The Republic of Fiji
Fiji Meteorological Service (FMS)

Data Collection Survey on Construction of the Meteorological and Disaster Awareness Regional Center for the Pacific in the Republic of Fiji

Summary of Survey Results

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Chapter 1 Background and Objectives

1 – 1 Background and Purpose for the Survey

Pacific island countries are vulnerable to climate change and natural disasters such as cyclones, floods caused by localized heavy rain, landslides, and storm surges.
It is said that the country suffered an economic loss of 3.2 billion dollars (World Bank, 2017). Disaster risks are becoming more serious year by year due to the expansion of social and economic activities in each country and the effects of climate change, and there is an urgent need to develop human resources in the meteorological field, improve forecasting and warning services with regional initiatives, and manage the quality of meteorological data. It becomes. The Fiji Meteorological Service (hereinafter referred to as "FMS") was established in 1995, with the construction of a new Meteorological Bureau headquarters and the provision of observation, forecasting, and communication equipment (1995 and 1996) through grant aid from Japan. In 2013, the World Meteorological Organization (hereinafter referred to as "WMO") Region V (Southwest Pacific Region) Regional Specialized Meteorological Center for Tropical Cyclone Program. Since 2015, it has been receiving meteorological data from the meteorological satellite Himawari-8 and providing cyclone forecasting and warning services to each country in the region. In addition, FMS has been continuously providing training to 10 countries in the Pacific region since 2001 through JICA's technical cooperation, etc., and provides human resource development related to basic meteorological work and calibration services for meteorological observation instruments. We have strengthened our system to implement this.
However, with the need to further expand disaster prevention and climate change countermeasures in Pacific countries, the demand for FMS's training opportunities and instrument calibration services in the 10 Pacific countries has expanded. Since the number of employees of FMS has increased by more than 1.5 times since its establishment, there is an urgent need to expand the training and office space necessary for acquiring meteorological skills and meteorological observation services. FMS offices also provide weather and climate information to government officials, the private sector, research institutes, etc. for disaster risk reduction, and provide information to the public and students for raising awareness. FMS provides learning opportunities and conduct awareness activities regarding weather, disaster prevention, and climate change for approximately 10,000 people visit the museum each year. There is a noticeable lack of space. In response to the recent intensification of natural disasters and increased attention to climate change in the Pacific region, there is a need to expand educational content and develop facilities that can accommodate increased reception capacity.

At the 4th Pacific Meteorological Council (PMC) meeting held in 2017, FMS (Regional Instruments Center (RIC)) in the Southwest Pacific region and the University of the South Pacific (hereinafter referred to as "USP"), as well as the Regional Training Center (hereinafter referred to as "RTC".), it was agreed to aim for WMO certification. Additionally, at the 6th PMC meeting in 2023, it was agreed that a task team consisting of major organizations would be established to aim for the establishment of an RTC in 2025, and to continue working to obtain WMO certification as a RIC.
Against this background, FMS has decided to construct a new building that will have facility for training room and instrument calibration, and space necessary for disaster prevention awareness, etc., and to develop it as a regional center in the meteorological field in the Pacific region.
This study will collect and analyze information regarding FMS facility plans and training plans, organize and analyze needs and issues, and collect and confirm information related to consideration of facility construction.
The purpose of this study is to collect and analyze information on the facility plan and training plan of the FMS and to organize and analyze needs and issues related to the construction of a facility with a training room, instrument calibration room, and space necessary for disaster awareness raising, etc., on the premises of the FMS in Fiji, to be developed as a core base in the meteorological field in the pacific region. The purpose of this study is to collect and confirm information related to the consideration of the construction of the facility, and to propose a candidate project for grant aid.

1 – 2 Survey Method（Survey Method、Schedule、Dispatch of Personnels
(1) Basic Policy
Clarification of the concept and development policy of the regional center of excellence when collecting information on the development of the main office building of the Meteorological Agency that corresponds to the WMO guidelines, a training room that fulfils the functions of a regional training center (RTC), a measurement calibration room that fulfils the functions of a regional examination center (RIC) and a space that contributes to disaster awareness-raising activities. (1) To confirm the requirements and appropriateness of the development of the RIC.

(2) Use of the results of JICA's previous and ongoing studies
In conducting this study, the contents and results of JICA's existing and ongoing cooperation shall be actively utilized, and an efficient study shall be conducted in coordination with the study activities of the "Fiji Oceania Advanced Meteorological and Hydrological Services Capacity Enhancement Project Detailed Plan Formulation Study" separately conducted by JICA, while taking care to avoid duplication. Care should also be taken to avoid duplication of efforts. In particular, information on the office space,

layout, ancillary facilities and equipment required for the RIC will be collected and analyzed through the above survey, and the results of this survey will be used as a basis for considering the content of proposals for facility development.

(3) Interviews with Melbourne RIC, Samoa SPREP and others
With regard to the RIC, information was collected, and opinions exchanged on the facilities and operational status of RIC Melbourne, the WMO's regional instrumentation center in WMO Region V, and the division of roles with the RIC to be established in Fiji. Interviews were also conducted with higher education institutions in Fiji and the South Pacific Regional Environment Program (SPREP), which is based in public and Samoa. The interviews were conducted with higher education institutions in Fiji, public and Samoa-based South Pacific Regional Environment Program (SPREP) and others, and the results and latest trends of collaboration and cooperation with the FMS to date were summarized, in addition to the use of the program policy, use of the RIC and training programs of these institutions and the status of implementation of training.
The visit to the Melbourne RIC and SPREP was conducted by three members of the study team.

(4) Schedule of the Study
・From 18th of November 2023 to 15th of December 2023: On site study
・From 21th of November 2023 to 22th of November 2023: Melbourne RIC visiting
・From 25th of November 2023 to 27th of November 2023; SPREP visiting

Chapter 2 General Information

2 – 1 Abstract of Fiji

The republic of Fiji is an Oceanian state and a member of the British Commonwealth. It is an archipelagic state located in the Fiji Islands in the South Pacific and the protectorate of Rotuma, about 500 km to the north, and is outlined as follows

Population : 801,000 (1999).
Area : 18,300 sq km2
Capital : Suva
GDP : USD 1,640 million (1999)
GDP/capita : USD 2,210 (1999)
Political system : Republican
Ethnicity : Approximately 390,000 Fijians, 340,000 Indians, 40,000 other people of European, Chinese, Polynesian, other neighboring island countries and mixed descent.

2 – 2 Abstract of Oceania Region

Oceania is the smallest of the six major states, with 86% of its small land area being occupied by the Australian continent, and a further 98% if New Guinea and New Zealand, the largest of the islands, are included [1]. The remainder are small islands scattered throughout the Pacific Ocean, hence the state name Oceania (Oceanic Provinces). Despite their small land area, these islands were colonized by Malayo-Polynesian peoples who used their unique navigational skills to colonize every inch of the islands and built their own maritime civilization.

2 – 3 Social and Economic Situation

Fiji's economic growth rate improved to 0.2% in 2008 after recording -6.6% in 2007, immediately after the coup d'état in December 2006, but fell to -3% in 2009 due to the decline in the sugar industry and the global economic crisis. In particular, the sugar industry, which has supported the Fijian economy for many years, has had problems with ageing machinery, etc. Since 2011, the Fijian economy has been generally stable, with growth in the 2%-5% range; since 2020, the new Corona has had a serious impact, particularly on the tourism sector, which accounts for 35% of GDP. However, it has been recovering since the Corona disaster.

Chapter 3 Current status of facility management at Fiji Meteorological Department

3 – 1 Existing operations/facilities

3 – 1 – 1 Training Facilities

(1) Overview of training services provided by FMS

As well as playing a key role in weather observation and information provision, the FMS has been providing training for more than a decade to FMHS staff in Pacific Island countries and others involved in weather observation and disaster management. Roles and plans for the future as a training provider include the following:

i) Conducting Basic Instruction Package Training (BIP-MT) courses for Fiji and Pacific Islands countries.
ii) Conducting meteorological training for Airport Fiji Limited's Air Traffic Controllers.
iii) Facilitating the JICA, UNDP, SPC, or other donor agencies sponsored Regional Meteorological Courses on meteorology, climate, hydrology, or other technical training.
iv) Facilitating climatological observation training for staff of other organizations who provide voluntary observations in climate to FMS.
v) Conducting awareness and education on meteorological hazards to all communities and schools in Fiji.

1) Training for NMHS staff of Pacific Island countries conducted by FMS without donor support

The role of the RTC is to provide education and training opportunities to WMO members in the region, particularly NMHS staff. The FMS provides training services to NMHS staff in Pacific Island countries without donor support, even though they are not designated as RTC at this time.

These FMS's own training programmes in Pacific countries covered 12 countries, and in 2023, the FMS sent instructor to three countries - PNG, Vanuatu and Kiribati - for local training. These trainings are conducted at the request of the target NMHS and are therefore irregular, but generally every 3-4 months. The training is targeted at technical officers/assistants. The training period is one week and the number of participants ranges from 5 to 10 per training session. In most cases, the training is

conducted by FMS instructors in the host country. This is because a larger number of staff can participate in the training at one time if the instructor is invited to the own country. Training in the partner country also has the advantage that it can be conducted in an environment that is more matched to the actual conditions of the NMHS in each country. For this reason, there is a high demand for this style of training.

2) Training for government agencies and private companies

The training is designed to address the training market within Fiji. The target is nationwide, with the main focus on institutions equipped with meteorological equipment and organisations that use meteorological information in their work. In terms of frequency, this category of training is the largest in the training conducted by the FMS, with a total of 19 training sessions (over 100 participants) planned for 2023/24, including for agricultural research stations, airport officials and dam offices. The content of the training is basic meteorological observation techniques. The number of participants per training session ranges from a few to at most 10. Some of these trainings also take place at the FMS, but most are conducted by instructor visiting the partner organisation.

Table3-1-1 **: Planned training for domestic institutions in 2023/24**

Target institutions	Subjects
1. Lautoka SRIF (Sugar Research Institute Fiji)	Climate observation & recording
2. Rarawai SRIF	Climate observation & recording
3. SRIF Labasa	Climate observation & recording
4. Ba SRIF	Climate observation & recording
5. Coconut Research (Taveuni)	Climate observation & recording
6. Legalega Research Station	Climate observation & recording
7. Wainigata Research	Climate observation & recording
8. Dobuilevu Agriculture	Climate observation & recording
9. Nawaicoba Agriculture	Climate observation & recording
10. Koronivia Agriculture	Climate observation & recording
11. Seaqaqa Agriculture	Climate observation & recording
12. Lautoka Sugar Mill	Climate observation & recording
13. Savusavu Airport	Weather observation and communication on a airport
14. Labasa Airport	
15. Fiji Airport	
16. Vatutu Dam	Climate observation & recording

17. Monasavu Dam	Climate observation & recording
18. Tokotoko Navua	Climate observation & recording
19. Marist Tutu Vocational (Taveuni)	Climate observation & recording

Source: FMS

3) Support for training organised by donor agencies

In meteorology, climatology, hydrology and other fields, technical training organised by JICA, UNDP, SPC and other donor agencies takes place in the FMS. In 2023, training courses conducted in the FMS were the only ones organised by JICA. These were the following three courses. These trainings covered 10 countries (Cook Islands, Kiribati, Nauru, Niue, Solomon Islands, Samoa, Tonga, Tuvalu, and Vanuatu) and had a duration of 8-12 days.

i) Meteorological Instruments Calibration and Maintenance Training (8days)
ii) Marine Meteorological Service Enhancement Training (8days)
iii) Forecast Verification Training (12days)

This type of training places a smaller financial burden on participants, as their travel and daily expenses are covered by donors. On the other hand, participants are usually selected from several countries, thus the number of participants from one NMHS is limited. According to the FMS, some NMHSs have expressed a desire for training on an organisational basis where more than 10 staff can participate.

4) Training for FMS staff (in-house training)

Training for FMS staff includes Internal Induction Training and pre-employment training. The induction training covers the basics of being an FMS employee, such as the role and structure of the FMS, the content of job descriptions, the Code of Conduct and the quality management system. It is covered for all new FMS staff. It lasts for one to two days and takes place in the FMS training room. The training for new staff is conducted by an internal instructor, following which technical skills are developed through on-the-job training. Other than new staff, there is no system of internal training. The professional development of staff is essentially dependent on upgrading training provided by external organisations.

Pre-employment training is provided when the FMS recruits new staff and requires applicants to attend training in advance. When the FMS fills a vacancy, FMS selects and hires from among those who have attended this training. Around 10 people take part in one training course. The duration is six months and takes place at FMS facilities.

(2) Training materials

The following three courses have developed modules and are used in the training. (i) is a qualification course for NMHS climate observers, (ii) and (iii) are mainly for air traffic controllers and aviation officials. These courses are currently in the process of applying for 'Micro-Qualification' accreditation by the SPC. It is expected that the accreditation will also allow these to be recognised as official WMO/RTC training courses. Courses in other training programmes have also been designed by applying these modules, depending on the duration of the training and the target audience.

i) Observe and Record Meteorological Phenomena and Parameters at a Climate station (1 week)
ii) Interpret and Communicate Weather Information on a Flight Path (5 weeks)
iii) Observe and Record Meteorological Phenomena and Parameters at an Aerodrome (8 weeks)

Table3-1-2 : **Outline of training modules implemented by the FMS (3 courses)**

Title	Observe and Record Meteorological Phenomena and Parameters at a Climate station
Target	Climate observers
Purpose/overview	The micro-qualification provides training on collecting information like weather variables such as rain, temperature, wind speed & and direction, cloud cover, visibility, soil temperature, and evaporation; and recording the information on appropriate templates.
Subject Area/Field	Climate Studies
PQF Level	Level 4
Credit	3 Credits 1) Measure weather variables using appropriate measuring instruments and skills 2) Apply appropriate techniques and tools to visually observe and record weather variables 3) Apply appropriate meteorological abbreviations and numerals to record the weather conditions
Minimum Duration	1 week

Entry Requirements	1) Possess a minimum of 2 years of work experience, endorsed by the relevant organization. 2) Attain a passing grade of at least 50% in Year 12 FSLC (Fiji School Leaving Certificate) or its equivalent.

Title	Interpret and Communicate Weather Information on a Flight Path
Target	Aviation officers at a weather forecasting office
Purpose/overview	This micro-qualification provides refresher training for aviation officers on the meteorological theories related to aviation. This training provides an opportunity for aviation officers to improve their knowledge and understanding of upper-level weather, and how it impacts airline flight safety. The micro-qualification provides training on flight documentation and pilot briefing, interprets aviation charts such as radar and satellite images; mean sea level charts; wind and temp charts; prognostics charts; terminal aerodrome forecast; route-forecast; and signet, and aviation hazardous weather. The training provided under the micro-qualification ensures that the skills of aviation officers are current with the changes in the World Meteorological Organisation (WMO) and International Civil Aviation Organisation (ICAO) standards.
Subject Area/Field	Aviation Meteorology
PQF Level	Level 7
Credit	20 credits 1) Interpret aviation products to determine the upper-level weather for high-level flights originating from an aerodrome (5) 2) Interpret aviation products to determine the upper-level weather for low-level flights originating from an aerodrome (5) 3) Develop flight documentation for a selected flight route (3)

	4) Communicate aviation weather information to pilots (2) 5) Demonstrate competency as an aviation officer (5)
Minimum Duration	5 weeks
Entry Requirements	For admission into this micro-qualification, candidates must have completed: Basic Instruction Package for Meteorological Technicians (BIPMT) training; Senior Level Meteorological Technician (SLMT), and had at least 12 months of experience as an aviation officer.

Title	Observe and Record Meteorological Phenomena and Parameters at an Aerodrome
Target	Newly recruited Air Traffic controllers
Purpose/overview	This micro-qualification provides training on collecting information like weather variables such as rain, temperature, atmospheric pressure, wind speed & and direction, cloud types & and amount, and visibility; interpreting the information; and preparing Meteorological Aviation Report (METAR), Special Aviation Reports (SPECI), Synoptic report (SYNOP) and climate reports.
Subject Area/Field	Aviation Meteorology
PQF Level	Level 6
Credit	28 credits 1) Measure weather variables using appropriate measuring instruments and skills (4) 2) Apply appropriate techniques and tools to visually observe and record weather variables (6) 3) Apply appropriate meteorological abbreviations and numerals to record the existing weather conditions (6) 4) Apply appropriate tools to analyse meteorological information (5) 5) Generate meteorological reports in the prescribed format (5) 6) Transmit meteorological reports using appropriate tools (2)

Minimum Duration	8 weeks
Entry Requirements	1) A high school diploma or equivalent is often the minimum educational requirement. Some advanced courses may require a bachelor's degree in a related field such as meteorology, aviation, or aeronautical science. 2) Participants are typically expected to be at least 18 years old. 3) Proficiency in English is usually required. 4) May require the completion of prerequisite courses in meteorology or related subjects to ensure participants have the necessary foundational knowledge.

Source: Application form accreditation of a Micro-Qualification

(3) Instructor

Currently, there is only one instructor in the FMS, who is the Senior Training Officer. He alone handles all training tasks, including planning, implementation, management and coordination (as well as awareness-raising activities). He is already over-capacitated and it is currently difficult to expand FMS' training services. In addition, as his area of expertise is meteorological observation, he is not able to carry out training in other areas. Staff from other division basically do not provide training.

(4) Training Management

1) Planning

Training plans are prepared for the following year's activities in line with the FMS budgeting process. The training included in this (budgeted for) is mainly for national institutions. It does not include training for the NMHS in the Pacific Island countries, which is paid for by the recipient, or training by donors. No annual training planning document has been prepared, including a perspective for the future.

No systematic survey has been conducted on training needs, which is necessary for training planning. In particular, no process has been established for obtaining information from regional NMHSs. However, training evaluations submitted by trainees after training are used for training planning. It should be noted that the three training modules currently in use involve stakeholders (e.g. Fiji Airport Limited, Sugar Research Institute of Fiji, etc.) during its development process and take into account their training needs.

2) Learning management system

The “FMS e-Learning Platform” is developed using the learning management system “Moodle”. The system enables the registration of trainees, distribution of teaching materials, comprehension tests and training evaluations by trainees to be carried out in a centralized manner. In addition, distance education, face-to-face education and hybrid education are possible. This system contributes to efficient training in the current situation in the FMS, where there is only one instructor, as it reduces the number of work hours for training implementation management. However, at present, the FMS uses the free version of “Moodle”, which has limited functionality. In addition, the server capacity is insufficient, which makes it necessary to limit the number of trainees who can access the system. Therefore, a review of the system with experts is required, taking into account the future expansion of the training service.

3) Evaluation

A training report is prepared by the training officer after the training is completed. In addition, the above-mentioned training management system has a function to obtain feedback from trainees and there is a process to measure the effectiveness and quality of the learning services. On the other hand, no annual report is prepared to summarise the year's training, and there is no system to systematically evaluate training performance, training effectiveness and challenges.

(5) Training facilities

The FMS has a training room, which is used for multiple purposes, including meetings as well as training, etc. Eight training courses, including a JICA training course, were held using the FMS training room over a period of about two years from January 2022 to November 2023. The number of participants in these training courses is 1~12 per course. The duration of the training courses ranged from 1 day to 16 weeks, and in the case of the JICA course from 1 to 2 weeks. The FMS training rooms can be divided into two rooms with partitions, but only once have more than two training courses been held in parallel (FMS generally arranges the dates so that the courses do not overlap, or provides venue out of FMS).
Training courses for government agencies, private companies, etc. are organized both in FMS training rooms and in the training/meeting rooms of the partner organizations (e.g. Fiji Airports Aviation Academy). These trainings also have a maximum of 15 participants per session.

Table3-1-3：**Training conducted at FMS facilities 2022~23**

Course title	Trainees	Timing
1. Meteorological Technicians Training (BIP-MT course, 13 modules)	8	19 Oct. 2021 – 05 Feb. 2022
2. Internal Induction Training	2	09 Feb. 2022
3. Internal Induction Training	1	04 Mar. 2022
4. Meteorological Technician's Training on Meteorological Theory and Observations	5	08 to 09 Sep. 2022
5. Forecast Verification Training (JICA/BMKG)		Feb. to 3 Mar. 2023
6. Marine Meteorological Service Enhancement Training (Third Country Training Programme of JICA)	9	21 to 30 Aug. 2023
7. Internal Induction Training	1	28 Sep. 2023
8. Meteorological Instruments Calibration and Maintenance Training (Third Country Training Programme of JICA)	10	30 Oct. to 8 Nov. 2023

Source: FMS Training Report

The WMO sets out the requirements for training facilities through the RTC Operational Management Guide. The current status of FMS facilities against this is shown below.

■ One or more classrooms for lectures, private study and exercises

- Classroom sessions are held in the Conference/Seminar room. The room is also used for staff meetings and meetings with visitors.
- The training room is 6x14 m (84 m2) and can be divided in two by a movable partition. The classrooms have a vertical shape, which means that the distance between the instructor and the trainees is greater when there are a large number of trainees.
- In theatre-style without desks, the room can accommodate up to 70-80 people. Normally, there is a maximum of 10-15 participants per course and the current training room is adequate in terms of space, but there are not enough rooms for group work, individual study or other purposes.
- FMS facilities are poorly equipped and under-utilised for holding conferences and seminars such as WMO/SPREP.

■ Weather forecast simulator rooms with access to observations and forecasts

- None.

■ Computer laboratories
- None.
- In training, it is a general requirement that trainees bring their own laptop PCs, although some participants do not have a PC.

■ Libraries
- There is a library in the FMS with a librarian (3.2x5 m: 16 m2). No reading space.
- When the FMS was first built, a larger library (48 m2) was provided, but with the increase in the number of staff, this room was converted to the Hydrology Division.
- The collection is old, with many textbooks from the 80s and 90s.

■ Meeting rooms
- The training room is shared with a meeting room. It is necessary to arrange with the training when holding meetings that accommodate large numbers of people.

■ Storage room for teaching and learning resources
- At present, teaching and learning materials are stored in the training staff room (there is no specific storage room).

■ Amenities (Bathrooms/toilets/Kitchen/Locker room)
- The FMS has a Tea Room (18 m2) for staff, where trainees can also prepare and eat and drink refreshments.
- Toilets are also not a problem in terms of capacity.
- There are no lockers for trainees and it is the responsibility of the individual to store valuables such as PCs.

■ Recreational facilities
- None.

■ Residential facilities such as cafeterias and laundries
- None.
- Trainees usually stay in hotels within walking distance of the FMS.

■ Staff room
- There is one staff room (originally planned as the Hydrology Division) measuring

5x6m = 30m2.

- The room is separated by a middle wall and can be used by a Senior Training Officer (1 person) and a Training Officer (2 persons).

■ Video and data projection systems/video or web conferencing systems

- The training room is equipped with a ceiling projector (1).
- There is no sound equipment in the training room, although Zoom meetings etc. are held.

■ Internet access

- Available. Free Wi-Fi is available in the training rooms.
- Distance learning is affected by the telecommunications situation in the learner's country.

■ Web server access for hosting a website

- Some training is conducted using the management system Moodle. Trainees can access curriculum and reference materials using the same system, but the existing FMS server has low capacity, which has led to the need to limit the number of trainees who can access the system.

■ Learner response systems

- Available using 'Moodle'.

■ Black/white and smart boards

- There is one set of smart boards in the training room. However, the number is not enough to support group work.

■ Printing and photocopying facilities (room)

- There is one photocopier in the training room. In addition there is one photocopier in the staff room. Currently, there are no problems.

■ Access to the same equipment that is used in real-time operations. This equipment might include:

i) Surface and upper-air instruments and radars
ii) Maintenance facilities and communication and calibration equipment
iii) Forecasting workstations and observing equipment

- Available. Practical training requiring equipment can be carried out in FMS

divisions. However, with regard to training in the calibration of measuring instruments, there are limits to the training that can be provided under the current FMS facilities.

(6) Designation of RTC by the WMO

1) Consensus building on establishing RTC

It was agreed at the 2017 4th Pacific Meteorological Council (PMC) meeting that the FMS will seek WMO accreditation as the RIC and RTC for the Southwest Pacific region. It was also agreed at the 6th PMC meeting in 2023 to establish a task team consisting of key organizations to establish an RTC in 2025.

2) Procedure for designation

According to the WMO's guidelines for RTC designation, the procedures for RTC designation are as follows. At present, steps (i) and (ii) are in the process of being completed. Currently, Task teams have been formed and are working on these procedures.

i) A Member wishing to offer national training facilities as a WMO RTC submits its proposal through its Permanent Representative (PR) to the President of Regional Association (PRA) for consideration and a recommendation by the regional association.
ii) The recommendation of the regional association, or its president, is reviewed to determine regional interest in the designation.
iii) A self-assessment by the proposed WMO RTC or the additional Component is completed and submitted to the Secretariat.
iv) A representative of the WMO Secretary-General will survey the training facilities and programs and assess, using the self-assessment template and suggested questions, their compliance with the criteria for the designation of a WMO RTC.
v) The report of the Secretariat mission is considered by the EC Panel or by its Chairman on behalf of the EC Panel.
vi) The recommendation of the EC Panel is considered by the Executive Council or WMO Congress.

3) Self-evaluation of whether the designation criteria have been met

Self-evaluation is a material to determine the extent to which the institution concerned meets the criteria for the establishment of an RTC. The five evaluation criteria are as follows.

i) Identifying learning needs

ii) Designing the learning service
iii) Delivering the learning service
iv) Assessing learning and evaluating the learning service
v) Administering and managing the learning service

The table below shows the results of the evaluation by the FMS training officers according to the WMO's self-assessment form. According to this, the current FMS is in a situation where all of the above items (1) to (5) are "partially fulfilled" ("not fulfilled" in some sub-items). In this case, the FMS may be recommended by the WMO to defer its designation as an RTC if significant improvements are identified as necessary. The FMS will therefore need to correct certain issues before a formal external review can take place.

Table3-1-4 : **Self-evaluation by FMS training officers on RTC criteria**

Criteria required	Results	Matters not meeting requirements.
1. Identifying learning needs The RTC component has processes in place to gain information about the education and training needs of the Region.	Partially Meets	Regional needs assessment plans or reports, including data collection methods used.
2. Designing the learning service 1) The RTC component selects methods of learning that respond to the aims and requirements of the curriculum and learning outcomes, and are appropriate for the learners.	Partially Meets	Reports available on the implementation of new learning solutions (such as DL, new classroom approaches, etc.)
2) The RTC component ensures that its courses of instruction and other activities (e.g., delivering/developing e-learning, running off-site activities, providing advice/support) are carried out in a way that is consistent with the standards and guidance material issued by WMO.	Fully Meets	-
3) The RTC component provides courses and other resources and activities that address the expressed education and training needs of the Region.	Fully Meets	-
3. Delivering the learning service	Fully Meets	-

1) The RTC component demonstrates that, during the previous four years, it has made a contribution to meeting the education and training needs identified by the Region [Regional Association].		
2) The RTC component delivers training with competent instructors in terms of their scientific/technical ability and training expertise.	Fully Meets	-
3) The RTC component delivers training in an environment which is conducive to learning with adequate learning resources, buildings, ICT systems and training facilities.	Fully Meets	-
4. Assessing learning and evaluating the learning service 1) The RTC component assesses the knowledge and competency of students, documents this information in a fashion suitable for a recognized quality management system, and provides students with a record of the education and training that has been successfully completed.	Partially Meets	Summaries of course test results for some training events
2) The RTC component has processes for measuring the effectiveness and quality of the learning service, including obtaining feedback from stakeholders.	Fully Meets	-
5. Administering and managing the learning service 1) The RTC component has adequate arrangements for administration, governance, planning, staffing, continuous professional development (of RTC staff members), reporting and self-assessment.	Partially Meets	• Training policies • Staffing information and organizational diagrams
2) If the RTC component has no national accreditation as a provider of vocational training, the RTC component can demonstrate that it	Partially Meets	• Certificates of accreditation and accreditation reports. • Evidence comparing

carries out its training activities in accordance with the requirements of ISO 29990:2010.		institutional practices to ISO 29990:2010
3) The RTC component produces an annual report on activities in the previous twelve months, and its plan for the next 12 months with an outlook for future years.	Does Not Meet	• Annual reports on regional education and training activities • Recent outlook for future years
4) The RTC component is open to students from all countries in the Region and, subject to availability of resources, to interested countries in other Regions.	Partially Meets	• Annual reports • Description of services to support international/regional students (tuition support, library, accommodation, sports/recreation, visa, cultural induction, language support)
5) The RTC component has appropriate services in place to support international/regional students.	Partially Meets	

Source: Interviews with FMS training officer

3 – 1 – 2 Facilities for disaster awareness-raising

(1) Overview of disaster education and awareness-raising activities by FMS

1) Awareness-raising activities through community visits

The FMS provides awareness and education to community residents and school personnel (students, teachers and parents) to minimize loss of life and property due to tropical cyclones and other weather-related disasters.

FMS's education and awareness-raising activities are characterized by the provision of consistent services regarding (i) provision of weather and disaster information, (ii) improvement of understanding of the information, and (iii) response to disasters.

Many organizations, including NGOs, conduct disaster education and awareness-raising activities, but the FMS, as a weather specialist, has great potential as a different kind of learning provider from them.

Awareness-raising activities are conducted on a quarterly basis throughout the country, particularly in disaster risk areas. World Meteorological Day (23 March each year) and International Disaster Preparedness Day/Fiji National Disaster Awareness Week (13 October each year) are particularly important events. Each event lasts from one day to one week and is attended by 50-150 people per event. For example, a one-week course targeted at schools consists of the following, including a video presentation.

i) Weather, Climate and Hydrology
ii) Meteorological Instruments
iii) Impact of Tropical Cyclone and Storm Surge
iv) Lightning and Thunder
v) Waves and Swells
vi) Climate Change and its Impact
vii) El-Nino & La-Nina
viii) Understanding Alerts, Warning and Advisories
ix) Video Clips on Extreme Weather events
x) Tropical Cyclone forecast track and threat map and plotting of cyclone position
xi) Career path for Fiji Meteorological Services

2) Awareness-raising activities for FMS visitors

According to the FMS, the FMS receives 9,600 visitors a year. The FMS provides them with information on Fiji's weather, disasters and the work of the FMS, which is an important opportunity for disaster risk reduction awareness.

Table3-1-5：**Number of visitors per year to the FMS**

Visitor classification	Number	%
General Public	2,000	21%
Government Officials	300	3%
Emergency	300	3%
Aviation Industry Representatives	400	4%
Marine Industry	100	1%
Tourism Industry	300	3%
Researchers and Scientists	200	2%
Educational Groups	6,000	63%
Total	9,600	

Source: FMS

63% of visitors are educational groups, mainly primary school pupils. Of the total number of visitors, 5,368 people in 79 groups in 2023 can be traced from visitation records. These include primary and secondary school students, as well as university students such as USP and FNU, church groups, women's groups and disabled groups. In the case of awareness-raising for visitors, participants are given a brief introduction to the FMS, followed by a tour of the various divisions and receive an explanation of the work of the FMS, how the weather works and the equipment

used. The stay lasts approximately one hour.
Primary and secondary school students make up the majority of visitors, but their purpose is more a social tour of the FMS than disaster education and awareness-raising. Although there are opportunities to learn about climate change and the mechanisms of weather and disasters, the time available for this is limited. This is partly due to the fact that school visits to the FMS are conducted according to the curriculum of the Ministry of Education. FMS visits fall under “School Excursions” or “Enterprise education” and are not implemented as part of the disaster management curriculum, as their purpose is to get to know society and work. In addition, these activities tend to be concentrated in November-December as it is considered as an “after examination activity” of the school.

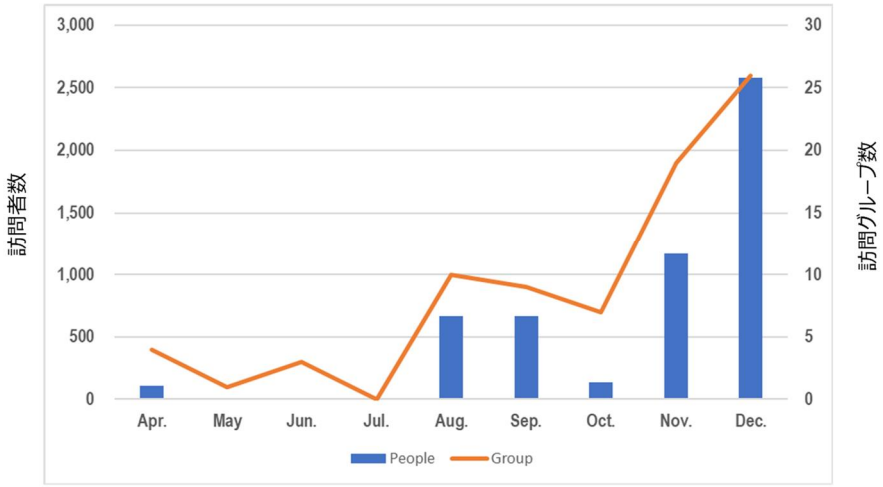


Figure3-1-1：**Number of visitors to the FMS by month, 2023**

Source: FMS Visitor records

The average number of visitors per group was 67.3. The maximum number of visitors was 265. There were 21 large groups with more than 100 people in 2023 (36% of the total number of groups). The FMS, which does not have any facilities for awareness-raising, becomes very crowded when it receives such large groups. For this reason, groups of more than 100 people are divided into groups of about 50 people and visited in turn.

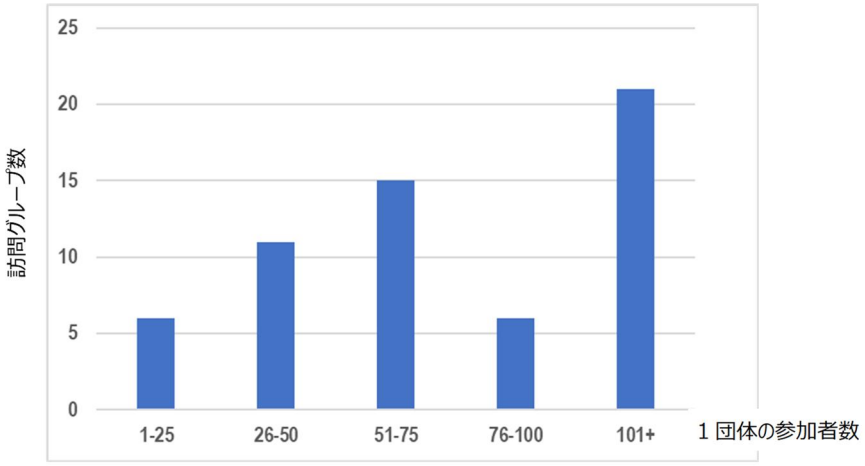


Figure3-1-2：**Number of groups visited to FMS by size**

Source: FMS Visitor records

(2) Awareness materials

Seven types of educational videos are available as educational materials. In addition, five types of awareness books are available. These were developed by the NDMO or BOM and the FMS applies these materials as appropriate during community visits to conduct awareness-raising activities. In addition to these, the FMS has produced and printed one-page paper brochures for awareness-raising purposes, but the number of these brochures is insufficient to distribute to all participants.

Table3-1-6：**Awareness Videos and Books available at FMS**

Awareness Videos	Awareness Books
i) Tropical Cyclone Formation ii) Wind Direction and Speed iii) Floods iv) Atmosphere v) El Nino & La Nina vi) Wave Buoy vii)Coastal Inundation	i) Awareness Books ii) Tsunami iii) Land Slides iv) Storm Surges v) Cyclones vi) Floods

Source: FMS

No videos or awareness books are used in the awareness-raising activities for FMS visitors. However, a number of panels and posters showing weather information and disaster mechanisms are displayed in the corridors of the FMS, from which participants can learn.

(3) Instructor

Awareness-raising activities related to disaster management are concurrently handled by a Senior Training Officer, of which there is only one as of January 2024. The Senior Training Officer specializes in meteorology and has no specialized training in disaster education. In the case of awareness-raising activities for FMS visitors, the visitors are briefed by the FMS divisional officers. If the training officer is not available, an appropriate person should lead the visiting group in his/her place. As there is only one training officer, the number of awareness-raising activities through community visits is affected by his schedule.

(4) Awareness activities management

A budget plan is prepared every year for the awareness-raising activities carried out by visiting communities. However, annual activity plans and annual reports are not prepared. The PDCA management of awareness-raising activities is not well functioning. Adequate management is difficult in a situation where there is only one person in charge and where he is concurrently responsible for training tasks.

As regards organizations visiting the FMS, they are required to submit an application form in advance according to the FMS format. The training officer coordinates the reception schedule for each organization and prepares a record of visitors (date, name of the organization, number of participants. The records are handwritten, and the data is not computerized). Awareness-raising of visitors is carried out in a customary manner and no implementation manual has been prepared outlining the purpose of awareness-raising, methods and procedures of implementation, points to be considered, etc.

(5) Awareness facilities

In the awareness-raising activities for FMS visitors, visitors are taken around to the various divisions, where they stand and listen to a brief explanation. There is no program of lectures in classrooms. For this reason, the FMS does not have specific facilities for awareness-raising. As mentioned above, various panels are displayed in the corridors, but the corridors are narrow and do not provide time for participants to stop and look at them.

Visitor groups, especially student groups, arrive in large buses, sometimes as many as three or four buses at a time. These buses are parked in a open space outside the FMS premises, but no problems have been identified. This open space is also used by participants for lunch and rest. The FMS allows participants to use the toilets. Although the number of participants exceeds 200 at the most, no particular

congestion has been observed in the existing toilets.

3 – 1 – 3 Calibration

(1) Present Situation of Calibration in FMS

1) Present situation of Weather observation and its maintenance

Surface observation network of FMS consists of 29 automatic weather observation stations (AWS), 32 manual synoptic stations, 10 rain observation station.

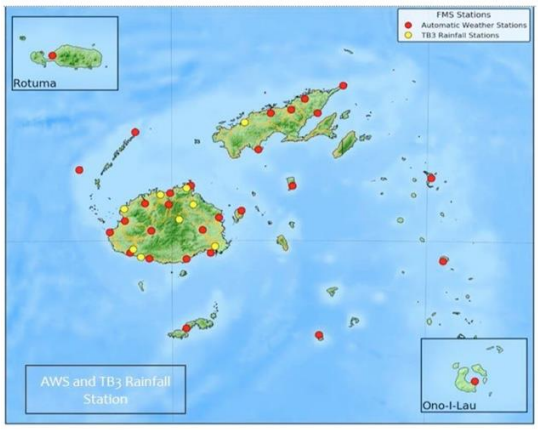


Figure 7: FMS Automatic Weather Stations and Rainfall Stations (Source: FMS)

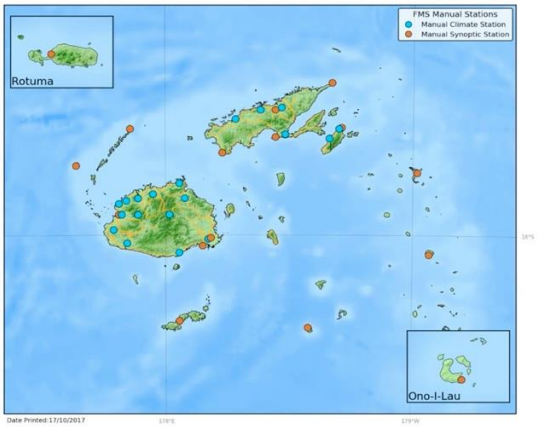


Figure 8: FMS Manual Climate and Synoptic Stations (Source: FMS)

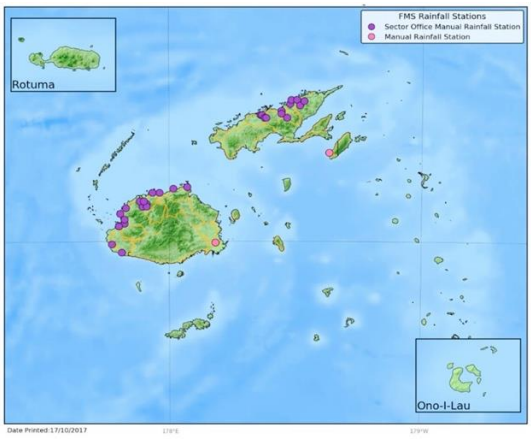


Figure 9: FSC Sector office and Manual Rainfall Stations (Source: FMS)

Source: Fiji Implementation Plan for Enhanced Climate Services 2019 – 2024

Figure3-1-3：**Surface observation network of FMS**

On-site inspections of observation equipment are conducted once a year at each observation station. Thermometer, hygrometer, and barometer are checked by comparing them with working standards, and rain gauge are checked by using a portable simple calibration device. On the other hand, the operation of the moving parts of the cup-type anemometer for wind observation has been visually confirmed.
In addition, solar radiation observation is also carried out in about half of the AWS, and the inspection of the pyranometers consists of zero-point calibration with a cover on and cleaning sensor.

2) Calibration standard and calibration procedure

Instrument calibration at FMS began with a JICA grant aid project in 1996 and was later established as a regular part of FMS's work with JICA's technical cooperation and equipment provision through short-term expert dispatch and third country training. Many of the various FMS calibration equipment and standard instruments described below were supported by JICA, and the staff's calibration techniques were also transferred through training in Japan at RIC Tsukuba through JICA and a series of technical guidance provided by Japan Meteorological Agency experts.
Currently, FMS is calibrating three elements: atmospheric pressure, temperature, and relative humidity, and the outline of each calibration method is as follows.

A) Atmospheric pressure:

Vaisala PTB330TS is used as the main calibration standard and working standard for patrol inspections. The calibration equipment such as manual air pumps and calibration procedures are the same as those used by Japan Meteorological Agency (JMA).

B) Temperature:

I. A pair of Sankyo International CTR2000 and Pt100 is used as the main calibration standard.
II. The Precision Constant Temperature Water Baths used to calibrate the glass thermometer is Thomas Scientific's Celsius 100L, the same as that used by JMA.
III. Temp/RH Calibration Chamber (ESPEC PR-1J) is used to calibrate the electric thermometer. The calibration procedure and the chamber are the same as that of JMA. The working standard is HMP155.

C) Relative humidity:

A Chilled mirror dew-point hygrometer set (S1-S) is used as the standard, and calibration is performed in the Temp/RH Calibration Chamber (ESPEC PR-1J) mentioned above. The working standard is HMP155.

3) Traceability

FMS requests the Australian Bureau of Meteorology (BoM; RIC Melbourne) to calibrate each standard instrument and sends the set of equipment shown in Table3-1-7 to BoM once a year. On the other hand, calibration of working standard equipment for on-site inspections is carried out once a year at FMS.

Table3-1-7：**Standard instrument to be calibrated by RIC Melbourne**

ITEMS TO BE SENT TO RIC-AUSTRALIA FOR CALIBRATION

	Model No. and S/N	Item No	Item	Quantity	Case Number
Pressure	PTB330TS, s/n-K3140002	B1	Barometer	1	No. 1
	M170, s/n-K3110054	B2	Display (M170)	1	
		B3	Power cable	1	
		B4	Carrying case	1	
	HMP155, s/n-F3750066	B5	Humidity & Temperature probe	1	
		B6	Communication cable for B2	1	
		B7	Communication cable for B1	1	
Temperature	HMT331, s/n-J1540102	B8	Humidity & Temperature transmitter	1	No. 2
	CTR 2000 s/n: 026542/05	T5	Display Unit	1	
	Temperature probe s/n:TS-0165C0117	T6	Pt100 Probe	1	
	M170, s/n-K3110049	D3	Carrying electronic type standard indicator	1	
	HMP76, s/n-K3120009	D4	Carrying electronic type standard probe	1	
Relative Humidity	S-1S, 009H14	H1	Chilled mirror dew-point hygrometer set	1	No.3
		H2	Connection cable	1	
		H3	Power cable	3	
		H4	Communication cable (RS-232C)	1	

On-site inspections are carried out by the FMS headquarters (Nadi), Suva branch, and Labasa branch, dividing the country into three regions (Western Viti Levu, East/Central, and Vanua Levu).
Personnel from the FMS headquarters, Suva branch, and Labasa branch visit observation stations in each region once a year.

4) Calibration of standards of neighboring countries

During the third country training (instrument calibration) held in 2015, FMS calibrated standard equipment brought in by participants from neighboring countries as part of the calibration training.
Since then, FMS have been providing calibration services for measuring instruments (temperature, humidity, atmospheric pressure) as required by various countries.
The general pattern for this service is that participants from each country bring their instruments to weather-related meetings and training events held in Fiji, and after calibration them at FMS, take them home.
Past implementation status is shown in Table3-1-8. The number of instruments calibrated in the third country instrument training in 2015, 2016, and 2023 was 36, 25, and 14, respectively.

Table3-1-8：**Status of calibration by FMS for the past 6 years (According to FMS records)**

Country	Instrument	Cook Islands	Kiribati	Nauru	Solomon Islands	Tonga	Tuvalu	Vanuatu	Samoa	Niue	Annual count
2018	Barometer	2	2		1	1	1	3			6
	Thermometer, hygrometer	2	2				4	2	1		11
2019	Barometer						1				1
	Thermometer, hygrometer						1				1
2020	Barometer							1			1
	Thermometer, hygrometer							7			0
2021	Barometer										0
	Thermometer, hygrometer										0
2022	Barometer				2						2
	Thermometer, hygrometer										0
2023	Barometer	4	3			1	1	1			10
	Thermometer, hygrometer	4				1		1			6
Total	Total number of calibrations	12	7	0	3	3	8	15	1	0	45

5) Calibration equipment of FMS

As mentioned before, most of the FMS calibration equipment was provided with JICA support. Table3-1-9 shows the calibration-related equipment currently owned by FMS.

6) Calibration laboratory

The FMS calibration laboratory is approximately 10 square meters in size. Standard instruments and various calibration equipment are placed in this narrow space. Additionally, across the hallway from the calibration laboratory is a workshop where machinery is inspected and repaired. The space is several times larger than the calibration laboratory, and equipment calibration and maintenance records are stored on shelves on the side. (Figure3-1-4　Photo Related to calibration, Figure3-1-5：Photo Related to workshop).

Table3-1-9：**List of equipment for calibration of observation equipment at FMS**

	Item	**Model No. and S/N**			**quantity**
Atmospheric pressure	Barometer	PTB330TS, s/n-K3140002	Vaisala PTB330TS barometric pressure standard, portable with battery power, with data functionhttps://www.vaisala.com/ja/products/devices/instruments/ptb330ts		1
	Display (M170)	M170,	s/n-K3110054		1
	Power cable				1
	Carrying case				1
Relative humidity	Humidity & Temperature probe	HMP155, s/n-F3750066	Vaisala's HUMICAP® HMP155 humidity and temperature probe is a humidity referencehttps://www.vaisala.com/ja/products/weather-environmental-sensors/humicap-humidity-temperature-probe-hmp155		1
	Communication cable for B2				1
	Communication cable for B1	PTB110 K1110013 /N1730721			1
Temperature	Humidity & Temperature transmitter	HMT331, s/n-J1540102	VAISALA HMT331 Humidity/temperature Calibration https://totalcal.com/vaisala-hmt331-calibration-services/		1
	Display Unit	CTR 2000 s/n: 026542/05 TM6165	Sankyo International/High precision digital thermometer CTR2000 German WIKA digital thermometer [for 3-wire and 4-wire platinum resistance thermometers]		2
	Pt100 Probe	Temperature probe s/n:TS-0165C0117	Temperature sensor, combination of this and CTR2000 above is the reference device		1
	Carrying electronic type standard indicator	M170, s/n-K3110049			1
	Carrying electronic type standard probe	HMP76, s/n-K3120009			1
	Precision Constant Temperature Water Baths	Tomasu Kagaku Celsius 100L	Calibration of glass thermometers https://www.tomasu.co.jp/product/cel100l/		1
Relative humidity	Chilled mirror dew-point hygrometer set	S-1S, 009H14 https://www.shinyei.co.jp/stc/eng/products/humidity/dewstar-s1.html	High performance chilled mirror sensor with Shinei-Peltier thermoelectric mirror cooling		1
	Connection cable				1
	Power cable				3
	Communication cable (RS-232C)				1
	TXN 400 Temp Controller	13-G-014			1
	Temp/RH Calibration Chamber	ESPEC PR-1J SN: 15014419			1
Measuring device	Digital Multimter	124C20155			1
	Power Supply	PMC18-2VB000645			1

	
Photo from the back of the calibration laboratory (temperature and humidity chamber on the right side)	temperature and humidity chamber (right side) Humidity working standard (left side)
	
Barometric pressure calibration equipment (front) And Standard transportation case (back)	Photo from the door side of calibration laboratory Precision Constant Temperature Water Baths (right)

Figure3-1-4　Photo Related to calibration

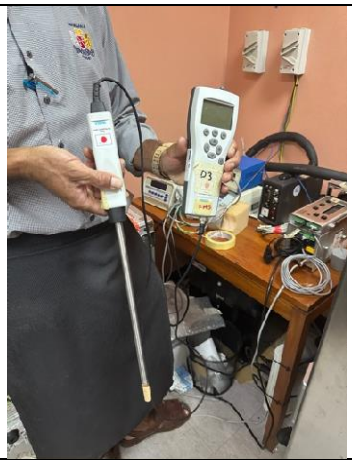
	
Workshop for fixing instruments	Record note of Calibration and equipment maintenance
	
Barometer standard (Vaisala PTB330TS-FMS)	Hygrometer sub-standard (HMP155 FMS)

Figure3-1-5：Photo Related to workshop

7) Calibration budget

FMS does not have a special budget for calibration but has a budget for maintenance of meteorological observation equipment. The calibration budget is included in the maintenance budget.

(2) Future plans for calibration

1) Calibration needs

■FMS

As shown in Table3-1-10, the number of instrument calibrations performed by FMS over the past six years was 57 for barometers and 19 for thermometers. The annual average is 9.5 times for barometer and 3.2 times for thermometer.

Table3-1-10：**Number of calibrations in the past 6 years at FMS**

	2018	2019	2020	2021	2022	2023	Total number of calibrations
Barometer (PTB etc.)	10	12	8	9	10	8	57
Thermometer Dig./Mercury/Min	2		7	4	4	2	19
							76

■Neighbouring countries

According to Table3-1-8, FMS is requested by neighbouring countries to calibrate 7.5 instruments every year. This average includes the period strongly affected by Covid-19. In 2018 and 2023, when calibration training was conducted, the annual average number of calibration devices was 17 and 16, respectively.

(Others)

In addition, FMS calibrates an average of about one simple instrument each year, free of charge, in response to requests from external organizations such as USP and shipping companies.

2) Plan for equipment calibration

Regarding equipment calibration, FMS is aiming for certification as a RIC. For this purpose, it is necessary to obtain ISO17025 certification. To ensure RIC and ISO17025 certification, traceability is required to ensure the accuracy of calibration equipment and standards.

For this reason, it is necessary to clarify the relationship between calibrations, from the FMS standard (national standard), to the sub-standard, and to the work standard used to actually verify equipment on site.

Currently, the FMS standard instruments for temperature, humidity, and atmospheric pressure are calibrated once a year by the Australian Bureau of Meteorology (BoM), and it is expected that this cooperative relationship will continue in the future.

Therefore, traceability of FMS temperature, humidity, and pressure to FMS standards is guaranteed.

In the future, with the cooperation of Japan's grant aid and technical cooperation projects, Japan may develop and train the personnel involved in handling equipment such as FMS standards, sub-standards, and work reference devices, which will ensure the accuracy of FMS calibration. We believe that this will form the basis of future equipment calibration plans.

Regarding calibration training, since 2015, third country training has been conducted for technicians from NHMS of surrounding island countries and FMS. FMS and the meteorological bureaus of neighboring countries hope to continue providing training through technical cooperation programs.

3 – 1 – 4 Current Situation of Operation and Management of Existing Facilities

(1) Policy and strategy

The Fiji Meteorological Service Strategic Plan 2021 to 2024, which sets the direction of the FMS, has been developed (in collaboration with WMO, Climate Risk and Early Warning Systems Initiative, Environment and Climate Change Canada). The Strategy comprises the following five strategic objectives.

Table3-1-11 : Five **strategic objectives in the FMS strategic plan 2021 to 2024**

Strategic objectives	Outline
i) Better Serve Societal Needs for Weather-, Climate-, Hydrology- and Ocean-related Services.	Improving FMS's contribution to the national multi-hazard early warning system, introducing impact-based forecasts and improving access of all Fijians to FMS's data and products.
ii) Strengthening the Technical Foundation of the FMS for the Future.	Technology path to be taken in strengthening FMS's ability to improve its meteorological and hydrological observations, develop improved forecasts and distribute data, information, forecasts and warnings more efficiently.
iii) Promote Insight and Innovation within FMS	Improved use of applied research with service users and cooperative research with local and international universities and laboratories to develop forecasts and warnings aimed at better meeting national and international needs.
iv) Pursue the "Daunidraki Way" - Vibrant, Effective Corporate Support.	FMS's management to modernize systems and policies to improve the efficiency with which the FMS asset base is managed and to establish a robust framework for free basic services to be provided along with cost recovered and commercial services.
v) Serve the International Community.	Planning the process for supporting and strengthening the important international roles FMS plays within the World Meteorological Organization, the Pacific Meteorological Council and other relevant regional bodies.

Source: FMS strategic plan 2021 to 2024

The establishment of RTC and RIC, which are the subject of this study, is clearly stated in Strategic Objective 5: "Contribute to the international community".

Table3-1-12 : **Strategic initiatives and implementation plans for the establishment of RTC and RIC**

Strategic initiative	Implementation plan
i) Work towards the implementation of a WMO Regional Training Center (RTC) in the South Pacific.	• Step 1: The FMS will continue to collaborate with a number of parties that collectively would be able to work together to put in place a Center that could meet WMO requirements for designation as a Regional Training Center for hydro-meteorological professionals and technical officers in the South Pacific with a campus in Fiji. • Step 2: FMS to give support to USP's proposed. • Step 3: Implement an MoU with USP to support provision of data to USP and cooperative training and research activities.
ii) Establish a WMO Regional Instrument Center (RIC) within the FMS.	• Step 1: Continue to work with JICA in developing the FMS's capabilities in meteorology. • Step 2: Explore opportunities for working with other RICs in the WMO V Region, including those in Australia and the USA. • Step 3: Build links to instrument makers through involvement in HMEI (Association of the Hydro-Meteorological Industry).

Source: FMS strategic plan 2021 to 2024

On the other hand, the FMS Strategic Plan does not contain the item/term disaster education and awareness-raising. However, it does state that in order to achieve Strategic Objective 1 'Better meet society's needs for FMS services', the FMS must work with the NDMO, the Ministry of Waterways and Environment and other relevant ministries to implement risk management activities for severe weather, floods and droughts. In disaster prevention and response, the FMS has an important responsibility in information services, but it is also indicated that it is the role of the FMS to ensure that this information is properly understood by the population.

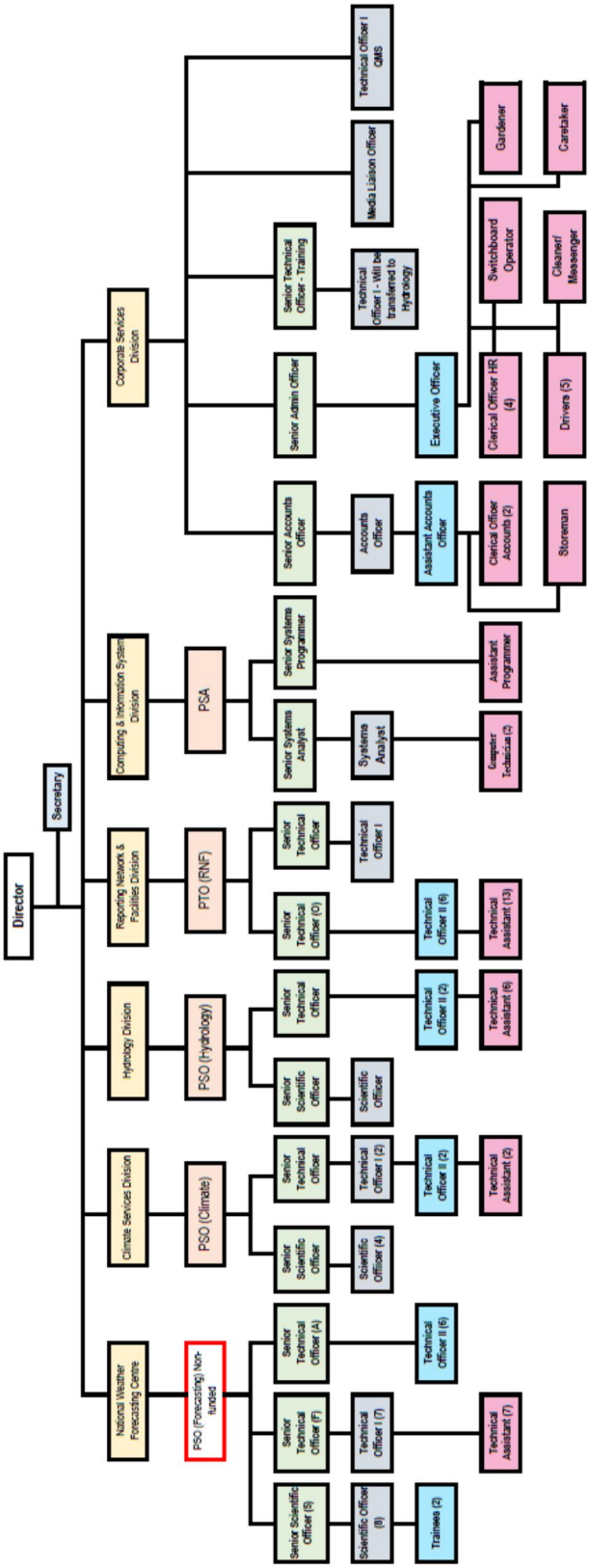
With regard to disaster education and awareness-raising, the Fiji National Disaster Risk Reduction Policy 2018-2030 similarly indicates that the FMS has an important position in information dissemination but does not state its role with regard to disaster education and awareness-raising.

(2) Organisational structure

The FMS organisational structure consists of six Divisions under a FMS Director. Each division is headed by a Principle Scientist/Technical Officer, who is responsible

for the division's operations.

i) National Weather Forecasting Center Division (30 staffs)
ii) Climate Services Division (12 staffs)
iii) Hydrology Division (12 staffs)
iv) Reporting Network & Facilities Division (22 staffs)
v) Computing & Information System Division (10 staffs)
vi) Corporate Services Division (25 staffs)



Source: FMS

Figure3-1-6：FMS organization chart

With regard to training and awareness-raising activities, there is no specialized section with only one person in charge placed in the Corporate Services Division. Due to the expertise of the person in charge, the main training subject that can currently be provided is meteorological observation, but there is no mechanism in place to mobilize staff from other divisions to provide training in other subjects. Therefore, at present, the organizational structure is not in place to take on the planned RTC.
On the other hand, the Reporting Network & Facilities Division is responsible for the work of the planned RIC and the maintenance of new facilities and equipment. The Principal Scientist/Senior Technical Officer responsible for the division is also in place, so there are no problems with the organizational structure.
The competent authority for the FMS is the Ministry of Public Works, Transport and Meteorological Services. The Ministry is responsible for the administration of the operation and management of the FMS in terms of policy, budget and personnel.

(3) Human resources (staffing and human resources development)
The number of FMS personnel currently stands at 123, of which 73 are assigned to the Nadi Meteorological Service. The number of staff has increased by a factor of 1.2, as the number of Nadi staff in 1995 was 59 (the overall number of staff at that time was 88).
In terms of posts, the staff, excluding administrative staff, has a balanced composition with 26% Scientific Officers (including Principle and Senior) with a bachelor's degree or higher, 32% Technical Officers and 32% Technical Assistants. The proportion of female staff is 27.5%. The average age of staff is relatively young, at 39.9 years on average, and the organisation is stable in the medium term. The age structure is unbalanced in that the largest number of staff is in their 30s and there are few staff in their 20s and 50s.
The low number of staff in 50s is due to the system of retirement at 55 years old. In the FMS, the retirement age has been extended to 60 years from 2023, which has enabled the retention of highly skilled veterans.

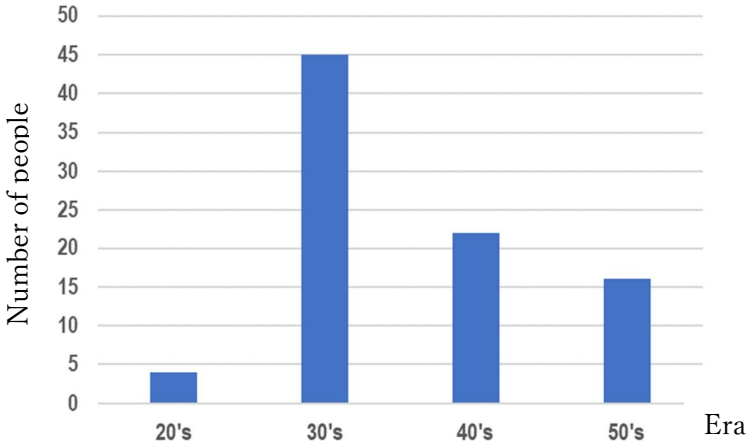


Figure3-1-7：**Age distribution of FMS staff**

Source: FMS

The capacity building of FMS staff, with the exception of training for new recruits, relies on external training institutions. Such training opportunities are numerous, and in 2023, 22 different training courses and workshops were attended by staff. The FMS has a Staff Training Committee consisting of representatives from each division, and there is a system in place to select the right training participants. However, there is currently no system for evaluating the effectiveness of training.

Table3-1-13：**External training courses attended by FMS staff, 2023**

Training providers	Course title	Timing
China Met. Administration Training Center (CMATC)=RTC Beijing	International Distance Training Course on Agricultural Met. (on-line)	May
	International Distance Training Course on Application of Met. Satellite Products (on-line)	Apr.
	12th international Distance Training Course on Nowcasting Techniques in Disaster Prevention and Mitigation (on-line)	Sep.
	3rd International Distance Training Workshop on management and Leadership for Senior Management of NMHSs (on-line)	Oct.
	11th International Distance Training Course on Aeronautical Met. Service (on-line)	Jun.
	International Distance Workshop on Climate Change and Adaptation under Grovel Development Initiative (on-line)	May
SPREP/Republic of Korea-Pacific Island	Training workshop	May

Climate Prediction Service Project 2 (ROK PI ClipS-2)		
Pacific Community (SPC)/ Australian Government/Climate and Oceans Support Program in the Pacific (COSPPac).	Regional Tide Training	Feb.
Pacific Community (SPC)	Sub-regional Training Workshop (Solomon, PNG, Vanuatu, Kiribati, Fiji)	May
	Fostering resilience education and best practice in the Pacific (in PNG)	Jun.
RTC Indonesia: Agency for Meteorology, Climatology and Geophysics (BMKG)	WMO Development of Competency in Weather Forecasting course to support the UN Early Warnings for All Initiative	Nov.
	Workshop on Volcanics Ash Impact Handing for Aviation	Nov.
WMO	WMO RA II Technical Workshop on Marine and Coastal Service	Dec.
	The 13th Asia-Oceania Met. Satellite Users' Conference in Korea	Nov.
	Annual Common Alerting Protocol (CAP) Workshop and Training Programme, Geneva, Switzerland	Oct.
	Seventh Port Met. Officers (PMO-7) Workshop	Oct.
	FFGS Female Technical Empowerment Workshop (in Geneva, Switzerland)	May
ICAO (International Civil Aviation Organization)	ICAO APAC SWIM Seminar and the 7th Meeting on System Wide Information, Bangkok Thailand	Apr.
Korea/Asian Productivity Organisation	Training course on Cybersecurity management System (Hybrid training)	May
Pakistan/Asian Productivity Organisation	Workshop on Reskinning of the Workforce in the Service Sector (Hybrid training)	May
Sri Lanka/Asian Productivity Organisation	Training course on Leadership in Public Sector Organisation (Hybrid training)	May
SPREP/PCCC	SPREP/PCCC Open-Learning Course	-

Source: FMS training report

The high number of resignations has been identified as a problem common to NMHSs in the Pacific countries. In this context, the number of FMS staff leaving has been low, 1~2 per year, but in FY2023/24 there were 12 mass leavers. The reason for the resignations was to move to institutions offering higher salaries, including the associated institutions SPREP, Australia BOM and New Zealand NIWA (National Institute of Water and Atmospheric Research).
FMS staff salaries follow civil service salary regulations, with a wide disparity between senior and junior staff. Salary bands are mainly influenced by degree, but due to the busy nature of work at FMS, it is not easy to take a study leave to complete a degree. Training history and qualifications are not reflected in salary. It is similar for WMO BIP training, which is an international qualification, unless it is accredited within the National Qualifications Framework (NQF) of the Fiji country.

Table3-1-14：**Annual salaries of FMS technical staff by title**

Title	Band	Salary (Fiji $)	円換算
Senior Scientific Officer	I	43,297~70,496	2,792,000~4,546,000
Senior Technical Officer	H	34,760~56,597	2,241,000~3,649,000
Technical Officer Class I	G	28,605~47,676	1,844,000~3,074,000
Technical Officer Class II	F	22,529~36,104	1,452,000~2,328,000
Technical Assistant	D	14,428~22,567	930,000~1,455,000

Source: Fijian civil service salary bands (29 June 2017)

(4) Technical level of staff

1) Staff in charge of training and awareness-raising

There is only one staff member in charge, Mr. Sajiva Nand Sharma , Senior Training Officer. He has more than 10 years' experience in training delivery and management. He is considered to have a high technical level as the responsible person for training operations in the FMS for the following reasons.

- His experience in training, including NMHS staff from Pacific Island countries.
- He has managed training using the FMS eLearning System. Proficient in its operation and use.
- Teaching skills are high and have been rated highly by trainees in training in the past (4.59 points on a 5-point scale for instructor knowledge: training in 2023).
- In order to acquire higher expertise, he completed the USP Post Graduate Diploma in 2023 and is currently undertaking a Master's programme.
- Morale in the management and administration of the training is also extremely high.

2) Person in charge of calibration

The Reporting Network Facilities Division is in charge of calibration work at FMS, and the following staff members who belong to the division are currently working at the Nadi headquarters, Suva branch, and Labasa branch. There is.

A) Harish Pratap - Principal Technical Officer (Nandi)
B) Ashnil Kumar - Chief Technical Officer (Nandi)
C) Amori Nabainivalu - Technical Officer Class 1
D) Esiki Tukana - Technical Officer Class 1 (1st class technical officer: Nandi)
E) Vuniwaqa Veitokiyaki - Technical Assistant (Technical Officer; Nandi)
F) Vincent Lincoln - Technical Officer Class 1 (Suba)
G) Rajendra Charan - Technical Officer Class 1 (Labasa)

Among these members, staff members B), C), E), F), and G) are responsible for inspecting and calibrating measuring instruments. Furthermore, the staff at B), C), and F) have the skills to perform calibration in a calibration laboratory (laboratory calibration) using standard equipment. Esiki Tukana is in charge of ISO documentation. However, field chief Ashnil Kumar is scheduled to retire by the end of December 2023. Along with this, FMS is planning to publicly recruit new staff.

(5) Finances

The FMS budget for 2023/2024 is F$5,986,811. In terms of composition, personnel costs account for 64%, while operation and maintenance costs are 27%.

Table3-1-15 : **FMS annual budgets**

Budget Categories		2019/2020	'2020/2021	2021/2022	2022/2023	2023/2024
Department Budget						
Operating Costs						
Established Staff	SEG 01	3,614,707	3,948,213	3,533,054	3,581,263	3,704,672
Unestablished Staff	SEG 02	178,610	138,027	107,208	108,202	113,339
Travel and Communication	SEG 03	350,000	375,000	348,000	399,500	399,500
Maintenance & Operations	SEG 04	694,034	523,360	533,600	1,615,000	1,616,860
Purchase of Goods and Services	SEG 05	608,620	465,326	451,040	117,440	75,440
Operating Grants and Transfers	SEG 06	30,000	67,814	37,000	42,000	42,000
Special Expenditures	SEG 07	40,000	95,000	20,000	35,000	35,000
Total		**5,515,971**	**5,612,740**	**5,029,902**	**5,898,405**	**5,986,811**
Capital Expenditure						
Construction	SEG 08	25,000	125,000	50,000	455,000	18,583
Capital Purchases	SEG 09	338,000	0	0	3,540,057	2,636,812
Capital Grants & Transfers	SEG 10	0	0	0	0	0
Total		**363,000**	**125,000**	**50,000**	**3,995,057**	**2,655,395**
Values Added Tax	SEG 13	185,009	145,937	126,238	554,130	716,580
Total Budget		**6,063,980**	**5,883,677**	**5,206,140**	**10,447,592**	**9,358,786**
Budget By Division						
Corporate Services	1	1,290,320	1,137,866	964,507	2,896,335	1,146,347
Reporting & Facilities	2	856,689	1,013,002	861,614	6,247,454	5,294,999
Weather Forecasting, Climate Servic	3	2,832,615	2,643,546	3,380,019	1,303,803	2,917,440
Climate Services	4	516,537	523,875	0	0	0
Hydrology	5	567,819	565,388	0	0	0
Total Budget		**6,063,980**	**5,883,677**	**5,206,140**	**10,447,592**	**9,358,786**

Source: FMS

Note: The budget for the Climate and Hydrology Division is zero from 21/22 because it is shown combined with the Weather Forecasting Division.

Personnel costs have not changed significantly over the past five years (meaning that staffing has not been increased). Equipment purchases are budgeted at F$3,540,057 and F$2,636,812 in 2022/23 and 2023/24 respectively, almost ten times more than in 2019/20. This was allocated for the purchase of radar, with a corresponding increase in operation and maintenance costs. This shows that the FMS has a certain cost-bearing capacity. On the other hand, the Reporting Network & Facilities Division also pointed out that there is a shortfall in the cost of

purchasing spare parts. The FMS does not provide any fee-based services and does not undertake any income-generating activities.

(6) Maintenance systems for existing facilities and equipment

The facility, which was built with grant aid in 1996, has been properly maintained and is in good condition after 27 years of construction. The Reporting and Facilities Division basically handles the regular maintenance and repair of the equipment and facilities at FMS.

The FMS has one workshop for maintenance and repairs, which is equipped with the minimum necessary tools. In addition, equipment specifications and other documents are properly filed in an easy-to-use manner. The department is staffed by 22 personnel and is considered technically sound. On the other hand, as a challenge, the management based on the registration book of facility equipment is not sufficiently effective. In addition, the budget for purchasing spare parts is not sufficient, which means that priority is given to repairs and maintenance has to be done later.

(7) Addressing gender mainstreaming in FMS

The FMS has not yet organised a specific document on gender mainstreaming and there is no mention of it in its strategic plan. However, in the provision of weather and disaster information, which is the core business of the FMS, the importance of inclusiveness and access to information for all, not only women but also children, the elderly and people with disabilities, is strongly recognised as a fundamental service issue.

The proportion of women among FMS staff is 25.5%, and 18.8% among technical staff excluding management staff. The low ratio of women is similar in the NMHSs of neighbouring countries, and as a result, the majority of participants in the training courses provided by the FMS are also male.

On the other hand, although accurate figures are not available for disaster education and awareness-raising activities, the ratio of male to female participants is almost the same. This is partly because both community visits and visitors to the FMS are mainly schools, where pupil enrolment is almost equal between men and women. The FMS also actively welcomes women's groups as visitors.

3 – 2 Plan and Policy for Facility Extension

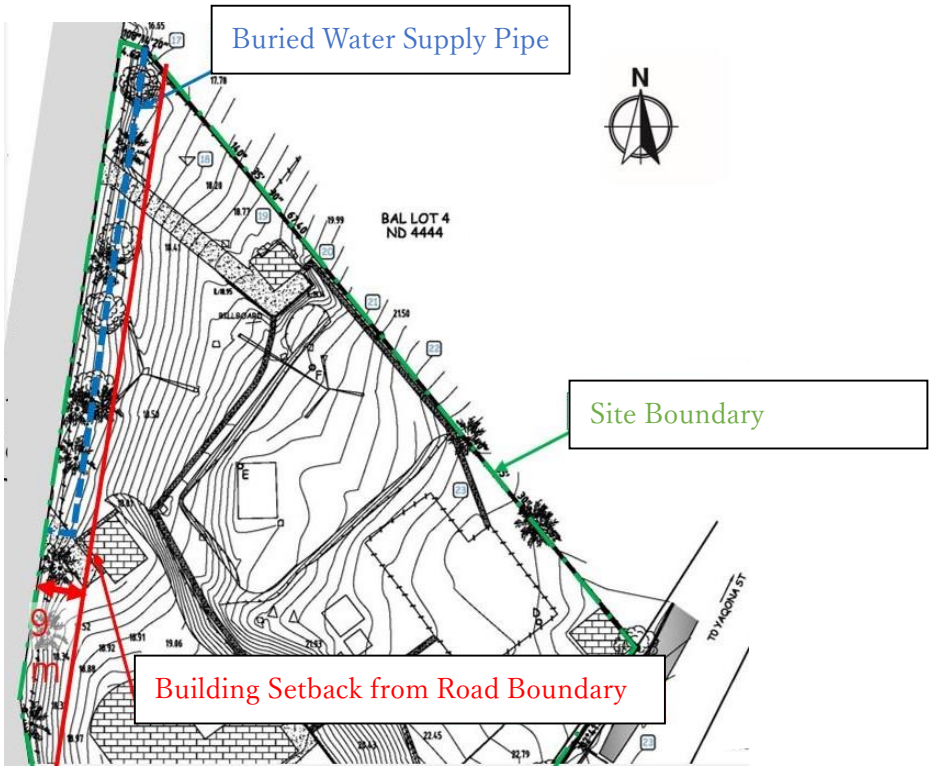
3 – 2 – 1 Architecture Planning

(1) Building Regulation

Main building regulations for the project site are as follows.

1) Setback from Road Boundary

9m setback from road boundary is required, because municipal water supply pipe is buried in the area.



Source: Survey Team

Figure3-2-1 : Building Setback Line from Road Boundary

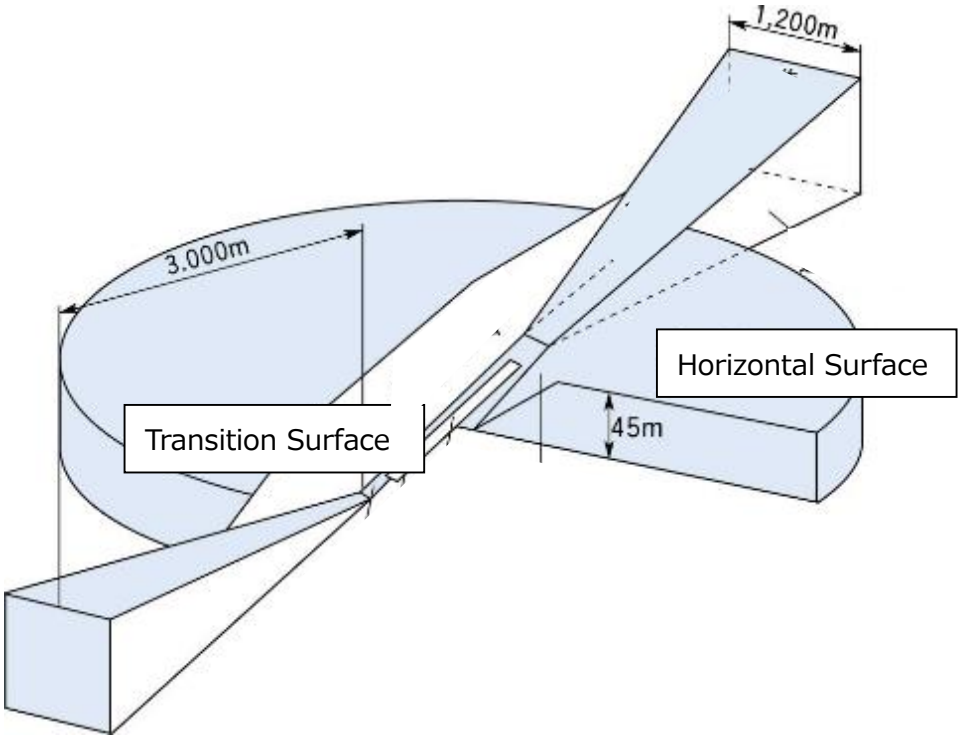
2) Height Limitation for Aviation Low

Height restrictions under the Civil Aeronautics Act are as follows. Of these, the height limit to ensure visibility from the control tower is the most restrictive for the proposed site, and this determines the height limit.

・Height limit by transition surface: the limit is the height of the slope 1/7 from the landing strip of the runway to the slope. In the planning area, this limits the height to 43.4 m above sea level and 23.4 m from the planning ground surface.

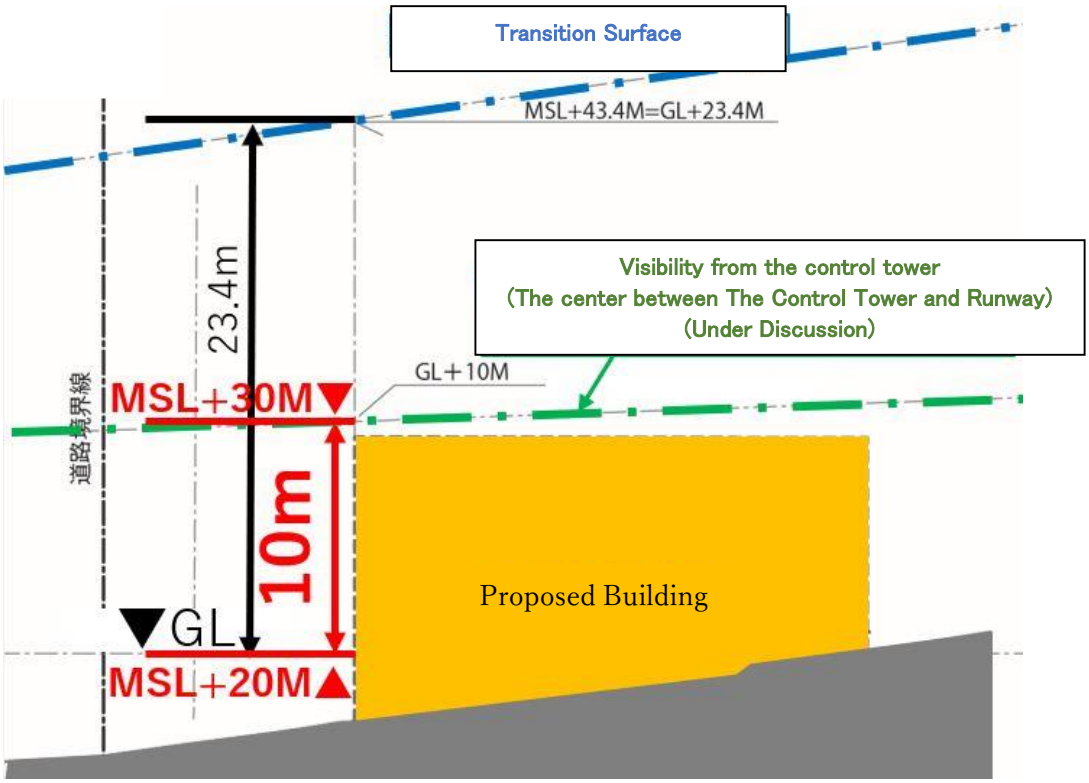
・Height limit to ensure visibility from the control tower: The limit is the height at which visibility can be ensured from the control tower to the center of the runway. This

limit is considered to be 10.0m above the planned ground level and the details are being discussed with the Civil Aviation Authority.



Source: Skyart JAPAN

Figure3-2-2 **: Height Limitation for Horizontal Surface and Transition Surface**



Source: Survey Team

Figure3-2-3 : Height Limitation for Visibility from Control Tower

3) Regulation for Health and Safety

OHS (Department of Occupational Health and Safety)'s main regulations are as follows.

Table3-2-1 **: Main Regulations by OHS (Department of Occupational Health and Safety)**

Building Type	Class5（Office, etc.）
Ventilation	Regarding opening ration for national ventilation, 10% of floor area is necessary. Mechanical ventilation can alter it.
Toilet	For maximum 87 users Each Floor, minimum requirement For men, 2 urinals, 2 large urinals, 1 hand wash basin For women, large urinals, 1 hand wash basin or more
Ceiling Height	Minimum 2.1M for Corridor, and 4M for other rooms

Source: Mady by Study Team, based on National Building Code

（3）Proposed Plan

1) Planning Condition

Table3-2-2 : Planning Condition

RIC	Assumes calibration of instruments for air temperature, air pressure, humidity, wind direction and speed, solar radiation and precipitation. The calibration laboratory for air temperature and air pressure will be a facility that complies with ISO requirements. Calibration services will be provided for instruments in Fiji and neighboring countries. → The scale of the content is to be confirmed in the future.
RTC	-Consideration of WMO guidelines (Check whether obligatory or recommended). -Maximum 10-15 participants per training course, 10 sessions per year expected → Future planning to be checked in the future.
Disaster Awareness Raising Area	・50 visitors for 1 unit ・Supposed visiting course: Current weather forecasting room→New disaster awareness raising area→Lecture→RIC area → Contents of exhibition, and operation method shall be considered later.
Number of Users	・RIC: 4（Constant） ・RTC: 2 lecturer, 15 Trainee（During Training Course）x Maximum 2 courses

	・ Disaster Awareness Raising Area: 1 (Constant) ・Disaster Awareness Rasing Area: 50 visitors (1hour stay) → Maximum: 87, During 1 training course: 22 Precise numbers shall be considered in next survey.

Source: Study Team

1) Planning Concept

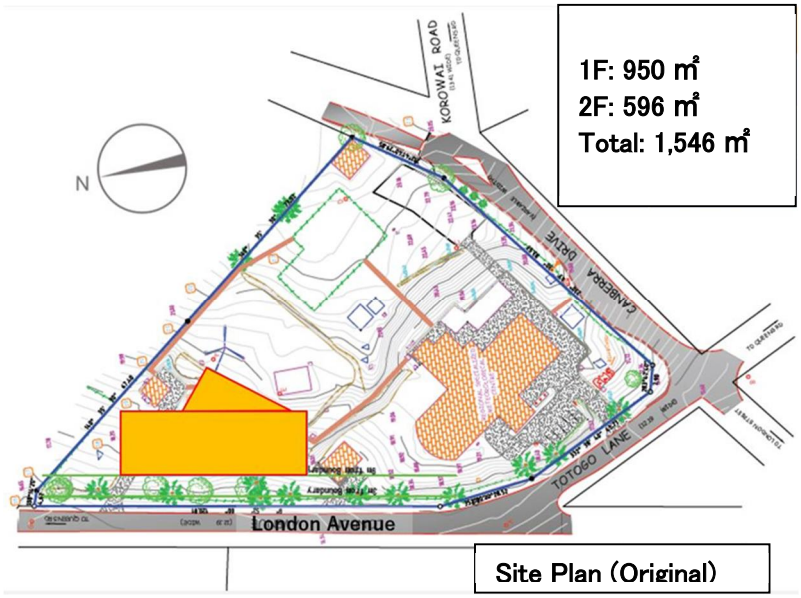
・Preserve trees along London Avenue, and keep the building setback line and height restrictions

・Consideration to noise of generator from opposite site (60dB-70dB)

- ・ RTC and Disaster Awareness Raising Area on Ground floor, and RTC on 1st floor
- ・ Reduce vibration from RIC by RC structure
- ・ Material choice considering decarbonization and low energy consumption
- ・ Consideration of installation of solar panel and its electricity operation
- ・ Utilizing local materials, like Pine wood, mahogany, monkeypod.

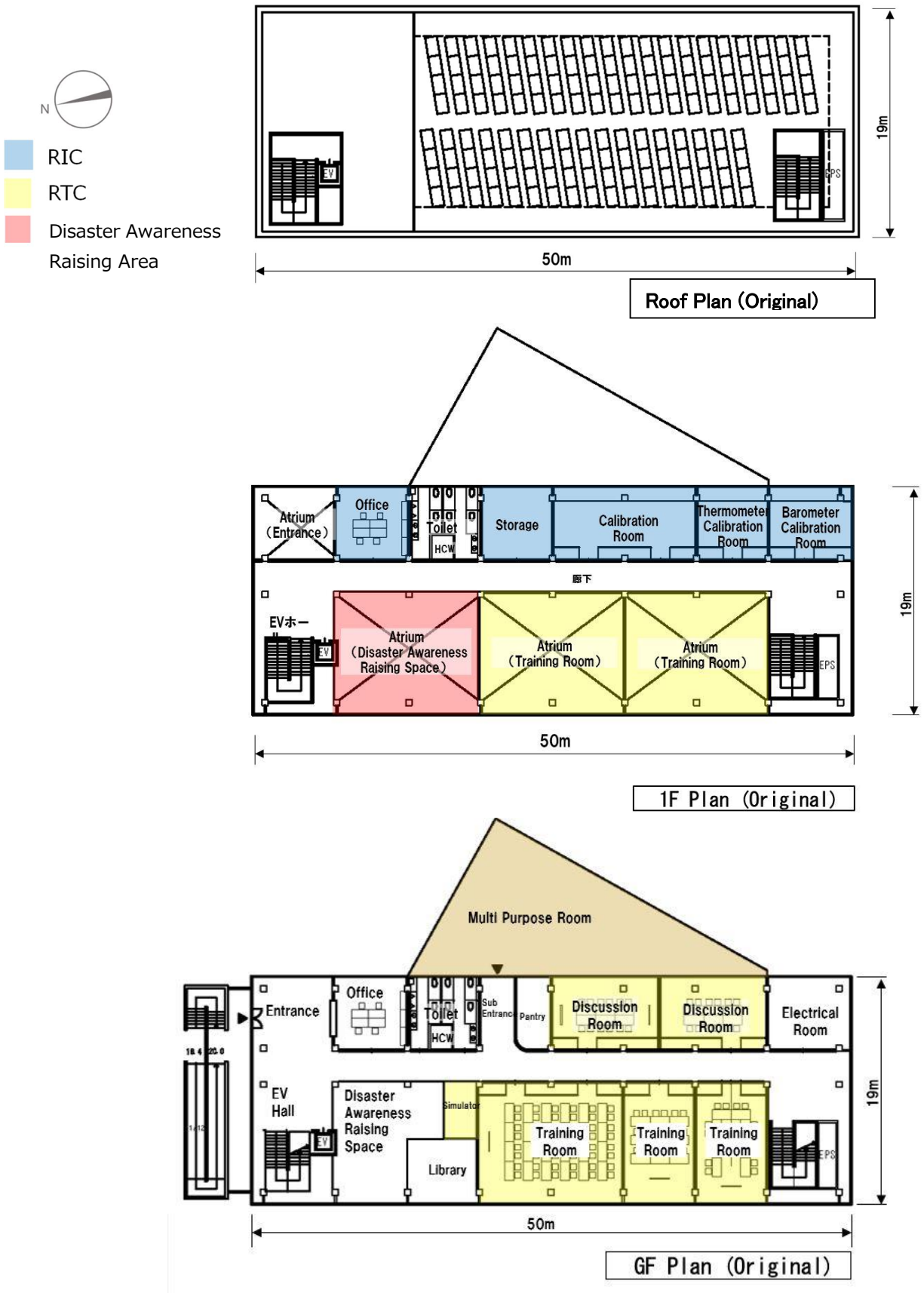
2) Proposed Plan

Considering building restriction, planning condition, and concept written above, proposed plan is shown as follows. To consider size of each room, deduced size proposal is also shown.



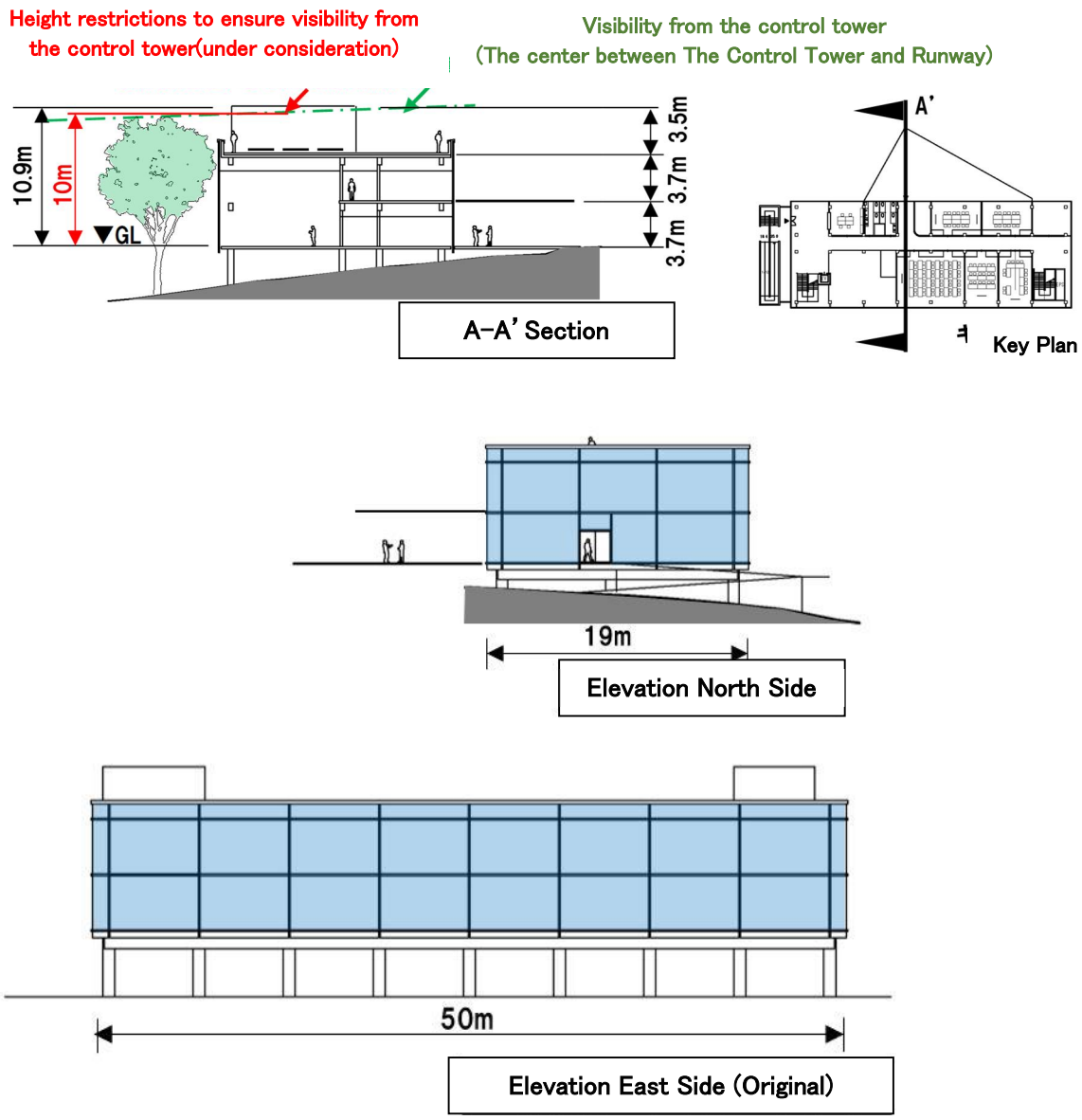
Source: Survey Team

Figure3-2-4 : Site Plan



Source: Survey Team

Figure3-2-5 : Plan



Source: Survey Team

Figure3-2-6 : Section･Elevation

3 – 2 – 2 Related Infrastructure and Facility Plans

（1）**Existing Infrastructure and Existing Facilities**

Through discussions with Energy Fiji Limited (EFL), the electricity distribution company, Dili Water and Sewage Authority of Fiji (WAF), FMS facilities Engineer and others, and a site survey of the existing FMS project site, the following results were obtained on the condition of the infrastructure and existing facilities around the proposed site.

1)Water Supply

The existing water source is the City Water distributed by the Water Authority of Fiji (WAF), however, due to the low and unstable water pressure of the city water, it was confirmed that the domestic water supply system is to store the city water in a Reservoir and supply it to the existing buildings by a pneumatic water supply pump.

2)Existing System

Source: City Water

- City water pipe size: 150 mm dia.
- Capacity of above ground type Water Reservoir located in Southeast: 5.3 m3 (HDPE)
- Capacity of water supply pump: Unknown
- Actual water supply volume data by FMS is under confirmation.
- Wastewater & Sewage pipe size: 150 mm dia.
- Existing Drawings: “FMS OF THE GOVERNMENT OF REPUBLIC OF FIJI AS BUILT DRRAWINGS," etc., prepared in December 1996.

3)Domestic Wastewater Drainage & Sewerage

In Nadi, the public sewerage system is provided by the Fiji Water Authority (WAF). Domestic wastewater (sewerage and miscellaneous drainage) is typically discharged directly from the facility to the main sewer system. There are rain water gutters on site, but storm water is generally not combined with domestic wastewater (sewerage and miscellaneous drainage) and is allowed to soak into the ground without being connected to the main sewer system.

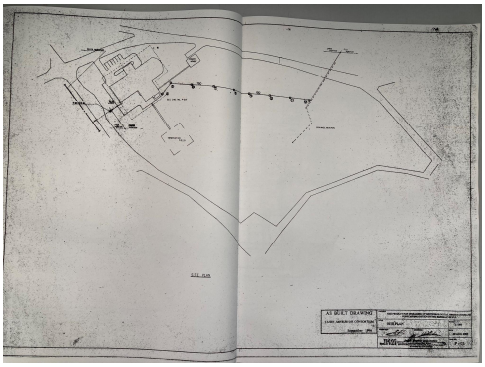
	
Water tank (5.3m3) and Pressure pump	Main water supply pipe
	
Drawing for existing sewer line	Existing sewer manhole

Figure3-2-7：The picture related to water supply

4)Electricity

The existing electricity supply on site is connected to Energy Fiji Limited's (EFL) Medium Voltage Distribution Network (11KV) via underground power service line, and the power is received at the Substation located in the building’s Electrical Room.

5)Existing EFL power system and distribution

Medium-voltage power supply (power company EFL) : 11kV, 3-Phase, 3-Wire, 50Hz

6)Existing power receiving and transforming facilities

- Substation: Indoor Transformer capacity of 300 kVA (Transformer installed in 1996), 11 kV /415V/ 240V
- 300 kVA (Transformer installed in 1996), 11 kV /415V/ 240V
- Indoor Low Voltage Switchgear panel (Main Circuit Breaker Capacity: 500 A) installed on the secondary side of the transformer.
- Low-Voltage Power Distribution
- -3-phase, 4-wire, 415V/240V, grounding method : TN-S system (neutral wire and protective conductor separation system)
- Low-Voltage Trunk Line is distributed by buried cables from the indoor Low-Voltage Switchgear Panel installed on the secondary side of the Transformer to the Main Distribution Panel in the existing building. The maximum power demand of the existing FMS is under confirmation with the FMS.

7)Emergency Diesel Engine Generator

During the field survey, there were almost no power outages and no generator startups. Although the power outages occur infrequently, interviews with FMS Electrical Engineers indicated that in the cyclone season (November through April), power outages of up to 3 hours could occur. The existing generator building is equipped with one set of Diesel Generator (220 kVA) and an above ground- type Fuel Tank (Capacity: 600 L).

Generator is connected to the low-voltage power supply system and supplies the security load of important equipment. In addition, an uninterruptible power supply (UPS) is installed at the input of the Low-Voltage Main Switchboard to prevent voltage fluctuations, and it was confirmed that the UPS is used to supply power to outlets in the Forecast Room, Training Room, and Server Room. The quality of the power supply will be investigated in the future through recommissioning.

	
Substation	Generator room

Figure3-2-8：The picture related to Emergency Diesel Engine Generator

8)Telephony and Communications

Existing FMS has a telephone line and fiber optic line for network services installed in the server room on the 2nd Floor, and telecommunication lines have been installed in the facility. Interviews with the FMS Facility Telecommunication Engineer confirmed that it would be possible to supply telecommunication lines from the existing Server Room to the new facilities. Currently, FMS has a contract with the Provider, Telecom Fiji Limited (TFL) and the current communication speed specification is in 100 Mbps service.

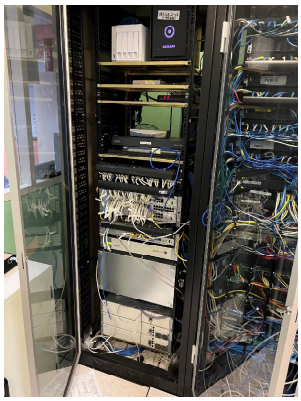
	
Server room 19 inch rack	Termination box for optical cable

Figure3-2-9：The picture related to Telephony and Communications

(2)Plumbing

1)Water Supply System

- Source of Water

Water Authority of Fiji (WAF) is responsible for the water supply (water supply and drainage) in Nadi. The water main is laid on the Southeast side (Canberra Drive) and West side (London Avenue) of the project site, and is connected to the FMS Water Tank through an 80 mm dia. branch from the 150 mm dia. water main. After the water tank, a 50mm diameter pipe is laid on the site to supply water to the buildings. For the water supply to the new facility, "water Receiving Tank + Pneumatic Water Pump System" will be considered, and a new municipal water pipe connection will be provided.

Water main pipe: 150 mm dia. (Existing)

Water supply pressure: Under confirmation with the Waterworks Authority.

Daily Water Consumption for new facility

Number of Users: 8 staff and 200 visitors (Training Rm.)

Average Daily Water Consumption Per Person (for domestic use) =80 liter/person･day x 8 persons + 25 liter/person･day x 200 persons = 5,640 liter/day Say 6.0 m3/day

- **Water supply system and capacity main equipment**

The water supply to the new facility will be provided with a new service intake pipe from the existing main water supply pipe, and above ground type water Reservoir will be installed with a pneumatic water supply pump system in the same manner as the existing system.

In general, above-ground type plastic Water Tanks are used on site. The capacity of the Water Tank will be sufficient for a half-day's usage in consideration of sanitation.

The water quality will be investigated by a subcontractor in the future under recommissioning.

- Water Tank (for domestic use): Capacity 6.0 m3/day x 0.5 days = 3.0 m3.
- Water source for Fire Extinguishing (for Hose Reels): Water discharge rate per hose reel: 40 L/min

Capacity of water source for 2 units of Hosee Reel for 90 min.

Capacity 40 L/min x 90 min x 2 units = 7.2m3

Reservoir Tank capacity totaling the above: 10.20 m3, external dimensions 2.5 m dia. x 2.6 m (height)

- Pneumatic Water Supply Pump Unit: 2 units (automatic alternating operation)
- Fire Pump Unit: 1 unit

2) Wastewater Drain and Sewage

Domestic wastewater from the new facility will be discharged directly into Main Sewerage System. Rainwater will be discharged into rainwater gutters on the site and will soak into the site without merging with domestic wastewater (sewage and miscellaneous wastewater).

3) Fire Fighting System

In Fiji, Fire Fighting System generally conforms to the National Building Code 1990 and the Australian and New Zealand Standards (AS/NZS) that regulate buildings and fire protection systems. Therefore, Firefighting Systems will be planned in accordance with the AS/NZS Standards. In this project, after consulting with the National Fire Authority (NAF) to confirm the use and size of the buildings, two Outdoor Hose Reel Units that are effective for initial fire extinguishing are to be installed. In addition, Dry Chemical Type Fire Extinguishers will be installed indoors, and CO2 Fire Extinguishers will be provided in the Corridors of the Electrical Room, Mechanical Room, and Calibration Room Areas on 2nd Floor as specified in New Zealand Standard 4503.

(3)Ventilation and Air-Conditioning Plan

Air-Conditioning System

Nadi City, the target site of this project, has a tropical rainforest climate, with a wet season from November to April, with days of heavy rain, and a relatively pleasant dry season from June to September.

The design outdoor air conditions (for cooling only) are as follows, based on the handbook of the American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.

Design Outside Air Conditions for Cooling: Dry Bulb Temperature 31.9 ºC, Wet Bulb Temperature 25.6 ºC (Source: ASHRAE Fundamentals 2021: at Nadi)

Taking into consideration the climate and the intended use of the rooms in the planned building, air conditioning systems are planned for various rooms where dusty, hot, and humid conditions are undesirable, and for various rooms where appropriate room environmental conditions must be maintained in order to improve operational efficiency.

Split-type air conditioners that can be operated individually in each room will be planned as general air conditioning equipment.　Rooms to be equipped with general air-conditioning unit include Office, Training, Conference, Calibration, And Server Rooms.
Mechanical ventilation will be provided in the following rooms to eliminate odors, heat, and humidity.
The following table shows the design criteria for the ventilation system to be applied in this project, based on the abovementioned ASHRAE criteria and the design criteria of the Ministry of Land, Infrastructure, Transport and Tourism of Japan.

Table3-2-3：**Design Conditions for Ventilation System**

Room	Type	Ventilation Air Exchange Rate	Note
Rooms with Air Conditioning	Supply Fan	30 m3/Person・Hour	For fresh air intake
Storage	Exhaust Air Fan Only	5 Times/Hour	
Toilet	Ditto	10 Times/Hour	For odor removal
Mech. Rm.	Ditto	5 回/時間	
Elec. Rm.	Ditto	10 回/時間	For remove calorific value
Generator Rm.	Supply & Exhaust Air Fans	25～30 回/時間	For combustion air supply and calorific value removal

Source : ASHRAE Standards,、Ministry of Land, Infrastructure, Transport and Tourism of Japan

(4)Electrical System

1)Substation

Power supply to the new facility was discussed with the Electricity Supply Company EFL and the FMS Electrical Engineer in attendance.　The outline of the project and the assumed power receiving capacity of 275 kVA were explained, and the method of incoming power was confirmed.

Existing facility receives 11KV intermediate voltage from the Power Supply Company EFL and distributes power to each building at a low voltage using a Transformer installed in Substation Rm.

As a result of discussions with EFL regarding the distribution of power to the new facility, it was confirmed that the existing 300 KVA Transformer will be replaced with a new 500 KVA Transformer on the EFL side, and a Low-Voltage Branch Switchgear will be added on the secondary side of the Transformer to supply power to the new facility. It was also confirmed that the EFL side will bear the cost of the power receiving and transforming facility modification work, and that the power cables to the new facility will be included in the scope of this work.

- Incoming Power : 11 kV, 3Phase, 3Wire、50 Hz

Estimated Power Load Capacity
The assumed load calculation for the Substation system will be the total load capacity calculated according to the following;

Table3-2-4 : **Estimated Power Load Capacity**

Load	Load Density (VA/m2)	Floor Area (m2)	Load Capacity (KVA)	Note
Lighting & receptacles	50	1500	75	
Training and calibration equipment	-	-	20	
Server	-	-	10	Assumption
Air Conditioning System	100	1500	150	General A.C
Plumbing System	-	-	20	
Total			275	

Source : Survey Team
Assuming that the total assumed installed capacity is 275 KVA and the demand factor is 60%, therefore the maximum power demand will be as follows
275 KVA × 0.6 = 165 KW

2)Emergency Diesel Engine Generator

In the new facility, an emergency generator will be provided to supply power for electrical outlets in Training Rms, Calibration Rms, Exhibition Rms, etc., and for security

loads in the air conditioning and ventilation systems, so that normal meteorological operations will be able to continue even in the event of a power outage. The capacity and number of Generators to be installed will be considered in the analysis in Japan.

A new Generator will be provided for the minimum required load to ensure that power will not be interrupted in the event of a power outage. The capacity of the Emergency Generator is expected to be approximately 80% of the maximum power demand. In addition, an outdoor Fuel Tank will be installed to provide 10 hours of operation, which is equivalent to the existing 10 hours, although there will not be a continuous power outage for an extended period of time.

- Type: Low-noise radiator-cooled, indoor package type
- Capacity: 3-Phase 4-Wire 415V/240V 50Hz 220KVA x 1 unit (fuel consumption: 50L/hour)
- Operation time: 10 hours (long run operation type) x 50L = 500L
- Fuel Tank: 600 L light oil

For Testing Equipment, Training Equipment, Server Machines, etc. that are sensitive to power fluctuations, facility-wide uninterruptible power supply (UPS) will be considered to provide, as it is undesirable for them to be down for even a moment.

3)Law Voltage Power Supply Trunk Line

The power will be distributed from the Main Distribution Board to each location via Local Distribution Boards, using 3-Phase 4-Wire 415/240V 50 Hz, with the system divided in consideration of load application and facility classification. Trunk line capacity will be set to satisfy the appropriate voltage drop and allowable current according to the capacity of the equipment to be connected. In principle, cable racks will be provided for wiring in the shafts, and piped wiring will be provided for other areas. The power distribution system will be as follows

- Power distribution system/trunk line: 3 Phase, 4 Wire, 240V/415V
- Single-phase load: 1 Phase, 2 Wire, 240 V
- Power load: 3 Phase, 4 Wire, 415 V

4)Lighting

In consideration of maintenance and running costs, lighting for each room, Corridor, etc. will be mainly LED (Light Emitting Diode) straight tube type lighting.
Illluminat5ion standard (general illuminance) will be as follows, referring to the average illuminance of International Standards and JIS Standards, and taking into consideration the current lighting situation in Fiji.

Table3-2-5：**Design Illuminance**

Office、	300lux
Conference Rm.	300lux
Training Rm.	300lux
Exhibition Rm.	300lux
Calibration Laboratory	500lux
Corridor & Stairs	150lux
Toilet, Storage	100lux
Mech. & Elec. Rms.	150lux

Source : Survey Team

In principle, each room will have its own flashing lights, and the flashing circuits should be separated to allow flashing in each necessary compartment. Electricity will be distributed to Lighting and Outlet Circuits with 240 V, single-phase, 2-wire circuits. Emergency lighting will be provided in each room.

5)Telephone and Communications

The new facility will be equipped with telephony and information communication (Computer Network) facilities to facilitate communication between rooms and with external parties. The communication lines for the new facility will be Telecom Fiji Limited (TFL) lines used in the existing building, and Optical Cables will be provided from the Server Rm. in the existing building to the new facility to enable mutual data sharing.

As telephone system, IP telephone switchboard with the following specifications and telephone equipment in various rooms will be planned to provide.IP Telephone Switchboard (with uninterruptible power supply UPS): 1 unit. Number of lines to be connected: 3 Outside Lines, 30 Extensions.

6)Public Address

New facility will be provided with a public address system for local broadcasting and emergency calls. Broadcast Amplifier will be provided in Office on Ground Floor.

In addition, the design of audio/visual equipment for Training and Conference Rms. will be considered for provision in the scheme of Equipment Provision.

LAN (Local Area Network)

LAN (Local Area Network) will be established to share data between the new facility and the existing FMS building, as well as to collaborate with other laboratories and research institutes via Internet.
Network configuration will consist of a Backbone Switch in the communications room of the new facility, which will be connected to the server room of the existing FMS, floor Switching HUBs on each floor, and LAN cabling (UTP CAT6) to the various rooms. Servers, Backbone Switches, etc. will be provided separately. 19-inch racks, Switching HUBs on each floor, and LAN cabling from the switching HUBs on each floor to LAN outlets in each room will be provided by the Japanese side. Provision of a Videoconference System will be considered to be the responsibility of the scheme by Equipment Provision.

- LAN: Single-Mode Optical Cable, UTP (CAT6))
- Data transmission speed: 100 Mbps

7)Access Control System

Since access to the Calibration Room Area on the 2nd floor of the new facility must be strictly controlled, an access control system will be provided at Entrance on the 2nd floor to allow only authorized personnel to enter and exit the room. The existing building uses a fingerprint authentication with numeric keypad system, however it will be confirmed whether the same system could be used in the future or whether a Card Reader System should be used.

8)Closed Circuit TV System

Surveillance cameras will be installed for security purposes in the new facility, and a Surveillance Closed Circuit TV system will be provided to monitor and display the cameras in the Office on the 1st floor. Camera will be installed at Entrance, Exhibition Rooms, Elevator Hall, Corridors and outside of the building.

9)Master Antenna TV System

New facility will be provided with a Master TV Antenna System to install in the Training and Conference Rooms, with TV antennas on the Roof, Amplifiers in the terminal panel, and cabling and wiring to the TV Outlets in the various rooms.

10)Fire Detection and Alarm System

New facility will be provided with an Automatic Fire Alarm System throughout the building to enable early fire detection. In addition, Fire Alarm Panel will be installed

near the exterior wall outside the 1st Floor Entrance in consultation with the fire Authority.

11)Solar Power Generation

Photovoltaic power generation system will be planned for the Roof of the new facility. The DC power generated will be connected through a Power Conditioner to a Low Voltage Distribution Panel to be provided in Electrical Room of the new building. Electric Supply Company will provide the necessary Watt-Hour Meter to sell the excess power. We will check the requirements for applying to install solar power generation system. In addition, cost of the installation work, annual changes of solar power generation and saved power cost will be confirmed.

12)Lightning Protection System

To prevent damage from lightning, lightning protection system will be provided to protect the entire new building.In addition, lightning arrestors (SPDs) will be installed in the Power Distribution Panel to prevent damage to electronic equipment, calibration equipment, computers, etc. due to internal lightning.

(5)Issues for future consideration

The layout of the new facility and the status of existing buried cables and buried piping, etc. will be required to investigate in the future.

- 11KV buried cables in Power Grid are under investigation by the Power Supply Company (EFL).
- Power and communication cables to the existing CTBTO building will be investigated in the future.
- Route of the buried drainage pipe interferes with the location of the new facility, so the route of the turnaround will be confirmed with the Water Authority (WAF).

3 – 2 – 3 Site Conditions

(1) Nature Conditions Survey

Following topography survey, geological survey, and infrastructure survey were implemented.

Table3-2-6 : Summary of Topography, Geological, and Infrastructure Survey

Survey	Period	Purpose	Specification	Location
Topography	November 2024	Drawing site geometry	・Plane table survey ・longitudinal survey ・Every 0.2m contour	Project site and the surroundings
Geological	November 2024	Checking geological condition	Dynamic Cone Penetration (DCP), 5m depth／ Hand Auger	6 points on building location
Infrastructure (Buried electrical cable)	December 2024	Checking buried electrical cable	Using gauge meter	Location of middle voltage electrical cable in project site

Source: Survey Team

1) Topography Survey

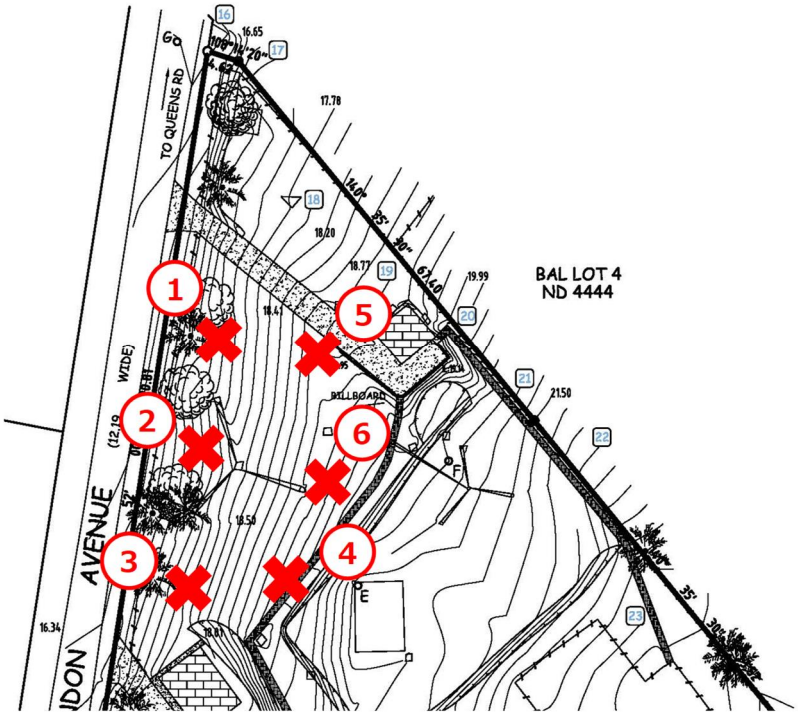
The topography plan for the project site are shown below. The area around the proposed construction site slopes upwards from the western road to the east, approximately 4 m

Source: Survey Team

Figure3-2-10 : Topography Map

2) Geological Survey

Cone penetration and hand auger tests were conducted at six points on the project site shown in the following Figure.

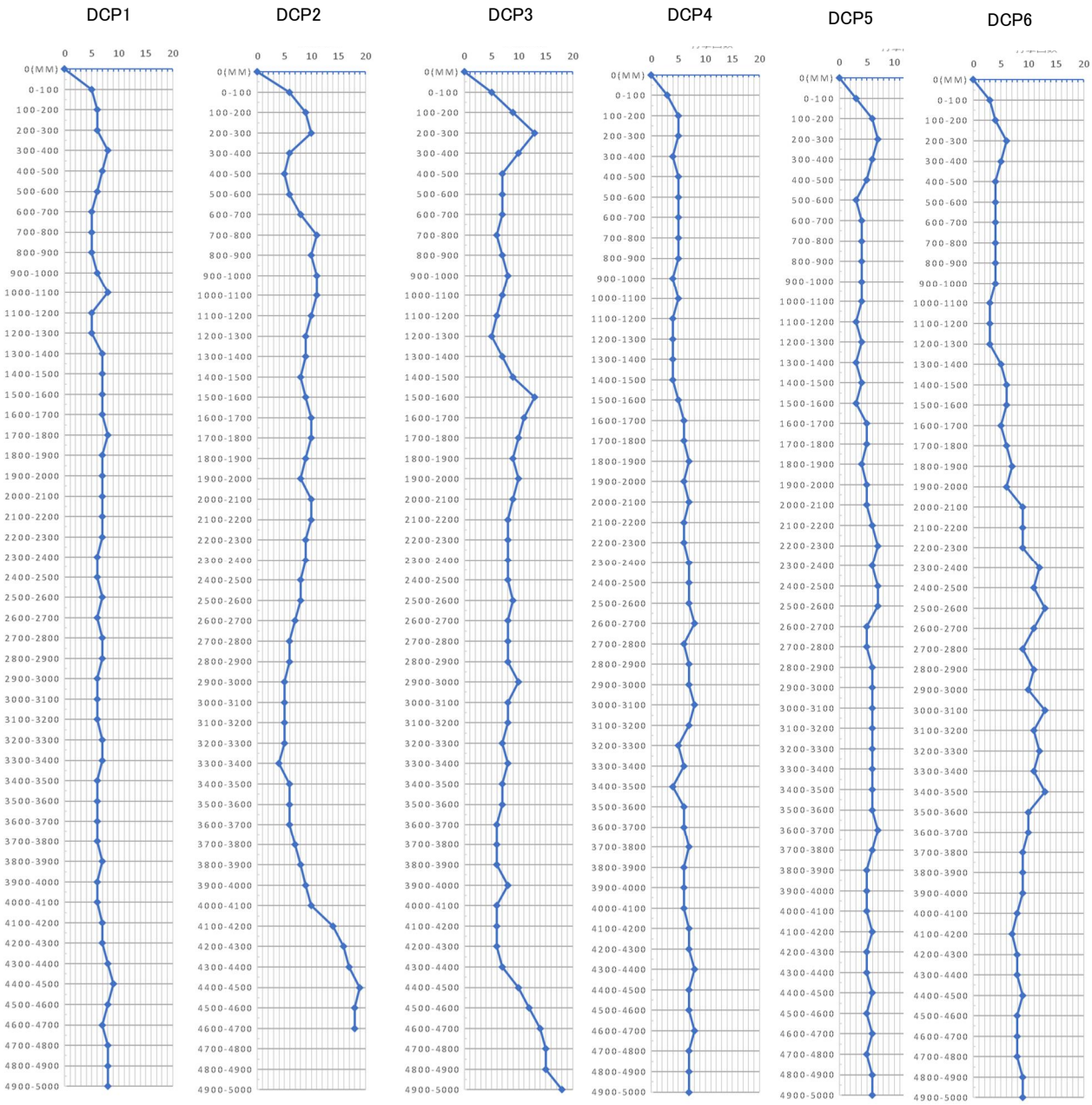


Source: Survey Team

Figure3-2-11 : Geological Survey Locations

Of the six locations tested, the ground was found to have a bearing capacity of 160 kPa (For 2-storey RC foundation) up to 1.7 m from the ground surface. The columnar graph shows the depth from the ground surface on the vertical axis and the number of blows in the test on the horizontal axis. Five blows show a bearing capacity of 160 kPa (on a foundation of approximately two stories of RC building) is achieved.

Based on the results of the ground investigation, it is considered that the shape of the foundation might be the same as that of the existing building on the site. The existing FMS building has a direct foundation at a depth of GL-1.3m.



※Vertical Axis: Depth from Ground Surface/ Horizontal Axis: Number of Blows

Source: Survey Team

Figure3-2-12 : Result of Geological Survey

3) Infrastructure Survey

Buried infrastructure is as shown on the figure below.

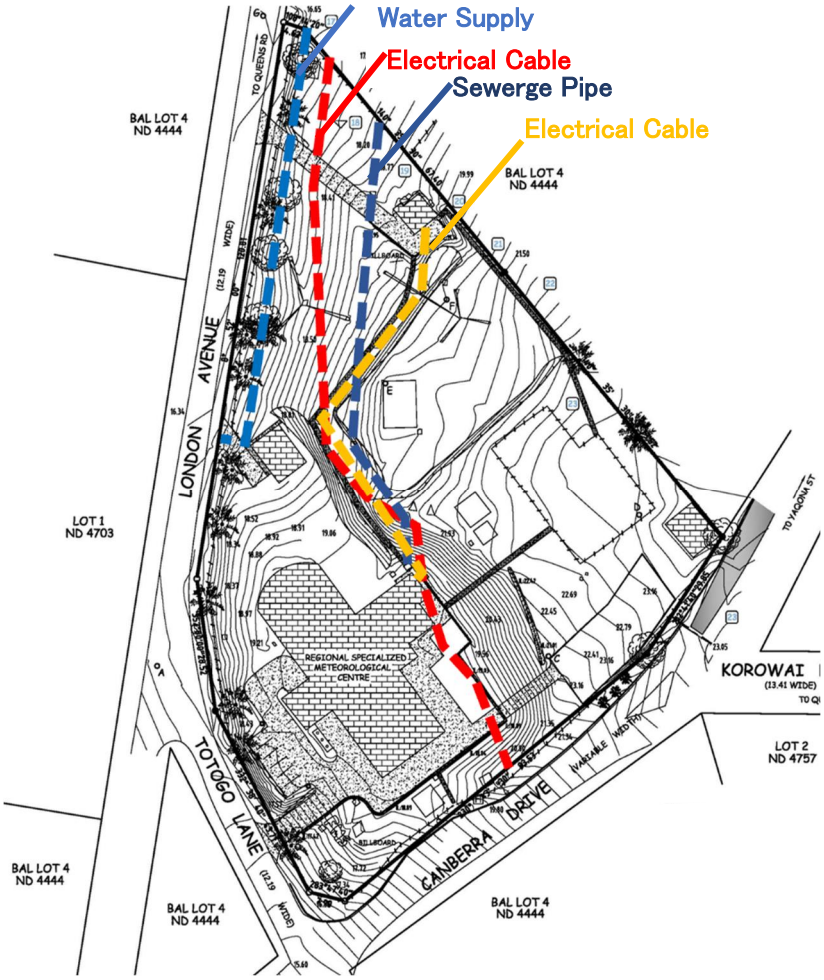


Figure3-2-13 : Buried Infrastructure

Source: Survey Team

Electrical distribution lines and drainage pipes are located where the facility is to be built, and it is necessary to consider whether they need to be relocated.

4) Climate of Nadi

Climate of Nadi is as follows

Table 3-2-7 : Nadi Climate Data

	1	2	3	4	5	6	7	8	9	10	11	12
Average Temparature (℃)	27.5	27.6	27.3	26.8	25.7	24.8	24.3	24.4	25.4	26.1	26.8	25.3
Monthly Rainfall (mm/月)	404.7	405.5	384.7	197.2	88.2	64.9	30.3	51.7	65.7	104.7	134.1	242.6
Maximum 1day Rainfall (mm/日)	107.7	105.5	90.1	73.0	42.4	37.5	19.6	22.0	33.3	35.2	42.5	67.1
Average Humidity (%)	75.0	77.8	78.4	77.7	76.4	77.5	74.4	71.3	70.3	67.8	68.1	70.1
Average Wind speed (m/s)	2.3	2.2	2.3	2.3	2.4	2.5	2.7	2.6	2.8	2.8	2.9	2.5

※Average during 2010～2023

SOURCE : Edited by Survey Team based on FMS's information

5) Earthquake

Earthquakes of magnitude 7 or greater have been observed in the waters around Fiji, Tonga and New Caledonia.

3 – 2 – 4 Construction plan/Estimate

(1) Construction plan

This section discusses 1) The construction capabilities of local contractors, 2) The labor force, and 3) The quality and price of building materials and equipment, as revealed by interviews conducted in the field.

1) The construction capabilities of local contractors

I)Local contractor orders and construction results

Interviews were conducted with three of the major construction contractors in the Fiji country.

Fletcher

The company is the largest contractor in Fiji, with construction experience in 40 countries in the Pacific (headquartered in New Zealand) and as a subcontractor for Japanese contractors. The company is particularly experienced in civil engineering, and most pf bridges in Fiji have been constructed by the company.

Fortech construction

The university of the South Pacific (USP) has experience as a subcontractor for Japanese contractors in the construction of the ICT center under the “University of the South Pacific Information and Communication Technology Center Development Project” (2007), a Japanese grant aid project. Fiji. The company also done construction in the Fiji Islands, and in such cases, have handled the processing and exporting of materials.

Western Builders

With over 1,000 projects in Fiji, the company has a wealth of experience in building systems and is particular about the selection of materials and finishes. In addition, building materials and equipment and furniture are procured from our group companies.

From the above, it can be inferred that the local contractor’s track record of receiving orders and constructing projects is sufficient for the promotion of this project.

②Availability of vendor registration system/category

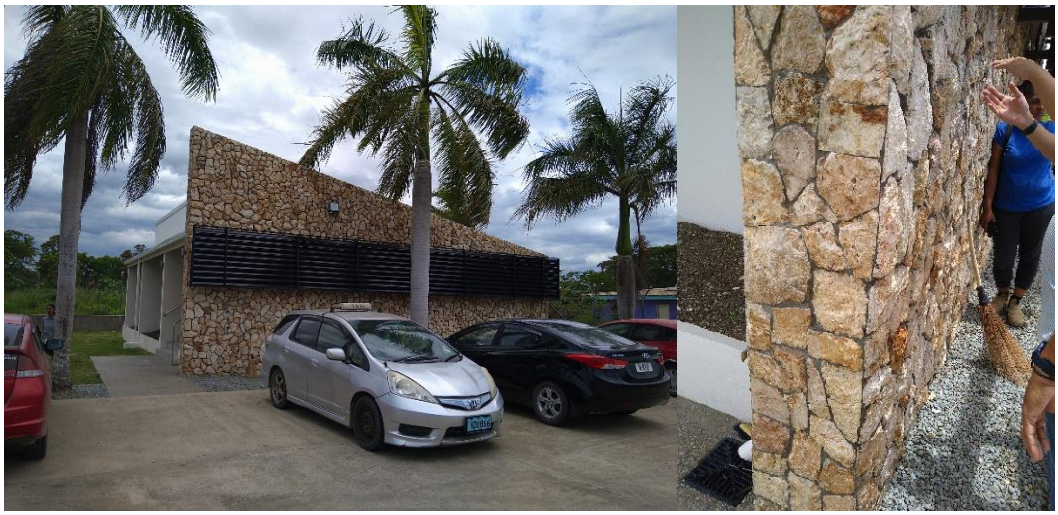
There is no system or category of registration of contractors in the construction industry in the country of Fiji. However, all contractors operating in Fiji are registered for tax purposes. There are about 200 construction companies in Fiji, of which about 20 are members of the Fiji Masters Builder Association. The category of builder does not exist in Fiji, but there are categories such as Tiar 1 and 2 in New Zealand, and several Fiji builders are registered in these categories.

③Construction capacity and technical capabilities

There were not many new construction sites in Fiji at the time of this study. Therefore, when we inspected properties that had just been completed, we were able to confirm that they had a high level of technology in terms of construction accuracy and quality control. In addition, during renovation work under construction, we were able to confirm the construction and technical capabilities of the craftsman and the construction methods they could handle. Depending on the construction company, we were also to confirm the active use of Fijian materials and attention to detail in finishing

(Source: Survey Team

Figure3-2-14)



Source: Survey Team

Figure3-2-14：Example of construction using Fijian domestic stone and the Finish of its detail part.

For buildings of about two stories, such as this project, RC or Steel construction is mainly used, although wood construction is also possible in some cases. Concrete blocks is often used for partition walls, etc. (Source Survey Team

Figure3-2-15：Example of using lightweight steel frames for partition walls and ceilings at a renovation site Source Survey Team

Figure3-2-15)

Source Survey Team

Figure3-2-15：Example of using lightweight steel frames for partition walls and ceilings at a renovation site

④ Financial Strength
Since many companies in the Fiji country are limited liability companies, information on capitalization, which indicates financial strength, was not available. Instead, annual sales were collected, and the Fletcher that responded had 150million FJD, which infers that it has sufficient financial strength.

⑤ Ownership of construction equipment
Major local contractor own construction equipment such as cranes and trucks. General construction equipment such as rafter cranes can be procured within Fiji.

⑥ Price (construction unit price)
Interviews with major construction companies revealed that the unit construction cost of a building is approximately 5,000-6,000FJD/m2, although it varies depending on the size and finish of the building. However, due to the recent sharp rise in labor costs, future construction unit costs may rise further.

⑦ Utilization of local contractors and issues
The major construction companies in Fiji have sufficient construction capabilities and experience, and can be fully utilized as subcontractors for Japanese firms. However, there are many issues related to safety management, etc., so cooperation by Japanese firms is necessary. In addition, since many construction materials and equipment are imported, and since prices are on the rise due to the impact of the re-spread of the new coronavirus infection and soaring global transportation costs, it is necessary to pay attention to procurement methods.

2) About laborers
The construction sites in Fiji country are basically engaged in a large number of Fijian laborers, and it is assumed that there will be no problem in securing workers throughout the year. However, skilled workers and engineers have tended to migrate to Australia and other countries in recent years, and it is necessary to call in Bangladeshi, Indonesian, and other foreign skilled workers and engineers to compensate the vacancies. The problem is that labor costs are rising, and construction costs tend to soar accordingly. Note that salaries vary depending on the skill level of the craftsmen but are around 6.5-7 FJD/h for general laborers.

3) Quality and price of building materials and equipment
①Quality
Fiji's material standards are based on the Australia/New Zealand Standard (AS/NZ Standard). The quality standard is almost equal to the Japanese standard.

② Price (building materials and equipment)

In Fiji, cement, sand, and gravel, which are materials for concrete, are produced domestically. Steel bars are imported from New Zealand and other countries and processed into deformed bars at factories in Fiji for distribution. Regarding the price of concrete, it is presumed that the cost is comparatively higher than Japan. Other construction materials and equipment are generally more expensive than in Japan due to added transportation costs.

Source Survey Team

Figure3-2-16：Fiji domestic cement on sale at major hardware shop.

③ Production and distribution status

Production status

Since there are several ready-mixed concrete manufacturing plants in Nadi city and they can transport the concrete to the proposed construction site within an hour, construction with plant-manufactured ready-mixed concrete can be adopted. One of the major concrete plants surveyed in Nadi City owns five mixer trucks and two pump trucks, so it is possible to transport ready-mixed concrete to the proposed construction site.

Heavy steel frames used in steel structures are imported from factories in Southeast Asia and other countries and assembled with high strength bolts and other materials. Truss beams and roof sheathing materials using lightweight steel frames can be manufactured in Japan.

Source: Survey Team

Figure3-2- 17：**Ready-mixed concrete production plant in Nadi city**

Sources and Distribution

Almost all other construction materials and equipment other than concrete and steel frames are imported from overseas, but there are many importers, so there are no distribution problems. The city of Lautoka, near Nadi, where the project is to be constructed, has a port, and there are many building materials and equipment distributors in the city, making it relatively easy to procure construction materials and equipment form overseas. The marine transportation route from the port of Yokohama in Japan to the port of Lautoka in Fiji is as follows: Port of Yokohama→Port of Auckland(New Zealand) →Port of Suva→Port of Lautoka. The entire process takes from 37 to 40 days, and the time required for customs clearance is from 3 to 10 days.

Transportation and import prices.

Transportation and import prices are on the rise due to the global shortage of containers and increased transport volumes. In addition, the price increase rate for 2023 is 3%. The rate of increase in recent years is shown in Table3-2-7.

Table3-2-7：Trends in price increases(annual average)

Year	2020	2021	2022	2023
Rate of price increase % of total	-2.60	0.16	4.32	3.00

Source: IMF- World Economic Outlook Databases (October 2023 edition)

(2) Approximate project cost

Interviews with three of the largest construction companies in Fiji regarding

construction costs for new buildings used for offices and other purposes revealed that the unit cost per square meter, which varies depending on specifications but is assumed to be moderate, ranges from 5,000 FJD/m2(about 320,000 yen) to 6,000FJD/m2(about 380,000 yen) for each company. However, since local construction sites do not have a high awareness of safety management, if the same level of safety management as in Japan is assumed, the cost of temporary construction and safety management is expected to increase. The specifications are also expected to increase because the quality is not up to the level required for grant aid.

Table3-2-8 : Past Grant Aid Projects in Neighboring countries and in Fiji per square meter

Country Name	Independent state of Samoa	Vanuatu	The republic of Fiji
Project Name	Pacific Climate Change Center construction project	Villa Central Hospital improvement plan	Development plan for the Center for Information and Communication Technology at the University of the South Pacific
Year	2016	2012	2007
USD rate	122.2 yen/USD	83.35 yen/USD	117.3 yen/USD
Compared to USD rate of 150.10 in Nov. 2023①	123%	180%	128%
Structure	RC, 2 stories	RC, partly steel framed, 2 stories	RC, 4 stories
Building expenses	798 million yen	1,146 million yen	1,916 million yen
Total floor space	1,560 ㎡	3,158 ㎡	6,659 ㎡
Square meters ②	512,000 yen/㎡	363,000 yen/㎡	288,000 yen/㎡
A : ① x ②	630,000 yen/㎡	653,000 yen/㎡	369,000 yen/㎡
Price increase rate ③	2016～2023	2012～2023	2007～2023
	129%	146%	168%
B : A x ③	813,000 yen/㎡	953,000 yen/㎡	620,000 yen/㎡

Source: Survey Team

As shown in Table3-2-8, the unit cost per square meter of past grant aid projects in neighboring countries and within Fiji was calculated and the effect of currency rates and the rate of price increases were taken into account, which ranged from 620,000 yen/m2 to 953,000 yen/m2. In addition to rising prices, the cost of labor for experienced engineers and skilled labors has increased in recent years for many projects.
Considering these circumstances, the unit price per square meter for this project is considered to be 600,000 yen/m to 800,000 yen/m2.

3 – 2 – 5 Procurement plan

The procurement plan will be divided into the following five categories of uses. Details are described in 5-1-2 as the support policy for equipment procurement. Specific equipment details are also described in 5-2-2.
(1) RIC-related calibration equipment
(2) RTC-related equipment
(3) Equipment for the Disaster and Climate Change Awareness Center
(4) Equipment for the Climate Office of the FMS
(5) Equipment for the RIC and RTC offices.
Procurement of these equipment will be reviewed after confirming FMS's request, WMO's RTC guidelines, FMS's personnel and budget, etc.

3 – 3 Analysis of issues related to the use and operation of the facility

This section identifies issues related to the use and operation of the facility, details of which are described in Chapter 4.

3 – 3 – 1 Identification of Issues Related to Training and Awareness-Raising Facilities

Issues for training and awareness-raising facilities were extracted according to the five criteria for establishing RTCs described in 3-1-1 "(6) Designation of RTCs by the WMO".
(1) Identification of learning needs
(2) Design of learning services
(3) Provision of learning services
(4) Evaluation of learning services
(5) Management and administration of learning services

Another specific project challenge is the restoration of old weather observation data as part of the Data Rescue (DARE) project promoted by the WMO to improve the accuracy of climate change analysis and prediction. FMS has one of the longest histories among

Pacific Island countries regarding meteorological observations, and its observation data is valuable for understanding climate change in the Pacific, where the amount of data is scarcer than in other regions. FMS started this work in 2014, and to date has filed observation data since 1942 into approximately 210,000 image data files, which are being digitization is underway. Much of the historical data was recorded by hand on paper. Although recovery requires a variety of equipment and tools for image and data processing, it is expected that if the data stored in the FMS from 1862 can be recovered, it will be possible to learn at a glance about climate changes in the South Pacific since the Industrial Revolution, when global warming began. The issues that can be obtained here are extracted as follows.

(6) Issues related to data storage work in the climate chamber

3 – 3 – 2 Extraction of issues at calibration facility

The following three issues for the calibration facility were extracted based on the results of the field survey.

(1) Calibration room

(2) Calibration equipment

(3) Human resources for calibration work

3 – 3 – 3 Extraction of issues at current FMS building

The following issues are identified for the current FMS building.

(1) Issues to be a RTC.

(2) Issues to be a RIC.

(3) Issues related to space for exhibitions and lectures for visitors.

(4) Noise from the generator on the west side of the site.

3 – 4 Training Services Provided by Other Higher Educational Institutions and Training Organizations

(1) USP

1) Education and training opportunities offered by the USP

USPs are envisaged to be constituent bodies of RTC Fiji, as is the FMS.
It is widely recognized in other RTCs that one RTC being composed of a Meteorological Service and an academic institution. In this case, it is common that the former provides job-related practical courses (Certificate level) for NMHS technicians, while the latter provides meteorology and oceanography courses (Academic degree, Certificate level) for intermediate and advanced meteorologists. A similar role-sharing is also envisaged for the FMS and the UPS.

UPS currently offers diploma and master's degree courses for university graduates. There are no meteorology and hydrology courses at undergraduate level. This course includes.

i) PC414: Climate Change Impacts, Vulnerability and Adaptation
ii) PC415: Climate Science
iii) PC420: Research Projects in Climate Change
iv) PC428: Tropical Meteorology
v) PC430: Advanced Physical Oceanography

In addition, the USP's "College of Continuing Vocational Education and Training (CVET)" offers the following qualification courses (Certificate level).

i) Certificate III: Resilience (Climate Change Adaptation and Disaster Risk Reduction)
ii) Certificate IV: Resilience (Climate Change Adaptation and Disaster Risk Reduction)
iii) Certificate IV: Training, Assessment & Evaluation
iv) Certificate IV: Disaster Risk Management (Team Leadership)

2) Coordination of FMS and UPS

Although the FMS provides the meteorological information necessary for USP education and research, there is currently no use of FMS facilities for practical training and exercises in the above-mentioned education courses (only student visits). However, the FMS strategic plan indicates that the FMS will strengthen its cooperation with the UPS in the following areas in preparation for RTC designation.

- Course to provide the WMO approved Basic Instruction Package for Meteorologists (BIP-M) and for Meteorological Technicians (BIP-MT).
- Workshop on data sharing.
- Implementation of an Automatic Weather Station (AWS) at USP as a part of the FMS's AWS network.
- The use of the USP's Moodle system for FMS staff on-line learning activities.
- The USP installation of the CLiDE climate database and software environment.

(2) SPREP/PCCC

With regard to the RTC designation of the FMS, which is being prepared by a task team comprising key members from the FMS, USP, SPREP and others, SPREP is playing a leading role, drawing on its expertise, networks and partnerships. SPREP also supports its members' access to climate finance as a regional implementing agency of the Green Climate Fund, the Adaptation Fund and through other funding mechanisms.

The Pacific Climate Change Center (PCCC), established in SPREP, has as one of its functions the implementation and management of training for member countries and has been working with JICA to provide training on climate resilience, since 2019. Also, Under the "Project for Capacity Building for Climate Resilience in the Pacific" (CBCRP-PCCC)", the following open learning programs are offered.

i) Climate Resilience and Access to Climate Finance
ii) Climate Change Adaptation and Disaster Risk Reduction through Structural Approaches
iii) Ecosystem-based Adaptation and Mitigation
iv) Enhancing Climate Resilience and Safe Water Access in Rural Area in the Pacific
v) Enhancing Climate Resilience in Tourism in the Pacific
vi) Health System and Climate Change: Enhancing Resilient and low-carbon Development in the Pacific
vii) Understanding Access to Climate Finance: Project Planning and management

(3) Other organisations

In 2023, 12 institutions are offering training courses, training workshops and other opportunities in the field of meteorology and hydrology to relevant institutions (in and out of Fiji), including the FMS. These institutions include RTC (Indonesia and China), CIMH (Caribbean Institute for Meteorology and Hydrology), SPREP, WMO and MOB. Some offer training courses online, such as RTC China, RTC Indonesia

and SPREP/PCCC.
In the private sector, the International Civil Aviation Organization (ICAO) regularly conducts seminars and workshops related to aviation meteorology, which are attended by FMS staff. In Fiji, FNU (Fiji National University) has also conducted a number of training courses related to operations management (12 courses in FY21).

3 – 5 Support for FMS by donors

There are currently no donor projects with FMS as the implementing agency. The following table provides an overview of donor projects in which FMS has received benefits in recent years.
From 2024, the WMO Adaptation Fund (USD 5.5 million) project 'Enhancing Climate Adaptation through scaling up Fiji's coastal inundation forecasting early warning system" is expected to be launched. This project aims to strengthen the disaster prevention early warning system and consists of the following six components, none of which overlap with this project in relation to RTC/RIC.

i) Identifying and assessing institutional and community capacity, state of infrastructure, communication platforms for coastal inundation adaptation requirements (USD 200,000)
ii) Expanding the forecast systems from CIFDP-F to other key parts of Fiji and upgrading the forecasting systems (USD 3,350,000)
iii) Assessing and mapping the risk of coastal inundation hazards (USD 150,000)
iv) Establishing a data archive of meteorological hazards for coastal/marine events and their impacts (USD 300,000)
v) Enhancing and streamlining communication with stakeholders and communities-at-risk (USD 500,000);
vi) Strengthening cross-sectoral partnerships with institutions and NGOs (USD 200,000).

Table3-5-1 : **Donor projects benefiting the FMS**

Australia/ New Zealand	COSPPac (Climate and Oceans Support Program in the Pacific) + Capacity building in climate service + Seasonal to Sub-seasonal prediction + Climate database + Sea level monitoring + Tide prediction + Provision of tools
WMO	Fellowship Programme (staff training)
USAID	Impact Based Forecasting Programme Weather Ready Nations (WRNs) program + Strengthening capacity at National Meteorological and Hydrological Services (NMHS) in improved use of weather and climate information to reduce impacts of hydrometeorological hazards.
UNDP	Resilience for Pacific Small Island Developing States (RESPAC) project (completed) + Provision of equipment + Capacity building

Source: Interviews with FMS training officer

3 – 6 Support by the Japanese Government

In 1995/96, the FMS received grant assistance from the Government of Japan for the construction of a new main office building and the provision of observation, forecasting and communications equipment. In addition, JICA has continuously provided training for 10 countries in the Oceania region since 2001 through technical cooperation and other means.

Currently, JICA is supporting the implementation of training by the FMS to NMHS staff in Pacific Island countries through the Third Country Training Program "Capacity Building of the Fiji Meteorological Service for Sustainable Meteorological Services in the Pacific Region" (2022 - 2025).

Major JICA projects in the field of meteorology and disaster management over the past decade are as follows.

- The Project for Capacity Building on Climate Resilience in the Pacific (2019~2022)
- The Project for Mainstreaming Disaster Risk Reduction (2019 ~2023)

- The Project for the Planning of the Nadi River Flood Control Structures (2014~2016)
- Dispatching DRR National/Regional Advisor (2016~)

From 2024, a new technical cooperation 'Project for Advanced Meteorological and Hydrological Services Capacity Development for FMS' is expected to be launched, with FMS as the implementing agency. The outputs of the project include strengthening the capacity of the FMS for weather forecasting, warning and information dissemination, as well as the establishment of an RTC training system in the FMS and accreditation of RIC by the WMO. Therefore, the facilities to be developed under the grant assistance are expected to accelerate efforts related to the establishment of RTC and RIC in collaboration with this technical cooperation.

Chapter 4 Challenges to the facility management of FMS

4 – 1 Issue analysis

4 – 1 – 1 Issue analysis of Training and awareness-raising facilities

i) Identifying learning needs

Processes for obtaining information on training needs (including disaster education) are not yet established. A needs assessment plan, including data collection methods, has not been developed.

ii) Designing the learning service

- The introduction of the 'FMS e-Learning Platform' enables the FMS to select the learning method that is suitable for the learner, including distance learning. On the other hand, the learning services and content provided by the FMS are not documented (including on the website), making it difficult for beneficiaries to access training information.
- Currently, the training courses developed are limited to three modules on weather observation. The FMS does not respond to other training needs such as weather forecasting, hydrology and equipment calibration.
- The three modules developed have not been formally accredited by the WMO (currently being applied for as micro-certificate courses).
- With regard to disaster education and awareness-raising, no implementation manual has been developed that outlines how to provide the service.

iii) Delivering the learning service

- There are not enough instructors for the FMS to fulfil the role of RTC. The current

training officer alone is not able to expand the type and quantity of training services. In addition, there is no one in the FMS with specialised training in disaster management education.

- The training facilities in the FMS do not fully meet the requirements of the RTC. In terms of disaster education and awareness, the FMS is limited to tours due to the lack of appropriate learning facilities. The public's interest in cyclones and global warming is high, and the number of visitors to the FMS is close to 10,000 per year. However, the FMS exhibits only panels and posters in the corridors for educational purposes, which do not lead to effective learning. In addition, due to the limited space of the building, the lectures given by the staff do not meet the expectations of the large number of visitors who arrive in buses, resulting in "token" visits. The Center for Disaster Prevention and Climate Change Awareness, which aims to improve this situation, needs to devise ways to explain climate change, which is particularly difficult to understand and recognize in a tangible form. The data should be restored to its original state.
- No annual training report is prepared, although there is a report per each training course. It is not easy for the FMS to demonstrate externally its contribution to capacity building to the NMHS of Pacific Island countries and national institutions.

iv)Evaluating the learning service

With the FMS e-Learning Platform, a system has been established whereby the evaluation of each training course is fed back from the trainees (the results can also be accessed by the trainees). However, annual training reports are not prepared. In addition, the FMS does not have a training section and there is no committee to evaluate training, which makes it difficult to evaluate systematically the FMS’s learning service.

v) Administering learning service

- The organisational structure to run the RTC is not in place. FMS training and disaster management education is not operated using two basic documents: an annual plan and an annual report.
- The direction of the learning service in the medium and long term is unclear. Although the FMS Strategic Plan states the establishment of RTC as a goal, it does not set out the responsibilities, roles and policies with regard to the learning services provided by the FMS.
- FMS does not have Fiji's national accreditation as a provider of vocational

training. In addition, FMS is accredited to ISO 9001 in the provision of meteorological services, but not ISO 29990, the international standard for learning services. These are the criteria for RTC designation.

- The fact that there is only one training officer is the biggest risk of establishing an RTC. If this person leaves, it is very likely that the FMS training services will stop. Planning the establishment of an RTC without measures in place to address this risk is highly problematic.
- There would be no serious financial problems in the provision of learning services if they were of the same size as at present. However, if the FMS enhances training by inviting NMHS staff from other countries to FMS, the financial situation of the participating NMHS would affect the delivery of the training. Without a sponsor, this type of training would be difficult.
- If the FMS is equipped with an exhibition room for disaster education, its operating costs will be a new cost item for the FMS. Exhibits will become obsolete if they are not updated regularly. Their content needs to be carefully considered from a financial perspective.
- Coordination system with stakeholders is weak. Currently, there is an urgent need to strengthen relations, in particular with RTCs in other countries (especially in Region V), USP and national institutions (including disaster agencies) that are training beneficiaries of the FMS. FMS has no experience in designating and running RTC. There is much to learn from other RTCs. Despite this, the FMS director and training officer have no experience of visiting other RTCs. Other RTCs are also promoting distance education and the provision of its materials. Distance education is more widely open to learners, which may lead to duplication and competition of learning services. Cooperation between RTCs will become more important.
- The FMS is isolated with regard to disaster education and awareness-raising services. The FMS is not sufficiently recognised as a learning service provider by the NDMO and disaster education partners.

Ⅵ) Issues related to data storage operations in climate chambers

- The recovery of old weather observation data has been done by using scanners to read images of past data, the weather monthly reports, but the licenses for the large scanners previously installed and the software built into the PCs have expired and the work is now stuck.
- The possibility of data loss is feared due to problems with the backup system for the recovered data. For this reason, FMS is seeking to upgrade aging equipment,

install new software for digitization, and provide equipment for data backup in a grant project.

4 – 1 – 2 Issue analysis of Calibration facilities

<Calibration laboratory>

FMS's calibration laboratory is about the size of 10 square meters, where all the equipment for calibration of temperature, humidity, and atmospheric pressure are installed. The limited space allows only for maximum two persons to work together. (See Figure3-1-4 Photo Related to calibration)

< Calibration equipment>

Issues are identified for the calibration equipment for each of the three variables, as follows.

(Atmospheric pressure)

- FMS has only one reference standard (PTB330TS). In order to avoid the limitation on calibration due to the absence of the standard during calibration at BoM, as well as the possible damage during transportation and for other unexpected reasons, more than one PTB330TS is required as a spare.
- The barometric pressure calibration equipment is capable of calibrating three barometers at the same time. Considering the calibration needs examined earlier, it is necessary to strengthen the processing capacity for barometer calibration.
- The current manual procedures of recording and storage of calibration data need to be fully automated.
- Each of the three local offices in charge of filed inspection (Nadi, Suva, and Labasa) should keep two sets of working standards (PTB330TS and MI-70), one of which is used as a spare.

(Temperature)

- Spare equipment (CTR2000 and Pt100) is required for the primary standard.
- Two sets of working standard (HMP155 and MI-70) are required at the three local offices.

(Humidity)

- A spare device (mirror type dew point meter) is required for the primary standard.
- A spare constant temperature and humidity chamber is required to calibrate the hygrometers and non-waterproof temperature sensors.
- For working standards, HMP155 mentioned above can be utilized.

(Others)

FMS requested the following equipment.

- Rain Gauge Calibration Rig

- Portable field rainfall calibration device (Hukseflux)
- Wind Speed and Wind Direction verification kit
- Solar Radiation Calibration Equipment/ Hukseflux indoor calibration system/ ISO 9847 Type IIc
- Solar Radiation field verification kit(Light meter LI-COR)
- Ultra sonic anemometers, hand held anemometers, portable easy setup (AWS)
- PC for calibration setup (Work Station for Different calibration setup)

Considering the current budgetary and human resource constraints of FMS, we should carefully assess the impact of facility expansion on the FMS's governance, as it could lead to an increase in maintenance costs and intensified labor. In other words, due attention needs to be given to sustainability by focusing on how FMS will take adequate measures to secure the necessary budget and human resources required to establish and operate RIC. To acquire ISO17025 certification, it is essential for FMS to prepare sufficient equipment for calibrating pressure, temperature, and humidity. However, regarding the calibration equipment for wind speed/direction, precipitation, and solar radiation listed above, we should further advance the consultations with FMS.

<Human resource for calibration >

As described in the section "2) Calibration personnel above", the number of FMS staff who are skillful in instrument calibration is limited. Obviously, JICA has worked to strengthen the calibration facilities of FMS and to transfer calibration techniques to its FMS staff since 1996. In particular, under the human resources development project from 2014 to 2018, FMS staff received three training sessions at JMA (RIC Tsukuba), further enhancing their technical level. However, two of the employees who participated in the training have already left FMS and Mr. Ashnil Kumar, the lead engineer who has led the calibration work to date, has decided to transfer to a private company in New Zealand. Hence, FMS's technological workforce for calibration, which once maintained a sufficient level, does not allow any optimism about establishing RIC. Recruitment of new personnel and acquiring laboratory calibration techniques by young staff are now critical issues, along with facility expansion.

4 – 1 – 3 Issue analysis of Current FMS Building

From 4-1-1 and 4-1-2 above, current FMS building has the following issues

(1) Issues to be RTC.

- Lack of space to set up a weather simulator
- The number of rooms is not sufficient, and there is no room for group work, individual study

(2) Issues to be RIC

The calibration room is about 10 square meters in size and contains all the equipment used for calibration of air temperature, humidity and air pressure.
The ideal indoor environment for calibration of air pressure, temperature and humidity is different in each case, but the calibration equipment is located in the same room.

(3) Other issues.

- The only space for exhibits is a corridor with posters and other materials as teaching aids, although 10,000 visitors come every year. The only place where lectures are given to visitors is in the meteorological forecasting room.
- If the FMS is designated as an RTC/RIC, the number of visitors is likely to increase. The current FMS only has one meeting room for staff on the second floor and a training room on the ground floor that doubles up as a meeting room, which is considered insufficient.
- Loud noise from the generator on the west side of the site.

4 – 2　Prioritizing each issue and organizing support demands

4 – 2 – 1　Prioritizing each issue and organizing support demands for training and awareness-raising facilities

1) Needs for facility and equipment

The needs on the part of the FMS in relation to training and awareness-raising facilities, taking into account the WMO's RTC designation, are outlined below.

■ One or more classrooms for lectures, private study and exercises

[Training room]

- The number of trainees is about 10~15 persons/course. Appropriately sized rooms to suit the number of trainees.
- At least two small classrooms are needed, considering the possibility of different long-term and short-term training courses running simultaneously and group work being conducted in separate rooms.
- In the training, each participant will be using his/her own PC. Electrical wiring is needed for each desk.
- Larger desks are needed for the use of weather maps in the exercises.

[Private study room/communication room]

- There is no need to secure a specific room for this purpose. If several small classrooms are provided, vacant rooms can be used.

[Seminar room]

- The FMS is interested in attracting seminars and workshops held in Nadi by WMO/SPREP, donors and others to the FMS. Large conferences are currently held in quality hotels, but it would not be reasonable to create an environment in the FMS equivalent to that of those in hotels. However, it could be used as a venue for small conferences or sub-sessions of large seminars.

[Disaster education lecture rooms

- About half of all FMS visitors are in groups of 50 or more. A lecture room with a capacity of 50 persons is needed to give lectures to them.
- This room can also be used as a seminar room for the external organisations mentioned above.

■ Weather forecast simulator rooms with access to observations and forecasts

- A display capable of showing real-time information from the observation room is

needed for training. This can be handled in a special simulation room or in a (multi-purpose) classroom.

■ Computer laboratories
- There is no need for a PC room with fixed desktop PCs. It is not user-friendly given the training style. Not used frequently enough.
- For training purposes, PCs are provided by the FMS in the form of laptops (15 sets).

■ Library
- Need. Existing library to be moved to the RTC. It should be available for use by both FMS staff and trainees. Need a table (space) where 4~5 people can sit and read books.
- One librarian should be stationed there.
- Needs a photocopier for visitors to print.
- Conduct an inventory of books and purchase up-to-date books. However, it should be noted that a lot of information can be downloaded online today.

■ Meeting rooms
- If the FMS is designated as an RTC/RIC, a conference room is needed as the number of visitors will increase. It is not advisable to use one room for both training and meetings, as this would make it difficult to manage schedules.

■ Staff room

The training section　is likely to be staffed by eight people in the future, four of whom are expected to hold concurrent positions. Therefore, the staff room should have space for at least　four people to work (individual room + 1 shared staff room).

The training room needs space for shelves and cabinets to take into account the large number of files that should be kept in the training room, such as training request forms and training records.

■ Storage room for teaching and learning resources
- It is convenient to store training materials mainly in the staff room (to ensure storage space).
- Storage rooms are needed to store laptop computers used for training.
- As regards for learning materials for the exhibition room for disaster prevention,

the size should be considered according to its content.

■ Amenities (Bathrooms/toilets/Kitchen/Locker room)

- Toilets are needed to accommodate the number of staff to be stationed at the new facility. The number of trainees who would use the toilets is 10~15 persons/course. The number of visitors targeted for awareness-raising is 100~200 at most (almost 50/50 ratio of male to female visitors), but the duration of stay is not long, about 1 hour. Currently, visitors use the FMS toilets, but this does not cause significant congestion.
- Trainees do not go out for lunch, so there is a need for a kitchen where refreshments can be taken.
- Lockers are needed to store personal computers and other valuables brought in by trainees.

■ Recreational facilities

- Not required.

■ Residential facilities such as cafeterias and laundries

- Not required.

■ Video and data projection systems/video or web conferencing systems/Internet access

- A projector should be available in each classroom.
- Ensure an internet environment where online education can be implemented.

■ Web server access for hosting a website

- Requires a server for operating the FMS e-Learning Platform.

■ Black/white and smart boards

- Electronic whiteboards/flipcharts should be in place, taking into account group work (max. 4~5 groups).

■ Learner response systems

- “FMS e-Learning Platform” is operated with improvements. Moodle, currently using the free version, will be switched to the paid version to expand its functions.

■ Printing and photocopying facilities (room)

- A photocopier would suffice in the staff room and library. No separate space for printing is needed. No photocopier needed in classrooms (unsuitable). Trainees can print in the library if necessary.
- Although it is preferable to distribute brochures and other materials for disaster awareness, it would be uneconomical to print them at the FMS (to be outsourced).

■ Access to the same equipment that is used in real-time operations.

- Practical training can use equipment from existing facilities. But, calibration centres are needed so that they can be used for training in instrument calibration.

2) Needs for organisational structure

In order for the FMS to manage the RTC in the future, a new organisational structure needs to be established. According to WMO guidelines, RTC are required to be staffed by a center director and a coordinator. In addition, the FMS considers that in the medium to long term, the RTC should be staffed with the following instructors and administrative staff.

i) Senior Training Officer (Training management)
ii) Training Officer (Weather forecasting)
iii) Training Officer (Climate)
iv) Training Officer (Hydrology)
v) Training Officer (Instrument examination/calibration)
vi) Training Officer (Disaster risk reduction education)
vii) Training Officer (Training development)
viii) Administrative Officer

3) Capacity development of instructors.

Newly appointed supervisors will need training on training course development and pedagogy, in addition to capacity-building in their own expertise. For these, support from international and regional organisations, universities and donors is expected.

4 – 2 – 2 Prioritizing each issue and organizing support demands for calibration facility

<Calibration laboratory>

The calibration laboratory is small, and the equipment and standard instruments for calibrating atmospheric pressure, temperature, and humidity are placed together. For

this reason, if the staff were to perform two or more calibrations in parallel, it would be quite complicated to conduct the work.
Additionally, in order to calibrate atmospheric pressure, temperature, and humidity, the required indoor environment is different, so it is not a very good environment.
Furthermore, the current proofreading room is too small for proofreading training for trainees from island countries.
Therefore, an air pressure calibration laboratory and a temperature/humidity calibration laboratory of appropriate size should be provided. In addition, the facility should be designed to accommodate other observation elements in the future while listening to the requests of the FMS side.

<Facilities/equipment>
FMS currently has standard instruments for barometric pressure, temperature, and humidity, and these are calibrated once a year using the BOM to maintain traceability of the standard instruments. Using this FMS standard instrument, FMS regularly calibrates domestic observation instruments and national standard instruments of surrounding countries.
Regarding the acquisition of ISO 17025 for the establishment of RIC Nadi, FMS intends to aim for ISO 17025 acquisition by taking steps for each element.
Considering the technical and human resources issues of FMS mentioned above, it seems realistic to focus on atmospheric pressure and aim for ISO certification at first.
Based on the issues mentioned in 4-1, the support that should be provided and its priority are considered to be as follows.

(Priority A: Required)
A) Calibration standard instrument: Prepare spare instrument for the current standard instrument for atmospheric pressure, temperature, and humidity.
B) Working standard: Multiple working standard sets for inspecting the 71 observation points will be deployed at three observatory offices in Fiji.
C) Environmental equipment for calibration: constant temperature and humidity chamber, constant temperature water bath, pressure pipe for calibration
D) PC for calibration setup

(Priority B: Support is desirable)
E) Standard pyranometer: Compare and calibrate with the device to be calibrated on the roof of the main office.
F) Base for pyranometer comparison observation, PC for data processing, and data processing software
G) Working calibration device for pyranometer (under investigation)

H) Working calibration device for Rain gauge : Portable field rain gauge calibration device
I) Working calibration device for anemometer: Portable ultrasonic anemometer (under consideration)

4 – 2 – 3 Prioritizing each issue and organizing support demands for FMS building

(1) Issues considered high priority for support

1) Space for installation of simulators
There is no space available for the installation of a weather simulator. There is a demand for support as the installation of simulators is also a criterion by the WMO for RTC.

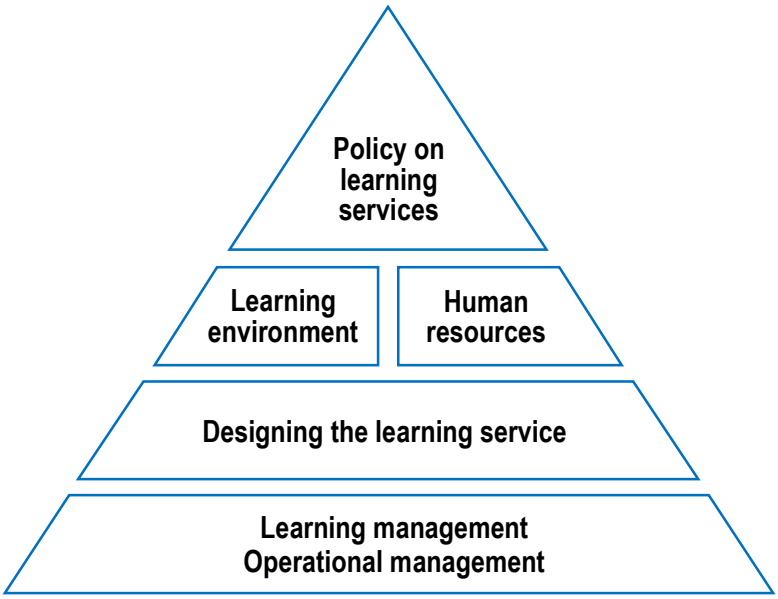
2) Ensuring the functionality to become a RIC
The following issues are important in becoming a RIC and the issues are considered to have demand for support.
The calibration room is about 10 square meters in size, in which all the equipment used for calibration of air temperature, humidity and air pressure is located.
The ideal indoor environment for calibration of air pressure, temperature and humidity is different, but the calibration equipment is located in the same room.

(2) Issues for which assistance is desirable
The following issues are not essential for the FMS to become an RTC or RIC, but their resolution is desirable to improve the learning effectiveness of visitors and observers, and there is sufficient demand for support.
1) Although 10,000 visitors come to the RTC annually, the only space for exhibits is a corridor with posters and other materials as teaching aids. In addition, the only place where lectures are given to visitors is in the meteorological forecasting room.
2) If the FMS is designated as an RTC/RIC, the number of visitors is likely to increase. The current FMS only has one meeting room for staff on the second floor and a training room on the ground floor that doubles up as a meeting room, which is likely to be insufficient.
3) The number of rooms is small and there is no room for group work, individual study or other purposes.

4 – 3　Necessary measures

4 – 3 – 1 Necessary measures for training and awareness-raising facilities

Addressing the challenges faced by the FMS requires a comprehensive response rather than dealing with parts and pieces in isolation. Policies for learning services, the learning environment and staffing are the basic requirements for addressing issues. Without these in place, improvements in learning services and operational management will not work effectively.



Source: Survey Team

Figure4-3-1：**Comprehensive approach to solving issues**

1) Clarification of the policy on learning services provided by the FMS

Describe basic policies and strategies on what learning services the FMS should provide in the next FMS strategic plan. It will also be useful to organize the FMS's policy on learning services by preparing RTC concept papers in the style of “business courses” as set out in the WMO guidelines.

2) Establishment and staffing of training section

- The FMS should recognise that establishing a new training section and assigning the necessary personnel as a top priority.
- For staffing, the highest priority should be given to assigning personnel (Training Officer) who can share and assist the duties of the current Senior Training Officer. It is also desirable to have full-time staff in place for disaster education and awareness-raising. In the short term, it is realistic to assign staff from other divisions as instructors for weather forecasting, hydrology, instrument calibration,

etc., in the form of a dual role with the training section. In this case, training of trainers for the appointed staff is essential. Cooperation with USPs and FNUs would be required.

3) Improving the learning environment

The development of training and awareness-raising facilities, together with the above-mentioned organizational structure, is a prerequisite for the expansion of FMS learning services. The learning environment will be greatly improved if the facilities are developed as an RTC under the Japanese project (grant aid). The development of training facilities will take note of the WMO's guidelines.

4) Designing the learning service

- Procedures need to be accelerated to ensure that the three modules currently in use are formally accredited as micro-certificate courses, in cooperation with the relevant bodies.
- Based on the training needs assessment, the training area needs to be expanded beyond meteorological observation. To this end, support for the development of curricula and teaching materials can be expected from the JICA technical project scheduled to start in 2024.
- Prepare a syllabus and implementation manual for disaster education and awareness-raising activities conducted by the FMS. In designing disaster education for students, it is essential to cooperate with the Ministry of Education and schools to ensure consistency with the Ministry of Education's curriculum.
- In designing the disaster management education provided by the FMS, attention should be paid to maximising the strengths of the FMS. This enhances the value of the FMS as an education provider. FMSs can explain how weather information is collected, analysed and warning information is disseminated by showing FMS workplaces and observation equipment. If this is done more timeously and carefully than it is now, it would be a very effective disaster awareness-raising exercise (e.g. awareness-raising exhibitions).
- The content of the FMS learning service could be made available on the website so that more prospective students can access the information. Its design could be made more efficient by working with USPs, SPREP/PCCC and others.
- Face-to-face training is preferred for training involving practical skills and exercises. However, considering the cost efficiency of training and the diversification of learning styles of trainees, online and hybrid learning methods are likely to increase. New RTC facilities should be designed to be flexible enough

to accommodate such learning service methods.

5) Learning management

- The preparation of training and awareness-raising plans and annual reports should be institutionalised as an FMS, as they are the basis of learning management.
- The design of the 'FMS e-Learning Platform' should be reviewed in anticipation of training being expanded as an RTC. The learning management system 'Moodle' is also used by USPs and could be redesigned as an 'RTC e-Learning Platform' with cooperation between the two.

6) Operation and Management

i) Cooperation with relevant institutions

With regard to the establishment (including national accreditation as a vocational training provider) and operation of RTC, a task team comprising SPREP, and other relevant organizations has now started to support the FMS and UPS. A JICA technical cooperation project scheduled to start in 2024 is also planned to prepare a business plan (training content, financial plan, operational plan, etc.) for the operation of the RTC. With such external support, the resolution of issues related to the operation of the FMS is expected to be accelerated.

ii) Risk management in case of staff (instructor) turnover.

It is difficult to prevent the resignation of staff seeking better incomes. It is therefore important to assess the impact of staff quitting and prepare measures to deal with this in advance.

The impact of the resignation of a trainee officer is particularly serious. A wide range of possibilities should be considered, such as preparing internal replacements or using external instructors.

iii) External support for training costs

It is considered that the training bringing Pacific Island NMHS officials at FMS would need to be supported by donors in terms of the cost of participation. Once the FMS is designated as an RTC, the need for funds and projects for human resource development in the NMHS of each country will increase. In the short to medium term, cost issues will be addressed through JICA technical cooperation projects, training in third countries and the use of Weather Ready Pacific. However, efforts should be made to secure other sources of funding in cooperation with

SPREP/PCCC.

iv)Occupancy rate of training facilities.
Training for Pacific Island NMHS staff, even if well conducted, is not very frequent. Furthermore, considering that distance education will become more common in the future, the classrooms at the RTC will not be used on a regular basis. Therefore, it is important to make the facility multipurpose by using it through training for national institutions and disaster education and awareness-raising. Increasing the frequency of all types of training is also an essential requirement for the FMS to maintain staffing and training sections. In the design of training facilities, attention must then be paid to the flexibility of facility use to accommodate such a variety of training styles.

v) Practical training for FMS executive officers on the operation of RTC
An understanding by the FMS of the RTC designation process and operating procedures in other RTCs would be of great help in promoting the establishment of the RTC. Training, including inspection and study tours, for FMS Director and senior staff, including training officers, should be supported by the WMO's Education and Training Fellowship and other regional bodies.

7)　Data archive in Climate Room
・Regarding the digitization of old observation data (data rescue) accumulated over many years in the FMS climate room, it is critical to investigate in detail the amount of data that needs to be processed. At the same time, carefully consider the necessary tools (hardware and software) and the time required for the work.
・FMS has requests for large flatbed scanners, overhead scanners, data storage servers, backup storage hard disks, and OCR software. The Disaster Prevention Awareness Center requires a computer and a liquid crystal display to display past data stored on the server.
・These equipment can also be used for climate change surveys and research.

4 – 3 – 2 Necessary measures for calibration facilities

A) Regarding calibration facilities, it is important to design the layout in accordance with the actual situation of calibration work.

B) Regarding calibration equipment, further discussions will be held with FMS regarding each equipment shown in Table 4-3-2 below in accordance with the priority stated in the previous section, and the final equipment to be provided will be determined.

C) In addition, when providing these equipment's, it is necessary to collaborate with technical cooperation projects and third country training.

Table 4-3-1: **List of instrument and equipment to be provided to FMS for establishment of RIC Nadi (draft)**

Necessary equipment and necessary numbers (Equipment with red color character is already installed one unit)

element	FMS Headquarters (RIC)				Regional base (Nadi, Suva, Lambasa)		
	Calibration standards (primary/sub)		Environmental equipment for calibration 1	Environmental equipment for calibration 2	Portable calibration device		spare
temperature	Reference thermometer (CTR2000)	Platinum resistance temperature sensor (Pt100)	Constant temperature and humidity chamber (HygroGen | HG-2S)	Constant temperature water tank	Portable temperature/hygrometer (HMP155)	Data display (MI-70)	
Deficient number	1	2	1	1	(Confirmation required)	(Confirmation required)	
Humidity	Mirror type dew point meter (S1-S; existing, MBW373; recommended)	HMP155 (as a secondary instrument)	Constant temperature and humidity chamber (HygroGen | HG-2S)	—	Same as above	Same as above	
Deficient number	2	2	1	—	Same as above	Same as above	
air pressure	Digital barometer (PTB330TS)	Data display (MI-70)	Calibration pump Metal piping Total of 4 connection ports including reference device	—	Digital barometer (PTB330TS)	データ表示器 (MI-70)	
Deficient number	(Confirmation required)	(Confirmation required)	1		Same as above	Same as above	
Wind direction/speed	-	-	—	—	—	—	Anemometer
Deficient number	-	-	—	—	—	—	(To confirm)
solar radiation	Pyranometer (kipp&zonen CMP22)		Comparative observation base	Data logger PC for data processing Data processing software	—	—	Pyranometer
Deficient number	3		1		—	—	(To confirm)
rain	-	-	—	—	Portable field rainfall calibration device Hukseflux	—	Rain Gauge
Deficient number	-	-	—	—	(Confirmation required)	—	(To confirm)

Other equipment (for the central government office)

Equipment for recording calibration data	Data processing PC (Windows)	RS232C-USB converter	Digital multimeter (for analog barometer)	DC power supply (for analog barometer; 124C20155)
Deficient number	1	3	Need confirmation	Need confirmation

Source: Survey Team

4 – 3 – 3 Necessary measures for FMS building

The following measures are considered necessary to address the current challenges to FMS buildings listed in 4-2-3.

(1) Ensure space for installation of simulators.
- Secure space for the installation of a weather simulator.

(2) Ensure the functionality to become a RIC.
(3) Ensure a space for the installation of new calibration equipment as RIC and for the calibration work of such equipment.
(3) Ensure separate calibration rooms for air pressure, temperature and humidity calibration, as the ideal indoor environment for each of these is different.

(3) Ensure that there is enough space for a highly effective learning display and sufficient lectures for the 10,000 visitors per year.

(4) Ensure a meeting room that is necessary when the FMS is designated as an RTC/RIC.

(5) Ensure rooms for different purposes, such as group work and individual study.

Chapter 5 Recommendation and future issues

5 – 1 Support policy

5 – 1 – 1 Support Policy for New Building

In view of the current issues in the FMS buildings, the following supporting policies should be used to plan the buildings.

(1) Study the layout of the following various rooms and their appropriate area for the installation of the relevant equipment of the RIC

Air temperature calibration room, air pressure calibration room and humidity calibration room

(2) Arrangement of the following rooms required for the RTC and consideration of the appropriate number of users and area

Training room, discussion room, simulation room

(3) Other policies

Securing space for disaster awareness displays

Securing a flow line that allows visitors to experience the entire facility

Installation of solar panels, and consideration of operation for generated electricity

Consider energy-saving and decarbonisation-friendly building materials and spatial composition

Retain trees along London Avenue and plan within building restrictions

Use of local building materials

(5) Ensure rooms for different purposes, such as group work and individual study.

(6) Consider measures to deal with noise from the generator on the west side of the site.

5 – 1 – 2 Support policy for equipment procurement

(Procurement of Calibration equipment for RIC Nadi)

Regarding the procurement of RIC's calibration-related equipment, the basic policy is as follows.

A) After confirming the requests from FMS in the basic design study, we will coordinate with FMS again based on the equipment candidates (draft) in Table 4-3-1.

B) When selecting the equipment to be procured, clarify the operational plan for the calibration work, including securing personnel and budget for establishing the RIC, and maintaining and managing the equipment.

C) Regarding procurement sources, we will investigate candidates such as within Japan, Fiji, and third countries, and select the most suitable procurement source.

(Procurement of RTC related equipment)

The basic policy regarding the procurement of RTC-related equipment is as follows.

A) The RTC's forecast simulator room will be set up in accordance with WMO's RTC guidelines to provide an environment where trainees can conduct forecast exercises efficiently. Specifically, it will be linked to the FMS forecasting system to create the same working environment as the forecasting office.
B) Establish a high-speed LAN to connect the new building, FMS main building, and USP.
C) A distance education (video conference) system equipped with RTC's CCTV security will be established in order to create an environment for distance education by connecting surrounding island countries and USP.
D) Provide the necessary furniture (desks, chairs, shelves, lockers, etc.) for the RTC training room.

(Procurement of equipment for the Disaster and Climate Change Awareness Center)

Detailed review of the exhibition content at the Disaster and Climate Change Awareness Center will be proceeded. The main equipment is considered to be various large displays (multiple) and a PC for displaying them. Depending on the exhibition content, it may be necessary to consider different media.

(Equipment for restoring FMS past observation data)

Update scanners for reading past monthly report data and weather maps stored in FMS. Additionally, OCR software will be installed to digitize the scanned monthly report data, and a data server will be set up exclusively for large-capacity monthly report and weather map image data. The list of expected equipment is as follows.

A) Large flatbed scanner
B) Overhead scanner
C) Archive server
D) Backup storage hard disk
E) Display terminal computer in Disaster and Climate Change Awareness Center
F) LCD display
G) OCR software

(RIC/RTC office)

RIC and RTC each require office equipment for inputting and managing calibration records and preparing training materials. Regarding these, the policy is to consider procuring the following equipment.

A) Copy machine (large) RTC
B) Copy machine (middle) RIC
C) Laptop computer
D) Office software

5 – 2 Recommendations and priorities of candidate projects

5 – 2 – 1 Recommendations and priorities regarding new building

For the various rooms proposed in 5-1-1, the priorities and the policies for each of the details are as follows.

(1) Priority considerations for facility construction

1) Arrangement of various rooms for installing the relevant equipment of the RIC.

For the air temperature calibration room, air pressure calibration room and humidity calibration room, the size of the calibration equipment to be employed and the required working space should be confirmed, and the area and appropriateness of the rooms should be determined.

2) Arrangement of the various rooms required for the RTC

Training rooms and meeting rooms After confirming the future training plans of the FMS, etc., the number of people that can be accommodated in these rooms shall be determined after consultation with the FMS. For the simulation room, the required space will be considered after confirming the size of the simulator.

3) Improvement of learning effects for visitors

To improve the learning effect for visitors, secure space for a disaster awareness exhibition. The shape of the exhibits should be considered, and the space should be designed in consideration of the visitor's route. Also, consider securing a flow line that allows visitors to experience the entire facility during their visit.

(2) Considerations that should be addressed in the construction of the facility

1) Consideration of building materials, space composition, installation of solar panels, etc. that take energy conservation and decarbonization into account.

2) Address noise from the generator to the west.
3) Retain trees along London Avenue and plan within building restrictions
4) Use of local building materials]

5 – 2 – 2 Recommendations and priorities regarding equipment procurement

■Calibration equipment related to RIC

Possible calibration equipment related to RIC is shown in Tables 5-2-1 (for FMS headquarter) and 5-2-2 (for local observatory). All equipment is high priorities for provision.

Table5-2-1： **Calibration equipment proposed for RIC (FMS headquarters)**

element	**FMS Nadi（RIC）**			
	Calibration standard (primary/sub)		**Test environment device 1**	**Test environment device 2**
temperature	Reference thermometer (CTR2000)	Platinum resistance temperature sensor (Pt100)	Constant temperature and humidity chamber (ESPEC/PR-1J)	Constant temperature water tank
Existing units	1	1	1	1
Deficient number	1	2	1	1
Humidity	mirror dew point meter(S1-S; existing, MBW373; recommended)	HMP155 (as a secondary instrument)	Constant temperature and humidity chamber (HygroGen | HG-2S)	-
Existing units	1	0	Same as above	–
Deficient number	2	2	1	–
air pressure	Digital barometer (PTB330TS)	Data display (MI-70)	Calibration pump Metal piping Total of 4 connection ports including reference device	–
Existing units	1	1	1	–
Deficient number	(Confirmation required)	(Confirmation required)	1	–
Wind direction/speed	–	–	–	–
Existing units	0	0	–	–

Deficient number	–	–	–	–
solar radiation	Pyranometer (kipp&zonen CMP22)		Comparative observation base	Data logger PC for data processing Data processing software
Existing units	0	–	0	0
Deficient number	3	–	1	1
rain	-	-	-	-
Existing units	0	–	0	–
Deficient number	–	–	–	–

Other equipment (for FMS Nadi office)

Equipment for recording calibration data	Data processing PC (Windows)	RS232C-USB converter	Digital multimeter (for analog barometer)	DC power supply (for analog barometer; 124C20155)
Existing units	1	1	1	1
Deficient number	1	3	1	1

Source: Survey Team

Table5-2-2： **Proposed calibration equipment related to RIC (for local bases (Nadi, Suva, Lambasa))**

element	**Regional Office (Nadi, Suva, Lambasa)**		
	Portable calibration device		**spare**
temperature	Portable temperature/hygrometer (HMP155)	Data display (MI-70)	
Deficient number	(Confirmation required)	(Confirmation required)	
Humidity	Same as above	Same as above	
Deficient number	Same as above	Same as above	
air pressure	Digital barometer (PTB330TS)	Data display (MI-70)	
Deficient number	Same as above	Same as above	
Wind direction/speed	-	-	anemometer

Deficient number	-	-	(Confirmation required)
solar radiation	-	-	pyranometer
Deficient number	-	-	(Confirmation required)
rain	Portable field rainfall calibration device Hukseflux	-	rain gauge
Deficient number	(Confirmation required)	-	(Confirmation required)

Source: Survey Team

■Procurement of RTC, awareness facility, climate room, and other related equipment

Procurement of RTC, awareness facilities, climate room, and other related equipment will be considered in accordance with the list below.

Table5-2-3：**Procurement devices**

1. RTC simulation room

No.	Equipment name	specification	quantity
1.1	PC	Core i9 3GHz、32GB、1000GB SSD	12
1.2	LCD display	27 inches	12
1.3	Maintenance fee per year after warranty period		12
1.4	HPC computer server for numerical weather forecasting	under consideration	1
1.5	LCD display	27 inches	2
1.6	Weather map creation software for manual display	Creation of weather maps currently used in the forecast room	1
1.7	Maintenance fee per year after warranty period		1

2. FMS climate room

No.	Equipment name	specification	quantity
2.1	PC	Core i9 3GHz, 32GB, 1000GB SSD	3
2.2	LCD display	27 inches	3
2.3	flatbed scanner	Resolution of 40 million pixels or more	3
2.4	overhead scanner	Resolution of 40 million pixels or more	3
2.5	Archive server	HPC computer with 12TB SSD	3
2.6	storage hard disk backup	350-500TB	3
2.7	Computer for disaster prevention center display terminal	Core i9 3GHz, 32GB, 1000GB SSD	2
2.8	LCD display	27 inches	2
2.7	OCR software	Character recognition using AI	1

3. Communication equipment to connect the new building to FMS and USP

No.	Equipment name	specification	quantity
3.1	Switching hub	layer 3	1
3.2	router		1
3.3	patch panel		1
3.4	port outlet	100 ports	1
3.5	Wi-Fi hub		1

4. Distance education (video conferencing) system with CCTV security from RTC

No.	Equipment name	specification	quantity
4.1	conference kit	For 25 people	2
4.2	conference kit	For 15 people	2
4.3	speaker	(6,6,4,4) for 4 training rooms	20
4.4	laptop	Core i7 2GHz, 32GB, 512GB SSD	25

5. RIC and RTC Offices

No.	Equipment name	specification	quantity
5.1	Copy machine (large) RTC	multifunction printing machine	1
5.2	Copy machine (middle) RIC	multifunction printing machine	1
5.3	laptop	Core i7 2GHz, 32GB, 512GB SSD	2
5.4	office software	Microsoft office	2

6. Disaster and Climate Change Awareness Center (quantity under consideration, request for quotation)

No.	Equipment name	specification	quantity
6.1	LCD display	85 inches	
6.2	LCD display	75 inches	
6.3	LCD display	55 inches	
6.4	LCD display	27 inches	
6.5	PC	Medium performance for display operations only	

7. IT equipment for operating RIC calibration equipment

No.	Equipment name	specification	quantity
7.1	LCD display	27 inches	1
7.2	computer	middle performance	1
7.3	Laptop for document creation	middle performance	4
7.4	printer copy machine	55 inches	1

8. RTC furniture (desks, chairs, shelves, lockers, etc.)

No.	Equipment name	specification	quantity
8.1	desk	under consideration	
8.2	Chair	under consideration	
8.3	shelf	under consideration	
8.4	locker	under consideration	

Source: Survey Team

5 – 3 Issues for next study

Based on the above survey analysis, the following issues will be identified and discussed in the cooperation preparatory survey in the future.

(1) Issues related to building restrictions and building plans

1) Confirmation of building restrictions

Confirmation of height restrictions due to control tower visibility

2) Confirmation of planning conditions

Confirmation of scale and number of people

・Confirmation of the content, operation method and content of disaster prevention and awareness-raising facilities

Confirmation of the method of operation of photovoltaic panels.

(2) Recommendations to the FMS on training and awareness-raising activities

It is recommended that the FMS addresses the following points in order to improve its learning services (including disaster management education) and towards the designation of RTC by the WMO.

1） Documenting the FMS' policy and strategy on training services and disaster education and awareness activities.
2）Establishment of an organisational structure to be responsible for training services and disaster education/awareness-raising activities.
3）Assigning additional instructors (including dual roles) and strengthening their capacities
4）Expansion of training modules
5）Continuous budgetary measures (e.g. for training/awareness-raising activities, personnel costs, facility maintenance, etc.)
6）Strengthening of relations with target institutions for training
7）Strengthening of cooperation with international and regional organisations and donors

(3) Issues relating to survey of existing infrastructure.
1) The planned layout of the new facility and the status of existing buried cables and buried piping etc. should be investigated in the future.
2) The power and communication cables to the existing CTBTO building should be investigated in the future.
3) As the buried drainage pipe route interferes with the planned new facility location, the cut-off route should be confirmed with the Water Authority (WAF).行う。

(3) Issues for equipment procurement
1) The RIC needs to identify its essential resources, including personnel and budget, and its operational plan for calibration services, including equipment maintenance and management.
2) It is necessary to understand the actual situation of domestic calibration and inspection in neighbouring countries where the RIC should take the lead. Even at present, some countries are unable to calibrate and inspect their equipment.
3) Conduct a survey of existing RTCs with regard to equipment for forecast work simulation rooms as described in the WMO's Guidelines for RTCs (11 related documents).
4) Also, examine USP's experience and equipment requirements with regard to linking RTCs to USP and conducting distance learning via satellite links with neighbouring island states operated by USP.
5) With regard to the digitisation (Data Rescue) of old observation data accumulated in the Climate Information Office over many years, the quantity of data to be processed will be ascertained, and the necessary tools (hardware and software) and the time required for the work will be carefully examined.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