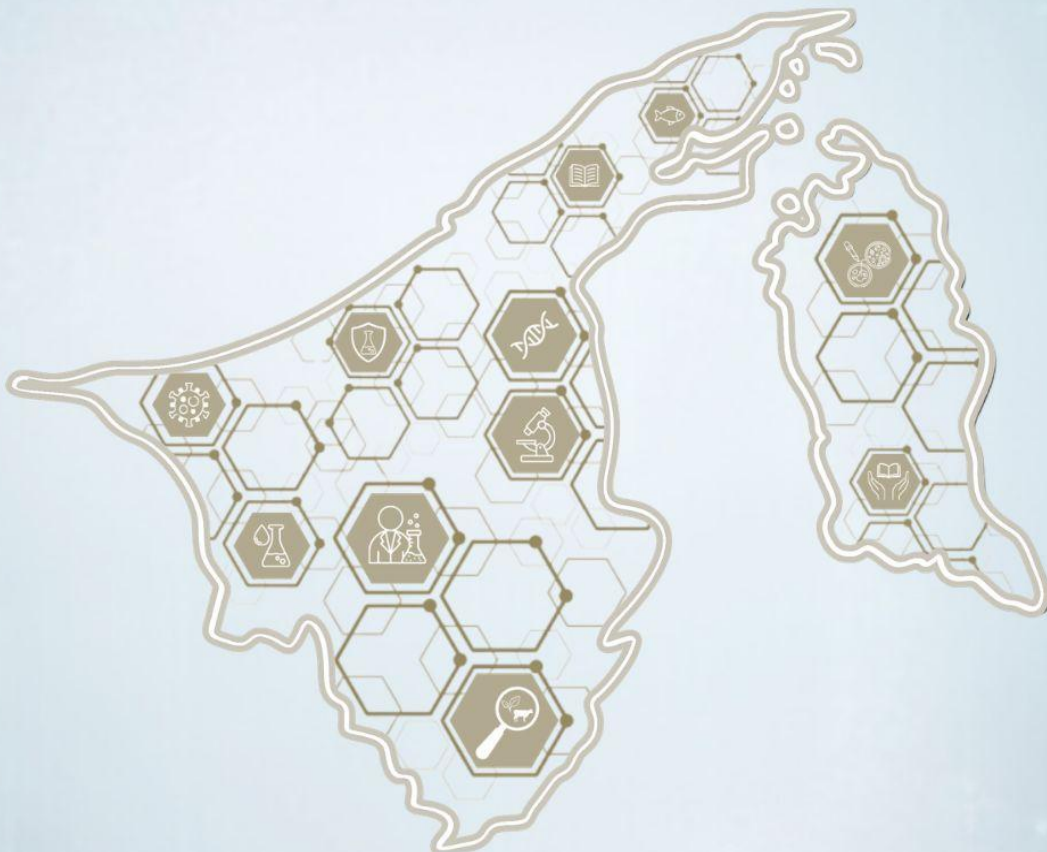




BRUNEI DARUSSALAM NATIONAL LABORATORY STRATEGIC PLAN 2026 - 2030



Published by
National Technical Working Group
for
Brunei Darussalam National Laboratory Strategic Plan 2026- 2030

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Foreword

by The Honourable Minister of Health, Brunei Darussalam

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Alhamdulillah, with the blessings of Allah Subhanahu Wata'ala, it is with honour and great pleasure that I present the Brunei Darussalam National Laboratory Strategic Plan (BDNLSP) 2026 – 2030.

Laboratory services lie at the very heart of a well-functioning health system. The vast majority of clinical decisions, from diagnosis and treatment to the monitoring of disease depend upon accurate, reliable and timely laboratory results. Beyond the individual patient, laboratories serve as the backbone of disease surveillance, outbreak detection, and public health emergency response. Strengthening our laboratories is therefore not a technical matter alone, but an essential investment in the health, safety and resilience of the nation.

BDNLSP builds upon the strong foundations laid through the Brunei Darussalam National Health Laboratory System and the wider efforts undertaken to strengthen core public health capacities across Brunei Darussalam. It carries that work forward by setting out a clear and coherent direction for the next five years; a roadmap that will guide us in delivering laboratory services that are of high quality, accessible, equitable and sustainable for all who live in Brunei Darussalam.

The Brunei Darussalam National Laboratory Strategic Plan (BDNLSP) articulates a shared vision, mission and set of strategic priorities to advance our laboratory services between 2026 and 2030. Guided by our vision of laboratory services that are resilient, sustainable and accessible, these priorities are directed towards ensuring excellence, protecting public health, and strengthening our diagnostic capacity so that we can support robust surveillance, foster meaningful partnerships, and act in a timely manner against public health threats. Together, they provide a framework through



The Honourable

**Dato Seri Setia Dr. Haji
Mohammad Isham bin
Haji Jaafar**
Minister of Health
Brunei Darussalam

which we can measure our progress, direct our resources, and hold ourselves accountable to the outcomes we seek.

The development of this plan is the result of extensive discussions and deliberations across the Ministry of Health and with partners from other ministries, agencies and stakeholders. Realising its vision will likewise require a whole-of-nation approach; engagement, support and partnership across every level of the laboratory community and beyond. Only through such collective commitment can we translate strategy into action, and action into lasting improvement in the health of our people.

At this juncture, I wish to express my sincerest appreciation to all those involved in the development of BDNLSP 2026-2030. Let us work together to implement these priorities, so that our laboratory services continue to grow in strength and capability in the years ahead. Through sustained and integrated effort, we will contribute meaningfully to achieving Wawasan Brunei 2035 as a healthy, prosperous and resilient nation.

Wabillahi Taufiq Walhidayah Wassalamu'alaikum Warahmatullahi Wabarakatuh.

Foreword

by The Honourable Coordinating Minister for Economic Policies & Minister of Economy, Trade and Industry, Brunei Darussalam

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Alhamdulillah Rabbil 'Alamiin, Wabihiee Nasta'eenu 'Alaa Umuuriddunya Waddiin, Wassalaatu Wassalaamu 'Ala Asyrafil Mursaliin, Sayyidina Muhammaddin, Wa'alaa Aalihee Wasahbihee Ajma'iin.

First and foremost, we give praise to Almighty Allah, the Most Gracious and Most Merciful, for His guidance and blessings in bringing us to this milestone, a collaborative effort across ministries, academic institutions, and the private sector to establish the Brunei Darussalam National Laboratory Strategic Plan (BDNLSP) 2026-2030.

The BDNLSP 2026-2030 serves as a five-year operational roadmap to execute the National Health Laboratory System Policy Framework. Anchored in Wawasan Brunei 2035, International Health Regulations (IHR 2005), and ASEAN health security frameworks, this plan streamlines investment, prioritisation, and cross-sector coordination. By adopting a unified One Health approach, integrating human, animal, and environmental health, the framework strengthens our collective capacity to safeguard public health while supporting national productivity.

Our core priority is to deliver resilient, sustainable, and accessible laboratory services that enable swift action against public health threats. Through targeted initiatives across key thematic areas, we are advancing governance, upgrading diagnostic capabilities, pursuing international accreditation, and expanding specialized workforce expertise. These measures guarantee long-term operational sustainability, robust monitoring, and active regional knowledge exchange.



The Honourable

**Dato Seri Setia Dr Haji Abdul
Manaf bin Haji Metussin**
Coordinating Minister for
Economic Policies & Minister of
Economy, Trade and Industry
Brunei Darussalam

Beyond health security, this strategic plan directly reinforces Brunei Darussalam's broader economic goals. Harmonising laboratory standards and establishing internationally recognized quality assurance builds a trusted regulatory environment for trade and industry. A robust national laboratory network is vital to economic diversification, enhancing business confidence, streamlining compliance, and empowering our local food, agricultural, health, and biosecurity sectors to expand market access globally.

The true success of the BDNLSP 2026–2030 lies in our collective execution. I hope this publication serves as an invaluable reference for public, private, and academic stakeholders as we work together to translate strategic vision into a lasting legacy of resilience. Finally, I convey my heartfelt appreciation to all contributors whose dedication and shared expertise ensured the successful publication of this strategic plan.

Wabillahi Taufiq Walhidayah Wassalamu'alaikum Warahmatullahi Wabarakatuh.

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List of Abbreviations and Acronyms

ABBREVIATIONS & ACRONYMS

AHP – Allied Health Professional	METI – Ministry of Economic, Trade and Industry
AMR – Antimicrobial Resistance	MGS – Microbial Genomics Services
ANAB – ANSI National Accreditation Board	MinDef – Ministry of Defence
ASEAN – Association of Southeast Asian Nations	MOD – Ministry of Development
BAMLS – Brunei Darussalam Association of Medical Laboratory Scientists	MOE – Ministry of Education
BDNHLS – Brunei Darussalam National Health Laboratory System	MOF – Ministry of Finance
BDNLSP – Brunei Darussalam National Laboratory Strategic Plan for 2026–2030	MOH – Ministry of Health
BDSAC – Brunei Darussalam Standards and Accreditation Centre	MRS – Medical Reception Station / Services
BRUNEI CDC – Brunei Centre for Disease Control	NBBC – National Biosafety and Biosecurity Committee
BSC – Biosafety Cabinet	NCMRL – National Clinical Microbiology Reference Laboratory
BSL – Biosafety Level	NHLS – National Health Laboratory System
BruHealth – Brunei Health Mobile Application	NIRL – National Immunology Reference Laboratory
Bru-HIMS – Brunei Health Information Management System	NLS – National Laboratory System
CAB – Conformity Assessment Body	NMRL – National Mycobacteria Reference Laboratory
CPD – Continuing Professional Development	NRL – National Reference Laboratory
CSRA – Central Specimen Receiving Area	NTLWG – National Technical Laboratory Working Group
DEHS – Department of Environmental Health Services	NVRL – National Virology Reference Laboratory
DLS – Department of Laboratory Services	PHEIC – Public Health Emergency of International Concern
DOAA – Department of Agriculture and Agrifood	PHS – Public Health Surveillance System
DOFI – Department of Fisheries	POCT – Point-of-Care Testing

DPP – Department of Policy and Planning	QAPSU – Quality Assurance and Patient Safety Unit
DSS – Department of Scientific Services	QMS – Quality Management System
DWS – Department of Water Services	RBAF – Royal Brunei Armed Forces
EIS – Epidemic Intelligence System	RIPAS – Raja Isteri Pengiran Anak Saleha
FAO – Food and Agriculture Organisation of the United Nations	RPHLN – Regional Public Health Laboratory Network
GISAID – Global Initiative on Sharing All Influenza Data	SAC – Singapore Accreditation Council
GLLP – Global Laboratory Leadership Programme	SME – Subject Matter Expert
HSSE – Health, Safety, Security and Environment	SWOT – Strengths, Weaknesses, Opportunities, Threats
IHR (2005) – International Health Regulations (2005)	TOR – Terms of Reference
ILC – Inter-Laboratory Comparison	TWG – Technical Working Group
ISO – International Organisation for Standardisation	UBD – Universiti Brunei Darussalam
JEE – Joint External Evaluation	UNISSA – Universiti Islam Sultan Sharif Ali
JPMC – Jerudong Park Medical Centre	VLS – Veterinary Laboratory Services
KPI – Key Performance Indicator	WHO – World Health Organisation
LIMS – Laboratory Information Management System	WHO LAT – WHO Laboratory Assessment Tool
LMT – Laboratory Mapping Tool	WOAH – World Organisation for Animal Health
M&E – Monitoring and Evaluation	

EXECUTIVE SUMMARY

Laboratory services underpin clinical diagnosis, disease surveillance, environmental health monitoring and outbreak response across Brunei Darussalam. The 2019 WHO Joint External Evaluation (JEE) recognised strong, quality-assured laboratory services and broad access to diagnostic testing, while also identifying system-level gaps in national governance, biosafety and biosecurity oversight, laboratory licensing, workforce competency, and emergency surge capacity. Building on Brunei's active engagement with the Regional Public Health Laboratory Network (RPHLN) since 2019 and its 2023 situational assessment, and in response to the JEE's "Detect 1: National Laboratory System" recommendation, Brunei Darussalam launched the Brunei Darussalam National Health Laboratory System (BDNHLS) policy framework in February 2024. The Brunei Darussalam National Laboratory Strategic Plan (BDNLSP) 2026–2030 operationalises this framework through a coordinated five-year roadmap of prioritisation, investment and action, developed through national workshops with RPHLN technical support and a SWOT-based situational and gap analysis of ten (10) laboratories.

The Plan is guided by the vision of a resilient, sustainable, and accessible laboratory services that ensures excellence and protects public health through a unified One Health approach, and the mission to provide quality laboratory services and robust diagnostic capacity that support surveillance, partnerships, and timely action against public health threats in Brunei Darussalam.

Stakeholder consensus, built on the findings of the SWOT and gap analysis, converged on four (4) strategies: (1) strengthening whole-of-nation governance and leadership to safeguard public health security for a resilient laboratory system; (2) strengthening and optimising laboratory testing to provide integrated, reliable, accessible, high-quality services supporting public health and One Health priorities; (3) strengthening national laboratory coordination and readiness for public health threats; and (4) strengthening the laboratory regulatory framework for a resilient, safe and high-quality national system. These strategies are delivered through ten (10) thematic areas — Governance and Workforce Development; Financing, Procurement and Supply Chain Management; National Diagnostic Network; Quality and Safety Management System; Biorisk Management; Disease and Genomic Surveillance; Laboratory Emergency Management; Data and Information Management; One Health and Multisectoral Coordination; and Research and Development — comprising twenty-one (21) sub-strategies and forty-nine (49) action plans to be implemented over the five-year period.

The implementation is overseen by BDNHLS Committee, supported by the Technical Working Group for BDNLSP that is responsible for implementation and systemic monitoring of activities. A robust monitoring and evaluation framework ensures key performance indicators (KPI) progress tracking with defined yearly timelines, while resource mobilisation and utilisation are assessed to ensure financial, human and technical resources are efficiently deployed.

The BDNLSP is anchored in Wawasan Brunei 2035 and adopts a One Health approach as its overarching vision, aligning with relevant Ministerial Strategic Plans, so that laboratory strengthening contributes directly to public health protection and Brunei Darussalam's broader development aspirations.

PART I

STRATEGIC CONTEXT

1. INTRODUCTION

Laboratory services play a vital role in public health in Brunei Darussalam by providing essential support for clinical diagnosis, disease surveillance, environmental health monitoring, and outbreak response. These functions are delivered by government entities, including the Department of Laboratory Services (DLS) and Department of Scientific Services (DSS) under the Ministry of Health (MOH); the Department of Agriculture and Agrifood (DOAA) and Department of Fisheries (DOFI) under the Ministry of Economic, Trade and Industry (METI); and the Department of Water Services (DWS) under the Ministry of Development (MOD); as well as private laboratories.

2. RATIONALE OF BRUNEI DARUSSALAM NATIONAL LABORATORY STRATEGIC PLAN

The Brunei Darussalam National Laboratory Strategic Plan for 2026– 2030 (BDNLSP) serves as a key operational document that outlines a five- year roadmap to implement the Brunei Darussalam National Health Laboratory System Policy Framework. It guides prioritisation, investment, and coordination efforts to improving public health outcomes.

2.1 WHO JOINT EXTERNAL ASSESSMENT BRUNEI DARUSSALAM IN 2019

The World Health Organisation (WHO) for the Joint External Assessment (JEE) conducted in Brunei Darussalam in 2019 provided an independent assessment of national capacities under the International Health Regulations (2005) (IHR), including laboratory-related functions. Whilst the evaluation recognised that Brunei Darussalam has well-established quality assured laboratory services and broad access to diagnostic testing, it also identified system level gaps that require a coordinated and strategic response to ensure long-term sustainability and preparedness.

In the area of biosafety and biosecurity, the JEE highlighted that biosafety practices and pathogen control measures are implemented at the institutional level, supported by departmental laboratory safety manuals and existing occupational safety legislation. Dangerous pathogens are largely consolidated and documented within an inventory system, and major safety equipment, including biosafety cabinets are properly

maintained, serviced, and certified. These measures provide a solid operational foundation for safe laboratory practices across the human health sector.

However, the evaluation also identified gaps in national-level governance and regulatory oversight for biosafety and biosecurity. These include the absence of a fully endorsed national biosafety and biosecurity framework, incomplete laboratory licensing mechanisms, and limited systematic implementation of biorisk assessment across sectors. The JEE further highlighted the need for a structured national training programme and trained and designated biosafety officers. Competency monitoring is not conducted systematically, and formal academic or in-service curricula in biosafety, biosecurity, and bio-risk management are lacking. These findings point to the need for a strategic and sustainable approach to workforce development within the laboratory system.

The evaluation acknowledged strong laboratory quality management systems and use of molecular diagnostic techniques for enhanced testing capacities while reducing reliance on culturing high-risk pathogens. Nevertheless, limitations remain in advanced laboratory infrastructure and surge capacity for public health emergencies.

Recognising the need for a structured and coordinated approach, Brunei Darussalam launched the Brunei Darussalam National Health Laboratory System (BDNHLS) in February 2024. This policy framework was developed in response to the recommendations from the 2019 WHO JEE recommendations—specifically under the “Detect 1: National Laboratory System” indicator. While BDNHLS establishes the national laboratory tier system for both the human and animal health sectors, a dedicated national strategic laboratory plan is essential to operationalise the policy through coordinated and measurable actions.

2.2 SITUATIONAL ANALYSIS RPHL NETWORK

Since joining the RPHL Network (RPHLN) in 2019, Brunei Darussalam has actively engaged in regional capacity-building. RPHLN situational assessment conducted in 2023 found that Brunei has well-defined institutional arrangements and widespread accreditation to ISO 15189 and ISO/IEC 17025 standards. The system provides infectious disease testing, functional biosafety programs for professional certification, and

availability of an integrated Bru-HIMS that ensures timely result transmission. Furthermore, available capacities in Antimicrobial resistance (AMR) surveillance and genomics, promoting One Health coordination in the country.

The assessment also highlighted systemic gaps including the absence of a unified national laboratory licensing framework, limited multisectoral network optimisation, need for enhanced emergency preparedness, and systematic biorisk assessments.

To support the development of the BDNLSP, Brunei Darussalam collaborates with RPHLN for consultation via peer-to-peer support, technical expertise and financial assistance. Through this collaboration, two national workshops were conducted. The first workshop conducted was focused on SWOT analysis and the development of zero draft of BDNLSP. The second workshop conducted in December 2025 facilitated exercises into the implementation of BDNLSP through the development of the actions plans with monitoring and evaluation components. With guidance and technical support from the RPHLN, led by DLS, Brunei Darussalam aims to develop a robust and evidence- based BDNLSP that is tailored to the current national capacities and realistically scoped as an emerging strategic initiative.

3. STRATEGIC ALIGNMENT WITH NATIONAL FRAMEWORKS AND POLICIES

The BDNLSP is aligned with national priorities, respond to evolving needs, and contribute to regional health security and laboratory system resilience. It is developed to align with key national development aspirations, ministerial strategic directions, regulatory frameworks, and the broader national laboratory system architecture. Guided by the One Health approach as the overarching vision of the plan, it underscores the critical role of laboratories in supporting a resilient, integrated, and evidence-driven health system that safeguards population health.

3.1 WAWASAN BRUNEI 2035

Brunei Vision 2035 or *Wawasan Brunei 2035* serves as the nation's main strategic framework that articulates His Majesty's Government to spur the socio-economic

development towards achieving sustainable prosperity and enhancing the well-being of the people of Brunei Darussalam by 2035. It aspires to transform the nation to be internationally recognised for its highly skilled and educated people, a quality of life that ranks among the top ten globally, and a dynamic, diversified, and sustainable economy. This vision provides the overarching strategic policy context guiding the formulation and implementation of the BDNLSP.

3.2 MINISTERIAL STRATEGIC PLANS

The BDNLSP support ministerial priorities by strengthening laboratory coordination across human and animal health sectors, improving preparedness for public health emergencies, and advancing a One Health approach through integrated governance, workforce development, and quality assurance mechanisms.

In support of the aspirations outlined in Brunei Vision 2035, the MOH endorsed the vision of *“Together Towards a Healthy Nation”* under the MOH Strategic Plan 2019–2025. The Strategic Plan guided by the national philosophy of *Melayu Islam Beraja*, established five (5) strategic goals encompassing the critical elements required for a resilient, high-quality, and sustainable health system, while reinforcing the importance of effective governance, policies, and regulatory oversight within healthcare delivery.

The contribution of laboratories is reflected through key performance indicators (KPIs) aligned primarily under the strategic thrusts of *“Excellence in Healthcare Services”* and *“Protection of Public Health through Effective Policies and Regulations.”* Key laboratory priorities include the strengthening and maintenance of ISO-accredited laboratory services, ensuring the provision of safe and reliable blood and blood products, enhancing governance and quality oversight of Point-of-Care Testing (POCT), and continuously upgrading diagnostic testing capabilities and laboratory facilities in line with evolving healthcare and public health needs. Collectively, these efforts contribute towards improving healthcare quality, strengthening public health protection, and advancing national health security objectives.

Under the METI strategic plan, four (4) primary strategic thrusts were identified i.e., Growth of Outputs, Increased Productivity, Increased Export and Resilience. The role and

function of the Aquatic Animal Health and Laboratory Services Centre, Crop Protection, Soil, and Veterinary Laboratories have been directly aligned with the METI Strategic Plan 2024 - 2029 and Brunei Vision 2035 through these four (4) strategic thrusts by the following needs:

i) Facilitating Export Market Access & Accreditation

The Strategic Plan emphasises increasing the export of primary resources to grow the National Gross Domestic Product. The laboratories act as the scientific authority for diagnostic testing and quality assurance through International Standards such as ISO/IEC 17025 accreditation that ensures diagnostic results meet international benchmarks.

ii) Strengthening Food Security & Industry Resilience

To address national food security goals, these laboratories provide critical biosecurity and diagnostic support for Pest & Disease Control through the Aquatic Animal Health and Laboratory Services, Crop Protection Laboratory whereby identification of emerging pest threats, while the Veterinary Laboratory implements animal disease control, emerging, re-emerging, zoonotic and novel diseases. For Soil & Nutrition management, the laboratory provides fertility and nutrient advisory services that directly impact farm productivity and need for fertilizers. Its role is inclusive of monitoring quality for Brunei Good Agricultural Practice which ensures consistent, and high-quality domestic output.

iii) Promoting Modern Technology & High Productivity

To promote diagnostic precision by transferring from conventional to advanced diagnostic approaches allowing for more accurate, efficient, and timely testing.

iv) Supporting Private Sector & Foreign Direct Investment Growth

Provision of technical advisory and offering specialised training and technology transfer (e.g., Integrated Pest Management) to help farmers reduce production costs and losses

3.3 NATIONAL REGULATORY AND LEGAL FRAMEWORK

The regulatory and legal landscape relevant to laboratory activities in Brunei Darussalam currently comprises sector specific legislation and policy instruments that may address selected aspects of laboratory functions. Existing legislations—including the Public Health (Food) Act (Chapter 182), the Infectious Diseases Act (Chapter 204), the Animal (Disease and Quarantine) Act (Chapter 254), and the Poisons Act (Chapter 114)—supports disease control, food safety, biosecurity, and the regulation of controlled substances.

At present, statutory regulatory oversight of laboratory services remains limited, applying only to private healthcare laboratories under the Private Healthcare Order administered by the MOH, which is in the process of enactment.

In addition, Brunei Darussalam has established a National Biosafety and Biosecurity Policy Framework and associated strategies in 2025, which provide guidance on the safe and secure handling of biological agents and contribute to risk management within laboratory settings.

3.4 BRUNEI DARUSSALAM NATIONAL HEALTH LABORATORY SYSTEM (BDNHLS)

The BDNHLS is a national policy framework jointly developed by the MOH and METI in 2024, supporting standardising laboratory services across human, animal, and plant health in Brunei Darussalam. The vision of the BDNHLS is to establish and maintain an effective, accessible, and equitable national laboratory system that supports clinical care, disease prevention and control, and public health surveillance of national and international importance. Its mission is to guide the development of a safe, reliable, and high-quality laboratory system aligned with *Wawasan Brunei 2035*. The policy is structured around thirteen key elements as shown below:

1. Financial Considerations
2. Regulatory Framework
3. Organisation of the Laboratory System
4. National Reference Laboratories
5. Laboratory-Based Disease Surveillance

6. Laboratory Networking
7. Laboratory Standards
8. Laboratory Workforce
9. Quality Management System
10. Laboratory Infrastructure
11. Equipment and Maintenance
12. Supply Chain Management
13. Laboratory Safety, Laboratory Information Management System (LIMS), Research and Development, and Public-Private Partnerships

The BDNHLS is overseen by a dedicated BDNHLS Committee, which serves as the highest governance and decision-making body responsible for providing strategic direction, policy oversight, and accountability for the national laboratory system.

The first National Technical Laboratory Working Group (NTLWG) was established under the governance of the BDNHLS to support the registration and licensing of private laboratories both for human health as well as animal and plant health. The NTLWG (human health) was constituted to initiate and operationalise regulatory mechanisms for private laboratories under the MOH, in preparation for the enactment of the Private Healthcare Order, with an added scope to support the inclusion of relevant laboratory services from the animal health sector.

Functioning as a technical arm of the BDNHLS governance structure, the NTLWGs support the BDNHLS Committee by contributing technical inputs, developing implementation mechanisms, and operationalising agreed policy directions. While the BDNHLS Committee retains overall strategic oversight and accountability for the national laboratory system, the NTLWGs facilitate the translation of policy into practice through coordinated technical work, progress monitoring, and reporting.

3.5 THE NATIONAL LABORATORY SYSTEM IN BRUNEI DARUSSALAM

This section provides an overview of the current structure, functions, and operational components of the national laboratory system, including financing arrangements, laboratory tiering, national reference laboratory (NRL) capacities, surveillance activities, networking mechanisms, quality management practices, and laboratory safety. The description reflects the existing system and serves as a baseline for identifying strengths, gaps, and areas for strategic strengthening through the BDNLSP.

3.5.1 FINANCIAL CONSIDERATIONS

Public laboratories in Brunei Darussalam have been provided with the proper capacity, resources, and budgetary allocation to ensure the effective implementation of laboratory and support services. Any financial operations are strictly governed by the Financial Regulations of Brunei, which mandate that all procurement activities—ranging from small-value purchases to large-scale tenders must demonstrate value for money, transparency, and administrative probity. This regulatory framework ensures that the departmental budget is used efficiently to meet increasing diagnostic demands while navigating a national fiscal environment focused on deficit reduction and prudent spending. To support national readiness, a specific budget '*Peruntukan Perkhidmatan Rampaian - Wabak Penyakit Berjangkit*' remains a vital financial instrument, to allow for immediate fund mobilisation during public health emergencies or cross-sectoral biological threats as demonstrated during the COVID-19 pandemic. This enabled DLS to rapidly scale diagnostic operations, including the setting up of new molecular testing facilities within weeks and procuring high-volume testing supplies through expedited procurement procedures.

Laboratory testing and services provided by the MOH facilities are available to non-Brunei passport holders and are subject to the fees specified under the MOH Scheme of Charges. Similarly, laboratory services provided by METI facilities are subjected to applicable endorsed charges under Ministry of Finance (MOF).

3.5.2 NATIONAL LABORATORY TIER SYSTEM

Brunei's laboratory system is structured as a three-tier level network comprising of NRLs, district and private sector laboratories, and primary-level testing facilities. NRLs provide specialised, and confirmatory testing and play a role in surveillance activities, while district and private laboratories perform routine diagnostics and selected surveillance functions, with established referral pathways for confirmatory testing to NRLs or overseas laboratories where applicable.

3.5.2.1 HUMAN HEALTH SECTOR

In the human health sector, the national laboratory system comprises two main laboratories under the MOH i.e., DLS and DSS, the Royal Brunei Armed Forces (RBAF) laboratory and private laboratories.

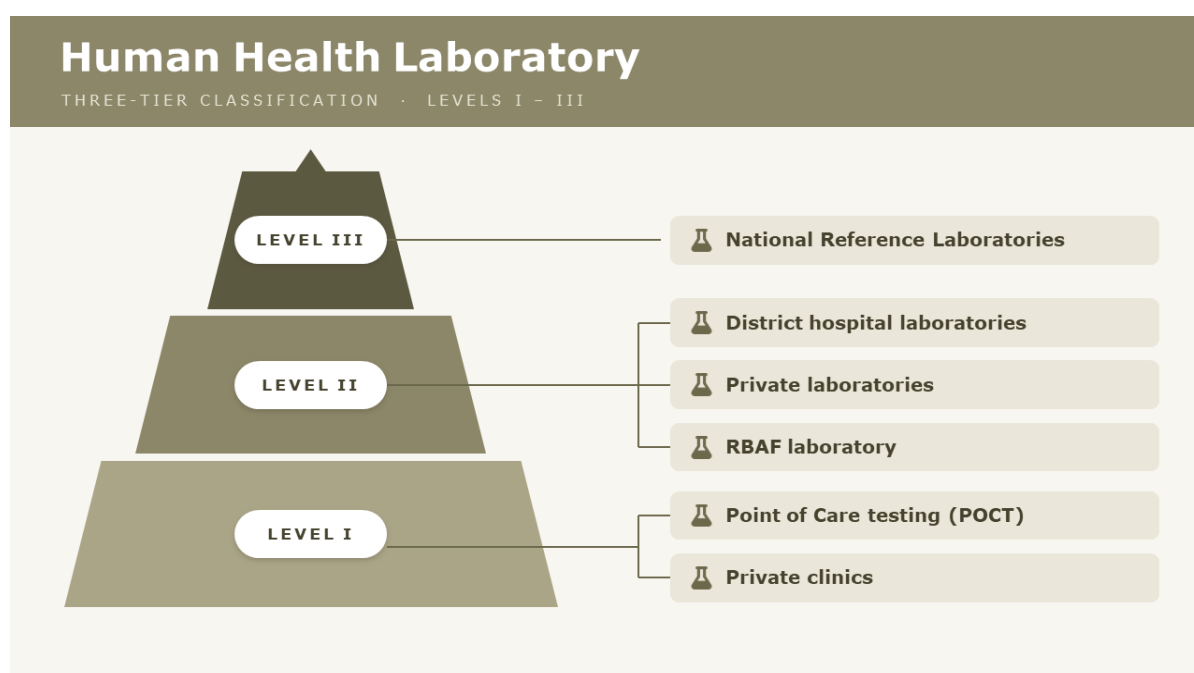


Figure 1: The three-tier system in the human health sector

3.5.2.2 ANIMAL AND PLANT HEALTH SECTOR

For the animal and plant health sector, the national laboratory system laboratories comprise of three main laboratories under the METI; Veterinary Laboratory Section and Crop Protection and Soil Science Section, DOAA and Aquatic Animal Health Laboratory under the DOFI.

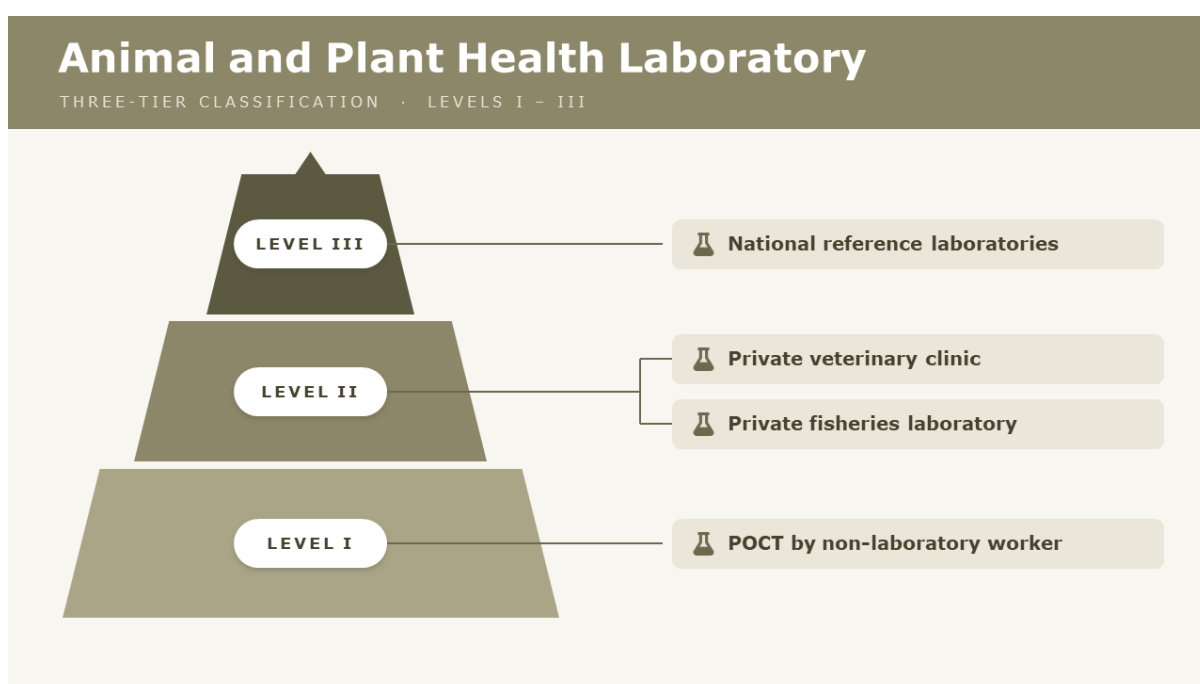


Figure 2: The three-tier level system in animal and plant health laboratory system

3.5.3 NATIONAL REFERENCE LABORATORIES

The DLS plays an integral part within the Ministry to provide clinical laboratory services consisting of seven (7) NRLs namely:

- i. National Clinical Chemistry Reference Laboratory
- ii. National Clinical Microbiology Reference Laboratory (NCMRL)
- iii. National Haematology Reference Laboratory
- iv. National Histology & Cytology Reference Laboratory & Mortuary Services
- v. National Immunology Reference Laboratory
- vi. National Virology Reference Laboratory (NVRL)
- vii. National Mycobacteria Reference Laboratory (NMRL)

These NRLs along with other diagnostic support services such as Phlebotomy Services and Central Specimen Receiving Area, Blood Donation Centre and Point-of- Care Testing (POCT) are in the Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital in the capital city of Brunei Darussalam. The two NRLs; NVRL and NMRL are in Sumbiling, offsite from the RIPAS Hospital. NVRL, NMRL and NCMRL perform public health functions and reports with the Brunei Centre of Disease Control (Brunei CDC) and WHO reporting platforms such as WHO Global Antimicrobial Resistance and Use of Surveillance System and WHO Global TB data collection for surveillance. NVRL is designated as a WHO-accredited National Measles and Rubella Laboratory since 2014 and recognised by WHO as National Influenza Centre in 2026. These laboratories are supported by Microbial Genomic Services (MGS) that performs genome sequencing activities for virological and Antimicrobial Resistance (AMR) surveillance.

There are also three District Hospital laboratories in the country; Belait, Tutong, and Temburong provide limited laboratory testing. Tests which are not performed in these District Hospital laboratory services will be referred to the reference laboratories. The specimen referral and transportation in Brunei operates using an MOH-approved land transport courier ensuring all clinical specimens are delivered to RIPAS Hospital Central Specimen Receiving Area (CSRA) within a day. CSRA receives, sorts and registers all relevant specimens including referral samples from private laboratories in Bru-HIMS before despatching to respective NRL. Laboratory information system module is available in Bru-HIMS and all laboratory results reporting are recorded and notified accordingly to the ordering clinicians using the same platform in real time.

All NRLs, where applicable, are categorised as Biosafety Level 2 (BSL2) laboratories guided using the WHO Biosafety Manual Edition 3 (2004). DLS intends to acquire third party certification for the upcoming Biosafety Level 3 (BSL3) facility in Tutong. This BSL3 facility is to support the routine services of NMRL and as the country's preparedness for any occurrence of Public Health Emergency of International Concern (PHEIC) for pre-analytical processes prior to dispatching to an approved international referral laboratory. The DSS on the other hand is committed to safeguarding public health through its laboratory services under the Health Science Division. It provides scientific services across various disciplines with laboratories including the Microbiology Laboratory, Food

Chemistry Laboratory, Environment Laboratory, and Pharmacy Laboratory. All the laboratories under Health Science Division are NRL. The analysis of raw and treated water, as well as environmental samples plays a vital role in safeguarding public health as it detects harmful microorganisms and contaminants that may lead to diseases that pose health risks. Laboratory analysis carried out routinely ensures water quality meets the safety standard and identify environmental pollution scientifically. Furthermore, the analysis can provide early warning of potential outbreaks and support timely intervention measures.

Laboratory analysis of raw and processed food products enables the detection of harmful substances, including microbial pathogens and chemical contaminants that may lead to food borne illness, such as Salmonella infection and food poisoning, as well as chemicals and food contaminants exceeding tolerance limits that may cause adverse health effects. Analysis of food for adulteration ensures compliance with food safety regulations. Meanwhile, the analysis of cosmetic products, traditional medicines and health supplements for adulterants and contaminants is also carried out in ensuring the safety and quality of the products.

Laboratory analysis carried out in food and food products under the Health Science Division is critical in reducing the risk of disease and ensuring the quality and safety of food in safeguarding public health.

Additionally, DSS maintains specialised capabilities in forensic analysis as one of its principal core functions. Laboratories under Forensic Science Division provide services to stakeholders in both government and private sectors in supporting law enforcement through the provision of scientific and laboratory evidence.

The Crop Protection and Soil Science Laboratories in Brunei Darussalam under the Plant Health Services Section play a critical role in safeguarding the nation's agricultural production system through science-based diagnostic, advisory, and regulatory support services. As part of the national plant health and regenerative agriculture framework, these laboratories serve as a foundation in ensuring crop and soil health, productivity, and compliance with international standards. At the core of their function is the provision of diagnostic services, where plant, soil, fertilizer and water samples collected by farmers,

extension officers, and other stakeholders are analysed to accurately identify plant pests and diseases, along with soil fertility and nutrient deficiencies. The laboratories provide technical advisory services to support farmers and industry players. Based on diagnostic findings, targeted recommendations are developed to guide pest and disease management practices, including integrated pest management strategies; similarly, analytical laboratory analysis is used to provide recommendations for soil health and plant nutrient management. The Crop Protection and Soil Science Laboratories also extend to strengthening industry resilience. By continuously monitoring pest, disease, and soil fertility trends, chemical and organic fertilizer quality, supporting surveillance activities, and providing evidence-based insights including collaborative research projects, the laboratories help build the capacity of the agricultural sector to respond to biosecurity risks and rising environmental challenges. Furthermore, the laboratories play a key role in facilitating agricultural trade and export readiness with reliable diagnostic capability is fundamental in supporting phytosanitary and quality certification processes, ensuring that agricultural produce meets the import requirements of regional and international trading partners. Aligned with national goals and initiatives such as the BDNLSP, Crop Protection and Soil Science Laboratories continue to advance towards accredited laboratory standards, ensuring that their services meet international benchmarks in quality, reliability, and credibility.

The Veterinary Laboratory Services (VLS) is responsible in safeguarding animal health and ensuring food safety through a comprehensive and up-to-date approach. The VLS supports national animal health and food safety programmes at the farm level, by delivering efficient, accurate, and reliable laboratory testing services. These diagnostic capabilities are complemented by continuous research and data analysis focused on food safety at farm production, disease diagnosis, and the development and validation of laboratory methods to keep pace with emerging risks and technological advancements. In addition, VLS serves as a critical source of evidence-based data, generating timely and credible information on food contamination and disease detection. This information is systematically communicated to relevant authorities to support informed decision-making, policy development, and rapid response during outbreaks or veterinary food

safety incidents. Operationally, VLS undertakes a wide range of activities for national biosecurity and food safety systems. This includes the analysis of food products of animal origin to detect pathogens, veterinary drug residues, and assess physical quality parameters, thereby ensuring compliance with safety standards and protecting veterinary public health. The laboratory also plays a vital role in the detection and identification of animal and livestock diseases, supporting efforts in disease surveillance, control, prevention, and eventual eradication. The VLS conducts specialised testing on animal feeds, including the detection of mycotoxins, evaluation of nutritional composition through proximate analysis, determination of gross calorific value, and identification of chemical contaminants. These functions are essential to ensure feed quality and prevent downstream risks to animal and human health.

The DOFI under the METI through its Aquatic Animal Health and Laboratory Services Centre provides diagnostic testing for aquatic animal diseases listed under WOA. The Department also monitor and assesses the health of aquaculture commodities in Brunei Darussalam through surveillance and early warning systems to prevent disease outbreaks. The laboratory provides diagnostic and certification services to support aquaculture farmers, conduct field assessments, and performs analysis of plankton related to harmful algal blooms. Overall, these functions ensure the safety of aquaculture products, mitigate environmental risks, and enable early detection and management of potential public threats, therefore safeguarding public health.

3.5.4 LABORATORY-BASED DISEASE SURVEILLANCE AND INFORMATION SYSTEM

Laboratory information and results are supported by LIMS which is the Brunei Health Information Management System (Bru-HIMS), which enables real-time transmission of laboratory results to clinicians and public health authorities, thereby strengthening clinical decision-making, disease surveillance, and relevant national health system coordination. These results are accessible across all government health facilities and authorised private hospitals and clinics. More recently, members of the public are also able to access and view their laboratory results through the BruHealth mobile application.

For human health, the national surveillance system for the prevention and control of any communicable diseases in Brunei- including environmental surveillance of vectors- is coordinated by the Department of Environmental Health Services (DEHS). Laboratory-based surveillance draws data from DLS, including NRLs and MGS. These data are recorded in Bru-HIMS, from which notifications of infectious diseases under the Infectious Diseases Act (Chapter 204) are extracted into the digital Public Health Surveillance (PHS) platform. PHS captures near real-time disease notifications in the form of laboratory results, ICD-10 codes, or clinician notifications, and serves as the primary tool for the Brunei CDC.

Complementing this digital infrastructure, laboratory notification processes also encompass manual reporting mechanisms: telephone notification to ordering clinicians for critical test results in accordance with ISO 15189 requirements, and direct email notifications to the Brunei CDC for notifiable diseases as prescribed under the Infectious Diseases Act. Together, these digital and manual channels form an integrated notification framework that ensures timely and reliable communication of laboratory findings to public health authorities.

Under DOAA, there are plans to upgrade data management of the Veterinary Laboratory Services utilising LIMS to automate and manage diagnostic workflows. The laboratory currently manages all data and disease surveillance for animal health through VLS for the analytical needs and requirements of the Veterinary Services under the Livestock Industry and Veterinary Services Division.

3.5.5 LABORATORY NETWORKING

Laboratory networking in Brunei Darussalam is strengthened through BDHNLS initiatives and active engagement with regional and international partners, including WHO, World Organisation for Animal Health (WOAH), and Food and Agriculture Organisation (FAO). Participation in platforms such as ASEAN and the RPHLN supports information sharing, benchmarking, and adoption of best practices. These collaborations facilitate professional development through training, technical exchange, and capacity-building initiatives.

3.5.6 LABORATORY STANDARDS AND QUALITY MANAGEMENT SYSTEM

Most laboratories within the national laboratory system have demonstrated conformity with ISO 15189 and ISO/IEC 17025 requirements, establishing consistent benchmarks for quality, technical competence, and reliability of laboratory services. Compliance to ISO standards and alignment to international guidelines is sustained through a highly skilled workforce whose competency is monitored and assessed. Furthermore, the technical integrity of the service is reinforced with the use of safe and appropriate equipment, with close monitoring of maintenance and metrological calibration for compliance. This strength has been reflected in the Brunei JEE Assessment report 2019 which recognised the contribution of quality-assured laboratories to effective disease surveillance and public health response.

Under the MOH, DLS has been a pioneer in clinical quality, first attaining ISO 15189 accreditation in 2011 and culminating in the 2024 transition to the latest ISO 15189:2022 standard by the Singapore Accreditation Council (SAC). The transition to ISO 15189:2022 further reinforces this framework through a risk-based approach to patient and personnel safety and the formal integration of POCT within QMS for human health laboratories. Complementing these achievements, the Health Science laboratories under DSS have maintained ISO/IEC 17025 accreditation through the SAC since 2016. Furthermore, the Forensic Science laboratories reached a dual milestone in 2023 by securing both ISO/IEC 17025 and ANAB forensic requirements. Together, these credentials reflect a ministry-wide compliance with internationally recognised standards, safeguarding public health and legal integrity.

Under VLS of DOAA, the department has continuously strengthened its laboratory quality system through the implementation and maintaining of ISO/IEC 17025 accreditation. VLS first achieved ISO/IEC 17025:2005 accreditation in 2012 with 13 accredited tests, demonstrating its commitment to providing reliable, accurate, and internationally recognised laboratory testing services. In 2019, VLS successfully transitioned to ISO/IEC 17025:2017 and expanded its accredited scope to 31 tests, reflecting significant improvements in technical competency, laboratory capability, and quality management practices. These efforts are closely aligned with METI Strategic Plan in strengthening food security, enhancing the competitiveness of the agrifood sector, and

developing credible and internationally recognised laboratory services. By maintaining ISO/IEC 17025 accreditation, VLS continues to contribute towards national preparedness in disease detection and control and food safety assurance, strengthening stakeholder confidence, and supporting Brunei Darussalam's commitment to international standards and best practices.

In the absence of formally established national laboratory quality standards, ISO accredited NRLs serve as practical benchmarks for the wider laboratory system. New and/ or existing private laboratories are therefore required to align with these practices as a basis for registration and test approvals through the respective NTLWG.

The Brunei Darussalam Standards and Accreditation Centre (BDSAC), a national authority under MOF promotes for quality benchmarks across the nation's laboratory landscape and enhances regulatory readiness by enabling a progressive transition towards formal QMS requirements upon enactment of the Private Healthcare Order.

3.5.7 LABORATORY SAFETY

At the operational level, biosafety practices within facilities or departments are implemented through introduction of risk assessments for appropriate safe practices, containment measures, and routine competency-based training with ongoing monitoring. Biosecurity measures are enforced through controlled laboratory access systems, secure storage of biological materials, and robust accountability mechanisms ensuring traceability throughout the handling and use of such materials. Biological waste management is conducted in accordance with the MOH Guidelines on Healthcare Waste Management, ensuring appropriate segregation, treatment, and safe disposal. Chemical and physical hazards are managed through established laboratory safety protocols and procedures. These requirements are formalised within institutional laboratory safety manuals, standard operating procedures, and related technical guidelines to ensure consistent implementation across facilities.

At the national level, a whole-of-government coordinating mechanism under the Prime Minister's Office serves to oversee safety and security across biological, chemical, and radiological domains, in alignment with key recommendations from the Brunei JEE 2019. Within this governance structure, the National Biosafety and Biosecurity Committee

(NBBC), or *Jawatankuasa Kerja Biokeselamatan dan Biosekuriti*, functions as the designated national body to guide the development of the national biosafety and biosecurity regulatory framework. The NBBC also facilitates coordination, compliance strengthening, and implementation of priority actions identified through the JEE process, supporting a more integrated and systematic approach to national biosafety and biosecurity governance in Brunei Darussalam.

4. DEVELOPMENT OF BRUNEI DARUSSALAM BDNLSP 2026- 2030

STEPWISE APPROACH FOR DEVELOPMENT OF BDNLSP

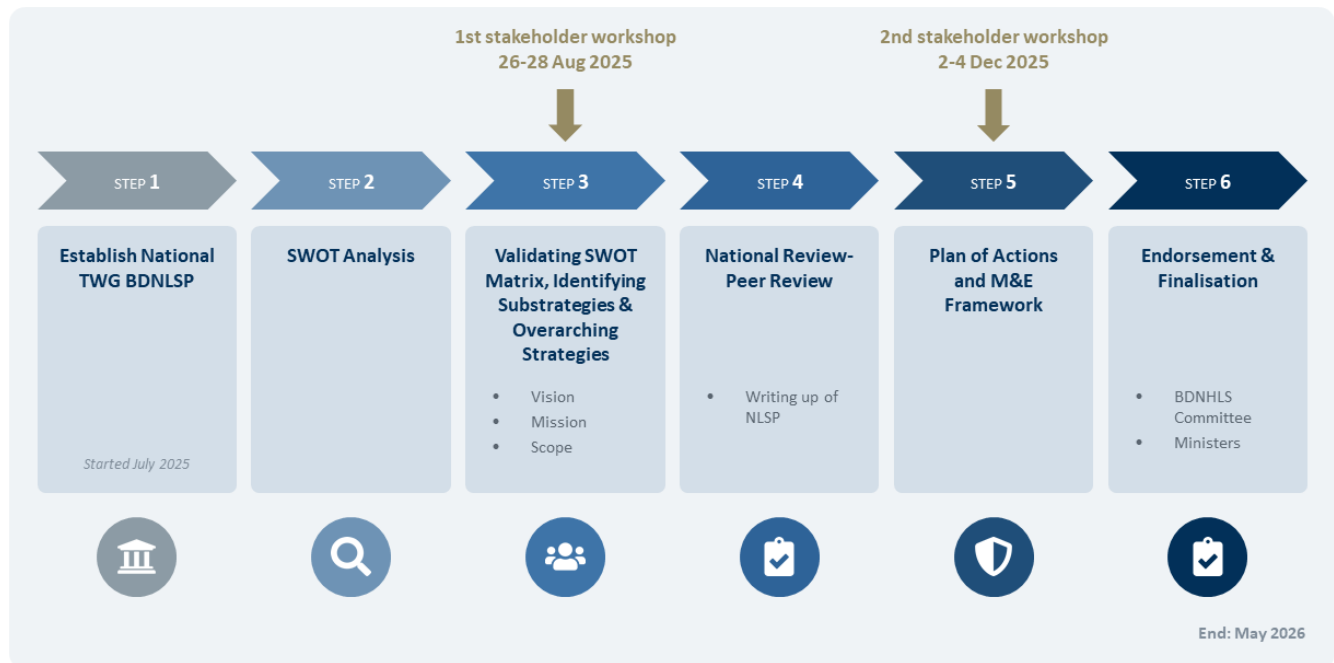


Figure 3: Development of the BDNLSP followed six (6) sequential steps anchored by two (2) stakeholder workshops. This structured approach ensured technical and consultations from situational analysis through to finalisation of the plan.

4.1 ESTABLISHMENT OF NTLWG FOR BDNLSP

The NTLWG for BDNLSP was formed in August 2025 under BDNHLS committee and is responsible for the execution and monitoring of the development of the BDNLSP 2026-2030. The members of this working group are responsible for reviewing technical inputs, monitoring implementation progress, identifying gaps and challenges, recommending corrective measures, and ensuring that the strategic plan remains responsive to national priorities and international standards.

The membership of the Technical Working Group comprises Directors or senior officers from the following agencies:

1. MOH- DLS, DSS, DEHS and DPP
2. METI- DOAA and DOFI
3. MOD- DWS
4. MinDef- Medical Reception Services (MRS)
5. Higher Education Institutions- Universiti Brunei Darussalam (UBD) and Universiti Islam Sultan Sharif Ali (UNISSA)
6. Private sector- Jerudong Park Medical Centre (JPMC)

The members and Terms of Reference for the NTLWG can be found in Appendix I and Appendix II respectively.

4.1.1 STAKEHOLDERS

4.1.1.1 MINISTRY OF HEALTH

4.1.1.1.1 DEPARTMENT OF LABORATORY SERVICES

DLS was established in 2001, with services dating back to 1927, the department delivers a comprehensive diagnostic, reference, and confirmatory testing for patient care management, communicable and non- communicable disease surveillance, and outbreak responses. The DLS QMS has undergone continuous refinement for over a decade. Building upon the foundational ISO 15189 accreditation secured in 2011, the department achieved a significant regulatory milestone in 2024 by securing accreditation under the ISO 15189:2022 standard. This transition, verified by the SAC, reflects an advanced

integration of risk-based thinking and clinical governance into our daily diagnostic operations.

4.1.1.1.2 DEPARTMENT OF SCIENTIFIC SERVICES

DSS serves as National Laboratory in providing scientific analytical support services in public health safety and law enforcement in Brunei Darussalam. The Department initially started with Narcotic Laboratory in 1988 and was formally established in 1990 as Laboratory of Scientific Services and further constituted as Department of Scientific Services (DSS) in 2000. The laboratories in DSS, under both Health Science and Forensic Divisions are equipped with state-of-the-art facilities dedicated to delivering excellent analytical services. DSS continuously strengthens its capabilities through its specialised laboratories, in alignment with national priorities and emerging scientific developments. As part of DSS's commitment to quality and technical excellence, DSS achieved ISO/IEC 17025 accreditation for laboratories under Health Science Division in 2016 and Forensic Science Division in 2023. This milestone reflects adherence to internationally recognised standards while enhancing the credibility, reliability, and global recognition of DSS laboratory services.

4.1.1.1.3 DEPARTMENT OF POLICY AND PLANNING

DPP serves as the strategic and policy coordination arm of the Ministry of Health, providing leadership and guidance in the development, implementation and evaluation of health policies, strategic plans and system-wide initiatives. The Department supports evidence-informed decision-making through policy research, health systems analysis, strategic management and performance monitoring to ensure that healthcare priorities remain responsive, sustainable and aligned with national aspirations, including *Wawasan Brunei 2035*.

In addition, DPP plays a key role in strengthening governance, partnership and institutional coordination through the facilitation of local and international collaborations, dissemination of strategic health information, and health-related legislative matters. Through a whole-of-system approach, the Department contributes

towards advancing a resilient, innovative and people-centred healthcare system for Brunei Darussalam.

4.1.1.1.4 DEPARTMENT OF ENVIRONMENTAL HEALTH SERVICES

DEHS is responsible for safeguarding public health through environmental health protection, disease prevention, surveillance, and outbreak response activities in Brunei Darussalam. Established from the early malaria control programmes in the 1950s and formally structured as Environmental Health Services in 2004, the department oversees a broad range of functions including environmental health surveillance, vector control, port health services, vaccination programmes, and communicable disease prevention. The Department plays a key role in national disease surveillance, outbreak investigation, epidemiological monitoring, and emergency public health responses. Supported by digital PHS and inter-sectoral collaboration, the department contributes significantly to national preparedness, health resilience, and evidence-based public health interventions.

During a PHEIC, DEHS serves as the national authority responsible for activating and coordinating the public health response, including case finding, contact tracing, quarantine measures, and the implementation of port health controls at points of entry. DEHS also fulfils Brunei Darussalam's IHR notification obligations, assessing and reporting potential PHEIC events to WHO within the timelines prescribed under Article 6 and communicating risk assessments through the national IHR focal point mechanism.

4.1.1.2 MINISTRY OF ECONOMY, TRADE AND INDUSTRY (METI)

4.1.1.2.1 DEPARTMENT OF AGRICULTURE AND AGRIFOOD

DOAA plays a key role in strengthening Brunei Darussalam's agricultural sustainability, food safety, and biosecurity systems. Through its veterinary public health, animal disease diagnostic, and food safety laboratory services, the department undertakes activities related to livestock health surveillance, zoonotic disease detection, plant health protection, pest and disease investigations, and analysis of veterinary drug residues. These scientific and regulatory functions contribute to safeguarding public health, maintaining food quality standards, and supporting compliance with national and

international requirements under the One Health framework. In line with national development priorities, DOAA advances resilient food production systems, enhances preparedness against transboundary animal and plant diseases, and improves agrifood standards for both local consumption and export readiness, while promoting innovation, technology adoption, and investment to enhance agricultural productivity and sustainable economic diversification.

4.1.1.2.2 DEPARTMENT OF FISHERIES

Established in 1966, the DOFI is the national authority responsible for the management, conservation, and development of fisheries and aquaculture resources in Brunei Darussalam. The department oversees fisheries regulation, stock assessment, resource conservation, aquaculture development, seafood product quality control, and technical support services for the fisheries industry. Its laboratory-related functions support fish health diagnostics, aquaculture disease surveillance, water quality monitoring, and seafood safety testing to ensure safe, sustainable, and high-quality aquatic food production.

Through implementation of fisheries legislation, disease monitoring programmes, environmental assessments, and food safety measures within seafood processing activities, DOFI supports consumer protection, aquatic ecosystem health, and sustainable industry growth. The department also promotes productivity enhancement, technology-driven aquaculture development, and export-oriented fisheries activities in support of national food security and economic diversification objectives.

4.1.1.3 DEPARTMENT OF WATER SERVICES, MINISTRY OF DEVELOPMENT

DWS oversees the planning, management, and sustainability of Brunei Darussalam's water resources, including the provision of safe and reliable potable water nationwide. Through its ISO 17025-accredited Water Services Laboratory, the department conducts routine sampling and analytical testing of drinking water in accordance with internationally recognised standards to monitor water quality and detect potential chemical, microbiological, and environmental contaminants. These laboratory activities support public health protection, regulatory compliance, and the safe operation of

national water supply systems serving approximately 99.9% of the population. In addition to public water surveillance, the laboratory also provides analytical services to relevant industry sectors, contributing to environmental stewardship, infrastructure resilience, water safety assurance, and coordinated national response during water-related incidents.

4.1.1.4 MEDICAL RECEPTION SERVICES, MINISTRY OF DEFENCE

MRS under the RBAF provides healthcare and medical support to the personnel of the RBAF and their families. Established in 1964, the unit has since evolved from a single MRS into a structured network comprising multiple MRS facilities nationwide, supported by subunits of environmental hygiene, medical logistics, and medical training. Currently, the existing laboratory supports basic toxicology screening for the personnel of RBAF only.

Within the NLS, MRS represents the defence health protection pillar. Within its limitations, its laboratory functions to complement workforce fitness and operational readiness. Strategically, the unit strengthens disease prevention within defence settings and ensures resilience and readiness of military personnel in support of national security objectives.

4.1.1.5 MINISTRY OF EDUCATION

4.1.1.5.1 UNIVERSITI BRUNEI DARUSSALAM

UBD serves as a key national academic and research institution within the NLS, contributing to laboratory and public health capacity through education, scientific research, innovation, and workforce development. The university supports biomedical, environmental, and public health initiatives, while providing training for laboratory and healthcare professionals. UBD also collaborates closely with government agencies in areas such as surveillance, diagnostics, data analysis, and research-based insights. Its research initiatives are aligned with national priorities, including biodiversity, health sciences, halal science, governance, sustainability, and energy, contributing towards strategic national development goals and *Wawasan* Brunei 2035. The Pengiran Anak

Puteri Rashidah Sa'adatul Bolkiah Institute of Health Sciences (PAPRSB IHS), as UBD's principal health sciences institute, plays a central role in advancing medical education, allied health training, biomedical sciences, and translational research. Its laboratory and teaching facilities support clinical skills development, scientific research, and research-to-practice integration, helping strengthen laboratory competencies and healthcare innovation in Brunei Darussalam. Through strong academic-clinical collaboration, professional training, and research capacity building, UBD and PAPRSB IHS continue to contribute towards national healthcare capacity, workforce sustainability, and the advancement of the country's healthcare ecosystem in line with *Wawasan* Brunei 2035.

4.1.1.5.2 UNIVERSITY ISLAM SULTAN SHARIFF ALI

UNISSA serves as a reference scientific laboratory that supports cutting-edge teaching and research using modern methods and technologies, with outcomes relevant to national and international interests. Through its scientific and academic contributions, UNISSA strengthens undergraduate and postgraduate programmes in both applied and pure sciences, especially those requiring laboratory-based skills, while also fostering inventive and innovative research that advances science and technology in Brunei Darussalam and beyond.

UNISSA strives contribute to public health governance, workforce development, and multidisciplinary scholarship at the intersection of health, ethics, law, and community wellbeing. In line with its commitment to quality teaching, research, training, and professional service, the university also builds strategic national and international networks with public and private institutions, agencies, industries, organisations, and communities for mutual benefit.

Through the establishment of the *Pusat Makmal Saintifik Ibnu Sina* or Ibnu Sina Scientific Laboratory Centre at the Sinaut Campus in 2024, UNISSA has enhanced its scientific laboratory capacity in both applied and pure sciences, including areas relevant to public health, halal science, and environmental monitoring. The laboratory centre supports teaching, innovative research, and collaboration with government and private agencies, contributing to scientific advancement, evidence generation, and the development of competent graduates in line with national and international standards.

4.1.1.6 JERUDONG PARK MEDICAL CENTER (JPMC)

JPMC represents one of the largest private clinical diagnostic laboratories in Brunei Darussalam. The laboratory services operate 24 hours daily and encompass biochemistry, immunology, haematology, blood bank and transfusion, clinical microbiology, virology and serology, specimen management, phlebotomy, and blood donation services, with selected tests referred to approved accredited reference laboratories where required.

JPMC's laboratory is accredited to ISO 15189 by the SAC and contributes clinical diagnostics, innovation, and quality benchmarking within the national laboratory ecosystem.

4.2 SITUATIONAL AND GAP ANALYSIS

4.2.1 METHODOLOGY

The situational and gap analysis was conducted using a structured approach as shown in Figure 4 comprising desk reviews, application of WHO and FAO laboratory assessment tools and key informant interviews. The desk review examined relevant policies, strategies, technical including assessment reports and operational documents to establish an evidence-based understanding of the current laboratory system. To systematically evaluate capacities and identify performance gaps across key functional domains, the stakeholders utilised the FAO Laboratory Mapping Tool comprising (LMT) Core (2016) and LMT Safety (LMT-S) modules, alongside the WHO Laboratory Facility Assessment Tool (LFAT, 2012), the latter of which was specifically adapted and revised to suit the national context of Brunei Darussalam. Findings from the desk review and tool-based assessments were consolidated through a SWOT (Strength, Weakness, Opportunity and Threat), with resulting statements validated through stakeholder consensus to ensure accuracy and relevance.

The initial findings served as the foundation for the consultative process with RPHL Network Subject Matter Experts (SMEs), which commenced in July 2025 through a series of online meetings and feedback sessions. This collaborative engagement facilitated the formal formulation of SWOT statements, ensuring that the system's strengths,

weaknesses, opportunities, and threats were accurately identified and articulated. To further support the strategic process, a sequence of workshops were conducted, beginning in August 2025, followed by an internal session in October 2025, and a second workshop with RPHL SMEs in December 2025. These workshops were instrumental in guiding the BDNLSP through its remaining developmental phases, transitioning from the refined SWOT analysis to the identification of sub-strategies, the selection of overarching strategies, and the finalisation of the plan of action with monitoring and evaluation framework.

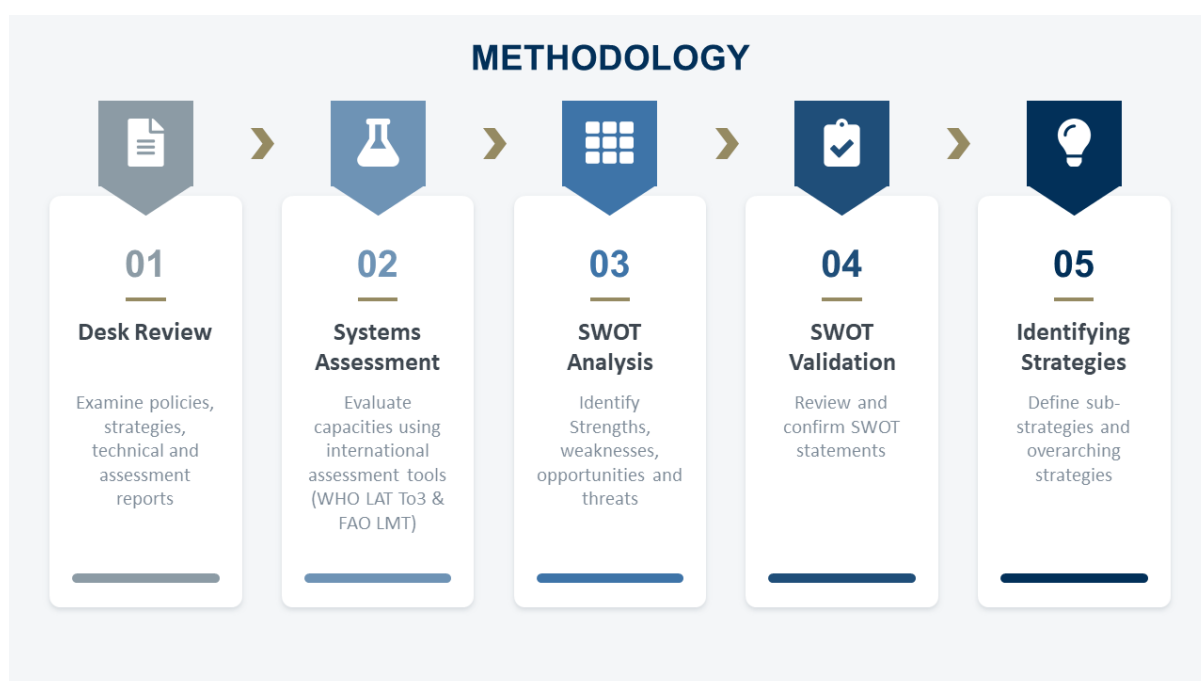


Figure 4: The BDNLSP situational analysis

4.2.1.1 DESK REVIEW

A desk review was conducted to systematically gather information for the development of the SWOT matrix. It examined a total of 58 documents consisting of assessment and audit reports, accreditation and certification findings, international technical assistance and evaluation reports, and quality management system related records such as management reviews. Strategic policy documents and operational records such as SAC Accreditation Scheme for Conformity Assessment Body Assessment Findings, 2025 were also reviewed.

The desk review focused only on documents published within the past five years to ensure the continued relevance and validity of the information. The review was conducted through a collaborative effort involving DLS, DSS, DOAA, DOFI and DWS. A detailed list of documents reviewed is provided in Appendix VI.

4.2.1.2 LABORATORY ASSESSMENT TOOLS

Key informant interview was conducted using the WHO LFAT to support a structured and comparable evaluation across institutions and recommended for facility who do not have any recent documents to be reviewed. The tool comprises a series of structured modules covering key functional areas of laboratory operations, including organisation and management, documentation, specimen collection and transport, data and information management, laboratory supplies and equipment, testing performance, facilities, human resources, biosafety and biorisk management, and public health functions.

The tool applies a standardised scoring system based on predefined response options, with automated calculations generating percentage scores for each functional module and an overall summary. Outputs from this assessment, including gap analysis were incorporated into the SWOT analysis to support the identification of system-level strengths and gaps.

Key informant interviews were conducted in nine (9) facilities using this tool namely: DLS, DSS, DOAA, DWS, DOAA, MRS, UBD, UNISSA and Panaga Health Laboratory.

In addition, two (2) facilities: DOAA and DOFI conducted similar procedure using the FAO LMT. Both LMT Core and LMT Safety modules were applied to assess laboratory capacity, functionality, and biosafety practices.

4.2.1.3 SWOT ANALYSIS

A SWOT analysis was undertaken to systematically collate findings from the desk review, assessment tools output, and key informant interviews. Statements relating to strengths, weaknesses, opportunities, and threats were identified and organised to provide a structured overview of internal and external factors affecting the laboratory system. Collectively, this process yielded 405 SWOT statements, which were mapped to fourteen (14) thematic areas as shown in Figure 5.

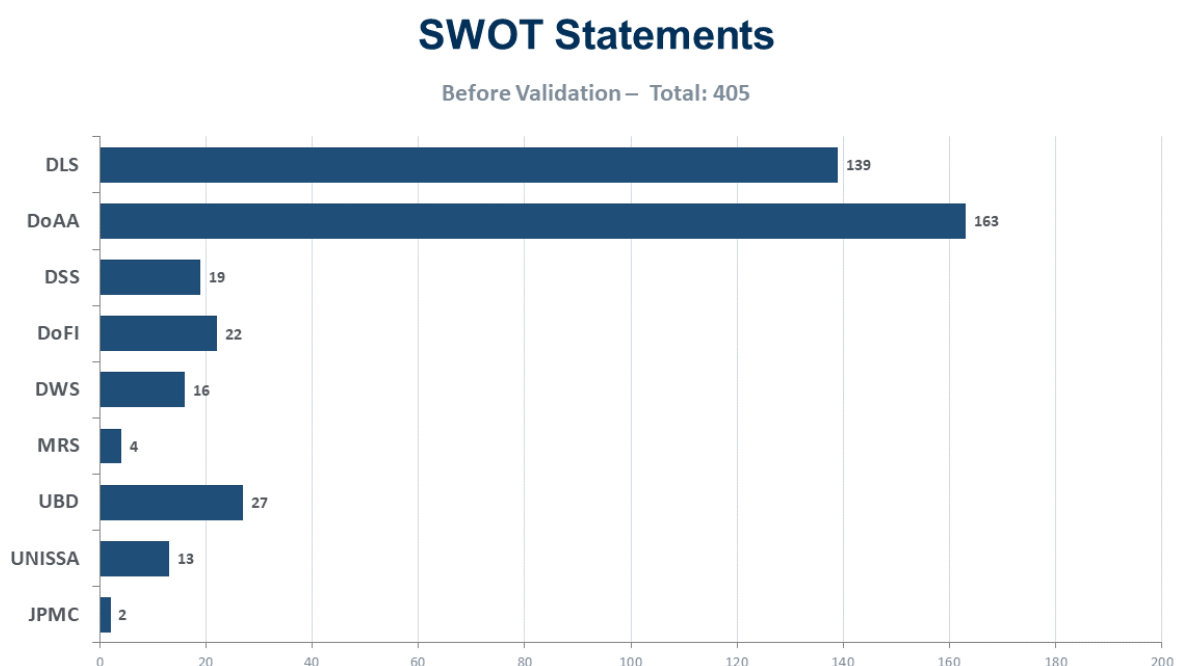


Figure 5: A total of 405 SWOT statements were contributed by nine stakeholders spanning health, agriculture, fisheries, defence, and academia. This wide participation underpins the analysis with cross-sectoral input.

The resulting statements served as a preparatory analytical input for structured discussion and analysis, facilitated by the RPHL Network between 26th and 28th August 2025.

1st RPHLN STAKEHOLDERS' CONSULTATIVE WORKSHOP

BDNLSP 2026 - 2030



6 – 28 August 2025, The Rizqun International Hotel

FOLLOW-UP WORKSHOP

BDNLSP 2026–2030



22 – 23 October 2025, Health Promotion Centre, Ministry of Health

2nd RPHLN STAKEHOLDERS' CONSULTATIVE WORKSHOP

Plan of Action & M&E Framework for BDNLSP 2026 -2030



2 – 4 December 2025, The Rizqun International Hotel

4.2.1.4 DEVELOPMENT OF STRATEGIES

The development of strategies was initiated during the 1st consultative stakeholder workshop with RPHLN in August 2025, which in validating the SWOT statements for accuracy and relevance, and introducing participants to a structured methodology for translating validated findings into actionable sub-strategies.

During this workshop, participants were guided through the '**match and convert**' **technique** — a systematic approach to linking SWOT-related factors to derive strategic direction. The *matching* principle involves connecting external factors (opportunities and threats) to internal factors (strengths and weaknesses), enabling a holistic assessment of how the laboratory system can leverage its strengths to capitalise on opportunities or mitigate threats. The *converting* principle encourages more transformative thinking — reframing unfavourable factors into beneficial ones; for instance, converting a threat into a strategic opportunity, or turning a weakness into a strength. This application enables formulation of evidence- based strategies and systematic appraisal of the laboratory system, producing outcomes that address current gaps and aligned with longer-term national priorities.

Due to the complexity and volume of the work, the activities could not be fully completed within the August workshop. A follow-up internal workshop was therefore convened in October 2025 — attended by the stakeholders and working group members, without the RPHLN technical experts — to finalise the process. In summary, the fourteen proposed thematic areas were subsequently consolidated into a final set of ten (10) thematic areas to eliminate redundancy and ensure closer alignment with the core components of the laboratory system. Participants also reviewed the consolidated 405 SWOT statements and refined to a final set of 208 validated SWOT statements. Applying the 'match and convert' technique to these statements, the group derived a total of 21 sub-strategies spanning the ten thematic areas. To facilitate peer review and ensure strategic coherence, the workshop employed a 'Gallery Walk' format, whereby groups critically evaluated each other's work, provided structured feedback, consolidated overlapping initiatives, and refined the alignment of sub-strategies with the emerging overarching strategies. This format served as an essential quality-control mechanism, promoting cross-functional dialogue and

collective ownership of the strategic framework. The workshop concluded with participants working to develop the overarching strategies and organise the 21 sub-strategies under the appropriate strategic goals, establishing the foundational architecture of the BDNLSP.



Figure 6: Timeline of the situational analysis and strategy development process

4.2.1.5 KEY FINDINGS

Based on the key findings from the SWOT analysis and situational assessment, stakeholders reached consensus on four (4) strategies, organised into ten (10) thematic areas, supported by twenty-one (21) sub-strategies and forty-nine (49) implementation activities as summarised in Table 1.

The four (4) Strategies are:

Strategy 1: Strengthen whole-of-nation governance and leadership to safeguard public health security for a resilient laboratory system.

Strategy 2: Strengthen and optimise laboratory testing to provide integrated, reliable, accessible, high-quality services supporting public health and One Health priorities.

Strategy 3: Strengthen national laboratory coordination and readiness for public health threats.

Strategy 4: Strengthen the laboratory regulatory framework for a resilient, safe and high-quality national system.

The ten (10) Thematic Areas are:

- 1) Governance and Workforce Development
- 2) Financing, Procurement and Supply Chain Management
- 3) National Diagnostic Network
- 4) Quality and Safety Management System
- 5) Biorisk Management
- 6) Disease and Genomic Surveillance
- 7) Laboratory Emergency Management
- 8) Data and Information Management
- 9) One Health and Multi-Sectoral Coordination
- 10) Research and Development

No.	THEMATIC AREA	Sub-strategies	Activities
T1	Governance and Workforce development	6	14
T2	Financing, Procurement and Supply Chain Management	2	2
T3	National Diagnostic Network	1	1
T4	Quality and Safety Management System	2	14
T5	Biorisk Management	3	6
T6	Disease and Genomic Surveillance	3	6
T7	Laboratory Emergency Management	1	1
T8	Data and Information Management	1	2
T9	One Health and Multisectoral Coordination	1	2
T10	Research and Development	1	1
Total		21	49

Table 1: Breakdown of sub strategies and implementation activities according to the ten (10) thematic areas

PART II- STRATEGIC DIRECTIONS

5. BDNLSP VISION AND MISSION

2026-2030

Strategy Vision:

A resilient, sustainable, and accessible laboratory services that ensures excellence and protects public health through a unified One Health approach

This vision reflects Brunei Darussalam's commitment as aligned in the Brunei Darussalam National Health and Laboratory System (BDNHLS), to maintain a network of high-quality diagnostic laboratory services that are resilient- able to respond quickly and adapt to emerging threats; sustainable- supported by strong governance, financing and workforce continuity, and accessible- ensuring equitable services across the country. Through a unified One Health approach, it aspires towards strengthening the coordination of human, animal, and environmental health capacities in protecting Brunei from infectious disease threats.

2026-2030

Strategy Mission:

To provide quality laboratory services and robust diagnostic capacity that support surveillance, partnerships, and timely action against public health threats in Brunei Darussalam

This mission translates the national vision into an operational foundation in strengthening the national laboratory system in safeguarding population health. Its implementation for bolstering nation's public health security is enabled by four overarching strategies which focuses on strengthening areas of leadership, advancing laboratory capacity and capability while recognising the need for policy alignment and regulatory mechanisms.

6. SCOPE

This Strategic Plan 2026- 2030 applies to all laboratories contributing to public health functions which is an integral part of Brunei Darussalam's national health laboratory system. These laboratories may extend beyond diagnostic testing to include disease surveillance, and other specific roles in environmental and water quality monitoring, food safety, and the advancements of scientific or research innovations. The scope intends to foster an effective One Health collaboration among public and private, and academic laboratories as shown in Figure 7:

LABORATORIES SUPPORTING PUBLIC HEALTH FUNCTIONS

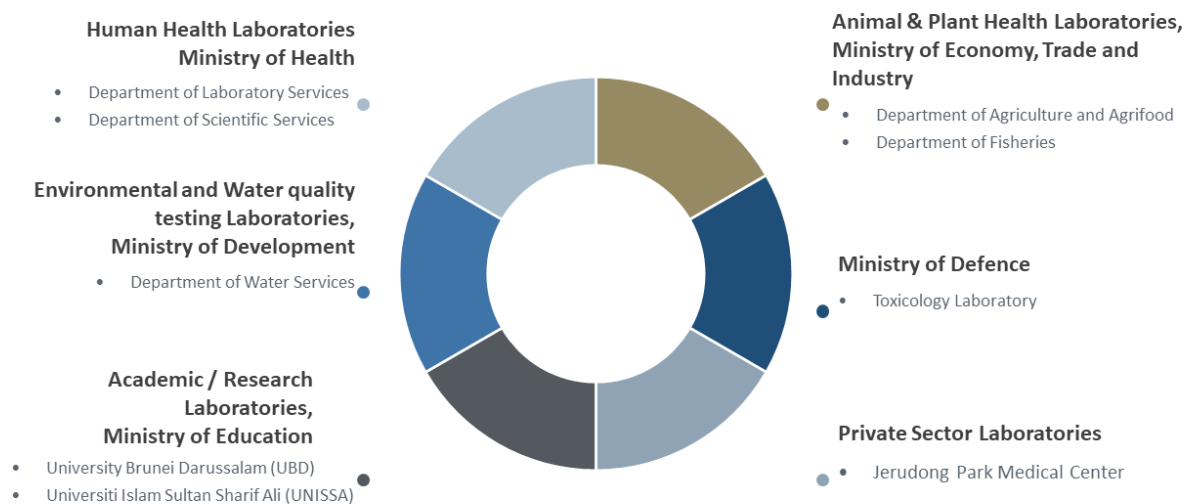


Figure 7: Laboratories across six ministries and sectors underpin Brunei's public health functions. This cross-sectoral network reflects the coordinated One Health approach central to the national laboratory system.

PART III

STRATEGIC

FRAMEWORK

7. THEMATIC AREAS

7.1 GOVERNANCE AND WORKFORCE DEVELOPMENT

Effective governance and a competent, future-ready workforce are critical and interrelated areas for laboratories to perform and sustain their services including core functions of public health such as quality assurance, disease surveillance and emergency responses. Laboratories require strong strategic leadership and effective management to deliver quality- assured services. This thematic area focuses promoting competence-based workforce development opportunities and emphasises advancing capacity building including integrating robust leadership pipelines to strengthen technical expertise, management capabilities and building future- ready leaders. These efforts also contribute towards meeting workforce requirements for Allied Health Professional (AHP) licensure and aligned with the AHP scheme to support career progression and promotions for MOH's workforce. A structured multisectoral coordination utilising the One Health approach will enhance further support relevant coherent planning, implementation and monitoring initiatives such as system- regulatory oversight of laboratory services.

7.2 FINANCING, PROCUREMENT AND SUPPLY CHAIN MANAGEMENT

Reliable financing and efficient supply chains ensure uninterrupted laboratory operations. While annual budget proposals are submitted through established government processes, funding allocations may vary due to competing national priorities and the need to respond to unplanned expenditures such as outbreak responses or the expansion of diagnostic services driven by evolving clinical needs. Global supply volatility, delivery delays, and higher procurement costs associated with Brunei Darussalam's high-income country status necessitate more coordinated procurement and supply chain management practices. Addressing these financial constraints requires more strategic and systematic financial planning approaches that improve predictability, prioritisation, and flexibility in budget utilisation.

The strategic actions focus on the development of coordinated procurement mechanisms, enhanced demand forecasting, shared procurement strategies, and strengthened

inventory management across laboratories. These actions aim to optimise resource use, improve procurement transparency and timeliness, and ensure continuous access to essential reagents, consumables, and equipment for both routine operations and emergency response.

7.3 NATIONAL DIAGNOSTIC NETWORK

An integrated national diagnostic network ensures equitable access to reliable laboratory services across Brunei Darussalam. A 'robust' laboratory network for public health entails coordination among public, private, and integration of academic/ research laboratories for optimised use of national resources. In preparation for the enactment of the Private Health Institutions Order, strengthened oversight mechanisms support the alignment of private laboratory testing with national requirements, and public health priorities. This integration enables the rational distribution of testing capacity, minimise duplication, and strengthen referrals and surge mechanisms across the laboratory system. It further enhances innovation, workforce development, and testing the system's ability to any health emergency needs.

7.4 QUALITY AND SAFETY MANAGEMENT SYSTEM

The NRLs and specific private laboratories operates with a strong foundation of ISO accreditation which is pursued as an independent accreditation. This strength has been reflected in the WHO JEE, which recognised the contribution of quality-assured laboratories to effective disease surveillance and public health response. The transition to ISO 15189:2022 further reinforces this framework through a risk-based approach to patient and personnel safety and the formal integration of POCT within QMS for human health laboratories. Accreditation recognition by internationally recognised accreditation bodies has provided a practical benchmark for quality, technical competence, and reliability of laboratory services.

While these accreditations are currently granted by recognised international accreditation bodies, the framework is supported locally by the BDSAC. The BDSAC serves as the national authority for maintaining the registry of accredited Conformity Assessment

Bodies (CABs), acting as an oversight body rather than a direct provider of commercial certification.

In the absence of formally established national laboratory quality standards, the monitoring and oversight of QMS in laboratories are largely reactive, driven by internal institutional requirements rather than a proactive, whole-of-nation regulatory mandate. The national requirements for registration of new private laboratories and approval to operate testing are aligned with requirements drawn by the respective NTLWG. This is to ensure the reliability of test results or services and supports regulatory readiness by facilitating a progressive transition towards formal QMS requirements upon enactment of the Private Healthcare Order, where applicable.

7.5 BIORISK MANAGEMENT

Brunei Darussalam is guided by an established National Biosafety and Biosecurity Policy Framework and associated strategies, which provide important policy direction for the safe, secure, and responsible handling of biological agents and materials within laboratory settings. While these policy framework support risk management and good practice, the statutory oversight or regulatory authority over these practices within the laboratory services remains limited. This context underscores the importance of strategic coordination and system level strengthening through the BDNLSP. Amongst these are to strengthen coordination among laboratories in different sectors and national agencies, leveraging national expertise including certified personnel in the field of biosafety and biosecurity and collaboration with partners to further enhance Brunei Darussalam's preparedness for emerging biological threats.

7.6 DISEASE AND GENOMIC SURVEILLANCE

The COVID-19 pandemic marked a pivotal turning point in global genomic surveillance, underscoring the importance of timely pathogen characterisation and rapid data sharing for informed public health decisions. In response, Brunei Darussalam established its initial genomic sequencing capacity for SARS-CoV-2, contributing sequence data to the Global Initiative on Sharing All Influenza Data (GISAID) and supporting national and

international surveillance efforts an. Building on this foundation, there are continued expansion of disease and genomic surveillance to support early detection, and advancing cross-disciplinary collaborations to enhance capacity within the One Health scope. In addition, the strengthening of laboratory facility infrastructure and genomic data management including data sharing across relevant sectors will enhance compliance to IHR.

7.7 LABORATORY EMERGENCY MANAGEMENT

A considerable burden on laboratory capacity, human resources, and infrastructure was faced during the surge phases and peaks during the recent COVID-19 pandemic in Brunei, highlighting critical considerations for laboratory emergency management. This was mitigated through rapid mitigation measures including the deployment of mobile laboratories, the implementation of SARS-CoV-2 genomic surveillance, and the engagement of temporary contract laboratory personnel to enable continuity of diagnostic services.

Building on this experience, there is a need for systematic documentation and reviewing response strategies. Such analysis is essential to inform evidence-based decision-making and to strengthen laboratory preparedness through structured response plan including workforce mobilisation, scalable infrastructure, and resilient diagnostic operations for future public health emergencies and contingencies.

7.8 DATA AND INFORMATION MANAGEMENT

The national laboratory system in Brunei for human and animal sector is under the MOH and METI respectively. For MOH, a LIMS was introduced in DLS since 1979 and later transition to Bru-HIMS in 2013. Results are shared and accessible in real-time to clinicians in both government hospitals and health centres, and the Brunei CDC under MOH only. This integrated data platform and enhanced security support analytics provides opportunity for digital adoption to private entities. In comparison to other laboratory entities, LIMS is not available and hence laboratory data management system is manually reported in another format such as excel.

Nevertheless, this presents an opportunity to strengthen the sharing of best practices in data management and to expand information-sharing mechanisms through ongoing digitalisation initiatives. In particular, these efforts may be prioritised to support enhanced genomic surveillance of AMR as an initial step towards operationalising a national One Health approach through the Brunei Darussalam AMR Committee.

7.9 ONE HEALTH AND MULTISECTORAL COORDINATION

The BDNLSP adopts a One Health approach to initiate an initial coordination among laboratories supporting human, animal, and environmental health. Many public health threats, including zoonotic diseases, antimicrobial resistance, food safety risks, and environmental hazards, occur at the human–animal–environment interface and require integrated laboratory systems for timely detection, surveillance, and response. Strengthening multisectoral coordination is therefore essential to ensure an effective and coherent national laboratory response.

Under the NLSP, One Health approach focuses on enhancing cross-sectoral governance, harmonised laboratory practices, and structured collaboration across ministries, agencies, academia, and the private sector. Priority actions include strengthening joint surveillance, improving sample referral and data sharing mechanisms, and promoting interoperable laboratory information systems to support coordinated risk assessment and decision-making. Through these measures, the BDNLSP aims to improve national preparedness, reduce duplication of efforts, and support Brunei Darussalam's commitments under the IHR.

7.10 RESEARCH AND DEVELOPMENT

Research and development are critical enabler for strengthening evidence-based laboratory services and advancing public health priorities in Brunei Darussalam. The BDNLSP recognises the importance of leveraging existing laboratory capacities, data assets, and sectoral expertise to support applied research, innovation, and knowledge generation relevant to public health, and national development goals.

Under this thematic area, the BDNLSP focuses on strengthening collaborative, multisectoral laboratory- based research through structured partnerships among government laboratories, academic institutions, and relevant stakeholders. Priority actions include promoting joint analysis of laboratory and surveillance data, supporting operational research that addresses national public health needs, and facilitating the translation of laboratory findings into policy-relevant evidence.

The BDNLSP also emphasises the need for coordinated research governance and responsible data use, ensuring that laboratory generated data are utilised in a secure, ethical, and impactful manner.

PART IV
IMPLEMENTATION,
MONITORING &
EVALUATION
FRAMEWORK

8. GOVERNANCE AND ACCOUNTABILITY MECHANISM

The BDNLSP is implemented through a structured governance via the NTLWG BDNLSP and the Terms of Reference (TOR) of this NTLWG encompasses accountability mechanism that ensures sustainable oversight, and measurable outcomes across the national laboratory system. This framework establishes decision-making pathways, and reporting structures to support implementation across the laboratory system. The mechanism enables transparency, strengthens intersectoral collaboration, and promotes data-driven decision-making, ensuring that progress is systematically monitored and implementation challenges are addressed in a timely manner.

8.1 BDNHLS COMMITTEE

The BDNHLS Committee serves as the central oversight body for BDNLSP 2026- 2030 as part of its governance function, ensuring accountability across all sectors.

The progress reports of BDNLSP will be reported to the Committee at least on an annual basis, or as required. The annual reporting process enables the committee to review performance, provide strategic guidance, and recommend corrective actions where necessary.

8.2 TECHNICAL WORKING GROUP FOR BDNLSP MEMBERS

As outlined in the TOR, members of the TWG BDNLSP are responsible for the implementation and systematic monitoring of the activities in BDNLSP through a formalised performance review process. The reports are generated based on updates on the implementation of planned activities, progress against established key performance indicators (KPIs), and any challenges or gaps encountered.

Any changes to action plans, implementation timelines, or priority activities shall be endorsed at the technical level through the members and formally reported to the BDNHLS Committee for approval.

The members and Terms of Reference for the NTLWG can be found in Appendix I and Appendix II.

9. IMPLEMENTATION PLAN

The Implementation Plan translates the BDNLSP 2026–2030 into structured, time-bound activities across ten (10) thematic areas, twenty-one (21) sub-strategies, and forty-nine (49) implementation activities, serving as the primary operational guide for all stakeholders involved in strengthening the national laboratory system.

The plan was developed through a consultative process with RPHLN experts including the 2nd stakeholder BDNLSP workshop conducted in December 2025. In this workshop, respective stakeholders discussed defined plans of action, outputs, timelines, key performance indicators (KPIs), and proposed resource allocation for each activity. The following section presents the plans of action by thematic area for information purposes. Detailed outputs, timelines, KPIs, and proposed budgets for each activity are captured in a dedicated matrix, provided as a supplementary document (Supplementary 1) to this plan.

9.1 PLAN OF ACTIONS

9.1.1 THEMATIC 1: GOVERNANCE AND WORKFORCE DEVELOPMENT/ T1

STRATEGY 1: S1 STRENGTHEN WHOLE-OF-NATION GOVERNANCE AND LEADERSHIP TO SAFEGUARD PUBLIC HEALTH SECURITY FOR A RESILIENT LABORATORY SYSTEM	
SUB-STRATEGY / SS	ACTIVITY / A
SS1 EFFECTIVE GOVERNANCE WITH DEFINED LEADERSHIP STRUCTURE AND MULTISECTORAL COLLABORATION	A1. Participate in RPHL GLLP Training of Trainers and Mentors programme
SS2 STRENGTHENING WORKFORCE SUSTAINABILITY AND RESILIENCE	A1. Conduct inter-agency cross-training in genomics and bioinformatics (UBD)
	A2. Establish succession planning framework for staff retention

STRATEGY 3: S3 STRENGTHEN NATIONAL LABORATORY COORDINATION AND READINESS FOR PUBLIC HEALTH THREATS	
SUB-STRATEGY / SS	ACTIVITY / A
SS1 STRENGTHENING PANDEMIC PREPAREDNESS THROUGH MULTI- SECTORAL COLLABORATION	A1. Establish TWG for multi-sectoral laboratory preparedness
	A2. Develop database of trained personal from relevant agencies for pandemic preparedness
	A3. Develop mobilisation protocol for inter-agency deployment
	A4. Conduct refreshers course/training on specific public health testing needs (e.g., PCR, sample packaging, sampling methods, etc - this will be disease-specific)
	A5. Develop a shared laboratory inventory of specific equipment and consumables for outbreaks and pandemic
	A6. Assess suitability of pre-existing laboratory facilities for shared use during pandemic/outbreak.
	A7. Conduct simulation exercise workshop for laboratory pandemic preparedness.
SS2 PROMOTING CONTINUOUS PROFESSIONAL GROWTH TO ENHANCE TECHNICAL COMPETENCY, LEADERSHIP CAPACITY AND SYSTEM-WIDE PREPAREDNESS FOR PUBLIC HEALTH EMERGENCIES.	A1 Utilising designated collaborating centres and regional reference laboratories for public health referral laboratory capacities

STRATEGY 4: S4 STRENGTHEN THE LABORATORY REGULATORY FRAMEWORK FOR A RESILIENT, SAFE AND HIGH-QUALITY NATIONAL SYSTEM	
SUB-STRATEGY / SS	ACTIVITY / A
SS1 STRENGTHENING LABORATORY GOVERNANCE AND QUALITY	A1. Transition from international accreditation body to the national accreditation body for ISO15189 and ISO17025 (BDSAC)
	A2. Develop Inter-laboratory data sharing *Similar to T8 S1 SS1 (refer 9.8)
SS2 ESTABLISHING AN OPERATIONAL LABORATORY REGISTRATION AND LICENSING OFFICE TO MONITOR LABORATORIES NATIONWIDE.	A1 Set up a centralised registration body which encompasses audit and inspection mechanisms for private laboratories (in compliance with Private Healthcare Order, Public Health (Food) Act (Chapter 182), Infectious Diseases Act in Brunei (Chapter 204 the Animal (Disease and Quarantine) Act (Chapter 254), and the Poisons Act (Chapter 114) 1.1 Draft a working paper on the setting up of a central registration office for private laboratories. 1.2 Review and endorsement of working paper by BDNHLS committee 1.3 Launching of the registration body.

9.1.2 THEMATIC 2: FINANCING, PROCUREMENT AND SUPPLY CHAIN/ T2

STRATEGY 1: S1 STRENGTHEN WHOLE-OF-NATION GOVERNANCE AND LEADERSHIP TO SAFEGUARD PUBLIC HEALTH SECURITY FOR A RESILIENT LABORATORY SYSTEM	
Sub-Strategy / SS	Activity / A
S1 ENSURING FINANCIAL SUSTAINABILITY AND RESILIENCE BY EFFICIENT AND EFFECTIVE PROCESSES.	A1. Conduct best practices training session on 'Laboratory Procurement and Supply Chain Management'

STRATEGY 2: S2 STRENGTHEN AND OPTIMISE LABORATORY TESTING TO PROVIDE INTEGRATED, RELIABLE, ACCESSIBLE, HIGH-QUALITY SERVICES SUPPORTING PUBLIC HEALTH AND ONE HEALTH PRIORITIES.	
Sub-Strategy / SS	Activity / A
SS1 STRENGTHENING PROCUREMENT WORKFLOW AND BUDGET	A1 Conduct best practices training session on 'Laboratory Procurement and Supply Chain Management'

9.1.3 THEMATIC 3: NATIONAL DIAGNOSTIC NETWORK/ T3

STRATEGY 2: S2 STRENGTHEN AND OPTIMISE LABORATORY TESTING TO PROVIDE INTEGRATED, RELIABLE, ACCESSIBLE, HIGH-QUALITY SERVICES SUPPORTING PUBLIC HEALTH AND ONE HEALTH PRIORITIES	
Sub-Strategy / SS	Activity / A
SS1 STRENGTHENING DIAGNOSTIC SERVICES	A1. Conduct specialised training for sequencing and bioinformatics *Similar to T1 S1 SS2 A1 (refer 9.1)

9.1.4 THEMATIC 4: QUALITY AND SAFETY MANAGEMENT SYSTEM/ T4

STRATEGY 2: S2 STRENGTHEN AND OPTIMISE LABORATORY TESTING TO PROVIDE INTEGRATED, RELIABLE, ACCESSIBLE, HIGH-QUALITY SERVICES SUPPORTING PUBLIC HEALTH AND ONE HEALTH PRIORITIES	
Sub-Strategy / SS	Activity / A
SS1 FOSTERING STRATEGIC INTERNATIONAL COLLABORATIONS WITH RECOGNISED INSTITUTIONS, PARTNERS AND SUPPLIERS TO ENHANCE WORKFORCE COMPETENCY, STRENGTHEN QUALITY SYSTEMS AND ADVANCE NATIONAL CAPABILITIES.	A1. Attend RPHLN Training for trainers' workshop for QMS.
	A2. Conduct QMS training for Quality Officer /Manager in relevant agencies by certified QMS trainers and RPHLN SMEs
	A3. Participate in RPHL Network community of practice in QMS
	A4. Participate in RPHLN Twinning Program for National Proficiency Testing (PT) Panel Production and ISO 17043 accreditation
	A5. Participate a program to support interlaboratory comparison (studies facilitated by RPHLN
	A6. Secure PT material providers from ISO17043 accredited laboratories within RPHLN
	A7. Participate in Singapore Food Agency Twinning program for food laboratories
SS2 STRENGTHENING THE QUALITY MANAGEMENT SYSTEM THROUGH COLLABORATION, PEER-TO-PEER SUPPORT AND SHARED LEARNING AMONG LABORATORIES.	A1. Develop a structured QMS training curriculum for continuous professional development (CPD).
	A2. Establish an in-country QMS training hub through development of subject matter experts.
	A3. Develop secondment program between ministries and departments to promote the sharing of good practices (MOH)
	A4. Develop a mechanism for laboratories to share laboratory resources (for example: reference materials or consumables) within the country *With reference to T1 S3 SS1 A5: Develop a shared laboratory inventory of specific equipment and consumables for outbreaks and pandemic (refer 9.1)
	A5. Create a centralised monitoring system for vendor/supplier performance and serve as a reference point for other labs
	A6. Develop National Proficiency Testing Panel Program for Bacteriology led by UBD
	A7. Develop Brunei Darussalam QMS roadmap

9.1.5 THEMATIC 5- BIORISK MANAGEMENT/ T5

STRATEGY 1: S1	
STRENGTHEN WHOLE-OF-NATION GOVERNANCE AND LEADERSHIP TO SAFEGUARD PUBLIC HEALTH SECURITY FOR A RESILIENT LABORATORY SYSTEM	
Sub-Strategy / SS	Activity / A
SS1 STRENGTHENING PERSONNEL TO BE MORE SKILLED AND COMPETENT IN BIOSAFETY AND BIOSECURITY REQUIREMENTS AND PROGRAM.	A1. Conduct Biorisk Management training facilitated by IFBA certified personnel in Biorisk Management.
	A2. Conduct Biorisk Assessment training facilitated by IFBA certified personnel in Biological Risk Assessment.

STRATEGY 2: S2	
STRENGTHEN AND OPTIMISE LABORATORY TESTING TO PROVIDE INTEGRATED, RELIABLE, ACCESSIBLE, HIGH-QUALITY SERVICES SUPPORTING PUBLIC HEALTH AND ONE HEALTH PRIORITIES	
Sub-Strategy / SS	Activity / A
SS1 ENHANCING BIOLOGICAL WASTE MANAGEMENT PRACTICES.	A1. Conduct training on verification study for biological waste decontamination protocol.
SS2 ENHANCING THE BIORISK MANAGEMENT SYSTEM WITH RELEVANT AGENCIES AND PARTNERS	A1. Establish reporting mechanism of Biorisk assessment to the national biosafety and biosecurity committee.
	A2. Incorporate Biosafety and Biosecurity modules in University Curricula in health and science programs by using WHO Biosafety mapping tools tailor to curriculum content.
	A3. Participate in the RPHL Twinning Program on Biorisk Management System (6-month program).

9.1.6 THEMATIC 6: DISEASE AND GENOMIC SURVEILLANCE/ T6

STRATEGY 3: S3	
STRENGTHEN NATIONAL LABORATORY COORDINATION AND READINESS FOR PUBLIC HEALTH THREATS	
Sub-Strategy / SS	Activity / A
SS1 ENHANCING REAL-TIME DISEASES SURVEILLANCE AND REPORTING FRAMEWORK.	A1. Develop Inter-laboratory data sharing using an electronic communication mechanism between different agencies/ministry. *Similar to T1 S1 SS2 A2 (refer 9.1) and T8 S1 SS1 A1 (refer 9.8)
	A2. Participate in RPHL training in Pathogen Genomics for Public Health Laboratories
	A3. Conduct specialised training for sequencing and bioinformatics (Similar to T3 S2 ss1 A1 – refer 9.3) with relevance to data management and epidemiological analysis (Similar to T1 S4 SS1 A2 – refer 9.1).
SS2 REINFORCING LABORATORY CAPACITY AND INFRASTRUCTURE FOR BETTER PANDEMIC AND EPIDEMIC RESPONSE	A1 Create a national registry of maintenance and calibration of available BSL-2 and BSL-3 laboratories
SS3 STRENGTHENING CROSS-SECTORAL COLLABORATION TO IMPROVE EARLY DIAGNOSTIC CAPABILITIES FOR EMERGING INFECTIOUS DISEASES.	A1 Participate in regional and international surveillance efforts collaboration with WHO and international partners on AMR Tricycle Project.
	A2. Expand international laboratory referral arrangements to enhance diagnostic capabilities for emerging infectious diseases.

9.1.7 THEMATIC 7: LABORATORY EMERGENCY MANAGEMENT/ T7

STRATEGY 3: S3 STRENGTHEN NATIONAL LABORATORY COORDINATION AND READINESS FOR PUBLIC HEALTH THREATS	
Sub-Strategy / SS	Activity / A
SS1 IMPROVING STRATEGY IN PREPAREDNESS AND RESPONSE DURING PUBLIC HEALTH EMERGENCIES	A1. Create a response plan that mitigates power, ICT, and resource risks via national collaboration for biohazard sample hosting during major disruption.

9.1.8 THEMATIC 8: DATA AND INFORMATION MANAGEMENT/ T8

STRATEGY 1: S1 STRENGTHENING WHOLE-OF-NATION GOVERNANCE AND LEADERSHIP TO SAFEGUARD PUBLIC HEALTH SECURITY FOR A RESILIENT LABORATORY SYSTEM	
Sub-Strategy / SS	Activity / A
SS1 STRENGTHEN DISEASE SURVEILLANCE AND RESEARCH CAPABILITIES	A1. Develop a secure digital data sharing platform (dashboard) for genomic and bioinformatics services.
	A2. Standardise digitalised LIMS for non-clinical laboratory facility.

9.1.9 THEMATIC 9: ONE HEALTH AND MULTISECTORAL COORDINATION/ T9

STRATEGY 1: S1 STRENGTHENING WHOLE-OF-NATION GOVERNANCE AND LEADERSHIP TO SAFEGUARD PUBLIC HEALTH SECURITY FOR A RESILIENT LABORATORY SYSTEM	
Sub-Strategy / SS	Activity / A
SS1 STRENGTHEN CROSS-SECTORAL COLLABORATION AND ENGAGEMENT WITH RELEVANT STAKEHOLDER	A1. Develop a harmonised multi-sectoral term of reference (TOR) for sample collection and data sharing for AMR surveillance.
	A2. Establish and operationalise a multi-sectoral laboratory data dashboard for priority diseases in Brunei Darussalam include zoonotic.

9.1.10 THEMATIC 10: RESEARCH AND DEVELOPMENT/ T10

STRATEGY 1: S1 STRENGTHENING WHOLE-OF-NATION GOVERNANCE AND LEADERSHIP TO SAFEGUARD PUBLIC HEALTH SECURITY FOR A RESILIENT LABORATORY SYSTEM	
Sub-Strategy / SS	Activity / A
SS1 STRENGTHEN NATIONAL RESEARCH CAPACITY	A1. Conduct a joint data analysis for public health-related research paper.

10. MONITORING & EVALUATION METHODOLOGY

10.1 KEY PERFORMANCE INDICATORS

KPIs are critical components of the Monitoring and Evaluation (M&E) framework, enabling the tracking of progress of action plans against strategic objectives, assessment of implementation effectiveness, and identification of gaps or bottlenecks. Importantly, KPIs provide measurable benchmarks that link planned activities to defined yearly timelines, ensuring that implementation remains on schedule.

10.2 RESOURCE MOBILISATION AND UTILISATION

The framework also assesses resource mobilisation and utilisation, allowing TWGs to evaluate whether financial, human, and technical resources are being efficiently deployed to achieve intended outcomes. Both are essential to ensure that actions are timely implemented and sustained over time.

10.3 REVIEW PROCESS

A structured review process is established to ensure effective oversight of implementation and progress under the BDNLSP. Scheduled monitoring activities are complemented by a formalised performance review process conducted on a mid-term and annual basis, where required.

This process provides a systematic platform to assess progress against planned outputs and outcomes, evaluate implementation challenges, and review the feasibility and prioritisation of action plans based on evidence, performance data, and emerging national needs. Findings from these reviews inform adaptive management, enabling timely adjustments to strategies and implementation approaches as required.

10.4 DOCUMENTATION

Monitoring and evaluation findings, including implementation progress, performance indicators, and review outcomes, will be documented and consolidated as a supplementary report. This document is maintained as a living document, allowing for

updates and revisions to action plans, timelines, and implementation priorities in response to the outcomes of the review process and evolving national and operational needs. It serves as a reference to support transparency, accountability, and informed decision-making.

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APPENDICES

APPENDIX I | Technical Working Group for BDNLSP 2026 - 2030

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Fisheries Officer

Department of Fisheries

Ministry of Economy, Trade and Industry

Roles and Responsibilities	Chairperson: • Provides strategic direction and leadership to the TWG. • Facilitates meetings and ensure consensus-based decision-making. • Ensure alignment with national and international frameworks. • Approve proposals, reports and key outputs of the TWG. Secretariat: • Coordinates and documents meetings (agenda, minutes, follow-ups). • Acts as liaison between members and stakeholders. • Manage logistics and records. • Supports reporting and technical inputs. Technical Members: • Provide technical expertise. • Oversee the development of the BDNLSP. • Conduct situational assessments, review policies and frameworks. • Define vision and strategy, contribute to drafting, participate in consultations, support implementation, and facilitate regional collaboration.
Scope of Work	• Conduct a situational and gap analysis of the national laboratory system. • Develop the NLSP including goals, objectives, indicators and timelines. • Recommend sustainability mechanisms including governance, workforce development, financing and digital transformation. • Monitor implementation progress and recommend corrective actions.
Meeting Frequency	• Meetings will be held at least biannually or as needed. • Emergency meetings may be convened by the Chair with the Secretariat's agreement.

Reporting and Accountability	• The Technical Working Group reports to the BDNHLS Committee. • Summaries of discussions and recommendations must be submitted within two weeks after each meeting.
Review and Amendments	The Terms of Reference will be reviewed annually or as required to reflect evolving national and regional priorities.

APPENDIX III | Contributors

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APPENDIX IV | Subject Matter of Experts

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Thailand

1. T1 GOVERNANCE AND WORKFORCE DEVELOPMENT

STRENGTH (7)	WEAKNESS (10)	OPPORTUNITY (4)	THREAT (8)
S1 (S1+S3+S4). Effective governance with defined leadership structure supported by BDNHLS. 5, 7, 33(q), 27, 33(e), 33(w), 33(i), 33(v), 43, 56 ~~S1. Strong governance, leadership commitment, and dedicated committees/units reinforce accountability, safety, and multi-sectoral collaboration.~~ 5, 7, 33(q), 33(ae) ~~S3. Effective governance structures, outsourcing frameworks, inspections, structured project management, and improvement initiatives demonstrate strong organizational systems.~~ 33(e), 33(w), 33(i) ~~S4. Strategic planning (2019–2023), ensures service accessibility, facility upgrades (e.g., BSL3), and future-oriented governance.~~ 27, 33(v) S8. Proper organizational structure defining the lines of authorities and responsibilities for key staff. 43	W1. HR challenges include staff shortages, due to retirements/unfilled posts, and specific gender requirements based on task, burnout, and resistance to changes. 33(f), 33(i), 33(u), 33(v), 24, 54, 53, 51	O1. International support, integrated strategies, and global partnerships strengthen preparedness and emergency readiness. 28	~~T1 T2.~~ Absence of the updated/reviewed 5-year Strategic Plan under the Ministry of Health¹¹ Department Strategic Plan not aligned with Ministry Strategic Plan because Strategic Plan has lapsed
S2 Early engagement with strategic planning (SP 2026–2030) inclusive of HR	W2. Insufficient on-the-job training. 21, 22, 23, 24 (<i>One Health function, unmatched</i>)	O2. Multisectoral collaboration. 48, 50, 56, 57, 58	T2. Workforce threats include retirements without succession planning, prolonged

STRENGTH (7)	WEAKNESS (10)	OPPORTUNITY (4)	THREAT (8)
ensures alignment of departmental goals with national health strategies. ^{33(v),45} S. DLS's commitment to enhancing human resource performance aligns with the Ministry of Health's (MOH) broader goals, ensuring consistency and support across the healthcare system. ^{33(v)} S. Adequate number of staff to undertake the laboratory work. ⁴⁵	qualifications, GLP, biosafety, biosecurity), and experienced hire (management system)		vacancies, causing poaching(external), high turnover and recruitment delays. ^{33(e), 33(i), 33(v), 33(p), 33(ac)}
S3. <u>Cross-departmental</u> collaboration improves service quality, coordination, and rational resource use. ^{33(i), 33(v)}	W3. Lack of systemic assessment and monitoring of staff competencies in biosafety and biosecurity. ^{5,7}	O3. Expand and standardise workforce training through vendor support, Ministry-led initiatives (for example PSU training on IR system), regional or international partnerships, digital platform, overseas training and continuous education to improve staff competency and staff readiness. ^{1, 5, 6, 8, 12, 17, 28, 29, 33(f), 33(v)}	T3. Requirement of specialised trainings depends on availability of training program and expert. ^{24, 25}
S4. MOH and MPRT allocate funding to run ongoing programs (local and overseas) to strengthen staff capacity through courses and workshops — e.g., biosafety/biosecurity training and Medical Assessor training. ^{5, 7, 33(i), 33(v)}	W4. Lack of long-term strategies for staff training in sub-specialist areas including outbreak planning and preparedness. ^{7,22}	O5. Support workforce sustainability through succession planning (CSLP), recruitment, retention, recognition, and team-building initiatives. ^{33(i), 33(v)}	T4 ~~W3~~. No available academic training programmes or curricula for biosafety and biosecurity for pre-service (academic) or in-service training. ⁵
S5. Staff suggestions are considered and acted upon, reflecting	W5 Lack of dedicated and adequately trained staff for		T5 No national body in charge of laboratory

STRENGTH (7)	WEAKNESS (10)	OPPORTUNITY (4)	THREAT (8)
engagement in professional development, welfare, and career discussions (<i>muzakarah</i> , meeting, town hall, employee feedback). ^{33(f)}	specialised tasks, leading to multitasking , with no surge capacity plan in place for outbreaks and emergencies.” ^{23,36, 46, 54,53}		inspection/audit for laboratory registration and licensing and laboratory accreditation. ⁸ (From same thematic area - changed to Threat)
S6 Demonstrated competence on specialised fields through systematic assessment. ^{1, 4, 19, 20, 55}	W6. Space allocated is not sufficient and not properly maintained to perform the work without compromising the quality and safety of staff [Plant Pathology Lab]. ^{51,33(u)}		T6. Private labs are not mandatory for licensing as the private healthcare order has not been enacted ³⁶ .
S7. (Experienced hires) Specialised technical personnel working in Veterinary Laboratory Services have necessary qualifications to fulfil their responsibilities while others have picked up working knowledge through being associated with laboratory, farm, and field extension work. ²⁵	W8. Sequencing technology available but not in use (not functional, no kits, no experienced operator...) and/or some access to external sequencing services ²²		T7. Threats include constrained lab space, equipment maintenance delays, and infrastructure project setbacks which risk reliability and timely diagnostic services. ^{33(u), 33(e), 33(i), 33(v)}
	W9. Transportation of specimens: there is no back-up dispatcher and transport problem on occasion ⁴² Reason: There is not enough staff to maintain a reliable sample transportation. Currently there is only one driver and one car and there is no back-up. [MOVED FROM SAMPLE REFERRALS AND TRANSPORT		T8. Threats include reliance on a single courier, absence of regulations for infectious material transport (national and cross-border), and delays in finalizing MoUs for referral testing. ^{27, 33(f)} [VALIDATED 27 Sep 2025] [From Group B - Sample Referrals and Transport System]

STRENGTH (7)	WEAKNESS (10)	OPPORTUNITY (4)	THREAT (8)
	SYSTEM]		
	W10. increased demand for POCT and phlebotomy services that stretch resources.^{33(d), 33(i), 33(u), 33(v)} Note: not enough staff [Moved from Group B]		
	W13. Competing Priorities: DLS must balance between routine diagnostic demands and system-level initiatives such as the National EQA programme.^{34, 35}		

2. T2 FINANCING, PROCUREMENT AND SUPPLY CHAIN MANAGEMENT

STRENGTH (8)	WEAKNESS (6)	OPPORTUNITY (4)	THREAT (7)
S1. Functional forecasting and procurement systems, compliant with financial regulations, ensuring reliable equipment availability and servicing. ^{1, 4, 7}	W1. Lack of forecasting system on usage of consumables and reagents. ^{42, 54} [combined W1 & W2]	O1. Streamlined procurement process under TAFIS 2.0. ^{33(ff), 33(i), 55}	T1 Supply chain disruption due to reagent recalls, faulty consumables and global shortage. ^{45, 53, 55} [VALIDATED] [combined with T2, T3& T4]
S2. Efficient budget utilisation (close to 100%) achieved, with proactive planning already in place for 2025/2026. ^{33(ff)}	W2. Delays in issuing purchase orders , especially during COVID-19 and TAFIS 2.0 transition. ⁵⁵	O2. Improve financial sustainability through ~~new costing models, revenue schemes, and broader revenue diversification~~ (PPPs, corporatisation and outsourcing ~~National Health Accounts~~). ^{33(ff), 33(v)}	T3 ~~T1~~ . Financial threats include dependency on specific budget lines, inflationary pressures, and resource constraints that undermine sustainability of upgrades and critical projects. ^{33(f), 33(v)} [Adhoc procurement, RKN)
S3. National funds available for pandemic preparedness. ²⁷	W3. Financial issues especially regarding the need of high-end equipment and maintenance contracts. ^{53, 55}	O3. Secure long-term financing for systematic preventive maintenance and equipment upgrades. ⁵⁵	T4. Budget allocation requested may not necessarily be granted ^{15, 14, 25, 24,} [VALIDATED]
S4. Implementation of TAFIS 2.0 strengthens financial management, transparency, and budget execution within DLS. ^{33(v)} [VALIDATED]	W4. Sequencing technology available but not in use (not functional, no kits, no experienced operator...) and/or some access to external sequencing services ²² [VALIDATED]	O4. Establish long-term service contracts with external providers. ⁵⁵ [Moved from Group B. REASON: CONTRACT NEEDS BUDGET]	T5. High Cost for equipment maintenance and servicing. ⁷ [VALIDATED]
S5. Reagents and consumables are under contract and delivered on a timely basis. There are also reserves in case of deficit or need replacement for	W5. The disposal of equipment, laboratory apparatus, and accessories is delayed due to ongoing decommissioning procurement, compounded by the		T6. SAC Accreditation status has been suspended with effect from 09 April 2025, pending clearance of the outstanding payment. ⁴¹

STRENGTH (8)	WEAKNESS (6)	OPPORTUNITY (4)	THREAT (7)
compromised reagents.⁵⁴ [VALIDATED]	lack of a designated storage area for segregating defective or unused equipment.^{4, 45} W5. Disposal of equipment, laboratory apparatus and its accessories take longer time to process.⁴⁵ Reason: decommissioning of equipment is under procurement [Moved from Group B] W11. Lack of designated storage area for segregation of defective or equipment not in use. ⁴ [MOVED FROM QUALITY MANAGEMENT SYSTEM]		
S6. Digital procurement tracker and inventory management system managed by designated personnel and updated for easy access and tracking.^{53, 55} Consumables and reagents tracked via <i>Univentory</i>; chemical store and consumables managed by designated personnel. Items are cross-checked against	W7. Poorly maintained facilities, unresolved infrastructure repairs, dependency on vendors [Moved from Group B] [combined with W10]		T7. Disposal of equipment, laboratory apparatus and its accessories takes longer time to process.⁴⁵

STRENGTH (8)	WEAKNESS (6)	OPPORTUNITY (4)	THREAT (7)
purchase orders before acceptance. Air-conditioned storage room ensures proper storage conditions.⁵⁵ S7. Invoice/Delivery Order/Purchase Order documents are filed. Digital procurement tracker is kept up-to-date to allow for easy access and tracking.⁵³ [VALIDATED - combined]			
S7. No hindrance on budget.⁴⁵ [VALIDATED]			
S8. Procurement and disposal follow established financial regulations.⁵⁵ [VALIDATED]			

3. T3 NATIONAL DIAGNOSTIC NETWORK

STRENGTH (3)	WEAKNESS (7)	OPPORTUNITY (1)	THREAT (1)
S1. Functional referral laboratory system in both human & animal health. ^{5, 6} (Note: clinical lab is 24/7) [VALIDATED]	W1. Peripheral health facilities currently lack access to rapid molecular diagnostics such as GeneXpert. ⁶ [VALIDATED]	O1 Strengthen diagnostic networks through active participation in regional laboratory initiatives/ programs and other collaboration models^{15, 33(i), 42,15,42}	T1 The laboratory is not able to perform the sequencing of resistant strains of interest and does not have them sequenced externally¹⁵ [VALIDATED]
S2. System has capacity for ≥5 WHO-defined core tests and ongoing investments in new/upgraded national referral human health laboratories. ^{27, 33(v)} [VALIDATED]	W2. There is only one veterinary laboratory in Brunei Darussalam which offers limited services for the diagnosis of animal diseases and the testing of livestock products for physical quality parameters.²⁵ [VALIDATED]		
S3. There is ready access to a number of regional and OIE reference laboratories offering a complete range of tests.²⁵ [VALIDATED]	W3 Regularly face electricity interruption, No UPS available, and regularly face water shortage.⁴⁵ [VALIDATED-DWS]		
	W4 Sequencing technology available but not in use (not functional, no kits, no experienced operator...) and/or some access to external sequencing services²² [VALIDATED]		
	W5. Collaboration with other laboratories in the country - Current status: Laboratory never had or does not currently have any active collaboration with other laboratories in the AMR field¹⁵ [VALIDATED- Transferred from O2		

STRENGTH (3)	WEAKNESS (7)	OPPORTUNITY (1)	THREAT (1)
	W6. Lack of diagnostic capacity through molecular testing expansion, HPV, allergy panels, and Disease X. ^{6, 33(e), 33(f), 33(v)}		
	W7. Dependence on External/ Overseas Labs: Limited in-country advanced testing capacity increases turnaround time for some diagnostics. ^{6,5} [Moved from Governance]		

4. T4 QUALITY AND SAFETY MANAGEMENT SYSTEM

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
S1. Strong EQA/IQC participation with excellent performance across core tests, standardized SOPs, and quality manager/officers in all labs. 1, 4, 5, 7, 8, 33(u), 33(f) S18. The laboratory uses several reference strains which are adapted to the bacterial species tested for AST to check the quality of its assays and tests them at least weekly or each time the AST is conducted¹⁵ S19. The laboratory participates successfully, each year, to one or several proficiency tests on AST, organized by an international reference laboratory¹⁵ S11. Monitoring performance by comparison with results of other laboratories through participation in proficiency testing¹³ S24. Planned participation of various PT programs and results for 2024-2025 participation were generally satisfactory. Outliers were addressed with root-cause investigation and	W1. breakdown of communication between labs and clinicians . 33(e), 33(f), 33(gg)	O4. Alignment and collaboration with RPHL QMS Roadmap (Advised by RPHL Network): - Short-term (0–1 year): Maintain ISO 15189/17025 compliance, build national quality indicators, and initiate training in PT sample preparation and auditing. - Medium-term (1–3 years): Operationalise PSABD as the national accreditation body, appoint a National Quality Manager, and develop national statistical capability for PT programmes. - Long-term (3–5 years): Achieve ISO/IEC 17043 accreditation and establish an in-country QMS training institute or regional partnership centre. 34, 35 [SS✓]	T3. Underreporting of incidents by clinicians*; weak hemovigilance follow-up, and compliance challenges with biosafety, blood donation QC, and blood donation screening protocols. 33(v), 33(p), 33(i) *Refer to as clients [SS✓]

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
planned corrective action.¹⁹ [VALIDATED] [COMBINATION S1+S18+S19+S11+S24] [SS✓]			
S2. High compliance with turnaround times, critical value notification, inter-laboratory comparisons, and corrective actions for non-conformances. 33(u), 33(e), 33(i), MOH IR MRM (2024) [SS✓]	W6. Laboratory needs to prepare a flow process in <u>handling complaints</u>¹³ (No procedure in handling the complaints) [COMBINED WITH ALL SOP/PROCEDURES] [VALIDATED] W35. ~~W27. Q8.~~ Need to establish procedure for <u>improvement</u>¹³ COMBINE WITH W6 (MOVED FROM OPPORTUNITY) W37. ~~W29. Q10.~~ Need to identify <u>environment conditions to be monitored</u> then have SOP and record for it¹³ COMBINED WITH W6 W44. ~~W6.~~ Need a proper procedure on how to attend to situations on overloaded, mishandled or poorly functioning equipment to be taken	O14. Engagement with SAC-SINGLAS on laboratory accreditation.⁴⁵ [SS✓]	T6. BME* is responsible for managing a large inventory of critical equipment across multiple facilities. Due to their extensive workload and the need to prioritize urgent cases, tracking and scheduling preventive maintenance for all equipment, including the VITEK2-Compact, has become increasingly challenging.⁴⁰ *Outside the department [SS✓]

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
	out of service, isolated and not reused until verified that it performs correctly. The effect of such defective equipment shall be investigated and management of nonconforming work initiated ¹³ COMBINED WITH W6 [VALIDATED] W45. ~~W7~~. Need SOP to identify and address laboratory activities or results of activities that do not conform with its own procedures or agreed customer requirements ¹³ COMBINED WITH W6 [VALIDATED] W63.No defined protocol or timeframe for pipette calibration ⁵⁵ W65. ~~W27~~. The available laboratory SOP for testing is not updated/reviewed regularly. [Plant Pathology Lab].⁵¹ [VALIDATED] COMBINED WITH W6 W67. ~~W29~~ ~~W25~~. ~~O9~~. To draft No SOP for reporting of results¹³ [VALIDATED]		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
	~~W69, W31, W27, O11.~~ To draft SOP on how samples are maintained or kept¹³ [COMBINED WITH W67] COMBINED WITH W6 (MOVED FROM OPPORTUNITY) ~~W70.~~ Lack of structured internal for <u>equipment disposal</u> (dependent on financial regulations). 55 [VALIDATED, COMBINED WITH OTHER SOP ISSUE] COMBINED WITH W6 <u>Rephrased Statement:</u> Absence of laboratory procedures such as on complaints, improvement, environmental monitoring, equipment management, non-conformances, pipette calibration, result reporting, and sample storage. There is no policy in place on procedure review frequency. [COMBINED W6+W35+W37+W44+W45+W63+W65+W67+W69+W70] [SS✓]		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
S3. Blood safety assured through screening, surveillance, corrective/preventive actions, and donor care. ^{33(i), 33(p)} [SS✓]	W7. control of data and information management not practised¹³ [SS✓]	O16. Outsourcing of phlebotomy, external partnerships*, is well received by Minister of Health. ^{33(f), 33(w)} *Vendors [SS✓]	T7. Scored 75% for assessment of Facility, whereby the laboratory building and infrastructure is generally in medium condition, and sometimes face electricity interruption and water shortages.⁴² *Under the management of Estate [SS✓]
S4. Longstanding ISO 15189 Accreditation: DLS laboratories (RIPAS and district hospitals) have successfully maintained ISO 15189 accreditation since 2011, demonstrating consistency in quality and competence. ^{34, 35} S9. The team leader reviewed the laboratory's documentation on their quality management system and found that the quality system was quite robust and any requested documents for examination were readily traceable. The assessment team opined that the laboratory had met the requirements of ISO/IEC 17025:2017 and SAC-SINGLAS guidelines. ⁹ S10. Extracted form Article "Kementerian Kesihatan terima	W8. Have not done risk assessment associated with laboratory activities¹³ [SS✓]	O17. Department of Healthcare Technology is implementing BruHIMS 2.0 and development of mobile application (BloodKad). ^{33(i), 33(v)} *Under different department [SS✓]	T9. Recurring pre-analytical issues involving specimen collection and handling such as specimen contamination, ongoing mislabelling of specimen.^{33(e), 33(f), 33(gg)} *Caused by outside of the department example: nurse in the wards collecting samples in wrong tubes [SS✓]

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
pengiktirafan Akreditasi ISO 17025 SAC-Singlas, Singapura” on Page 12: <i>“Dengan penganugerahan Akreditasi ISO 17025, ia menunjukkan bahawa Perkhidmatan Makmal (Saintifik) telah diiktiraf sebagai sebuah perkhidmatan yang mempunyai kompetensi dalam melakukan aktiviti pengujian makmal yang dijalankan dan sistem pengurusan kualiti makmal yang diiktiraf antarabangsa.”</i>¹¹ S23. Council Committee for Laboratory - Medical & Sciences (CCL-MS) has granted the continuation of the accreditation of your organisation to ISO/IEC 17025:2017.¹⁸ S25. The audit team found that the laboratory is in conformance to ISO/IEC 17025:2017 SAC SINGLAS requirements and its management system.²⁰ S37. Department of Laboratory Services holds ISO 15189 accreditation. In addition, the National Virology Reference Laboratory (NVRL) is WHO-accredited as a National Measles and Rubella Laboratory,			

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
supported by ongoing external quality reviews and technical assessments. ^{1, 5, 6, 7, 27, 33(f), 33(i), 33(u), 33(v)} S54. Laboratory is accredited under SAC-SINGLAS for ISO 17025:2017 [COMBINED S4+S9+S10+S23+S25+S37+S54] [SS✓]			
S5. Centralised management of laboratory services: DLS manages laboratory services for government laboratories in all districts, enabling standardisation nationwide. ^{34, 35}	W9. Need to establish procedure for internal audit¹³ [SS✓]	O18. National health screening program (UHC, NCD reduction) is available ^{33(v)} *UHC - Universal Health Coverage	T10. Delay in conducting annual planned preventive maintenance (PPM) by external, repairs for purchased equipment resulting in NCs during ISO audits. ^{4,7,1} ~~W63.~~ Preventive maintenance not systematic (relies on one-off/annual servicing).⁵⁵ *BME [SS✓]
S6. Established Quality Culture: A dedicated Quality Assurance and Patient Safety Unit coordinates QMS implementation. ^{34,35} [SS✓]	W10. The MCL Lab is recommended to improve the investigation on the PT outliers in Coliform/E.coli¹⁹ [SS✓]	O27. A more comprehensive residue analysis program that meets the quality and safety needs should be developed.²⁵ *Reliance to SFA to develop the methodology [SS✓]	T11. Reliance on External Accreditation Bodies: Current accreditation is dependent on SAC (Singapore) and ANAB (USA), which increases cost and reliance on external evaluators. ^{34, 35} [SS✓]
S7. Continuous Improvement Projects: Every year, DLS implements several	W21. Major accidents and adverse incidents are reported, documented,		T12. No Valid PT available - Detection of Worm Ova Eggs by

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
quality improvement initiatives that enhance patient safety and service delivery. 34,35 [SS✓]	investigated, and corrective measures taken. Trends and control measures are not monitored for effectiveness. The documentation is available but not updated regularly.²³ [SS✓]		Flotation Method. PT: 16706/PA.¹⁹ No PT available for Rapid Agglutination Test Detection of Salmonella pullorum Antibodies in Avian - APHA, 08BTF265, In-House Method VLS-SRL-TM-01-ch8, Rev01, 2024. There is in-house monitoring of results based on QC with positive and negative control. Noted there is a plan to participate in PT in the future.¹⁹ PT0114 for enumeration of ova egg dated 04/02/2025 (not satisfactory).¹⁹ There was no proficiency testing undertaken, though control samples are used.²⁵ T17. MIC (Microbiology Laboratory) is currently facing difficulty in identifying a suitable PT provider for Salmonella serotyping that target four (4) specific serotypes, which is the current capability of MIC. Available PT schemes only provide general serotyping of various Salmonella serovars, not the specific ones required. In addition,

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
			the PT provider for TMHS is also not available. ³⁹ [SS✓]
S8. Training and Competency Evaluation: Staff training and competency assessments are conducted regularly, ensuring continual professional development and alignment with ISO 15189 requirements. 34,35 [SS✓]	W24. The unsatisfactory PTs were from 2 accredited tests under MCL (<i>E. coli</i> Coliform MPN and Petrifilm) and 2 unaccredited tests (LCMS Feed and Egg count) which are in process of solving ²⁴ [SS✓]		T13. Laboratory service threats include delayed turnaround times, declining blood collection, and repeated donor complications that may reduce supply levels and donor retention. ^{33(f), 33(r), 33(i), 33(p)} *Dependence on blood donors [SS✓]
S12. Laboratory has a form that records opinions and interpretations ¹³	W26. Water Services Laboratory ~~not~~ ISO17025-accredited accreditation was withdrawn. ⁴⁵ [SS✓]		T16. Service delivery gaps include suspended testing (due to recalls, low inventory, or shipment delays), and QC performance concerns. ^{33(e), 33(h)} *Caused by vendors [SS✓]
S13. The laboratory has sample acceptance criteria for every type of samples submitted for AMR surveillance ¹⁵	W27. Gaps in quality practices, particularly in equipment calibration and preventive maintenance. Informal issue-reporting undermines quality assurance. ⁵⁵ [COMBINE WITH W71] W71. T8. Lack of consistent quality practices may affect credibility of results ⁵⁵ .		T18. Pathology department receives 5-15 carcasses weekly or 20-59 monthly or 240-719 yearly for post-mortem ²² Immunoserology laboratory receives between 10,000 and 50,000 routine samples per year. Lab is involved in surveillance of 1 animal disease and receives 1,000-9,999 samples per year Reason: NUMBER OF SAMPLE DOES NOT

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
			<u>MEET THE REQUIREMENT BY WOA</u> Only a few SOPs describing the method of identification of parasites** causing notifiable disease in animals and/or zoonotic in the region are available in the laboratory and/or the laboratory does not regularly perform (less than once per quarter) these methods²² Conventional PCR technology applied only for <5 genome targets.
S14. The laboratory uses appropriate culture media (selective/non selective) and consumables to cultivate bacterial species involved in the most common animal infectious diseases & food safety ¹⁵	W28. The laboratory (Plant Pathology Lab) has not been certified ISO 17025. ⁵¹		T19. Some residue testing programme is performed but only for selected animal products for export.²⁵ There is currently not a significant export market. Routine testing is limited to antibiotics.²⁵ [SS✓]
S15. Most of bacteriology activity is performed under accreditation or follows international guidelines (e.g., CLSI, EUCAST, BAM)¹⁵ S16. A national or international standard (CLSI, EUCAST, ...) is correctly applied to perform the AST in all bacteria¹⁵ [COMBINED S15+S16]	W29. No quality control specimens included when performing the test nor does the laboratory participate in EQA for the test. [Plant Pathology Lab]⁵¹ [SS✓]		T20. ~~T2~~. Between 60% and 80% of the samples reaching the laboratory are submitted in appropriate conditions for bacteriological testing (e.g., time to reach the lab, appropriate media transportation, appropriate temperature, etc.)¹⁴ *Outside the department

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
			[SS✓] [MOVE FROM SAMPLE REFERRALS AND TRANSPORT SYSTEM]
S17. The laboratory implements SOPs managed under a Quality management System to identify bacteria, to evaluate and interpret AMR for all the methods performed (disk diffusion, MIC determination, molecular biology etc.)¹⁵	W30. New reagents or equipment are not validated against reference material or previous reagents before use due to no proper procedure. [Plant Pathology Lab]⁵¹ [SS✓]		T21. ~~T3~~. It is reported that all labs in VLS, except microbiology labs, did not achieved the targeted number of samples set by FAO.²⁴ [SS✓] [MOVE FROM SAMPLE REFERRALS AND TRANSPORT SYSTEM]
S20. Veterinary Laboratory Services Certification is based on the requirements from the World Health Organization Laboratory and Biosafety Manual 4th Edition (WHO LBM 4TH EDITION), United Biosafety in Microbiology and Biomedical Laboratories 6TH Edition (BMBL) 6TH Edition and Industrial Best Practice.¹⁶ S22. The Veterinary Laboratories Services granted certification for the period of September 2022 to September 2023 by World BioHazTec¹⁶ [COMBINATION OF S20+S22]	W31. Expired reagents are sometimes being used and no quality control is performed on these expired reagents. [Plant Pathology Lab]⁵¹ [SS✓]		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
S26. The accommodation was good and laboratory's documentation were in kept systematically.²⁰ [SS✓]	W32. There is no quality manager designated.⁵³ [SS✓]		
S27. The laboratory demonstrates management commitment to impartiality.²¹ S28. The laboratory identifies risks to its impartiality on an ongoing basis, including risks arising from its activities, its relationships, and the relationships of its personnel, and takes appropriate steps to address them.²¹ S29. The laboratory eliminates or minimizes the identified risks to impartiality.²¹ [COMBINATION OF S27+S28+S29] [SS✓]	W33. There is no preventive maintenance programme in place, with priority being placed for high-end equipment only that were mostly received from previous laboratory organization.⁵³ [SS✓]		
S30. Laboratory objectives stated in quality manual are all achieved and maintained.⁴⁴ (until June 2025)	W34. Internal auditor needs to attend internal audit course¹³ [SS✓]		
S31. Quality manual describing the quality management system and the quality procedures are available.⁴⁵	W36. Need improvement in LQM¹³ [SS✓]		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
S33. A Quality Manual for the lab is available readily which outlines the laboratory manual required to apply for the ISO17025. [Plant Pathology Lab]⁵³ [COMBINATION OF S31+S33] [SS✓]			
S32. Trained personnel oversee critical laboratory functions. ⁵⁵ [SS✓]	W38. No accreditation for laboratory facilities, services, and tests — including POCT — while implementing continuous quality improvement initiatives to strengthen credibility, quality assurance, and international collaboration. ~~Q12~~ In particular ISO 17025 accreditation should be vigorously pursued for all the laboratory's activities. ²⁵ [SS✓]		
S34. UNISSA has undergone audit/assessment through UNISSA Internal Audit and Bureau Veritas (ISO 9001) accreditation.⁵³ UNISSA IS ACCREDITED BUT NOT THE LAB	W39. Service delivery gaps include suspended testing (due to ~~recalls~~, low inventory, or ~~shipment delays~~), and QC performance concerns. ^{33(e), 33(h)}		
S35. Improved Public Trust & Accreditation Visible improvements in quality, safety, and donor care can boost public confidence,	W40. No national EQA program. ⁸ [SS✓]		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
support accreditation, and strengthen partnerships.			
S36. Private Sector Role: As regulator and technical advisor, DLS can guide private laboratories towards QMS alignment, harmonising standards across the country. ^{34, 35} [SS✓]	W42. breakdowns in critical equipment, donor dissatisfaction. ^{33(d), 33(i), 33(u), 33(v)} [SS✓]		
S38. Expanded POC testing at district/health centre level, robust blood safety systems, donor confidence, and continuous expansion of ISO-accredited services. ^{33(u), 33(v), 33(p)}	W47. No calibration plan ¹³ [SS✓]		
S39. The assessment team found that the staff were friendly, knowledgeable with technical competence in their respective arena of works. The laboratory environment and facilities were managed well and the analytical equipment were generally maintained with up-to-date calibration status. ⁹ [SS✓]	W48. The bacteriology laboratories use only one reference strain and tests it at least once a month ¹⁴ [SS✓]		
S40. Laboratory activities meet the requirements of the Standard, its customers, regulatory authorities and organisation	W50. The laboratory does not currently ensure that measuring equipment is calibrated or capable of achieving the required measurement accuracy or		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
providing recognition ¹³	uncertainty needed to produce valid results. ²¹ [SS✓]		
S41. Results are shared within an appropriate time (3-7 days, sometimes more depending on the bacterial species for more than 80% of samples ¹⁵	W53. Pathology department is equipped to perform basic histopathological techniques, but these techniques are performed rarely. ²² (Non-compliance to procedure by trained staff due to low workload) [SS✓]		
S42. Bacteriology laboratory sufficiently equipped to carry out identification and AST of some important and common bacterial species ¹⁵	W64. Equipment are not properly maintained and not calibrated [Plant Pathology Lab]. ⁵¹ [SS✓]		
S43. Bacterial isolates can be identified by Proteomic profiling (MALDI-TOF) or molecular biology (PCR, sequencing, ...) or serotyping of bacteria (e.g., Salmonella) ¹⁵	W70. No formal staff meetings; reliance on informal and undocumented discussions. ⁵⁵ <i>(note: linked to lack of documentation, i.e. recording, no traceability. Legal framework exists but no QMS/procedure for traceability.)</i> al staff meetings; reliance on informal and undocumented [SS✓]		
S44. Satisfactory facilities and environmental conditions ¹⁹ [SS✓]	W71. Lack of consistent quality practices may affect credibility of results ⁵⁵ . [SS✓]		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
S45. Good maintenance and timely calibration of the equipment.¹⁹ [SS✓]	W72. Fully diagnostic capacity is not available as laboratory equipment for some disciplines have not been maintained in a functional state (e.g. histopathology and clinical biochemistry).²⁵ [SS✓]		
S47. The new complex is housed ample spaces and the segregations of labs are excellent.²⁰	W73. Unplanned equipment downtime may disrupt laboratory operations. Inconsistent calibration could affect reliability of results.⁵⁵ W51. The laboratory does not currently have a defined process for handling equipment that no longer meets specified requirements.²¹ [SS✓]		
S48. The laboratory informs the customer ahead of time about any information it plans to share with the public.²¹	W74. The Excel file used for the Gross Calorific Value using Oxygen Bomb Calorimeter can be improved to avoid rounding errors.¹⁹		
S49. Quality control systems have already been developed and implemented by several of the discipline laboratories in the veterinary laboratory.²⁵ [SS✓]	W75. for how a sample is to be distributed safely to the appropriate laboratory/department for processing.²³		
S50. Detailed records were being maintained of	W76. W18. Limited reagents/material for diagnostic use are produced (e.g. RBC,		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
submissions and test results. SOPs were being developed and quality control checking of reagents and the operation of machinery were routine and recorded. Information on hazards and safe practices were prominently displayed in the workplace. ²⁵ [SS✓]	~~buffer), quality questionable with regard to animal source for reagents (not quarantine, not monitored for diseases (not SPF, or not SAN))²²~~ [MOVE BACK FROM GROUP A] [No longer applicable. REMOVED]		
S51. Feed analysis including minerals, trace elements and heavy metals are carried out. ²⁵	W77. ~~W1.~~ Identification and tracking of each sample entering the laboratory by the use of well documented Log-Book or Excel file (Not LIMS or barcode system).¹⁵ [SS✓] [MOVE FROM SAMPLE REFERRALS AND TRANSPORT SYSTEM]		
S52. Equipment is labelled with inventory tags; records kept digitally. Preventive maintenance is conducted for heavily used equipment. ⁵⁵ [SS✓]	W78. ~~W3, W2 O1.~~ High rate of sample referral to overseas.^{33(e)} Rephrase: Newly introduced tests reduce dependency on overseas referrals and expand local capacity. [MOVE BACK FROM GROUP A] [Caused: Longer TAT] [MOVE FROM SAMPLE REFERRALS AND TRANSPORT SYSTEM] [SS✓]		

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
S53. Food Chemistry Laboratory under Department of Scientific Services (DSS), Ministry of Health (MoH) is the focal lab in Brunei Darussalam for GMO testing • Has capabilities in terms of instrumentation including PCR as well as competent / trained workforce • Current capacity is for DNA speciation on Halal-related / Authentication testing for Porcine DNA, Bovine DNA and Poultry DNA. • Has the capability to develop methods for GMO detection”¹² [SS✓]			
S54. Laboratory define and document range of activities which it claims conformity to the Standard (ISO 17025)¹³			
S55. Introduce structured quality assurance reviews and monitoring processes.⁵⁵ [SS✓]			
S56. Lumpy Skin disease (LSD), is in plan to be developed by both MBL and SRL²⁴			
S57. Strong quality assurance measures in patient result auto validation^{33(u), 33(gg)} [SS✓]			

STRENGTH (42)	WEAKNESS (34)	OPPORTUNITY (6)	THREAT (12)
S58. ~~S4~~. Functional system with safe shipment capacity (domestic & international), ensuring timely specimen transport. ^{7, 27} [MOVE FROM SAMPLE REFERRALS AND TRANSPORT SYSTEM]			

5. T5 BIORISK MANAGEMENT

STRENGTH (9)	WEAKNESS (26)	OPPORTUNITY (2)	THREAT (4)
S1. Established governance & expertise: Laboratory operations are supported by skilled personnel, clear biosafety protocols, and institutional biosafety/biosecurity programmes. ^{6, 7} [Validated]	W1. Gaps include facility safety concerns (lighting, air flow, VAV adjustments), absence of biosafety legislation, weak regulatory oversight, lack of standardized training. ^{27, 31, 32} [Validated]	O1. Strengthen national and regional biosecurity by establishing clear enforcement mechanisms, expanding pathogen preparedness (using SARS-CoV-2 lessons), and enhancing laboratory capacity for infectious disease detection and response. ^{1, 28, 33(v)} [Validated]	T1. WBHT will like to highlight the Biosafety committee must ensure that all protocols have been met if the BSC certifier were to enter the BSL-3 facility when it is "Hot". ¹⁷ [Validated]
S2. Certified safety equipment: Biosafety cabinets (BSCs) are well maintained, certified, and include advanced units (BSC2B1) offering added flexibility and compliance with international standards. ^{7, 31} [Validated]	W2. Biorisk assessment is not conducted systematically. ⁵ [Validated]	O2. Use of WHO tools for mapping Biosafety and Biosecurity capacity in the University curricula as well as Brunei's workforce, including the academic and whole of government agencies e.g. army, police and others to determine gaps etc. ⁵⁹ [Validated] <i>(minute meeting from group JKBB)</i>	T2. Supply and exhaust air may be HEPA filtered. The HEPA filters are not scanned annually to suitable international or national standards. ²³ [Validated]
S3. Waste management systems are in place across facilities, ensuring safe disposal practices. ⁷ [Validated]	W3. There is no established agency (or agencies) responsible for the enforcement of biosecurity legislation and regulations. ¹ [Validated]		T3. The laboratory is certified consistent with the recommendations of the CDC BMBL current edition or WHO LBM BSL3 recommendations (or other national regulations) but this was only performed during commissioning and not on an regular schedule; failure scenarios are not simulated to ensure

STRENGTH (9)	WEAKNESS (26)	OPPORTUNITY (2)	THREAT (4)
			that all backup systems are working as expected and this is documented. ²³ [Validated]
S4. Brunei's availability of BSL-3 laboratory infrastructure meets WHO standards. ^{31, 32} [Validated]	W4. Shortage of trained biosafety officers undermines oversight and enforcement of biosafety and biosecurity requirements. ⁷		T4 ~~W19~~ . There is no security measure in place in case of natural disasters such as earthquake and flood. ⁴² [Validated]
S5. Trained and certified officers in the following fields: 1) Biorisk Management - 26 officers 2) Biosecurity - 22 officers 3) Biological Waste Management 4) Biological Risk Assessment - 15 officers ¹⁰ [Note: SWOT applicable to officers from DLS, DSS, DoAA, DoFI, UBD, MRS] [Validated]	W5. No mechanism for biosecurity oversight of dual-use research of concern, nor is there a code of responsible conduct for scientists. ⁵ [Validated]		
S6. Facilities of the bacteriology laboratory are appropriate for carrying out biosafe identification and AST of some important bacterial species and AST (at least 1 BSC-II) ¹⁵ [Validated]	W6. Under Species Identification / Meat Speciation using Conventional PCR, recommend indicating ethidium bromide area for safety purpose. ¹⁹ [Validated]		
S7. Any accidents or incidents and nonconformities related to biorisk are correctly managed; reported and recorded in the appropriate	W7. Portable fire extinguishers are not maintained fully charged and in working order. ²³ [Validated]		

STRENGTH (9)	WEAKNESS (26)	OPPORTUNITY (2)	THREAT (4)
form (DSS-HSE(F)-008 Risk Assessment Form, DSS-HSE(F)-004 Accident Incident Assessment Form, DSS-HSE(F)-005 Accident Incident Reporting Form) investigated, and leading to preventive or corrective actions. ⁴² [Validated]			
S8. Emergency plans are available and managed by the Health, Safety, Security and Environment unit of UNISSA. ⁵³ [Validated]	W8. There is no verification of effectiveness for the pathogenic agents being used and/or no justification; labelled disinfectants may have inconsistencies or absences of preparation and expiry dates. [Validated]		
S9. The laboratories surveyed are deemed to be compliant with WHO and BMBL Framework for Biosafety Level 2 requirements. ¹⁶ [Validated]	W9. Missing flowchart of waste that describes the separate waste streams. ²³ [Validated]		
S10. ~~S14~~ . Some disinfection has its own SOP and labelling. ²³ [Originally from W9] [Validated]	W10. Biological indicator use for verification of animal waste decontamination/sterilization is not satisfactory. ²³ [Validated]		
S11. The laboratory policies and procedures ensure that all waste are properly contained and as necessary rendered. The decontamination system has been validated at least one time.	W11. ~~W12~~ . The pathology department is sufficiently equipped to carry out necropsies of various sized animals including large animals*. Biocontainment and safety measures*** are		

STRENGTH (9)	WEAKNESS (26)	OPPORTUNITY (2)	THREAT (4)
[Originally from W10] [Validated]	in place but are not fully respected (e.g., inadequate PPE, insufficient cleaning and disinfection, incorrect biocontainment of diagnostic materials, poor effluent management). All necropsies are conducted or supervised by specifically trained and/or experienced (>5 years) pathologists, but the volume of activity is not sufficient to maintain needed skills. [Validated]		
S12. All animal waste is appropriately decontaminated or sterilized prior to removal from the experimental animal facility [Originally from W11] [Validated]	W12. Staff have not received hands-on training on chemical spillage ²³ [Validated]		
S13. Chemical substances are correctly and safely stored in minimal amounts in approved cabinets, appropriate signage is used; appropriate separation of chemicals is applied. [Originally from W13] [Validated]	W13. The documentation on risk assessment is sometimes available but not recorded. PPE is provided but it may not be suitable for mitigation of the risk. [Validated]		
S14. Compressed gas cylinders are stored inside of the laboratory and restrained to prevent falling; regulators are tested annually (and it is documented) and	W14. A chemical safety officer is appointed, but not trained regularly and the appointment is documented in the laboratory safety manual. ²³ [Validated]		

STRENGTH (9)	WEAKNESS (26)	OPPORTUNITY (2)	THREAT (4)
replaced every 5 years (as a minimum). ²³ [Originally from W14] [Validated]			
S15. Risk assessments were used to determine biosafety practices required for the handling of a subset of a pathogenic agents and for the laboratory procedures (e.g. work with specific high-risk agents and toxins) ²³ [Originally from W26] [Validated]	W15. Safety risks include faulty infrastructure (e.g., dried floor traps, VAV valve issues, falling cement slabs), unchecked structural hazards, and non-compliance that may affect accreditation and biosafety confidence. ^{31, 33(i), 33(v)} [Validated]		
	W16. Policy on Biorisk management is not available. ⁴⁵ [Validated]		
	W17. No designated biosafety officer assigned for the Department, as some scopes have also been assigned to focal HSSE officer in each lab services ³⁶ [Validated]		
	W18. No written biosafety procedures available, no emergency protocol and no Material Safety Data Sheets available for review in the immediate laboratory area. [Plant Pathology Lab]. ⁵¹ [Validated]		
	W19. Biorisk has not been assessed and categorized in the lab and so there is no appropriate security measures in place to minimize potential inappropriate removal or release of biological		

STRENGTH (9)	WEAKNESS (26)	OPPORTUNITY (2)	THREAT (4)
	agents and incidents related to biorisk are not managed appropriately [Plant Pathology Lab].⁵¹ [Validated] - Conduct biorisk assessment training by trained and certified officers in Biological Risk Assessment. [Plant Pathology, UNISSA, JPMC (Private Labs)]		
	W20. No biological agent inventory established [Plant Pathology Lab].⁵¹		
	W21. There is no designated biosafety officer.^{51, 53, 13} [Validated] - Conduct training for plant pathology, UNISSA by certified personnel (Trained and certified officers in Biorisk Management (26 officers), Biosecurity (22 officers), Biological Waste Management, Biological Risk Assessment (15 officers))		
	W22. The centre is yet in preparation for training regarding chemical waste		

STRENGTH (9)	WEAKNESS (26)	OPPORTUNITY (2)	THREAT (4)
	management and developing SOP for chemical waste management. ⁵³ [Validated]		
	W23. Risk assessments to determine biosafety practices required for the handling of a subset of a pathogenic agent and for the laboratory procedures were not regularly reviewed. [Validated]		
	W24. There are no academic training programmes or curricula for biosafety and biosecurity for pre-service (academic) or in-service training.⁵ [Validated]		

6. T6 DISEASE AND GENOMIC SURVEILLANCE

STRENGTH (6)	WEAKNESS (4)	OPPORTUNITY (3)	THREAT (2)
S1. National surveillance supported by Bru-HIMS with real-time electronic reporting, clinician/laboratory notifications, and a notifiable disease framework. ^{5, 27} [Validated]	W1. Surveillance systems rely heavily on external guidelines, with implementation delays due to logistical and budgetary constraints. ²⁶ [Validated]	O1. Strengthen laboratory capacity and infrastructure (BSL-2/3 labs, DLS capabilities) to enhance readiness for epidemics and pandemics. ^{32, 33(v)} [Validated]	T1. Threats include legal/ethical data-sharing barriers and limited sequencing capacity of emerging pathogens. ^{28, 33(f)} [Validated]
S2. Strong laboratory system covering 28 notifiable diseases, including core WHO tests, with expanded capacity for early detection and outbreak response. ^{5, 33(v)} [Validated]	W2. There is no alert function in BruHims (electronic tools as part of surveillance reporting system) for timely detection, risk assessment and decision making. ⁵ [Validated]	O2. Active collaboration with WHO (VIDRL Australia, Melbourne) through routine sharing of influenza samples strengthens regional and international surveillance. ^{33(f)} [Validated]	T2. Emerging Infectious Diseases: Increased global travel and climate change raise risk of importation and emergence of diseases. ⁵ [Validated]
		O3. There were arrangements to send samples to specialised testing requirements to other recognized laboratories in Malaysia, Singapore, Australia and OIE reference laboratories. ²⁵ [Validated]	
S3. Strong TB monitoring with WHO-aligned reporting, consultant engagement, and updated national guidelines. ^{33(h)} [Validated]	W3. Panaga HC and DWS is not part of the national and international surveillance network. ^{45, 46} [Validated]		
S4. The laboratory organises the surveillance program and maintains the records for various poultry diseases, including Newcastle disease, Infectious	W4. Difficulty in developing a required new test method as well as sustaining accreditation due to lack of sample		

STRENGTH (6)	WEAKNESS (4)	OPPORTUNITY (3)	THREAT (2)
bursal disease and avian influenza. ²⁵ [Validated]	received and high cost. ²⁴ [Validated]		
S5. The laboratory also offers quality control testing for fresh milk, meat products and manufactured meat products, including for bacteriology, drug residues and species identification. ²⁵ [Validated]			
S6. Roles and functions of DSS are inclusive of scientific support services to government agencies and private sectors on public health-related issues, assistance to food industry. The services provided are inclusive of the following: i. examination and analysis of environment-related samples, local and imported food samples [Partially extracted] ii. assistance in health screening services, iii. other activities relating to health science services. ⁴⁷ [Validated]			

7. T7 LABORATORY EMERGENCY MANAGEMENT

STRENGTH (3)	WEAKNESS (9)	OPPORTUNITY (2)	THREAT (1)
S1. Clear emergency response structures and lab plans exist, with strong coordination through the National Committee on Health & Emergency Management and support from top government leadership. ^{5,7} [Validated]	W1. Lack of strategy for laboratory testing during public health emergencies undermines preparedness and response. ²⁷ [Validated]	O1. Participate in national/regional emergency surveillance studies to enhance health security. ^{33(f)} [Validated]	T1. Threats include recurring power/system failures, ICT/server trips, and resource constraints that limit timely corrective measures, posing risks to blood and emergency testing safety. ^{33(u), 33(i), 33(p)} [Validated]
S2. Strengthen emergency preparedness through ownership documentation, legal alignment with IHR (2005), and rapid BSL-2/3 lab upgrades. ^{5,9,32} [Validated]	W2. Limited surge capacity for testing and deployment of response teams, and expansion of health services during major health events constrains national laboratory outbreak preparedness and response capabilities. ⁵ [Validated]	O2. It is the recommendation of WordBio HazTec to the Ministry of Health that the BSL-3 laboratory to be granted certification for a one-year period. ¹⁷ [Validated]	
S3. The laboratory has a response plan in place with another organization for hosting biohazard samples in case of major facility failure (electricity, pressure, etc). ²³ [Validated]	W3. Limited routine assessments and after-action reviews to evaluate health emergency responses. ⁵ [Validated]		
	W4. There are no instructions for the packaging of infectious materials and no appropriate shipping containers. ²³ [Validated]		
	W5. It was not apparent if the laboratory would be able to sustain more complex		

STRENGTH (3)	WEAKNESS (9)	OPPORTUNITY (2)	THREAT (1)
	investigations due to the limited specialised expertise available. The laboratory would likely be challenged to maintain the required service levels if there was a disease emergency requiring sustained laboratory support. ²⁵ [Validated]		
	W6. Laboratory emergency procedures with is not yet documented. ⁴⁵ [Validated]		
S4. Existence of emergency plan and resources.²³ [Validated]	W7. Response to public health emergencies such as outbreaks and protocols for laboratory investigation of public health events are not available. ^{45,46} [Validated]		
	W8. There are significant gaps (need explanation) to formulate activities to mitigate the significant gaps such as in calendar/schedule and staff training and exercise record including documentation of individual staff member participation.²³ [Validated]		
	W9. All BSC and most significant equipment were not installed with UPS. No staff is trained for the available genset and response plan. [Validated]		

8. T8 DATA AND INFORMATION MANAGEMENT

STRENGTH (13)	WEAKNESS (7)	OPPORTUNITY (4)	THREAT (1)
S1. Nationwide LIMS is fully implemented and integrated with Bru-HIMS, enabling seamless real-time transmission of lab results to clinicians. ⁷	W1. Data analysis on Bru-HIMS is not yet automated with automatic triggers and alert functions for timely action. ⁷	O1. Develop secure, cloud-based and integrated digital platforms (e.g., dashboards, databases, EHR, Bloodkad) for real-time genomic analysis, hemovigilance, and enhanced reporting. ^{28, 33(gg), 33(p)}	T1. Digitalisation is pending availability of WIFI where it is still under discussion during management meeting, last update was to subscribe to Imagine and liaise with UNN.(24)
Statement validated Convert W1 to S1= X Convert T1 to O4 = Y X + Y = SS1	Statement validated Convert W1 to S1	Statement validated Convert O1 with S4	Buy in from Group A. Validated. Convert to T1 to O4.
SS1: Achieve full implementation and seamless integration of Laboratory Information Management Systems (LIMS) with existing information systems to enable real-time transmission of lab results to Public Health providers			
S2. Genomics and bioinformatics services established; pathogen sequence data sharing expanded; ongoing sample collection projects strengthen national surveillance capacity. ^{28, 33(f)}	W2. No website, no regular information sharing ²²	O2. AMR data transmission to a dedicated epidemiology unit - Current status: There is no sharing of AMR with a dedicated epidemiology unit ¹⁵	

STRENGTH (13)	WEAKNESS (7)	OPPORTUNITY (4)	THREAT (1)
Statement validated Combine S2, S6 = SS2	Statement validated Convert W2 to S4	Move from One Health thematic	
SS2 Strengthen disease surveillance and research capabilities by establishing and expanding genomics and bioinformatics services, while maintaining a comprehensive, up-to-date computerised inventory of stored isolates and samples to support pathogen sequence data sharing, traceability, and rapid response to infectious threats.			
S3: Digital tools adopted for specimen tracking and non-conformance management, ensuring reliability and regulatory compliance. ^{33(u), 33(gg)}	W3. There is a designated area for specimen reception that includes appropriate biological safety equipment and PPE; there is no clear system for accessing samples into a LIMS. There are clear SOP about leaking/suspicious packages, and appropriate materials to deal with those. ²	O3. Transition to centralized, automated laboratory information systems (LIS). ⁵⁵	
Sentence separated (one part sold to group B, another part rephrases S3 to SS3	Convert W3 + W4 = S4	Convert O3 to S13.	

STRENGTH (13)	WEAKNESS (7)	OPPORTUNITY (4)	THREAT (1)
SS3: Conduct ongoing sample collection projects to enrich data sources, improving the accuracy and reliability of laboratory diagnostics and public health monitoring.			
S4. Modernization initiatives (e.g., BloodKad 4.0, barcode systems,) enhance efficiency, reliability, and workflow; integrated data platforms and enhanced security support analytics, planning, and MOH-wide digital adoption targets (50% by 2030). ^{33(i), 33(v)}	W4. Threats include system access failures, slow adoption of EHR. ^{33(r), 33(v), 33(gg)}	O4. Digitalisation is pending availability of WIFI where it is still under discussion during management meeting, last update was to subscribe to Imagine and liaise with UNN.(24)	
Validate Convert O1 with S4 Convert W3 + W4 = S4 Combine S4 S7 & S8, S9, S11, S12: SS4	Move from Threat Convert W3 + W4 = S4	Convert to T1 to O4. Included in SS1	
SS4: Modernise laboratory workflows through initiatives like advanced digital systems and barcode technology to increase efficiency, accuracy, and reliability of laboratory operations.		SS1: Achieve full implementation and seamless integration of Laboratory Information Management Systems (LIMS) with existing-information systems to enable real-time transmission of lab results to Public Health providers	

STRENGTH (13)	WEAKNESS (7)	OPPORTUNITY (4)	THREAT (1)
S5. An inventory of archived isolates and data (including epidemiological information, disk diffusion-AST, MIC determinations, and molecular biology results) is maintained in a reliable, up-to-date computerized database. ¹⁵	W5. Laboratory data management system is manually keyed in using excel format only. No automated version yet. ⁴⁵		
Validated Convert W5, W6, W7 to S5 = SS5	Validated Convert W5, W6, W7 to S5 = SS5		
SS5: Develop and maintain integrated data platforms with robust security features to support data analysis, strategic planning, and advance digital transformation goals within the laboratory and public health			
S6. Maintain and enhance national surveillance systems, including event-based and electronic reporting, across national and sub-national levels. ²⁷	W6. Laboratory data management system is manually keyed in excel format. ¹³		
Move from Opportunity Combine S2, S6 = SS2	Validated Convert W5, W6, W7 to S1 = SS5		

STRENGTH (13)	WEAKNESS (7)	OPPORTUNITY (4)	THREAT (1)
SS2 Strengthen disease surveillance and research capabilities by establishing and expanding genomics and bioinformatics services, while maintaining a comprehensive, up-to-date computerised inventory of stored isolates and samples to support pathogen sequence data sharing, traceability, and rapid response to infectious threats.			
S7. Strengthen data quality and verification protocols, improve alarm/notification systems, and promote standardized national systems for inventory, screening, and reporting. 33(i)	W7. Heavy reliance on manual Excel spreadsheets increases error risks. 55		
Move from Opportunity Combine S4 S7 & S8, S9, S11, S12: SS4	Validated Convert W5, W6, W7 to S1 = SS5		
SS4: Modernise laboratory workflows through initiatives like advanced digital systems and barcode technology to increase efficiency, accuracy, and reliability of laboratory operations.			

STRENGTH (13)	WEAKNESS (7)	OPPORTUNITY (4)	THREAT (1)
S8-Utilise modern data systems and surveillance outputs to support research, policy development, performance tracking, and evidence-based planning. 33(i), 33(v)			
Move from Opportunity Combine S4 S7 & S8, S9, S11, S12: SS4			
SS4: Modernise laboratory workflows through initiatives like advanced digital systems and barcode technology to increase efficiency, accuracy, and reliability of laboratory operations.			
S9. Inventory system and statistics dashboard are currently drafted and developed by officers-PPTK (<i>Pegawai-pegawai Tugas Khas</i>) - they will gather data and develop the statistics, TPOR and inventory system.³⁷			
Combine S4 S7 & S8, S9, S11, S12: SS4			

STRENGTH (13)	WEAKNESS (7)	OPPORTUNITY (4)	THREAT (1)
SS4: Modernise laboratory workflows through initiatives like advanced digital systems and barcode technology to increase efficiency, accuracy, and reliability of laboratory operations.			
S10. Good data security confidentiality in controlled access and protection from modification: physical hard copies of clients' data are kept where only authorized personnel have access and softcopies are uploaded to SharePoint where only relevant staff have access. 42			
Validated. S10 = SS6			
SS6: Strengthen the connection between laboratory data, such as hemovigilance or other specialty data, and national safety or policy frameworks to ensure data-driven improvement of safety standards.			
S11. Inventory managed via <i>Univentory</i> (consumables/reagents) and Excel spreadsheets (equipment) ⁵⁵			

STRENGTH (13)	WEAKNESS (7)	OPPORTUNITY (4)	THREAT (1)
Combine S4 S7 & S8, S9, S11, S12: SS4			
SS4: Modernise laboratory workflows through initiatives like advanced digital systems and barcode technology to increase efficiency, accuracy, and reliability of laboratory operations.			
S12. Equipment inventory is digitally recorded using Microsoft Excel which is accessible in google drive. ⁵³			
Validated. Combine S4 S7 & S8, S9, S11, S12: SS4			
SS4: Modernise laboratory workflows through initiatives like advanced digital systems and barcode technology to increase efficiency, accuracy, and reliability of laboratory operations.			
S13. Transition to centralized, automated laboratory information systems (LIS). ⁵⁵			
Convert O3 to S13. Included in SS1			

9. T9 ONE HEALTH AND MULTISECTORAL COORDINATION

STRENGTH (2)	WEAKNESS (2)	OPPORTUNITY (3)	THREAT (1)
S1. Strong multi-sectoral collaboration (human, animal, agriculture, environment) with defined governance structures and TWGs. ^{5, 26}	W1. Limited integration between human and animal health labs, plus the lack of standardized methods and reporting for AMR testing in hospitals, hinder effective public health responses. ^{5,7}	O1. Foster One Health collaboration across human, animal, and environmental health sectors. ⁵	T1. Sustainability concerns exist, with risks of losing momentum once external support declines. ²⁸
Statement validated Match O1 + S1= X Match O2 + S2= Y X+Y+Z= SS1	Statement validated Match W1, W2, O3 = SS2	Statement validated Match O1 + S1	Move from Weakness
SS1: Strengthen cross-sectoral collaboration through joint action plans, shared data platforms, and coordinated preparedness activities to improve prevention, detection, and response to health threats which are aligned with WHO, WOA, FAO, UNEPP and international best practices.	SS2: Engagement with relevant stakeholders and partners for the implementation of AMR initiatives to strengthen laboratory autonomy, enhance AMR and environmental surveillance (including potable water monitoring), and ensure sustainability of efforts beyond external support.		
S2. National AMR surveillance across sectors aligned with WHO, OIE and international best practices. ²⁶	W2. Laboratory management has a limited independence and autonomy for the implementation of a strategy on AMR. ¹⁵	O2. Strengthen surveillance through One Health integration, linking human, animal, and environmental health data streams. ²⁸	

STRENGTH (2)	WEAKNESS (2)	OPPORTUNITY (3)	THREAT (1)
Statement validated Match O2 + S2 = SS1	Move from Threat Buy in from Group A Validated.	Move from Data and Information - O1 Match O2 + S2 = SS1	
SS1: Strengthen cross-sectoral collaboration through joint action plans, shared data platforms, and coordinated preparedness activities to improve prevention, detection, and response to health threats which are aligned with WHO, WOA, FAO, UNEP and international best practices.	Match W1, W2, O3 = SS2	SS1: Strengthen cross-sectoral collaboration through joint action plans, shared data platforms, and coordinated preparedness activities to improve prevention, detection, and response to health threats which are aligned with WHO, WOA, FAO, UNEP and international best practices.	
	SS2: Engagement with relevant stakeholders and partners for the implementation of AMR initiatives to strengthen laboratory autonomy, enhance AMR and environmental surveillance (including potable water monitoring), and ensure sustainability of efforts beyond external support.	O3. Engagement with relevant authorities with regards to environment especially on issues related to potable water. ⁴⁵	
		Validated Match W1, W2, O3 = SS2	

STRENGTH (2)	WEAKNESS (2)	OPPORTUNITY (3)	THREAT (1)
		SS2: Engagement with relevant stakeholders and partners for the implementation of AMR initiatives to strengthen laboratory autonomy, enhance AMR and environmental surveillance (including potable water monitoring), and ensure sustainability of efforts beyond external support.	

10. T10 RESEARCH AND DEVELOPMENT

STRENGTH (5)	WEAKNESS (3)	OPPORTUNITY (3)	THREAT (0)
S1. Most research activities attempted have however been focused only on developing appropriate technologies for diseases control strategies and food safety, such as the use acidification agent and probiotics to improve broiler immuno-competence, serological surveys on various diseases (including Newcastle diseases, IBD and mycoplasmosis in broilers), monitoring on the infestation of internal parasites in ruminants and effects of temperature and humidity on table egg quality. ²⁵	W1. More research is required to confirm appropriate methods and samples, since diagnostic development is lacking and existing tests depend heavily on commercial kits with limited investigative depth	O1. Advance research through adoption of sequencing technologies, academic collaboration, and regional partnerships. ^{18, 28, 89}	
Validate Match O1 to S1 = X Convert W1 to S1 = Y X+Y= SS1	Duplicate statement with W3 W4 Rephrase to become W1 Convert W1 to S1	Statement validated Match O1 to S1	
SS1: Develop internal platforms that support and advance emerging research.			

STRENGTH (5)	WEAKNESS (3)	OPPORTUNITY (3)	THREAT (0)
S2. Training of PhD and Master students in IHS laboratories. ⁵⁵	W2. Scientific publications - Current status: The laboratory has never published its scientific results on AMR ¹⁵	O2. International collaboration (ASEAN+3, US CDC) with rapid adoption of advanced diagnostics (e.g., sequencing) and internal platforms for critical discussion of new research. 5, 28, 33(u), 33(w)	
Validated Convert W2 +S2+S3=SS2	Validated Convert W2 +S2+S3=SS2	Statement validated Move from Strength	
SS2: Strengthen national research capacity by fostering scientific excellence through publications, capacity-building programs for postgraduate students, and integration of modern digital tools in laboratory research.	SS2: Strengthen national research capacity by fostering scientific excellence through publications, capacity-building programs for postgraduate students, and integration of modern digital tools in laboratory research.		
S3. Regular publications in peer-reviewed journals ⁵⁵	W3. There is limited (personal) space for research students and limited storage for items especially for chemicals. ⁵³	O3. Strengthen international collaboration and accelerate the development of advanced diagnostics.	
Validated Convert W2 +S2+S3=SS2	Validated. Convert W3 to S5 = SS4	Match O2, O6, S4 = SS3	

STRENGTH (5)	WEAKNESS (3)	OPPORTUNITY (3)	THREAT (0)
SS2: Strengthen national research capacity by fostering scientific excellence through publications, capacity-building programs for postgraduate students, and integration of modern digital tools in laboratory research.	SS4: Establish state-of-the-art research facilities with cutting-edge equipment to enhance research and innovation.	SS3: Enhance diagnostic capabilities through innovation, digital transformation, and international partnerships, ensuring continuous advancement and adoption of cutting-edge laboratory technologies.	
S4. Focus on innovation, digital upgrades, audits ^{33(v)} , ^{33(p)}			
Buy in from Group A Validated. Match O6 + S4 = SS3			
SS3: Enhance diagnostic capabilities through innovation, digital transformation, and international partnerships, ensuring continuous advancement and adoption of cutting-edge laboratory technologies.			
S5. Very good facilities with storage and some great cutting-edge equipment the latest in the market are available at IHS research laboratories ⁵⁵			

STRENGTH (5)	WEAKNESS (3)	OPPORTUNITY (3)	THREAT (0)
Validated. Convert W3 to S5 = SS4			
SS4: Establish state-of-the-art research facilities with cutting-edge equipment to enhance research and innovation.			

Colour Coding:

Department of Laboratory Services

Department of Scientific Services

Department of Agriculture and Agrifood

Department of Fisheries

University of Brunei Darussalam

University Islam Sultan Shariff Ali

Medical Reception Services, Ministry of Defence

Panaga Medical Health

Department of Water Services

Jerudong Park Medical Centre (JPMC)

APPENDIX VI | Desk Review Documents

List of reference documents reviewed by stakeholders during the SWOT analysis.

No.	Document Name	Department
1	SAC-SINGLAS Assessment Report 2024	Department of Laboratory Services
2	Final NIC Assessment-NVL team Brunei de-briefing	Department of Laboratory Services
3	DLS Internal Audit Report 2025	Department of Laboratory Services
4	DLS Internal Audit Report 2024	Department of Laboratory Services
5	Joint External Evaluation of IHR Core Capacities of Brunei Darussalam 2019	Department of Laboratory Services
6	Technical Assistance for Tuberculosis Prevention and Management in Brunei Darussalam 2024	Department of Laboratory Services
7	Situational Assessment For RPHL Network Capacity Building 2023	Department of Laboratory Services
8	Laboratory System for HIV, Hepatitis and Syphilis in Brunei Darussalam (WHO)	Department of Laboratory Services
9	Report "SAC Accreditation Scheme for Conformity Assessment Body Assessment Findings" (2025)	Department of Scientific Services
10	Directory of Certified Professionals Masterlist - International Federation of Biosafety Association	Department of Scientific Services
11	MOH Strategic Book 2019 - 2023	Department of Scientific Services
12	Slides "The 21st Meeting of ASEAN Genetically Modified Food Testing Network (21st ASEAN GMF Net): Brunei Darussalam Country Report" 4th Oct 2024	Department of Scientific Services
13	ISO 17025: 2017 Gap Analysis	Department of Fisheries
14	FAO-ATLASS LMT AMR (MCL VML) 2025	Department of Agriculture and Agrifood
15	FAO-ATLASS LMT AMR (AMP) 2025	Department of Agriculture and Agrifood
16	Veterinary Laboratory Service -BSCL 2- Laboratory certification report on 24th August 2022	Department of Agriculture and Agrifood
17	Veterinary Laboratory Service - BSL-3 Certification report on 29 April 2023- 28 April 2024	Department of Agriculture and Agrifood
18	SINGAPORE ACCREDITATION COUNCIL (SAC) SURVEILLANCE ASSESSMENT – LABORATORIES Letter	Department of Agriculture and Agrifood
19	Assessment Findings, Date Visit: 23rd & 24th April 2025	Department of Agriculture and Agrifood
20	Internal Audit Report Lead Sheet - VLS-IA-16 (October 2024)	Department of Agriculture and Agrifood
21	SAC-SINGLAS Laboratory Assessment CheckLIMSt (October 2024)	Department of Agriculture and Agrifood
22	LMT Assessment, FAO LMT CORE 2024	Department of Agriculture and Agrifood
23	LMT Assessment, FAO LMT SAFETY 2024	Department of Agriculture and Agrifood
24	2024 Management Review Agenda and Minute	Department of Agriculture and Agrifood
25	OIE PVS Draft Evaluation Report, June 2008	Department of Agriculture and Agrifood
26	Brunei Darussalam Antimicrobial Resistance National Action Plan	Department of Laboratory Services
27	Global Health Security Index 2021 Brunei	Department of Laboratory Services

No.	Document Name	Department
28	Global Genomic Surveillance Strategy for Pathogens with Pandemic and Epidemic Potential 2022-2032 (WHO)	Department of Laboratory Services
29	Technical Assessment for Tuberculosis Prevention and Management in Brunei Darussalam 2024	Department of Laboratory Services
30	Situational Assessment Report for RPHL Network Capacity Building (2023)	Department of Laboratory Services
31	Pre-certification Audit Report for National Isolation Centre (2022)	Department of Laboratory Services
32	Pre-certification Audit Report for CMDLID	Department of Laboratory Services
33	Management Review Meetings MRM for 2024 (NCCRL) MRM for 2024 (NHRL) MRM for 2024 (NCMRL) MRM for 2024 (NHCRLM) MRM for 2024 (NIRL) MRM for 2024 (NVRL) MRM for 2024 (NBTRL) MRM for 2024 (NMRL) MRM for 2024 (BDC) MRM for 2024 (POCT) MRM for 2024 (Phlebotomy & CSRA) MRM for 2024 (MGS) MRM for 2024 (PMMPMHAMB) MRM for 2024 (PIHM) MRM for 2024 (SSBH) MRM for 2024 (HVSC) MRM for 2024 (HSSE) MRM for 2024 (IT) MRM for 2024 (MPK & TPOR) MRM for 2024 (BBC) MRM for 2024 (PPM) MRM for 2024 (Strategic Planning) MRM for 2024 (Outsourcing Blood Collection) MRM for 2024 (Journal Club) MRM for 2024 (Human Resources) MRM for 2024 (Pengurusan Kakitangan) MRM for 2024 (Penghapusan) MRM for 2024 (Project) MRM for 2024 (Allowance) MRM for 2024 (Training) MRM for 2024 (QAPSU) MRM for 2024 (FPU) MRM for 2024 (MOH IR)	Department of Laboratory Services
34	Quality Management System Mapping in Asia Pacific Region	Department of Laboratory Services
35	Quality Management System Mapping by Country Brunei Darussalam	Department of Laboratory Services
36	DLS TO3 Laboratory Facility Assessment Tool	Department of Laboratory Services
37	Minute of Meeting Health Science Division Q4 2024	Department of Scientific Services
38	Minute of Meeting Health Science Division Q1 2025	Department of Scientific Services
39	Minute of Meeting Health Science Division Q2 2025	Department of Scientific Services
40	Minute of Meeting between Microbiology Laboratory, DSS and Healthcare Technology Department	Department of Scientific Services
41	Email on ISO Accreditation Suspension 09042025	Department of Scientific Services
42	DSS T03 Laboratory Facility Assessment Tool	Department of Scientific Services

No.	Document Name	Department
43	Water Services Laboratory - Organisational Chart	Department of Water Services
44	Management Review Meeting No. 1/2025	Department of Water Services
45	DWS T03 Laboratory Facility Assessment Tool	Department of Water Services
46	PANAGA T03 Laboratory Facility Assessment Tool	Panaga Health Centre
47	DSS Laboratory Quality Manual (DSS-LQM Ver. 3 23NOV2024, Pg 9)	Department of Scientific Services
48	Program Penempatan Kerja Pegawai Perkhidmatan Awam ke Singapura	Department of Agriculture and Agrifood
49	Report of First Meeting of The Food Supply Working Group (1st FSWG)	Department of Agriculture and Agrifood
50	Notes of Meeting for the 2nd Brunei-Singapore Food Supply Working Group (FSWG) Meeting	Department of Agriculture and Agrifood
51	Plant Pathology Lab: T03 Laboratory Facility Assessment Tool 08092025	Department of Agriculture and Agrifood (Plant Laboratory)
52	Quality Manual Crop Protection Unit Brunei Agricultural Research Center (BARC)	Department of Agriculture and Agrifood (Plant Laboratory)
53	UNISSA: T03 Laboratory Facility Assessment Tool	Universiti Islam Sultan Sharif Ali (UNISSA)
54	MRS: T03 Laboratory Facility Assessment Tool	Toxicology Laboratory Royal Brunei Armed Forces
55	UBD Laboratory Assessment Tool T03	Universiti Brunei Darussalam (UBD)
56	Brunei Darussalam National Health Laboratory System (BDNHLS) Booklet	Department of Laboratory Services
57	1st Brunei National Biosafety & Biosecurity Strategy Workshop Objectives	Department of Laboratory Services
58	2nd Brunei National Biosafety & Biosecurity Strategy Workshop Objectives	Department of Laboratory Services
59	Biosafety and Biosecurity Module Online Meeting with WHO	Department of Laboratory Services

Acknowledgements

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