEAM

FORM A2-1			
Ref	Sub-Contractor Name	Scope of Works Undertaken in reference to Section 3, Part 1 – Employer's Requirement, Scope of Works and Specification	No. of Projects previously worked together with the Tenderer
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Notes:

* Expand the above table if necessary.

** For each of the sub-contractor listed above corresponding Form A2-2 must be duly filled and submitted with the Tender.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 2 – DETAILS OF SUB-CONTRACTORS (Cont'd)

DETAILS OF SUB-CONTRACTOR

A2-2 Page ____ of ____

FORM A2-2			
Sub-Contractor Name:			
Scope of Works Undertaken: <i>(Write a summary of scope of works to be undertaken directly in relation to Section 3, Part 1 – Employer's Requirement, Scope of Works and Specification and where applicable supplement with attachments to elaborate the details of scope of works to be undertaken)</i>			
In operation since (please attach certificate of registration with registrar of companies or Certificate of Incorporation):			
Address:			
Telephone:		Facsimile:	
Email:		Website:	
Total No. of Staff:		Total No. of Technical Staff:	
Total No. of Administrative Staff:		Total No. of Other Staff:	
Paid-up Capital (B\$):		Authorised Capital(B\$):	
Details of Owners / Directors / Share-holders			
No.	Name	Citizenship / Resident	Position
1			
2			
3			
4			
5			

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 3 – DETAILS OF DESIGN CONSULTANTS

(DESIGN SUB-CONTRACTORS)

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 3 – DESIGN CONSULTANTS (DESIGN SUB-CONTRACTORS)

The Tenderer must submit details of the members of the proposed design team with this appendix, which shall include all appointed design consultants (local / international). The Tenderer must submit an original letter of support from each design consultant, clearly stating their scope of work and responsibilities within the project. The submission must include an overall organization chart indicating the company name of each design consultant and their respective roles in the project.

The Tenderer shall also submit all relevant information, including registration certificates in their country of operation, professional accreditation, details of key personnel, directors, and shareholders, as applicable, as part of the tender submission under this appendix.

Additionally, the Tenderer shall provide details of any local design consultants engaged for the project, outlining their specific scope, responsibilities, and contributions to ensure compliance with local regulations and project requirements.

For the purposes of the design & other associated deliverables and authority approvals, the Tenderer shall propose following minimum consultants as domestic sub-contractors: -

- a. Engineering design house that has proven track record of similar projects with integration capabilities of various disciplines including, but not limited to, such as civil, structural, electrical, mechanical, process, automation, control, optimisation and technical safety;
- b. Architectural consultancy with BAPEQS Practicing Certificate;
- c. All above engineering deliverables shall comply with the Architects, Professional Engineers and Quantity Surveyors Order 2011;
- d. Independent Accredited Checker in accordance with local regulations;
- e. Environmental consultant registered with JASTRe for EIA and EMMP for both construction and operation phases;

Proof of such registration with relevant authorities, including but not limited to BAPEQS certifications, ABCI registrations, JASTRe registrations shall be submitted including demonstrating its current validity.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 3 – DETAILS OF DESIGN CONSULTANTS (DESIGN SUB-CONTRACTORS) (Cont'd)

DETAILS OF PROJECT TEAM

FORM A3-1			
Ref	Design Consultant's Name	Scope of Works Undertaken in reference to Section 3, Part 1 – Employer's Requirement, Scope of Works and Specification	No. of Projects previously worked together with the Tenderer
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Notes:

* Expand the list if necessary.

** For each of the Design Consultant listed above corresponding Form A3-2 must be duly filled and submitted with the Tender.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 3 – DESIGN CONSULTANTS (DESIGN SUB-CONTRACTORS) (Cont'd)

DETAILS OF SUB-CONTRACTOR

A3-2 Page ____ of ____

FORM A3-2			
Design Consultants Name:			
Scope of Works Undertaken: <i>(Write a summary of scope of works to be undertaken directly in relation to Section 3, Part 1 – Employer's Requirement, Scope of Works and Specification and where applicable supplement with attachments to elaborate the details of scope of works to be undertaken)</i>			
In operation since (please attach certificate of registration with registrar of companies or Certificate of Incorporation):			
Address:			
Telephone:		Facsimile:	
Email:		Website:	
Total No. of Staff:		Total No. of Technical Staff:	
Total No. of Administrative Staff:		Total No. of Other Staff:	
Paid-up Capital (B\$):		Authorised Capital(B\$):	
Details of Owners / Directors / Share-holders			
No.	Name	Citizenship / Resident	Position
1			
2			
3			
4			
5			

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 4 – DETAILS OF SUPPLIERS

(SUB-CONTRACTORS UNDERTAKING SUPPLY WORKS)

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

**APPENDIX 4 – SCHEDULE OF SUPPLIERS (SUB-CONTRACTORS UNDERTAKING SUPPLY
WORKS)**

The Tenderer must submit details of the members of the proposed team proposed sub-vendors / Suppliers with this appendix which shall include all the sub-vendors / suppliers etc. The Tenderer must submit an original letter of support from each of the sub-vendors / suppliers which should clearly state the scope of works undertaken by the respective sub-vendors / suppliers. Submission must include an overall organization chart indicating the team members' company name and their role in the project.

The Tenderer shall also submit all the information, registration certificates of the companies in their Country of operations including the directors and shareholder details etc. as part of the tender submission under this Appendix.

Supply of materials and equipment which regulated by specific authorities such as the Department of Electrical Services (DES), Authority on Building Control & Construction Industry (ABCi), Brunei Fire and Rescue Department (BFRD) etc. shall be ensured by the Tenderer the supplies are through approved vendors / suppliers registered with the above authorities.

REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM

SCHEDULE OF TENDERER'S PROPOSED SUB-VENDORS/SUPPLIERS

FORM A4-1

NO.	EQUIPMENT / SERVICE	SUB-VENDOR	SUB-VENDOR ADDRESS	YEARS EXPERIENCE WITH SUB-VENDOR	SUB-VENDOR QA SYSTEM AUDITED BY VENDOR?
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

Note:

* Expand the table if necessary.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 5 – DETAILS OF FINANCING INSTITUTION

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 5 – DETAILS OF FINANCING INSTITUTION

The Tenderer, as part of its response to this Appendix, shall declare whether it is seeking or will seek external financing for this Project. Otherwise, the Tenderer shall demonstrate their own financial capabilities to undertake this Project for both the Design-Build Period and Operation Service Period.

In the case where the proposed Tenderer's structure is a Joint Venture, then the component percentage of funding from each Joint Venture member and their corresponding financial capabilities to undertake this Project for both the Design-Build Period and Operation Service Period must be demonstrated.

In the event of external financing, it is highly advisable for the following minimum documentations to be submitted:-

- a. Letters of Intent from the external financier(s);
- b. Support letters from the external financier(s);
- c. Indicative term sheets from the financier(s) including their written acknowledgement of the terms and conditions of this Project as well as the Power Purchase Agreement; and/or;
- d. High level financing assumptions (e.g. debt equity ratio, tenor, indicative pricing, etc).

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 6 – HUMAN RESOURCES

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 6 – HUMAN RESOURCES

The Tenderer must submit a specific overall project organization chart indicating all the proposed key personnel, including those of sub-contractors and sub-vendors for this project. The project organization chart shall be split into two i.e. one for the Design-Build Period and another for the Operation Service Period.

The Tenderer must submit form A5-1 below and the curriculum vitae of each of the key personnel as listed in Section 7.2 – Key Staffs requirement during Design-Build Period and Section 7.3 – Key Staffs requirement during Operations Service Period of Part 1 – Employer's Requirement under Section 3 of this tender document.

In addition, the Tenderer shall also submit the proposed Brunei-based key resources, their positions and roles and responsibilities for this project as part of the tender submission.

The Tenderer must demonstrate the above by the following submissions which must accompany this appendix:-

- a. A summary of overall number of resources proposed for this project with break down according to the categories or role proposed to be undertaken in this project. The summary and breakdown must include but not limited to the category of work, role of the resource in the project, whether the resource is for full time or part time role in the project, whether the resources is site based or office based, duration for which the resource will be employed for the project etc.
- b. Overall Project Specific Organisation Chart indicating the resources with their respective project role and nationality / residence status.
- c. For resources that are not currently employed by the Tenderer or Tenderer's sub-contractor, Tenderer to clarify, by a write-up under this section by the Tenderer, on how they will ensure the mobilisation of such resources will be achieved without affecting the program.

In addition, the Tenderer must provide a projection of employment of Bruneian resources as part of this appendix with the following minimum information:-

- a. Design-Build Period
 - (i) Proposed total number of resources;
 - (ii) Proposed total number of Bruneian resources (Citizens / Permanent Residents of Brunei Darussalam) complete with their position / category;
 - (iii) Proposed total number of foreign resources complete with their position / category;
 - (iv) The categorisation shall include grouping according to administrative, management, professional, skilled, semi-skilled and unskilled.
 - (v) The above information shall be provided for each year of the Design-Build Period.
- b. Operation Service Period
 - (i) Proposed total number of resources;
 - (ii) Proposed total number of Bruneian resources (Citizens / Permanent Residents of Brunei Darussalam) complete with their position / category;
 - (iii) Proposed total number of foreign resources complete with their position / category;
 - (iv) The categorisation shall include grouping according to administrative, management, professional, skilled, semi-skilled and unskilled.
 - (v) The above information shall be provided for each year of the Operation Service Period with demonstrated improvement of increment in the total number of Brunei resources for every two years of the Operation Service Period.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 6 - HUMAN RESOURCES (Cont'd)

CURRICULUM VITAE OF KEY PERSONNEL

A6-1 Page _____ of _____

FORM A6-1			
Company Name of Project Team Member: _____			
Name of Personnel:			
Position in the Company:			
Educational Qualification:			
Professional Memberships:			
Years of Experience:		No. of Years in Current Position:	
Projects Currently Involved:			
Date of Birth:		Current Employer:	
Nationality:		Brunei Residence Status:	
Age:		Identity Card No.:	
Languages known:			
Employment History			
From	To	Name of Employer	Position

* Please attach detailed curriculum vitae of the above personnel which shall include details of projects undertaken including the roles and responsibilities of the personnel in those projects.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 7 – EXECUTION METHODOLOGY

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 7 – EXECUTION METHODOLOGY

The Tenderer must submit an overall project execution methodology demonstrating his understanding of the Employer's Requirement and Scope of Works and Specification for this project. Such methodology must include but not be limited to Tenderer's programme of works for both Design-Build Period and Operation Service Period, financing strategy, Scope of work boundary limit, design development and design engineering activities, execution of various studies stipulated in the Employer's Requirements, authority liaisons, submission and obtaining approvals, procurement, equipment delivery, mobilisation strategy, interfaces management, method statement, planning and execution of the project including planning for each sections of the works, management aspects of Project Execution Team, management of sub-consultants, sub-contractors and suppliers, document control, quality control of project deliverables, HSSE, Technical Safety Engineering of the Plant, performance monitoring, progress reporting, Quality Management System (QMS), deliverables, etc.

The Tenderer, as a minimum, must submit detailed execution methodology including, but not limited to, the following activities:-

1. Financing Strategy
2. Planning, execution and obtaining approvals from relevant authorities of the various studies, including but not limited to the following:
 - Detailed Power System Study (PSS, including load flow and short-circuit analysis) for 11kv power export network through Telisiai Main Intake Station;
 - Quantitative risk and safety assessments
 - Coarse Quantitative Risk Assessment;
 - Coarse HAZID;
 - Human Factor Engineering (HFE) and Human Reliability Analysis (HRA);
 - Fire and Explosion Risk Assessment (FERA);
 - As Low As Reasonably Practicable (ALARP);
 - Environmental Impact Assessment (EIA) complete with both construction and operations Environmental Monitoring and Management Plan (EMMP);
3. Detailed Design Engineering
 - Engineering execution plan and tools;
 - Discipline-specific design approach:
 - Process design and simulations;
 - Mechanical: static/rotating equipment, HVAC;
 - Electrical and Instrumentation;
 - Infrastructure for Power Export / Import for 11kV or 66kV transmission lines with slim poles including Main Intake substation, distribution substation, Transformers, Generator sets, HV cables, etc.;
 - Control and Automation system integration;
 - Civil/Structural including foundations and superstructures;
 - Architectural/space planning and building design;
 - Process Safety strategy and SIL studies;
 - Design studies and assurance processes;
 - Drawing/documentation control strategy (vendor/subcontractor documentation, review cycles);
 - Compliance with codes, standards, and regulatory requirements;
 - Liaison with authorities for compliance to their requirements, submissions and obtaining approvals;
4. Materials, Inspection, Integrity and Flow Assurance
 - Materials selection and traceability strategy;
 - Inspection test plan (ITP) and QA/QC procedures;
 - Coating and painting program;

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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- Material Receiving Report (to report damages, compliance, and non-compliance);
- 5. Procurement, Materials and Equipment
 - Procurement execution strategy;
 - Vendor prequalification and selection criteria;
 - Expediting and inspection activities;
 - Spare parts, special tools, and test equipment plan;
 - Training programs by vendors/OEM;
 - Documentation deliverables: RFQ, PO, technical bid evaluations;
 - Customs, logistics, preservation of long-lead items;
 - Procurement control/reporting and final procurement close-out report;
- 6. Preservation and Logistics
 - Preservation methods for mechanical/electrical equipment;
 - Enclosed Storage (for Electronic and Instrumentation parts);
 - Logistics and transportation management;
 - Route surveys and transportation analysis;
 - Tow plans (if marine transport applies);
- 7. Fabrication, Testing, Construction and Installation
 - Fabrication yard readiness and procedures;
 - Construction methodologies (earthworks, concrete, steel erection);
 - Mechanical/E&I installation;
 - Hook-up and tie-ins;
 - Site mobilization strategy (including supervision and manpower planning);
 - External coatings/painting;
 - As-built and O&M documentation;
 - Equipment warranties;
- 8. Testing, Commissioning, Start-Up and Operation
 - Pre-commissioning and commissioning procedures (mechanical, electrical, instrumentation);
 - Start-up and performance testing;
 - Operation readiness checks;
 - Demobilization and surplus material return;
 - Waste management and disposal plan;
 - Mechanical erection strategy;
 - Tie-ins, trenching, burial depth compliance;
 - Fire protection commissioning;
 - Support for early gas supply (if phased startup is required);
- 9. Quality Management
 - Quality control/assurance system;
 - Regulatory compliance and certification;
 - Dimensional control and inspection methodology;
 - Traceability, documentation, and QA records;
 - Internal audit and surveillance plans;
- 10. Flawless Start-Up (FSI)
 - FSI implementation plan;
 - System walkdown and punch list methodology;
 - Defect closure tracking;
- 11. Operations and Maintenance
 - Waste receipt, bunker management and pre-treatment;
 - Bottom ash treatment;
 - Fly ash and APC system residue treatment and stabilization;

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- Leachate and waste-water treatment;
 - 11kv or 66kv power export network infrastructure and associated facilities;
 - Power export metering philosophy;
 - Raw water supply, treatment, storage and reticulation system;
 - Potable and fire water supply, treatment, storage and reticulation system;
 - Operations philosophy compliance;
 - Operability, maintainability, and asset management strategy;
 - Life cycle cost (LCC) analysis;
 - Maintenance procedures and schedules;
 - OEM documentation and spare parts list;
 - Statement of Fitness (SoF) and MOPO compliance;
 - Handover documentation and asset register;
12. Handback
- Strategy for preparation and handback of the WTE Plant at the end of the Operation Service Period;
13. Decommissioning
- Methodology for decommissioning in the event option for decommissioning at the end of the Operation Service Period is chosen by the Employer;
14. Extension to Operation Service Period
- Strategy for extension to Operation Service Period and associated strategy for processing the increment in the waste anticipated during the extension period in relation to the Plant capacity;
15. Local Business Development
- Strategy to engage local vendors and contractors;
 - Local manpower training and utilization;
 - Knowledge transfer plan;
 - Reporting and KPI tracking;
16. Training
- Training program schedule and curriculum;
 - Locations and number of CLIENT staff to be trained;
 - Involvement of OEM/vendor for specialized training;
 - Knowledge retention plan post-handover;
17. Information Management
- Information systems for document control (EDMS, 3D model, engineering databases);
 - Project information exchange protocols;
 - Data security strategy;
 - Application best practices;
 - Engineering data integrity;
18. Other Work Scope
- Noise control measures;
 - Environmental and social impact assessment work scope;
 - HSE specific work scope;
 - Performance standards for critical equipment;
 - Safety studies (HAZID, HAZOP, SIL);
 - Interface Management Plan;
 - Project Supervision & Site Management Strategy;
 - Resource and Manpower Plan;
 - Deliverables/Dossier Handover Plan;
 - Maintenance Reference Plan and Lifecycle Support;

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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- Spare Parts Lifecycle Management;
- Support during Commissioning and DRP;

In addition, the Tenderer shall also comply with all the local regulations, standards and international codes and standards specified elsewhere in the specifications.

Tenderer shall highlight and list down all software to be utilised in the services from Detailed Design Engineering to Plant commissioning / Start-up.

Tenderer shall elaborate on the methodology to provide Process and Performance Guarantees.

The Tenderer shall submit the following, including preliminary calculations, as part of the technical proposal submission:-

1. Schematic conceptual layout plans and methodologies of the entire development including all the authorities approval requirements;
2. schematic conceptual layout plans and methodologies of drainage works;
3. schematic conceptual layout plans and methodologies of road works;
4. schematic conceptual layout plans and methodologies of external water supply (both potable & fire water supply and raw water supply);
5. schematic conceptual layout plans and methodologies of external firefighting;
6. schematic conceptual layout plans and methodologies of external domestic sewerage works to demonstrate the understanding of the Employers' requirements for compliance.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER
APPENDIX 8 – PLANT, TOOLS AND EQUIPMENT

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 8 – PLANT, TOOLS AND EQUIPMENT

The Tenderer including its sub-contractors must furnish the following information related to the plant, equipment and tools that are currently owned or hired and are proposed for the implementation of this project for their respective Scope of Works undertaken. Tenderer must enclose copies of the valid certification of lifting equipment (where applicable) by third party inspectors in Brunei Darussalam. Plant, tools and equipment must also be listed.

LIST OF PLANT, TOOLS AND EQUIPMENT

A8-1 Page ____ of ____

FORM A8-1				
Company Name of Project Team Member: _____				
Ref.	Type	Model No.	Quantity Owned	Quantity Hired
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Notes:

* Expand the above table if necessary.

** For each of the sub-contractors listed above corresponding Form A8-1 must be duly filled and submitted with the Tender.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 9 – WAREHOUSE, WORKSHOPS, AND TOOLS STORE

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 9 – WORKSHOPS, TOOL STORES AND WAREHOUSE FACILITIES

The Tenderer including its sub-contractors must furnish the following information related to facilities owned/hired by them for the purposes of usage as workshops, tools store, warehouses, store area for serviced equipment etc. for this project. Such locations proposed shall have due considerations for timely movement of materials, tools and equipment to ensure the response time for the maintenance activities are not compromised.

LIST OF WORKSHOPS, TOOL STORES AND WAREHOUSE FACILITIES A9-1 Page ____ of ____

FORM A9-1			
Company Name of Project Team Member: _____			
No.	Type of Facility (Workshop, Tool Store, Warehouse, Porta Cabins etc.)	Area (in Sq. m)	Location
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Notes:

* Expand the above table if necessary.

** For each of the sub-contractors listed above corresponding Form A9-1 must be duly filled and submitted with the Tender.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 10 – PAST EXPERIENCE

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 10 – LIST OF PAST EXPERIENCES

The Tenderer, including its sub-contractors and sub-vendors must furnish details of their past experience on projects of similar nature in the following format. Projects listed below should be related to the scope of Works and Services of this project to be undertaken by the Tenderer / sub-contractors / design consultants (design sub-contractors) / suppliers / sub-vendors. The Tenderer, including its sub-contractors / suppliers / sub-vendors must submit (where appropriate) copies of the client commendations on the projects completed.

LIST OF PAST EXPERIENCES

A10-1 Page ____ of ____

FORM A10-1		
Company Name of Project Team Member: _____		
No.	Project Title	Year of Completion
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		

Notes:

* Expand the above table if necessary.

** For each of the project listed above, further details **MUST** be furnished in the form A10-2 below.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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APPENDIX 10 – LIST OF PAST EXPERIENCES (Cont'd)

LIST OF PAST EXPERIENCES – PROJECT DETAILS

A10-2 Page ____ of ____

Form A10-2			
Company Name of Project Team Member: _____			
Project Title:			
Commencement Date:		Completion Date:	
Value of Scope Undertaken (B\$):			
Client Name:			
Client Contact Name:		Client Contact Tel. No.:	
Project Location:		Overall Project Value:	
Project Role:	Main Contractor(<input type="checkbox"/>)	Sub-Contractor(<input type="checkbox"/>)	Sub-Vendor(<input type="checkbox"/>)
Please furnish below brief summary of scope of works undertaken in the project:			

Please furnish below information on number of manpower used to carry out the scope of works including their category:			

Please furnish below information on number of equipment and tools used to carry out the scope of works including their category:			

Please furnish below information on materials supplied for this project:			

.....
Signature of Tenderer

Date:

.....
Signature of Witness

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 11 – CURRENT PROJECTS COMMITMENTS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 11 – CURRENT PROJECTS

The Tenderer, including its sub-contractors / sub-vendors must furnish details of the projects they are currently undertaking in the following format. Projects listed below shall include **ALL** projects that are currently being undertaken by the Tenderer / sub-contractors / sub-vendors.

LIST OF CURRENT PROJECTS

A11-1 Page _____ of _____

FORM A11-1			
Company Name of Project Team Member: _____			
No.	Project Title	Date of Completion	Total No. of Human Resources Used
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Notes:

* Expand the above table if necessary.

** For each of the project listed above, further details **MUST** be furnished in the form A11-2 below.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 11 – CURRENT PROJECTS (Cont'd)

LIST OF CURRENT PROJECTS – PROJECT DETAILS

A11-2 Page ____ of ____

Form A11-2			
Company Name of Project Team Member: _____			
Project Title:			
Commencement Date:		Completion Date:	
Value of Scope Undertaken (B\$):			
Client Name:			
Client Contact Name:		Client Contact Tel. No.:	
Project Location:		Overall Project Value:	
Project Role:	Main Contractor(<input type="checkbox"/>)	Sub-Contractor(<input type="checkbox"/>)	Sub-Vendor(<input type="checkbox"/>)
Please furnish below brief summary of scope of works undertaken in the project:			

Please furnish below information on number of manpower used to carry out the scope of works including their category:			

Please furnish below information on number of equipment and tools used to carry out the scope of works including their category:			

Please furnish below information on materials supplied for this project:			

.....
Signature of Tenderer

Date:

.....
Signature of Witness

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 12 – FINANCIAL CAPABILITIES

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 12 – FINANCIAL CAPABILITIES

The Tenderers, including each member of a consortium, must provide financial information to demonstrate that they meet the requirements stated in the Instructions to Tenderers. Each tenderer or a member of a consortium must fill in this FORM. If necessary, use separate sheets to provide complete banker information.

The Tenderer must include references from Bank in the form A12-1 below.

The Tenderer must submit proof of financial capabilities to undertake the Works in the format given in Form A12-2 below, which shall include but not be limited to, copies of the Applicant's detailed profit and loss statement for the past five (5) years. Tenderer's submission **must include certified / audited copies of the company's financial account** in English (i.e., Profit & Loss and balance sheet statements for the past five (5) years).

The Tenderer, who in the case of a consortium / joint venture, shall be the lead member of the consortium, shall have an average annual turnover of B\$ 25,000,000.00 (Brunei Dollars Twenty-Five Million) for the past five (5) years of which any two consecutive years shall have a minimum of B\$ 40,000,000.00 (Brunei Dollars Forty Million) annual turnover. The Tenderer shall demonstrate meeting this requirement as part of submissions of this Appendix 12.

Tenderer are required to submit a Tender Security in the form of a Bank Guarantee for an amount of B\$4,000,000.00 (Brunei Dollars Four Million) accompanied with their Tender in the format prescribed in the Tender.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 12 – FINANCIAL CAPABILITIES (Cont'd)

REFERENCES FROM BANK

A12-1 Page ____ of ____

Form A12-1				
Tenderer: _____				
NO.	NAME OF BANK	ADDRESS	CONTACT PERSON / TEL NO.	CREDIT FACILITIES (B\$)
1.				
2.				
3.				
4.				
5.				

.....
Signature of Tenderer

Date:

.....
Signature of Witness

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 12 – FINANCIAL CAPABILITIES (Cont'd)

FINANCIAL STATEMENTS

A12-2 Page ____ of ____

Form A12-2					
ITEM	DESCRIPTION	BND (BRUNEI DOLLARS)			
		202...	202...	202...	202...
1.	Current Assets				
2.	Fixed and Other Assets				
3.	Current Liabilities				
4.	Other Liabilities				
5.	Authorised Capital				
6.	Paid Up Capital				
7.	Net Worth (1 + 2) - (3+4)				
8.	Working Capital (1-3)				
9.	Current Asset Ratio				
10.	Debt : Equity Ratio				
11.	Profit / (Loss) After Tax				
12.	Contingent Liability				
13.	Overdraft / Credit Facilities				
14.	Suppliers Credit				
15.	Facility/Fund Available (8+13+14)-12				
16.	Turnover				

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDIX 12 – FINANCIAL CAPABILITIES (Cont'd)

The Tenderer shall submit a letter from their bank(s) as shown in the sample below indicating the credit facilities that would be made available to the Tenderer should the Tenderer be awarded with the contract.

(This format is to be typed on the Bank's official letter head)

SAMPLE LETTER OF SUPPORT FROM BANK

To:

Chairman of Tender Committee
Mini Tender Board,
Ministry of Development,
Ground Floor, Ministry of Development Building,
Old Airport, Berakas,
Bandar Seri Begawan, BS3510,
Negara Brunei Darussalam

Dear Sir / Madam,

**RE: REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI
DARUSSALAM**

We, [Name of Bank] are pleased to advise that [Name of Tenderer] has been a customer of our bank since _____ . [Name of Tenderer] is currently enjoying total credit facilities of Brunei Dollars _____ (BND _____). We have found [Name of Contractor] to be credit worthy and are pleased to support them in their business.

We also confirm that we will be prepared to consider any application made by [Name of Contractor] for additional credit facilities, and issue an irrevocable and unconditional Performance Security for the project should [Name of Tenderer] be awarded the contract.

Yours faithfully,

For and on behalf of

[Name of Bank]

[Name]

[Designation]

SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER
APPENDIX 13 – QUALITY MANAGEMENT SYSTEM

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 13 – QUALITY MANAGEMENT SYSTEM

The Tenderer, including its sub-contractors must answer the questionnaire below and furnish the following information related to the Quality Management Systems practiced by their organisation:-

- 1) Is your company certified to a Quality Management System Standard? If so, then please submit a copy of your valid Quality Management Certification.
- 2) How do you ensure quality of work will be done according to contractual requirements? Do you have a quality management system in place? If so, please submit all documentation to support this.
- 3) Have your staffs and workers carried out the design, supply and construction, supervision, testing and commissioning work according to the procedures and checklists? If so, give examples.
- 4) How do you assure the competence of your staff and worker to perform the design, supply and construction, supervision, testing and commissioning work according to the quality required?
- 5) How do you ensure the Project team you will provide for this project shall have the competence and capabilities to carry out the management of the design, supply and construction, supervision, testing and commissioning work?
- 6) How do you ensure the Technical team you will provide for this project shall have the competence and capabilities to carry out tasks assigned?
- 7) How do you ensure your staff and workers will carry out design, supply and construction, supervision, testing and commissioning work at Site according to the procedures and checklists?
- 8) How do you assure the competence of your staff and worker to perform the design, supply and construction, supervision, testing and commissioning work according to tender requirements?
- 9) How do you assure the training and updating of the competence of your staff?
- 10) How will you obtain the feedback from the Employer and its Consultant on your performance on this contract, in particular on the work and services you are providing?
- 11) How will you set up your performance and improve it continuously? What Key Performance Indicators will you set to measure your performances? Please submit a draft copy of your proposed KPIs for this project.
- 12) Please submit a project specific Quality Assurance and Quality Control plan which shall be audited by Employer at regular intervals for your compliance / adherence throughout the Contract Period (both for Design-Build Period and Operation Service Period).
- 13) How do you manage any defects or non-compliances on products, services or processes found during project execution? Please provide sample of complete non-compliance report (NCR).
- 14) How do you manage quality of sub-contractors / vendors?
- 15) How do you manage the material packaging, tracking, storage and preservation?
- 16) Provide the following:
 - a. Audit findings by the certification body for the last 24 months;
 - b. Internal Audit findings for the last 12 months;
 - c. List of NCRs (both internal and external) recorded for the last 24 months;
 - d. Quality organization chart for both corporate and contract / project;
 - e. Sample of Inspection and Test Plan (ITP);
 - f. List of Inspection tools and Testing equipment with the calibration status.
- 17) How do you ensure the Operation Service to be provided by your company will meet the Contract requirements and any other regulatory compliance?

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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SECTION 4

PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 14 – HEALTH, SAFETY, SECURITY AND ENVIRONMENT (HSSE)

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 14 – HEALTH, SAFETY, SECURITY AND ENVIRONMENTAL SYSTEM (HSSE)

The Company is committed towards ensuring the health and safety of people, effective security controls and protection of the environment.

The Tenderer must submit a Contract specific ‘HSSE Plan’, as part of this appendix. Such Contract specific plan must clearly identify the hazards & associated risks with appropriate control measures. The HSSE Plan shall include, but not limited to, HSSE training and competency, land transport vehicles, occupational health, environment management including waste management, emergency response, HSSE critical activities, risk assessment, incident reporting procedures, statistics & mechanism for monitoring and measuring exposure man-hours, provision of accommodation for overseas workers etc.

In addition, the Tenderer including its sub-contractors must furnish the following information (complete with necessary attachments) related to the HSE systems practiced by their organisation in the tables below:-

Form A14-1						
Company Name of Project Team Member: _____						
No	Description	Attachment			Remarks (explanations must be provided below if the answer is No or N/A)	
		Yes	No	N/A		
1.	Experience with adherence to Permit-To-Work procedures					
2.	Safety Records For the last three (3) years, work sites, list down the following:					
a)	Number of workmen compensation cases and reportable incidents / accidents to Brunei Government or any other clients in the last three years					

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**

Form A14-1						
Company Name of Project Team Member: _____						
No	Description	Attachment			Remarks (explanations must be provided below if the answer is No or N/A)	
		Yes	No	N/A		
b)	Project Team Member's own safety statistics, for the previous 3 years, of the following :- <ul style="list-style-type: none"> • Fatalities • DAFWC (Days Away From Work Case) - Accidents • RWI (Restricted Work Injury) - Accidents • MTI (Medical Treatment Index) - Accidents • First aid – Accidents • Near miss incidents • Number of PPE violations (Cumulative within the contract year) • Number of housekeeping violations 					
c)	A narrative that identifies what the Project Team Member perceives to be the significant hazards of the work to be performed and the Project Team Member's plan to eliminate or minimize the potential for an incident that could result in an occupational injury or illness.					
d)	Safety organisation including the Project Team Member's safety staffing plan, describing the onsite person(s) to be appointed by the Project Team Member who shall be responsible for their expertise, authorities and HSE.					
3.	A description of the Project Team Member's proposed on-site job manager and supervisors who are to be held accountable for safety performance and how performance is monitored, assessed, and communicated to them. This shall include but not limited to the following:					

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
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Form A14-1

Company Name of Project Team Member: _____

No	Description	Attachment			Remarks (explanations must be provided below if the answer is No or N/A)
		Yes	No	N/A	
a)	SWP / JSA Procedures				
b)	Emergency Response and Preparedness.				
c)	Management of Site Change procedure				
4.	<u>Safety Program</u> This shall include but not limited to the following:				
a)	A description of the safety orientation program / induction shall be provided to all Project Team Member's employees on site.				
b)	Project Team Member's enforcement and disciplinary action program for safety violations.				
c)	A description of the Project Team Member's employee Safety and Health supervise program.				
d)	A description of the Project Team Member's accident investigation procedures and the types of incidents that are investigated.				
e)	A description of the manner in which safety inspections will be performed, a list of who will perform them, and the proposed frequency of the inspections.				

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Form A14-1

Company Name of Project Team Member: _____					
No	Description	Attachment			Remarks (explanations must be provided below if the answer is No or N/A)
		Yes	No	N/A	
f)	A description of how often safety meetings (i.e. including Tool, Box Meeting) are conducted, who presents and attends the meeting, and how the topics are selected.				
g)	A description of the Project Team Member's policies, and programs relating to alcohol and controlled substances.				
h)	A description of how the Project Team Member's safety programs apply to Sub-Contractors and of the method by which successful implementation of and compliance with the programs will be assured.				
i)	A description of the Project Team Member's program to comply with applicable regulatory requirements.				
5.	A list of the types of safety equipment that the Project Team Member anticipates will be used, including personal protective equipment (PPE) and equipment				
6.	List the safety awards and commendations received for good safety performance, if any				
7.	Safety Legislative compliance				
8.	Record keeping				
9.	HSSE Criteria for Sub-Contractor selection				

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Form A14-1						
Company Name of Project Team Member: _____						
No	Description	Attachment			Remarks (explanations must be provided below if the answer is No or N/A)	
		Yes	No	N/A		
10.	A description of how the Project Team Member's on-site job manager and supervisors are held accountable for safety performance and how performance is monitored, assessed, and communicated.					
11.	Project Team Member's written emergency response / evacuation plan which includes but not limited to the following :					
a)	Types of emergencies that may be encountered					
b)	Specific response actions and activities					
c)	Responsibilities					
d)	Evacuation instructions					
e)	Muster points / Safe Havens					
f)	A system to account for personnel and how Client personnel will be notified					
12.	Strategic HSE objective / KPI and description of how they are communicated to Project Team Members.					
13.	Provision of HSE communication meetings between client and Project Team members.					

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Form A14-1

Company Name of Project Team Member: _____					
No	Description	Attachment			Remarks (explanations must be provided below if the answer is No or N/A)
		Yes	No	N/A	
14.	A description of how the Project Team members monitor and record their health performance.				
15.	A description of how the Project Team members monitor and record their environmental performance.				
16.	A description of how the Project Team members monitor and record their logistics performance.				
17.	HSE auditing procedure.				
18.	A description of how HSE audits are conducted, who is involved, what scope of audit is covered and how audit findings are effectively followed-up and closed out.				
19.	Description of how HSE performance and management system is reviewed, how often review is conducted, who is involved and how improvements are implemented.				

.....
Signature of Tenderer

Date:

.....
Signature of Witness

Date:

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APPENDIX 15 – ENVIRONMENTAL PERFORMANCE

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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APPENDIX 15 – ENVIRONMENTAL PERFORMANCE

Provide details of the last three (3) projects where the Tenderer has been responsible for environmental compliance or performance, preferably similar WTE projects.

FORM A15-2		
PAST ENVIRONMENTAL TRACK RECORD		
Company Name of Project Team Member: _____		
No.	Key Features	Details
1.	Name of the project	
2.	Client Name and address	
3.	Location and type of project	
4.	Environmental permits obtained for the project	
5.	Any environmental non-compliance incidents?	
6.	Any penalties or fines imposed for such environmental non-compliance?	
7.	Corrective actions taken and implemented	
8.	Environmental Management System adopted for this project (e.g. ISO 14001)	
9.	Sustainability Initiatives included in this project including, but not limited to, any certifications/rating obtained from international providers such as LEED, BREEAM, BCA-Green Mark etc.	
10.	Details of any carbon credit schemes utilized	

* Please fill in this for each project separately for each of the project team member organisation with WTE or similar experience.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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APPENDIX 15 – ENVIRONMENTAL PERFORMANCE

The environmental consultant (registered with JASTRe) proposed for this project shall furnish the following information on environmental compliance features resulting from projects executed in the last ten (10) years or currently in progress as part of the tender submission. A separate sheet must be used for each project. The list shall include mitigation and management measure taken, recent fines or breaches of environmental compliance, etc.

FORM A15-2		
Name of the Tenderer:		
Name of the Environmental Consultant : _____		
No.	Key Features	Details including any Mitigation / Management Measure Taken
1.	Name of the project	
2.	Client Name and address	
3.	Location and type of project	
4.	Compliance to Environmental Protection and Management Order and approvals obtained	
5.	Environmental Impact Assessment (EIA) Guidelines adopted for the project	
6.	Application of National Climate Change Policy strategies for the project and its associated details	
7.	Pollution Control Guidelines for the Industrial Development adopted for the project	
8.	Strategies for Public Awareness and Education adopted for the project	
9.	Strategies for Forest Management adopted for the project	
10.	Strategies for Monitoring and Enforcement adopted for the project	
11.	Strategies for Waste Management adopted for the project	
12.	Strategies for compliance to any International Agreements adopted for the project	

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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APPENDICES TO LETTER OF TENDER

APPENDIX 15 – ENVIRONMENTAL PERFORMANCE

LIST OF BREACHES OF ENVIRONMENTAL COMPLIANCE

The following information shall be filled in by the Tenderer and **all proposed members** of the project team.

Signature of Tenderer

Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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APPENDIX 15 – ENVIRONMENTAL PERFORMANCE

STRATEGIES PROPOSED FOR THIS PROJECT

The following information shall be furnished by the Tenderer:-

1. Environmental Management System (EMS)

- Does the Tenderer operate under a certified Environmental Management System (e.g., ISO 14001)? Provide a valid certificate and scope.
- Describe how the EMS will be applied to this project.

2. Design-Stage Environmental Considerations

- What environmental standards or Best Available Techniques (BAT) will be followed in design? (e.g., EU Industrial Emissions Directive, IFC EHS Guidelines)
- How will the design minimize:
 - Air emissions (NOx, SOx, PM, dioxins, furans)
 - Water usage and discharge
 - Noise and odour pollution
 - Land and biodiversity impact
- Provide the proposed Air Emissions Control System specifications and expected performance values.

3. Waste Handling and Residue Management

- Describe the approach for ash and residue handling, including:
 - Bottom ash reuse or disposal
 - Fly ash and hazardous waste treatment
 - Compliance with local and international standards

4. Monitoring and Reporting Procedures

- Describe the Continuous Emissions Monitoring System (CEMS) proposed.
- Outline the frequency and parameters of environmental monitoring (air, water, soil, noise).
- Provide a sample format of environmental monitoring reports that will be submitted to the Employer or authorities.

5. Carbon and Energy Efficiency Performance

- Provide an estimate of the net Green House Gas (GHG) emissions per tonne of MSW processed (kg CO₂e/tonne).
- Provide the energy efficiency (R1) calculation and indicate whether the proposed facility qualifies as a recovery operation under EU standards.
- Has the company registered or traded in carbon credits (e.g., CDM, VCS/Verra, Gold Standard)? Provide details.

6. Sustainability Initiatives

- What design or operational strategies will be implemented to reduce environmental footprint beyond compliance? (e.g., solar panels, green roofs, rainwater harvesting, circular economy practices)
- Propose any plans to engage with local communities on environmental education or awareness.

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7. Environmental Staffing and Expertise

- Provide CVs or bios of key environmental personnel who will be involved in the project (e.g., Environmental Manager, Emissions Specialist).
- Indicate their experience in environmental management on similar projects.

8. Local Environmental Compliance Strategy

- Demonstrate understanding of and approach to comply with **Brunei Darussalam's environmental regulations**, including:
 - EIA submission and approval
 - Environmental permitting processes
 - Coordination with local authorities (e.g., JASTRe, DOE)

9. Environmental Risk Assessment

- Provide an outline of the key environmental risks identified and the proposed mitigation strategies.
- Submit a preliminary Environmental and Social Impact Assessment (ESIA) framework.

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APPENDIX 16 – TENDERER’S DECLARATION

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

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APPENDIX 16 – TENDERER’S DECLARATION

Tender Title	REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM JASTRE/BKP/RFP/01/2025
--------------	---

I / We (please fill in all the proprietor / shareholders’ name below):-

No.	Name	Brunei Identity Card No. & Colour / International Passport No.	Signature
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Address:

make the following DECLARATION:

1. I/We as the name stated above,
i a registered proprietor of

(please fill in the firm’s name)

with its place of business at

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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NEGARA BRUNEI DARUSSALAM**

(or)

ii a shareholder in a Company,

having its registered address at

which has submitted a Tender Proposal in the above mentioned project;

2. **iii I/We do not own any other firm(s)/ Company(ies);**
(please see notes 3 and 4 below and delete where appropriate).
3. **iv I/We also the proprietor / shareholder in the list of firm(s)/ Company(ies) described at Annex 1.**

AND I / We further DECLARE that to the best of my/our knowledge, none of my/our other firm(s)/Company(ies) set out in Annex 1, have submitted a Tender Proposal for this project.

4. I/We also hereby DECLARE:
 - a. that to the best of my/our knowledge, neither my/our spouse or his/her firm(s)/ Company(ies) have submitted a Tender Proposal for the above mentioned project ; and
 - b. that I/We have not colluded with any other firm(s)/Company(ies) or any other person or entity in submitting the Tender Proposal for the above mentioned project.
5. **v I/We also DECLARE that neither I nor the other owners of, or the Chief Executive Officer and Directors, and its associates as the case may be, of the entity participating in this Tender, is/are related (i.e. family ties) to any of the employees of the Department of Environment, Parks and Recreation and further declare that I/WE do not have any conflict of interest with the shareholders, directors and/or associates of Department of Environment, Parks and Recreation.**

(Or)

I/We DECLARE that I am / We are related to the employee(s) of Department of Environment, Parks and Recreation and/or there exists a conflict of interest with the shareholders, directors and/or associates of Department of Environment, Parks and Recreation as listed **herewith in the enclosed letter of declaration stating the details of the employee(s) of Department of Environment, Parks and Recreation related to me / us.**

6. I/WE understand that **Department of Environment, Parks and Recreation** reserves the right to conduct necessary background investigation on the information furnished/declared herewith.
7. I/We understand that my/our firm/Company will be disqualified for this Tender in the event any information given herein is found to be false.

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NEGARA BRUNEI DARUSSALAM**

8. I/We hereby authorize _____ to sign this Tenderer's Declaration on my/our behalf and also on behalf of the Tenderer to bind ourselves and the Tenderer to the matters set out in this declaration.

Dated this day _____ of _____, 20_____

(Name and Signature)
^{vi} **(The Owner / CEO / Director)**
(Company Stamp)

[THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK]

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
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APPENDICES TO LETTER OF TENDER

APPENDIX 16 – TENDERER’S DECLARATION

ANNEX I

Pursuant to paragraph 3 of the above declaration, I/We submit the following list of Firm(s) which I/We the proprietor of:

No	Name	Firm
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Pursuant to paragraph 3 of the above declaration, I/We submit the following list of Company(ies) which I/We a shareholder of:

No	Name	Company
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

ⁱ Fill in here if an Owner of a Business Name

ⁱⁱ Fill in here if a shareholder in a Company (Sdn Bhd)

ⁱⁱⁱ If you DO NOT own other firms/Companies, please delete paragraph 3.

^{iv} If you the Owner or Shareholder of other firms/Companies, please delete paragraph 2.

^v Delete where inapplicable

^{vi} Must be signed by the Owner of Co or CEO or Director.

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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APPENDIX 17 – DETAILS OF INSURANCE UNDERWRITER

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
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APPENDICES TO LETTER OF TENDER

APPENDIX 17 – DETAILS OF INSURANCE UNDERWRITER

A. Insurance Underwriter Information

Item No.	Description	Tenderer's Response
1	Name of Insurance Underwriter	
2	Country of Incorporation & Address	
3	Regulatory Authority / License Number	
4	Contact Person (Name, Title, Email, Phone)	
5	Financial Strength Rating (e.g. AM Best / S&P)	
6	Experience in underwriting infrastructure projects (No. of years / sample projects)	
7	Previous experience with Waste-to-Energy or energy infrastructure (if applicable)	

B. Insurance Broker Information (if applicable)

Item No.	Description	Tenderer's Response
1	Name of Broker	
2	Country of Incorporation & Address	
3	Contact Person (Name, Title, Email, Phone)	
4	Experience with similar projects	

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APPENDIX 17 – DETAILS OF INSURANCE UNDERWRITER

C. Insurance Coverages – Design-Build Period

Insurance Type	Required Minimum Coverage	Tenderer's Proposed Coverage	Insured Parties	Notes

D. Insurance Coverages – Operations Service Period

Insurance Type	Required Minimum Coverage	Tenderer's Proposed Coverage	Insured Parties	Notes

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
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APPENDICES TO LETTER OF TENDER

APPENDIX 17 – DETAILS OF INSURANCE UNDERWRITER

E. Claims History (Last 5 Years)

Year	Project Name	Type of Claim	Claim Value	Paid / Rejected	Remarks

F. Declarations

Please attach:

- - Letter from the Underwriter or Broker confirming:-
 - Awareness of project insurance requirements;
 - Willingness and capability to provide required coverage;
 - No history of cancellation or refusal to cover similar projects in past 5 years;

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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APPENDIX 18 – SCHEDULE OF WARRANTIES

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 18 – SCHEDULE OF WARRANTIES

The Tenderer shall provide warranties for the following list of items jointly executed by the suppliers, Vendors, sub-vendors, and applicators / installers of the element of the facilities in the table below. Items that are not included in this list but are listed in other sections of this tender document shall be covered as well as part of the proposal. The warranty period shall commence from the date of issuance of the Acceptance of the successful completion of testing and commissioning of Equipment and be of the required period of time as stated in the following:-

For Supply and Installation of the following Equipment / Finishes:-

Item	Product / Services	Tenderer's Proposed Warranty Period
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Notes:

*The Tenderer is allowed to expand this list based on its proposed warranties for additional materials / products.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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**APPENDIX 19 – TENDERER’S PROPOSED BRANDS AND SOURCE OF
MATERIALS & THEIR AVAILABILITY**

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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**APPENDIX 19 – TENDERER’S PROPOSED SOURCE OF MAJOR MATERIALS & THEIR
AVAILABILITY**

The Tenderer shall provide list of proposed source of **major** materials / equipment and their availability at Worksite in the table below.

Tenderer’s Proposed Source of Major Materials & Their Availability

No.	Items	Source / Make / Model	Availability at Worksite (weeks)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			

Notes:

*The Tenderer is allowed to expand this list based on his proposed source of Major Materials/equipment & their availability at Worksite.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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**APPENDIX 20 – TENDERER’S PROPOSED LIST OF TRAINING BEFORE
HANDOVER**

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 20 – TENDERER’S PROPOSED LIST OF TRAININGS

The Tenderer shall provide list of proposed training for respective proposed equipment & required nature of training to be conducted for the equipment / process related requirement.

Proposed List of Training offered by Tenderer

No.	Training Offered	Expected Duration	Max number of pax per section	Number of session offered
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Note:

*The Tenderer is allowed to expand this list based on his proposed equipment & required nature of training to be conducted for respective equipment / process related requirement.

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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APPENDIX 21 – SCHEDULE OF DEVIATIONS FROM TENDER REQUIREMENTS

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
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APPENDIX 21

PART A - SCHEDULE OF REQUESTS FOR DEVIATION FROM TENDER REQUIREMENTS (TECHNICAL / COMMERCIAL) INCLUDING DBOOT AND PPA

No.	Tender Section	Requested Deviation	Impact to technical	Impact to Commercial	Reason
1.					
2.					
3.					
4.					
5.					
6.					
7.					

.....
Signature of Tenderer

.....
Signature of Witness

Date:

Date:

Note:

The objective of this Schedule is to provide an opportunity to Tenderers to make selected requests for deviations where Tenderers feel that the Tender Requirements contain material errors or where specific requirements have a material impact on the technical and/or commercial aspects of their Tender response. For the avoidance of doubt, the Employer stresses the fact that general Tender compliance will form part of the Tender evaluation and Tenderers are therefore requested to minimize the number of requests for deviation and to refrain from making requests to material Tender requirements or alterations that would jeopardise the Project objective. The Employer reserve their right to accept or reject these requests in whole or in part and/or to propose alternatives to the same as part of Tender Evaluation process.

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APPENDIX 22 – DISPUTE HISTORY

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
WASTE TO ENERGY PLANT AT LOT 17394, KG. SG. PAKU, TUTONG,
NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 22 – LIST OF DISPUTE HISTORY

The Tenderer, including each of the project team member (or consortium or Joint Venture partners), must provide information on the history of litigation or arbitration resulting from projects executed in the last fifteen (15) years or currently in progress. A separate sheet must be used for each project team member (if any).

LIST OF DISPUTE HISTORY

Signature of Tenderer

Signature of Witness

Date:

Date:

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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PART 2 – APPENDICES TO LETTER OF TENDER

APPENDIX 23 – TENDERER’S GUARANTEES ON NET POWER OUTPUT

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER WASTE TO ENERGY PLANT AT LOT 17394, KG. SG.
PAKU, TUTONG, NEGARA BRUNEI DARUSSALAM**

APPENDICES TO LETTER OF TENDER

APPENDIX 23 – FORM GV1: TENDERER'S GUARANTEES ON NET POWER OUTPUT

1. As per the provisions of GCC Sub-Clause 4.1 [Contractor's General Obligations], the Contractor is to design, execute and complete the Works which shall be fit for the purposes for which the Works are intended as defined in the Contract, and as per GCC Sub-Clause 10.1 [General Requirements] the Contractor shall be responsible for ensuring that the Works remain fit for such purposes during the Operation Service Period.
2. The Employer has accordingly defined the Performance Guarantees listed in Chapter 4 of the Employer's Requirements, Table 4.1 to Table 4.3, of the Employer's Requirements. Among the Performance Guarantees are the Net Power Output [PG4] which are derived from the load points of the Tenderer's stoker capacity diagram and an additional load point.
3. Tenderers shall complete Form GV1 by inserting the load points, the guaranteed values for Gross Power Generation, Net Power Output (with/without LTP Operational), and Annual Electricity Export (PG4).
4. The guaranteed value for Annual Electricity Exports (with LTP operational) (PG4) for Load Point 1 will be factored into the Tenderer's evaluated bid price to account for the effects of lower or higher electricity generation efficiency, as further described in Section 3 Sub-Clause 2.2.
5. The guaranteed values of the successful Tenderer will be used to determine the net power output limit values in Schedule of Performance Guarantee (Table 4.1 of the Employer's Requirements). Failure to achieve the guaranteed values may result in the Contractor being liable to make good the failure and to remedy under GCC Sub-Clause 11.4 [Failure to Pass Tests on Completion of Design-Build and GCC Sub-Clause 11.11 [Failure to Pass Tests Prior to Contract Completion].
6. The Tenderer shall provide values for the electricity exports and the net power output at the metering location as specified in the Employer's Requirements.

Notes for Form GV1 (Form 23-1):

- 1) Net power output means the total WTE generation *less* internal power demand of the facility considering either the leachate treatment plant (LTP) as operational or not. The net power output shall be given for the metering location as specified in the Employer's Requirements.
- 2) LP8 and LP9 shall be the load points between LP1 and LP6 at the maximum continuous thermal rating.
- 3) Figures on gross power generation provided by the Bidder shall be calculated according to the efficiency characteristics of the turbine. Bidders shall provide supporting documentation to demonstrate correlation of bid values with the turbine efficiency characteristics.
- 4) The annual electricity exports shall be calculated by multiplying the net power output (LTP operational) by 8,000 hours (minimum availability).

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Form GV1 (Form 23-1): Bidder's – Guaranteed Values

1	2	3	4	5
Load Point as per Stoker Capacity Diagram (MJ/kg per line)	Gross Power Generation MW	Net Power Output, LTP operational MW	Net Power Output, LTP not operational MW	Annual Electricity Exports (PG4), LTP Operational MWh
LP1				
LP2				
LP3				
LP4				
LP5				
LP6				
LP7				
LP8				
LP9				

.....
Signature of Tenderer

Date:

.....
Signature of Witness

Date:

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SECTION 4
PART 3 – TECHNICAL PROPOSAL

**REQUEST FOR PROPOSAL TO INVEST, DESIGN, BUILD, OWN, OPERATE AND TRANSFER
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SECTION 4

PART 3 – TECHNICAL PROPOSAL

Documents Establishing the Eligibility and Qualifications of the Tenderer

1. To establish its eligibility and qualifications to perform the Contract, the Tenderer shall provide the information requested in the corresponding information sheets included in the various sections of the Tender document and accordingly submitted with the Tender. Where it is noted for the Tenderer's sub-contractors to provide such information the same shall be complied.

Documents Establishing Conformity of the Plant, Materials and services

1. The documentary evidence of the conformity of the Plant, Materials and services to the Tender Document may be in the form of literature, drawings, data, or any other medium and shall furnish:
 - a) a detailed description of the essential technical and performance characteristics of the Plant, Materials and services, including the performance guarantees of the proposed Plant, Materials and services, in response to the Employer's Requirements;
 - b) a list giving full particulars, including available sources, of all spare parts and special tools necessary for the proper and continuing operation of the Works for the Operation Service Period following completion of the Design-Build Period; and
 - c) a commentary on the Employer's Requirements and adequate evidence demonstrating the substantial responsiveness of the Plant, Materials and services to those Employer's Requirements. Tenderer shall note that standards for workmanship, Materials and equipment designated by the Employer in the Tender Document are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. In the event, Tenderer proposes to substitute any alternative standards, then the Tenderer shall provide substantive evidence to demonstrate to the Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Employer's Requirements. In this instance the Employer reserve their right to accept or reject such alternative standards and seek the Tenderer to comply with the standards stipulated in the Tender documents without any alterations to the the tendered prices.

Technical Proposal, Subcontractors

1. The Tenderer shall furnish a Technical Proposal including method statements for the Design-Build Period, Operation and Maintenance Plan, work methods, Contractor's Equipment, Contractor's Personnel, Schedules and any other information as stipulated in Tender Forms, in sufficient detail to demonstrate the adequacy of the Tenderer's Technical Proposal to meet the Contract requirements, including the Time for Completion of Design-Build.
2. For major items of Plant, Materials and services which the Tenderer intends to purchase or subcontract, the Tenderer shall give details of the name and nationality of the proposed Subcontractors, including suppliers, for each of those items. In addition, the Tenderer shall include in its Tender information establishing compliance with the requirements specified by the Employer for these items. Tenderer are free to list more than one Subcontractor against each item of the Plant, Materials and services. Quoted Rates and Prices will be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the Rates and Prices will be permitted in case of a change of a Subcontractor.

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3. The Tenderer shall be responsible for ensuring that any Subcontractor proposed complies with the requirements of the RFP, and that any Plant, Materials or services to be provided by the Subcontractor comply with the requirements of the RFP.

Technical Tender Submission Requirements

For the purpose of a fair and transparent Tender evaluation, the Tenderer shall furnish a technical proposal which includes a preliminary design, the Tenderer's proposed methodologies for design and construction and its plans for operating and maintaining the facility. Following contract award, the successful Tenderer/Contractor will be expected to translate the preliminary Tender design into a concept design that will be used for the detailed design.

The Tender design documentation shall be of a sufficient level of detail to allow the Employer to undertake a proper evaluation of the submitted Tender. The documentation must demonstrate the Tenderer's commitment to fulfil the Performance Guarantees and the terms of the Employer's Requirements.

Tenderer is expected to present their technical proposal in accordance with the following Table of Content.

1. Introduction
2. Critical analysis of the Employments Requirements [Section 3 of RFP]
The Tenderer shall undertake a critical assessment of the Employments Requirements (presented in Section 3), identify the key issues and challenges and suggest solutions or mitigation measures.
3. Tenderer work organisation and general project management
 - 3.1. *The Tenderer shall describe its intended project and contract management with an organisation chart and intended staffing plan, its procedures for QA/QM, H&S, environment and a tentative CEMP, risk management, liaison with the stakeholders, communication structure and public relations.*
 - 3.2. *The Tenderer shall set forth its approach on how to seamlessly and coherently design, procure, manufacture, supply to the Site, construct and assemble, commission and operate the Works.*
4. Methodology/Method statement Design Phase
 - 4.1. Description of proposed design
 - *The Tenderer shall provide a description of its intended site layout arrangement and describe the main Works sections as well as the intended design parameters. The Tenderer shall include in its proposal a tentative heat and mass balance for every load point of the stoker capacity diagram and shall provide the maximum raw flue gas concentrations (SO₂, HCl, etc.) that are pivotal for the design of the APC system.*
 - 4.2. Description of main components (WTE, wastewater and leachate management)
 - *The Tenderer shall describe the main process, mechanical and electrical components incl. the instrumentation and control, furnace, boiler, flue gas cleaning, bottom ash processing plant, leachate treatment, and cooling water system.*
 - *The Tenderer shall also provide a description of the architectural concept, the intended civil works and the general arrangement of the buildings on the Site.*
 - *The Tenderer shall submit a preliminary firing diagram, process flow diagrams and also the drawings as listed below.*

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Description
Overall site layout plan
Envisaged construction camp and land area demand
Layout plan tipping hall, bunker, machinery hall incl. waste feeding, combustion, APC system, turbine hall etc. level +0.000
Cross sections machinery hall as above
Machinery hall facades (all directions)
Layout plan bottom ash conveying system and treatment plant
Maintenance building/workshop: layout plan
Administration block layout all floor levels
Firefighting system scheme
Top view and cross sections landfill incl. details of base liner system, leachate collection
Layout plan and cross sections leachate treatment plant and permeate, concentrate storage tanks and hereto related pumps
Layout plan and cross sections cooling water inlet/outlet structure and cooling water pipes
Utility provision layout plan
Single line diagram
Control concept and lay-out of control system
Routing of Temporary access roads and associated permitting strategies for construction stage
Plans showing routing, tie-in and permitting strategies for temporary power, water and other utilities during the construction stage
Plans showing temporary site office for the Contractor and Employer and other accommodation facilities of the Contractor during the construction stage

4.3 List of drawings submitted during design phase

- The Tenderer shall provide a list, in table form, of the intended drawings and other documents to be submitted during the design phase (detailed design stage) with the format and scale for each drawing as per ERQ.*

4.4 Assessment and mitigation of risks

- The Tenderer shall identify the key technical, environmental and natural disaster risks that are relevant to the design of the Works (such as risks from tsunami, storm surge, storm water flooding, corrosion attack, cyclonic activity etc) and shall describe the measures to be taken for mitigation of such risks.*

5. Method statement for the Build phase

5.1. Method statement; site organisation

- The Tenderer shall provide a clear description of its intended site organisation including a site organisation layout with all temporary access roads and management, facilities and storage requirements during the construction period (contractor's facilities including camp for workers, Employer's Representative facilities, mixing plants, assembly areas, temporarily extension of the construction site etc..), crane locations and an organogram of the intended management staff during construction works.*

5.2 Method statement; earthworks

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- *The Tenderer shall provide a clear description of intended earthworks (cut and filling works) including all geotechnical measures for slope stabilisation, soil retaining etc. as well as the earthworks intended for the residual waste landfill and the envisaged borrow sites for soil that is needed during the construction period.*

5.3 Method statement; roads and carriageways

- *The Tenderer shall provide a clear description of intended work for internal traffic roads, carriageways, parking lots, the material intended to use (asphalt or concrete) and the norms and standards that will be adopted.*

5.4 Method statement; civil works

- *The Tenderer shall provide a description of the intended sequence of the civil works, the interfaces, foundation, civil engineering and bunker works, the norms and standards that will be applied etc.*

5.5 Method statement; mechanical and electrical works

- *The Tenderer shall elaborate a description for the installation of major components of the plant, such as, but not limited to, the waste pre-treatment, bunker cranes, the boiler incl. ancillaries, the turbine, the APC system, the steelwork etc., the different installation sections and interfaces. The Tenderer shall define which components of the facility are envisaged to be tested prior to shipment.*
- *The Tenderer shall provide a comprehensive description of the installation procedures for the major components of the plant. These shall include, but are not limited to: the waste pre-treatment system, bunker cranes, the boiler and its ancillary equipment, the turbine, the air pollution control (APC) system, steel structures, and other relevant mechanical and electrical elements. The description shall clearly outline the various installation phases and interface points between systems.*
- *Additionally, the Tenderer shall identify which components of the facility are planned to undergo testing prior to shipment.*

5.6 Method statement; site infrastructure and interfaces (water supply, electricity export, effluent discharge, rainwater/stormwater drainage, landscaping)

- *The Tenderer shall provide a description of the intended works for water supply, electricity export, effluent discharge, rainwater and stormwater drainage, the intended type of drainage, and the materials to be used.*
- *The Tenderer shall provide a detailed description of the proposed works related to site infrastructure and interfaces. This shall include provisions for water supply, electricity export, effluent discharge, and rainwater/stormwater drainage. The statement shall specify the intended drainage systems, including the type of drainage and the materials to be used. Landscaping measures and their integration with the overall site infrastructure shall also be addressed.*

6. Commissioning / Tests on Completion of Design-Build

- 6.1. Taking into account the Employer's Requirements, the Tenderer shall provide a tentative program on the Tests on Completion of Design-Build that shall include the pre-commissioning, the commissioning and trial operations including the proof for reaching the Performance Guarantees. It shall also include the requirements towards the Employer's contribution.

7. Operation and Maintenance Plan, including:

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7.1. Method statement for the operation and maintenance of the facility during the Operation Service Period.

- *Besides the general organisation of the Works, such as staffing, allocation of responsibilities taking into account the Employer's Requirements, provisions for the QA/QM, H&S Plan and CEMP, this method statement shall detail the envisaged monthly operating hours, the energy generation and export, the residue output as well as the chemicals' and auxiliary fuel consumption (assuming the design NCV) for a one-year lasting operations period. It shall also deal with the expected inspection and maintenance (both preventive and condition based) over a 3 year period and the envisaged planned downtimes of the entire facility or parts thereof. It shall also include the envisaged turbine revision and suggestions on how to respond to the then inevitable downtime of the entire facility. Apart from this, it shall cover the procurement strategy for supplies, wear and spare parts for the continuous operations of the facility. As well, it shall focus on the monitoring of the performance and the reporting towards the Employer.*

7.2 Method statement for the landfilling of bottom ash and APC residues

- *This method statement shall include a prospective 5 years operation of the disposal of bottom ash and APC residues at the landfill and shall detail the progress of landfilled residues, the consumption of landfill volume and the subsequent closure of a sub-cell. It shall also set forth how the Tenderer intends to stabilize the bottom ash and APC residues prior to landfilling, minimise leachate generation and the minimisation of the consumed landfill volume.*

7.3 A statement for replacement of assets with a lifespan of more than 5 years

- *This statement shall include the procurement and logistics strategy and it shall also deal with the onsite logistics and the hereto necessary personnel and its deployment arrangement during the asset replacement.*

7.4 Method statement on environmental management and monitoring, health and safety and quality assurance during the Operations Service Period.

7.5 A description of how the Tenderer intends to collaborate with the Employer, with the waste supplier and other third parties.

- *This shall include all interfaces, all monitoring tasks, all necessary compliance criteria to be met and also the regular preparation of reports and other deliverables throughout the contract term.*

7.6 A description of proposed arrangements for hand-over upon contract completion, or decommissioning upon contract completion.

8. Work schedule (Design-Build Period)

The Tenderer shall prepare a preliminary programme as per GCC 8.3.