PROPOSED INSTITUTIONALIZATION OF DATA MANAGEMENT, MAPPING AND OPERATIONS CENTER OF DENR PALAWAN

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Beneficiaries:	DENR Regional Office, Attached Agencies, Councils National Government Agencies Local Government Units Academic/Research Institutions Non-Government Organizations General Public
Project site:	PENRO Road, Bgy. Sta. Monica, Puerto Princesa City, Palawan
Project Duration:	FY 2022-2024
Total Project Cost:	Php 49,868,500.00
Date Prepared:	November 17, 2022

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Executive Summary

The province of Palawan is located in the southwestern most part of the country within the MIMAROPA region. It has a total land area of 1,489,626 *has* wherein land areas are classified as Alienable and Disposable, Forest lands, national parks and civil reservations. The whole archipelago is composed of roughly 1,769 islands and islets with a total coastline of 1,959 kilometers. The province is comprised of 23 municipalities, 1 component city and 3 congressional districts. The total population of the province of Palawan in 2020 (including Puerto Princesa City) is 1,246,673 where 939,594 live in different municipalities outside the city and 307,709 for Puerto Princesa City alone.

DENR PENRO Palawan is the primary government agency mandated to conserve, manage, develop, and spearhead the proper use of the country's environment and natural resources as stated in E.O. 192,s 1987. It has an administrative jurisdiction over 6 CENROs serving 23 municipalities and 1 city. The arm of the office is spread out in different areas and municipalities in the province through the establishment of 6 Community Environment and Natural Resources Office(CENRO)s. Currently, there are 2 CENROs located in the municipalities of Brooke's Point and Quezon, 3 CENROs in the municipalities of Roxas, Taytay and Coron, and 1 in the City of Puerto Princesa. DENR PENRO Palawan is headed by a Provincial Environment and Natural Resources Officer, Forester Felizardo B. Cayatoc. Under his wings are the 6 Community Environment and Natural Resources Officers assigned in different CENR Offices. In terms of administrative jurisdiction, the entire province is under the AOR of MIMAROPA Regional Office headed by the Regional Executive Director Lormelyn E. Claudio, CESO IV. Each CENROs oversees several municipalities. In the 3rd Congressional district, CENRO Puerto Princesa oversees municipalities of Cagayancillo, Cuyo, Magsaysay, Agutaya, Kalayaan Group of Islands, Aborlan and the City of Puerto Princesa. The office is headed by OIC-CENR Officer Pedro Velasco.

In the northern part of the province under the 1st Congressional district, here lie the 3 CENR Offices. Just 137 kilometers from the heart of the city is the CENRO Roxas which supervises the municipalities of Roxas, San Vicente, Araceli and Magsaysay headed by CENR Officer Pablo L. Cruz. Next to it sits the CENR Office of Taytay with an approximately 82km road distance from Roxas and some 220km from the city. The municipality of Taytay is home to the famous Fort Isabel and known as the first capital of the province. The office also cradles the 2 famous protected areas: the Malampaya Sound Protected Landscape and Seascape (MSPLS) and El Nido-Taytay Managed Resource Protected Area(ENTMRPA) which are both headed by Protected Area Superintendents under the supervision of CENR Officer Allan Valle. The last municipalities under the 1st Congressional district are the Calamianes group of Islands consisting of Coron, Busuanga, Culion and Linapacan. The CENR Office is located in the tourism-rich municipality of Coron which also oversees the other 3 island municipalities. The office is headed by CENR Officer Arnold Blaza.

The 2nd congressional district can be found in the southern part of the province. Unlike its north Palawan counterpart which capitalizes in its tourism industry, the south of Palawan geared towards the thriving agricultural and mining industries. Two CENR Offices have been installed in behalf of PENR Office in this part of the province. Within the vast stretch of agricultural land is the CENR Office in the municipality of Brooke's Point. Under its administrative jurisdiction are the municipalities of Sofronio Española, Brooke's Point, Bataraza all the way to island municipality of Balabac. Because of the massive land area and ENR activities, the CENR Office put up monitoring stations in each municipalities outside Brookes Point. The CENR Office also runs the Ursula Island Game Reserve and Bird Sanctuary (UIGRBS) which can be found in the islet of Ursula just 20km off of Brooke's Point and about an hour by boat from Rio tuba, Bataraza, Palawan. The office is under the leadership of its CENR Officer Conrado Corpuz.

The next CENR office under this district sits in the municipality of Quezon just an estimated 132.8 km from Brooke's Point via the Palawan south road. The area of jurisdiction of the CENR Office traverses the majestic Mt. Mantalingahan all the way to the municipalities of Rizal and Narra, Palawan. Two monitoring stations are installed in each municipality outside Quezon to discharge its functions mandated by law. The office is also home to Rasa Island Wildlife Sanctuary (RIWS) which can be found in the municipality of Narra, and the Mt. Mantalingahan Protected Landscape (MMPL) which intersects almost the entire southern municipalities. Both of the protected areas are managed by the designated Protected Area Superintendent under the supervision of CENR Officer Leonard Caluya.

In summary, DENR PENRO Palawan is in-charge of at least 6 CENR Offices, 4 Protected Areas, several monitoring stations, the Snake Island Coastal and Marine Center for Research and others, all posted in strategic locations in the province.

Palawan's long and irregular shape is lined with coves, rocky mountains and dense forest. Its underdeveloped road infrastructure, the presence of armed terrorists, and limited personal protective equipment makes it challenging to monitor activities and conduct surveillance in regular intervals. With this, the PENR Office with its limited resources employs task-specific equipment and information technology in its environmental law enforcement and monitoring activities. Since the installation of telecommunication towers in remote areas are still on-going, the monitoring of personnel movement during patrolling and ENR activities is challenging. Hence, belated emergency response in times of distress, apprehension, and other similar situation endangers the life of the field personnel. Assault which is commonly encountered by forest patrollers oftentimes resulted to physical injuries and fatalities. Thus, the office is proposing to establish a Data Management, Mapping and Operations Center for proactive monitoring of ENR activities within its area of jurisdiction and during the deployment of field personnel. The center shall provide 3 core services to its stakeholders. Firstly, as **Data Hub** for data management which will perform data analytics and visualization, statistical analyses and provide repository of reports, documentations, maps and alike for faster and informed decision-making. Secondly, as a **Mapping center** of the office which

generates and updates geospatial data within area of jurisdiction, locate hotspots of environmental threats, apprehensions and uploads the same to the DENR One control map portal. Thirdly, as **Operations Center** which will oversee the deployment of surveillance technologies for near real-time monitoring of personnel movement and ENR activities during field operations. Further, the center shall also deploy the LAWIN Forest and Biodiversity Protection System and Earth Ranger application for recording of threats and other ENR activities for enforcement action, monitoring and evaluation of DENR programs and projects, planning and evaluation purposes including response to disaster risk and reduction in times of calamity.

Rationale

The center of the province of Palawan is located at 9° 44' 26.5056" N and 118° 43' 48.2592" E, stretching 650km from tip to tip, composed of 1,780 islands and islets, 2,000km of beach areas and a volume of mineral deposits and natural gas. The entire province is being supervised by the DENR Palawan as Lead Agency in terms of ENR activities. Under DENR Palawan jurisdiction, a total of 637,146.05 *has* is identified as conservation areas in the different parts of the province[1]. The entirety of the conservation areas are targeted each year by the respective CENROs for its enforcement and monitoring activities. Each CENROs has a corresponding manpower complement of Forest Patrollers and Forest Rangers holding contractual and permanent positions. Based on the DENR Palawan Monitoring and Enforcement Section Consolidated Report for 2020-2022, the agency has employed 304 forest patrollers that resulted to 499 apprehensions involving forest products, tools, equipment and conveyances. Apprehensions of wood/lumber were prevalent based on 2021 and 2022[2] data with a total estimated market value of Php 2,464,529.84 and Php 1,008,045.75, respectively. However, the provision of limited personal protective equipment posed risks among forest patrollers during field work as some violators were armed and threatening. Incidence of stand-off, injuries and fatalities were among the reported occurrences involving Forest Patrollers[3]. Thus, the establishment of an Operations Center for tracking and monitoring of personnel movement during deployment is necessary in this type of activities to aid these personnel in the discharge of their function. A timely-response and provision of back-up support during emergency situations are essential to curtail these instances.

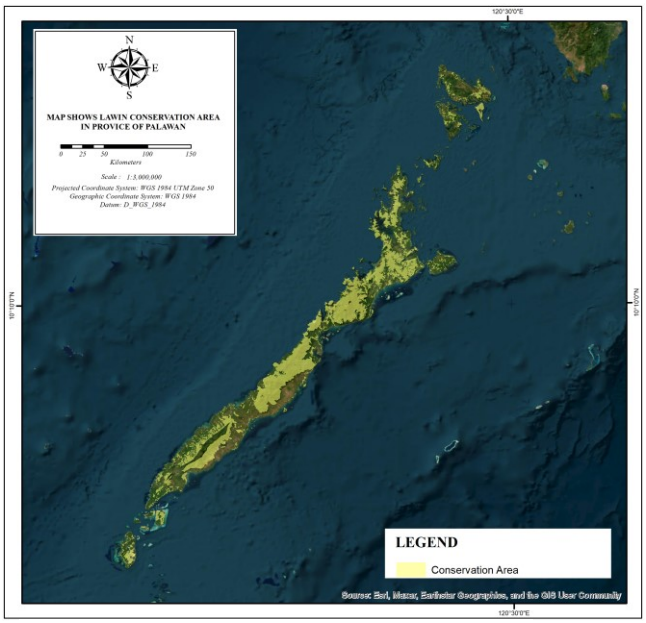


Fig. 1. Map of LAWIN Conservation Areas

Assessment of environment and natural resources, and environmental accounting are two of the commonly requested and generated data in the agency, especially after the onset of natural calamities. To do so, a complete, accurate and timely gathering of data is necessary. Several information systems are being implemented up to the CENRO level such as Lawin Forest and

[1] *Conservation Areas: CENRO PPC-183,860.03; CENRO Roxas-135,682.63; CENRO Taytay-73,378.17; CENRO Coron-36,420.12; CENRO Brooke's Point-93,992.27; CENRO Quezon-113,812.83*

[2] *Market value and Total Volume of Wood/Lumber Confiscation for CY 2021 and CY 2022 (as of Aug. 2022)*

[3] *Appendix H Map showing Apprehensions, Threats Observed and Ferocious act in 2019 and 2020*

Biodiversity Protection System, Enhanced Forestry Information System (eFIS), Land Management System(LAMS) to name a few. Nonetheless, being these systems as separated information systems, the office still needs a centralized processing and repository of data. The key aspect of the center is linking vital systems and communications – not just to gather information, but also to allow seamless and mass distribution of critical instructions, notifications, and alerts. The center will be the place of convergence of various IT infrastructures, Information Systems and Communication Technologies. Per DENR ISSP for 2021-2023, the DENR CO has various information systems deployed to field offices; others are programmed for deployment until the following year. The reports which can be derived from this various Information Systems shall be received, processed and analyzed at the Operations Center. Hence, the head of office will be armed with hot and current information to manage incident(s) and situational awareness quickly and effectively. Data analytics, visualization, and statistical analyses are of utmost importance for the decision-makers to come up with informed decisions from the data gathered from these information systems. Hence, a centralized data hub is necessary for consolidation and efficient data management.

One of the best tools nowadays to create visualization and analysis is through the use of geospatial data or mapping using Geographic Information System (GIS). The DENR Central Office has provided ArcGIS licenses to all CENROs and PENRO to be used by GIS Operators[4]. The DENR Palawan has already established GIS Units up to the CENRO level manned by designated GIS Focal persons/Operators. However, some GIS operators are holding non-permanent position which poses risk of high-turnover rate of personnel. To complement the ArcGIS licenses, the agency also provided drones and geo-tagging equipment. However, some personnel still needed trainings to fully-utilized the capability of the equipment. Further, the availability of high-resolution satellite images is also a challenge for the office since its sources relies heavily on the embedded basemaps at the ArcGIS software and Google Earth.

In response to these challenges, this office proposes the establishment of Data Management, Mapping and Operations Center to congregate information and communication technology and data from field offices to come up with informed decisions. To do so, the data gathered and generated from several information systems can be analyzed and stored in a centralized repository for efficient data management. Secondly, a mapping service shall be included to create high-resolution maps, analytics and visualization to help decision-makers see, interact with, and better understand the data. Whether simple or complex, the right visualization can bring everyone on the same page, regardless of their level of expertise. Lastly, the creation of Operations center for monitoring of environmental threats and tracking of personnel movement so that the office can respond accordingly in times of distress.

[4] *A total of 48 active ArcGIS license currently in-use at DENR Palawan*

Goal and Objectives

The goal of this project is to establish the Data Management, Mapping and Operations Center which primarily be responsible to create knowledge products to be used by decision-makers, planners and other agencies in crafting enforcement action on environment concerns, monitoring and evaluation of DENR programs and projects including response and mitigation strategies on disaster-risk and reduction projects.

Specifically, this project aims to:

a.) create a **Data Hub** for data management which will perform data analytics and visualization, statistical analyses and repository of reports, documentations, maps and alike for faster and informed decision-making;

b.) embed a Geographic Information System Unit for **Mapping** which is dedicated for consolidation of mapping data from CENROs and perform the following a.) *generate and maintain geospatial data to be used for decision making, planning, evaluation and program/project development; b.) perform image processing and analysis from drone footage; c.) support environmental monitoring of threats for enforcement action, monitoring and evaluation of DENR programs and projects, and planning and evaluation; d.) deploy ArcGIS software and drone-based video streaming software for real-time and accurate mapping; and e.) maintain geospatial data at DENR One Control Map*;

c.) establish an **Operations Center** which provides near real-time surveillance monitoring of environmental threats observed for enforcement action, safety and security of DENR infrastructure, and monitoring of personnel movement during field operations for immediate situational awareness, response and accurate mapping; and

d.) provide venue for high-level meetings and other Administrative Offices.

Strategies

This project will engage several strategies to meet its goal, that is:

a. **Construction of 3-storey building with perimeter fencing**
This project also includes construction of a 3-storey building which houses the Records Office on the 1st Floor, Office of the PENRO and Conference Room on the 2nd Floor and the Data Management, Mapping and Operations Center on the 3rd Floor[5]. The building is

[5] *Appendix A Proposed3-storey building Front Perspective view*

also designed to make use of a solar rooftop as a secondary energy source[6]. The proposed building site is located at PENRO Road, Sta. Monica, Puerto Princesa City, beside CENRO Puerto Princesa with an area of 3,300 *sq.m.* covered by Lot No. 4103, CAD-800-D[7]. The proposed budget for its construction including perimeter fencing is Php 23,000,000.00 with a start-up budget amounting to Php 1,100,000.00 programmed for 2022. The construction is expected to complete by CY 2024[8].

b. **Installation of IT Infrastructure**

Technology powers nearly every aspect of today's businesses, from an individual employee's work to operations to goods and services. When properly networked, technology can be optimized to improve communication, create efficiencies and increase productivity.

The components of IT infrastructure are made up of interdependent elements, and the two core groups of components are hardware and software. Hardware uses software – like an operating system – to work. And likewise, an operating system manages system resources and hardware. Operating systems also make connections between software applications and physical resources using networking components. The said components are as follows:

b.1 *Hardware*

Includes desktop computers, servers, switches, routers and facilities. This project employs several strategies which require hardware component such as:

b.1.1 *Data Hub for data management* –The recommended hardware are high-speed desktop computers, printers, scanners, and high-capacity storage and others.

b.1.2 *Geographic Information System (GIS) Unit for Mapping* –The hardware required in this unit are desktop computers with dual-monitor, Uninterruptible Power Supply (UPS), high-end laptop, plotter, A0 Large Format Scanner, Drone and accessories, and others.

b.1.3 *Central Monitoring System for the Operations Center* – this infrastructure is vital in the Operations Center component of the project. It refers to the use CCTV

[6] *Appendix B Proposed 3-storey building Right Perspective view and Top View with Solar Rooftop*

[7] *Appendix C Map showing Data Management, Mapping and Operations Center Building Site*

[8] *Appendix D Project Timeframe and Budget*

cameras for monitoring, safety and security of DENR infrastructures. It allows the center to view and conduct remote configuration of NVRs in different CENROs. Currently, all CENROs are equipped with IP cameras which can be utilized for near-real time streaming. The hardware required for this infrastructure includes desktop computers, IP cameras, Hybrid Digital Video Recorder (HDVRs), Video Display/video wall, cables, video encoder, power supplies, routers, Uninterruptible Power Supply (UPS) and others.

Another component of Central Monitoring System is the deployment of surveillance/monitoring technologies for near-real time monitoring of environmental threats observed and personnel movement during field operations. This will aid the Head of Offices to have an on-time situational awareness while the personnel is on field and provide immediate response in time of distress as necessary[9]. The required hardware for this type of component are the use of GPS device capable of transmitting photos through a cellular signal, GPS trackers and Personal Locator Beacons (PLB).

b.1.4 *Data Storage* – a high capacity Network Attached Storage (NAS) is required to handle large amount data. As of date, the file size of consolidated at the PENRO is already at 50GB. This excludes the maps and reports being maintained at the CENRO level with an average file size of 20GB per office. Presently, the offices are using cloud storage (Google drive) and 4TB NAS. This project, at least 1TB cloud-based storage subscription is required as centralized repository of data of CENROs and PENRO.

b.2 *Software and Managed Services*

Software component includes web servers, operating systems, managed services and information systems implemented by the agency and locally-developed by the PENRO. Apart from the operating systems, specialized softwares are needed as follows:

b.2.1. R and Python for Data Analytics
b.2.2. Microsoft Power BI and Tableau for Data Visualization
b.2.3. ArcGIS license
b.2.3. Pix4D for drone image processing
b.2.4 Video Editing Software
b.2.5 Central Monitoring System for CCTV cameras
b.2.6 Managed services for GPS tracker, GPS device, cloud storage and others as necessary for the operation of the center.

[9] *Appendix E Diagram showing near real-time monitoring of forest patrolling activities*

b.3 *Network Infrastructure*

Network infrastructure includes connectivity of different devices within the DMMOC and different CENROs with the DMMOC. Appendix F shows the proposed Network Topology involving the different offices and the DMMO[10]. Above all, since the transmission of data from different CENROs is simultaneous, enterprise-level infrastructure components shall be used to reduce the delay of data flow, hence, a low-latency network is pertinent for the center. Appendix G shows the Data Transmission protocol involving field personnel and the center[11].

b.4 *Provision of Internet service*

At least 2 dedicated internet service providers for the center is required with minimum speed of 1GBps or higher.

b.5 *Data security, back-up and Recovery*

This project aims to secure a Business Continuity/Disaster Recovery(BCDR) solution for data security, backup and recovery activities, apart from the disk backup to be maintained at the Center's server room.

b.6 *Provision of Conference Room*

A dedicated space for events, meetings and conference calls is included in this project. There will be 2 conference rooms on the 2nd floor of the building. These rooms will be equipped with furniture and fixtures, audio-visual and teleconferencing equipment for seamless communication with different offices.

c. **Plant, Property, Building Furniture and Fixtures and Equipment**

Building furniture and fixtures such as Solar Rooftop, Fire Alarm system, CCTV system, Office furniture and fixtures(*office tables and chairs, air conditioning units, shelves conference tables and chairs, etc*) are also included in this proposal as listed in *Appendix D Project Timeframe and Budget*.

d. **Manpower Requirement**

[10] *Appendix F Proposed Network Topology*

[11] *Appendix G Data Transmission Protocol during forest patrolling*

The operationalization of the Center requires hiring of manpower with task-specific skillsets since its activities needs a specialized trainings and skills. Below is the proposed manpower forecast for the center:

Position/Designation	Description of Work	Trainings/Certifications/ Experiences, if required
1 Operations Center Officer	▪ Supervises the day-to-day operations of the center ▪ Provides recommendation for the improvement of the center ▪ Reports directly to PENR Officer	▪ Preferably with at least 5 year experience in managing Operations center ▪ Knowledgeable in security and emergency response protocols ▪ With background in law enforcement
At least 1 Data Analyst	▪ Interpreting data, analyzing results using statistical techniques. ▪ Developing and implementing data analyses, data collection systems and other strategies that optimize statistical efficiency and quality. ▪ Acquiring data from primary or secondary data sources and maintaining databases. ▪ Maintains and updates geospatial repository	▪ Statistical knowledge, preferably using Excel, R or Python ▪ Data visualization knowledge/skills, preferably using MS Power BI or Tableau ▪ Report writing and presentation skills
At least 2 GIS Specialist	▪ Generates and provides geospatial data ▪ Performs image and drone footage processing ▪ Performs image analysis ▪ Coordinates with CENRO GIS operators on geospatial related data ▪ Maintains and updates geospatial repository	ArcGIS Image Processing and Analysis
At least 1 Drone Pilot/Operator	▪ Operates, maintains and repairs UAVs used to	Drone pilot Certification Image Processing and

Position/Designation	Description of Work	Trainings/Certifications/ Experiences, if required
	gather data aerially ▪ Uses drone-based streaming software ▪ Uses aerial photography software	Analysis Aerial Photography
At least 1 Network Administrator	▪ Supervises network activities at the center ▪ Manages IT infrastructure ▪ Supervises data storage facility	IT background Data security Cyber security
At least 1 Communication Equipment Technician	▪ Installs and maintain electronic equip ment at the center ▪ Provides technical support to the center	IT background Knowledge in communication equipment service repair
At least 1 Administrative Aide	▪ Performs administrative/clerical works.	

e. **Trainings and Certifications**

Since the work at the center requires task-specific skills, this proposal also includes trainings and certifications to be attended by each personnel to improve productivity and efficiency. Trainings such as Advanced GIS Mapping, Remote Sensing, Complete Drone Pilot/Operator training leading to Drone Pilot Certification, Aerial photography, Surveillance Operations training for Law Enforcers, Data Science and Data Visualization training and others which may be required for the full operation of the center.

f. **Networking and Linkages**

One of the strategies that this project perceives to enrich its databank is building networking and linkages with different agencies which are open for collaboration. This will give the center avenue to have extensive exchange of data, resource sharing, participation in technical activities and technology transfer. Potential partners are LGUs, other NGAS, NGOs and Tech companies whose products/services is in line with technology and services needed by the center. The proponents aim to cast networking and linkages with agencies for its satellite images and managed services for its IT infrastructure.

g. **Pilot Testing and Proof of Concept**

Pilot testing of appropriate technology for the project is of utmost importance. This is where the proponents test the technology being offered by tech companies if it meets the requirement of the project. Potential partners are those companies whose line of services/products are into GPS tracking, mapping, cloud storage service, etc. Instead of building the technology needed from scratch, the proponents opted for the procurement of managed services and outsourcing for its requirements.

Project Timeframe and Budget

Below is the timeframe and summary of budget breakdown of this project. The initial phase of building construction commenced on the 3rd Quarter of 2022 and its expected completion by 2024. While construction is on-going, preliminary activities are to be conducted, e.g. building collaboration, networking and linkages with potential partners and tech companies. It is expected that the center shall be operationalized by 3rd Qtr of 2024. *Appendix D Project timeframe and Budget* shows the detailed project timeframe and budget breakdown of this project.

a. Project Timeframe

	2022		2023				2024			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
A. Construction of Data Management, Mapping and Operations Center Building										
Phase 1										
Building Construction, 7% Completion										
Phase 2										
Building Construction, 50% Completion										
Phase 3										
Building Construction, 100% Completion										
Phase 4										
Construction of Perimeter Fencing										
B. Building Collaboration, Networking and Linkages										
C. Proposed Technology Proof of Concept and Pilot Testing										
D. Procurement of Plant, Property, Building Furniture and Equipment										
d.1 Building Furniture and Fixture Installation										
*d. 2 Procurement of IT and Office Equipment**										
d.3 Subscription of Internet Service and Managed Services										
*d.4 Hiring of Support Staff **										

	2022		2023				2024			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
d.5 Trainings and Certifications										
E. MOA Signing for Collaboration/Service-Level Agreement										
F. Operations Center Full Operation										

b. Proposed Budget per year

	Proposed Budget	2022	2023	2024
A. Construction of Data Management, Mapping and Operations Center Building				
Phase 1				
Building Construction, 7% Completion	1,100,000.00	1,100,000.00		
Preparation of Building Plan and Design				
Construction of Building Structural Foundation (Phase 1 of 4)				
Phase 2				
Building Construction, 50% Completion			6,400,000.00	
Phase 3				
Building Construction, 100% Completion				7,500,000.00
Phase 4				
Construction of Perimeter Fencing				8,000,000.00
SUB-TOTAL	1,100,000.00	**1,100,000.00**	**6,400,000.00**	**15,500,000.00**
B. Plant, Property, Building Furniture and Equipment				
b.1 Building Furniture and Fixture Installation				
a. Solar Rooftop	1,000,000.00			1,000,000.00
b. Fire Alarm System	500,000.00			500,000.00
c. CCTV System	200,000.00			200,000.00
SUB-TOTAL	**1,700,000.00**			**1,700,000.00**
b. 2 Procurement of IT and Office Equipment*				
a. Local Area Network Installation	300,000.00			300,000.00
b. Central Monitoring System	1,000,000.00			1,000,000.00
c. Meeting Room Teleconferencing Equipment	652,000.00			652,000.00
d. GIS Mapping Equipment	800,000.00			800,000.00
e. IT Equipment (server, storage, high-end computers, managed services)	18,086,500.00			18,086,500.00

	Proposed Budget	2022	2023	2024
f. Office Equipment	460,000.00			460,000.00
SUB-TOTAL	**21,298,500.00**	**-**	**-**	**21,298,500.00**
b.3 Direct Internet Subscription, at least 1GBps	900,000.00			**900,000.00**
SUB-TOTAL	**900,000.00**	**-**	**-**	**900,000.00**
b.4 Hiring of Support Staff *				
1 Operations Center Officer, 50k/month or equivalent to SG 18	450,000.00			450,000.00
1 Data Analyst, 25k/month	225,000.00			225,000.00
2 GIS Specialist, 25k/month	450,000.00			450,000.00
1 Drone Pilot/Operator, 25k/month	450,000.00			450,000.00
1 Network Administrator, 25k/month	225,000.00			225,000.00
1 Communication Equipment Technician, 15k/month	135,000.00			135,000.00
1 Administrative Aide, 15k/month	135,000.00			135,000.00
SUB-TOTAL	**2,070,000.00**	**-**	**-**	**2,070,000.00**
b.5 Trainings and Certifications				
Data Science and Visualization	100,000.00			100,000.00
Advanced GIS Mapping	100,000.00			100,000.00
Complete Drone Pilot/Operator Training	200,000.00			200,000.00
Aerial Photography	100,000.00			100,000.00
Surveillance Operations Training for Law Enforcers	200,000.00			200,000.00
Remote Sensing	200,000.00			200,000.00
SUB-TOTAL	**900,000.00**	**-**	**-**	**900,000.00**
GRAND TOTAL	**49,868,500.00**	**1,100,000.00**	**6,400,000.00**	**42,368,500.00**
	** Salaries subject to change per DENR CO MEMO No. 2021-856*			

Beneficiaries

The beneficiaries of this project aside from the office itself are DENR Regional Office, Attached Agencies, Councils, other National Government Agencies, Local Government Units, Academic/Research Institutions, Non-Government Organizations and the General Public.

Expected Outcome

This project is deemed to be beneficial to all stakeholders as it is expected to provide efficient access to information. The benefits that can be achieved out of this project outweigh its costs. Specifically, upon operationalization of this project, the office shall have:

a.) Efficient access to information;
b.) Safety and security of DENR infrastructures;
c.) Seamless and mass distribution of critical instructions, notifications, and alerts;
d.) Near real-time monitoring of environmental threats for enforcement action;
e.) Quick response to personnel in need during emergency and critical situations especially during forest patrolling; and
f.) Regular updating of geospatial data

Appendix A Proposed 3-storey building Front Perspective View

Proposed 3-storey building which houses 1st Floor - Records Office, 2nd Floor - Office of the PENRO, 3rd Floor - the Data Management, Mapping and Operations Center

Appendix B Proposed 3-storey building Right Perspective View and Top view with Solar Rooftop

Right View

Top View w/ Solar Rooftop

Appendix C Map showing Data Management, Mapping and Operations Center Building Site

MAP SHOWING DATA MANAGEMENT, MAPPING AND OPERATION CENTER BUILDING SITE

Location : PENRO Road, Bgy. Sta. Monica, Puerto Princesa City, Palawan
Survey No. CAD. 800-D
Lot No. 4103

Republic of the Philippines
Department of Environment and Natural Resources
Provincial Environment and Natural Resources Office
Bgy. Sta. Monica, Puerto Princesa City, Palawan

Appendix D Project Timeframe and Budget

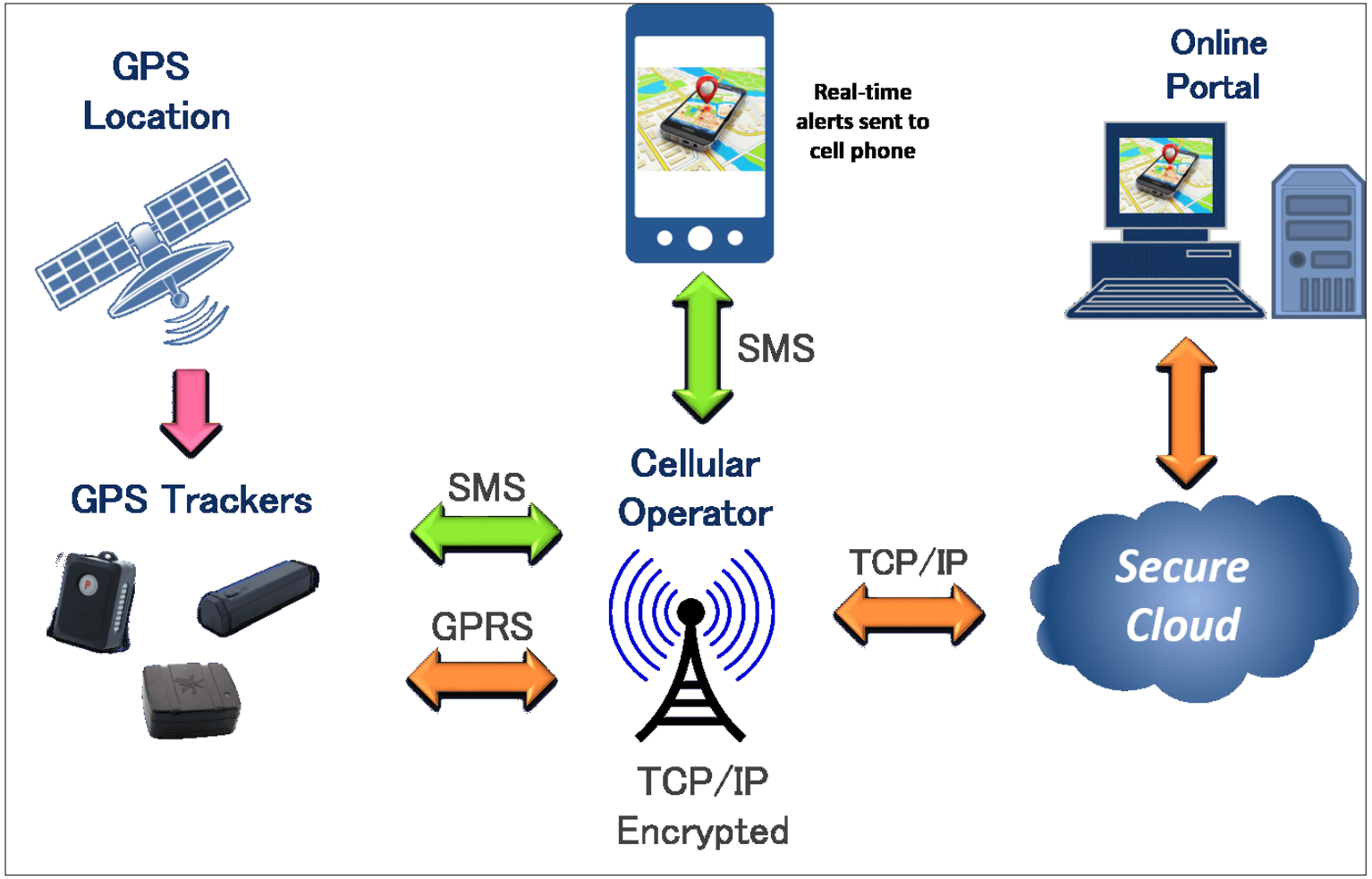
	Proposed Budget	2022	2023				2024			
		Q3	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
A. Construction of Data Management, Mapping and Operations Center Building										
Phase 1										
Building Construction, 7% Completion	**1,100,000.00**	1,100,000.00								
Preparation of Building Plan and Design	415,000.00									
Construction of Office Building (Phase 1 of 4)	685,000.00									
Phase 2										
Building Construction, 50% Completion	**6,400,000.00**		6,400,000.00							
Phase 3										
Building Construction, 100% Completion	**7,500,000.00**						7,500,000.00			
Phase 4										
Construction of Perimeter Fencing	**8,000,000.00**						8,000,000.00			
SUB-TOTAL	**23,000,000.00**	**1,100,000.00**	**6,400,000.00**				**15,500,000.00**			
B. Plant, Property, Building Furniture and Equipment										
b.1 Building Furniture and Fixture Installation										
a. Solar Rooftop	1,000,000.00							1,000,000.00		
b. Fire Alarm System	500,000.00							500,000.00		
c. CCTV System	200,000.00							200,000.00		
SUB-TOTAL	**1,700,000.00**						-	**1,700,000.00**		

	Proposed Budget	2022	2023				2024			
		Q3	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
b. 2 Procurement of IT and Office Equipment*										
a. Local Area Network In	300,000.00							300,000.00		
b. Central Monitoring Sys	1,000,000.00							1,000,000.00		
c. Meeting Room Telecon	652,000.00							652,000.00		
d. GIS Mapping Equipme	800,000.00							800,000.00		
e. IT Equipment (server, s	18,086,500.00							18,086,500.00		
f. Office Equipment	460,000.00							460,000.00		
SUB-TOTAL	**21,298,500.00**	-	-				-	**21,298,500.00**		
b.3 2 lot Direct Internet Subscription, at least 1GBps	**900,000.00**							300,000.00	300,000.00	300,000.00
SUB-TOTAL	**900,000.00**	-	-				-	**300,000.00**	**300,000.00**	**300,000.00**
b.4 Hiring of Support Staff *										
1 Operations Center Officer, 50k/month or equivalent to SG 18	450,000.00							150,000.00	150,000.00	150,000.00
1 Data Analyst, 25k/month	225,000.00							75,000.00	75,000.00	75,000.00
2 GIS Specialist, 25k/month	450,000.00							150,000.00	150,000.00	150,000.00
1 Drone Pilot/Operator, 25k/month	450,000.00							150,000.00	150,000.00	150,000.00
1 Network Administrator, 25k/month	225,000.00							75,000.00	75,000.00	75,000.00
Equipment Technician, 15k/month	135,000.00							45,000.00	45,000.00	45,000.00
1 Administrative Aide,	135,000.00							45,000.00	45,000.00	45,000.00
SUB-TOTAL	**2,070,000.00**	-	-				-	**690,000.00**	**690,000.00**	**690,000.00**

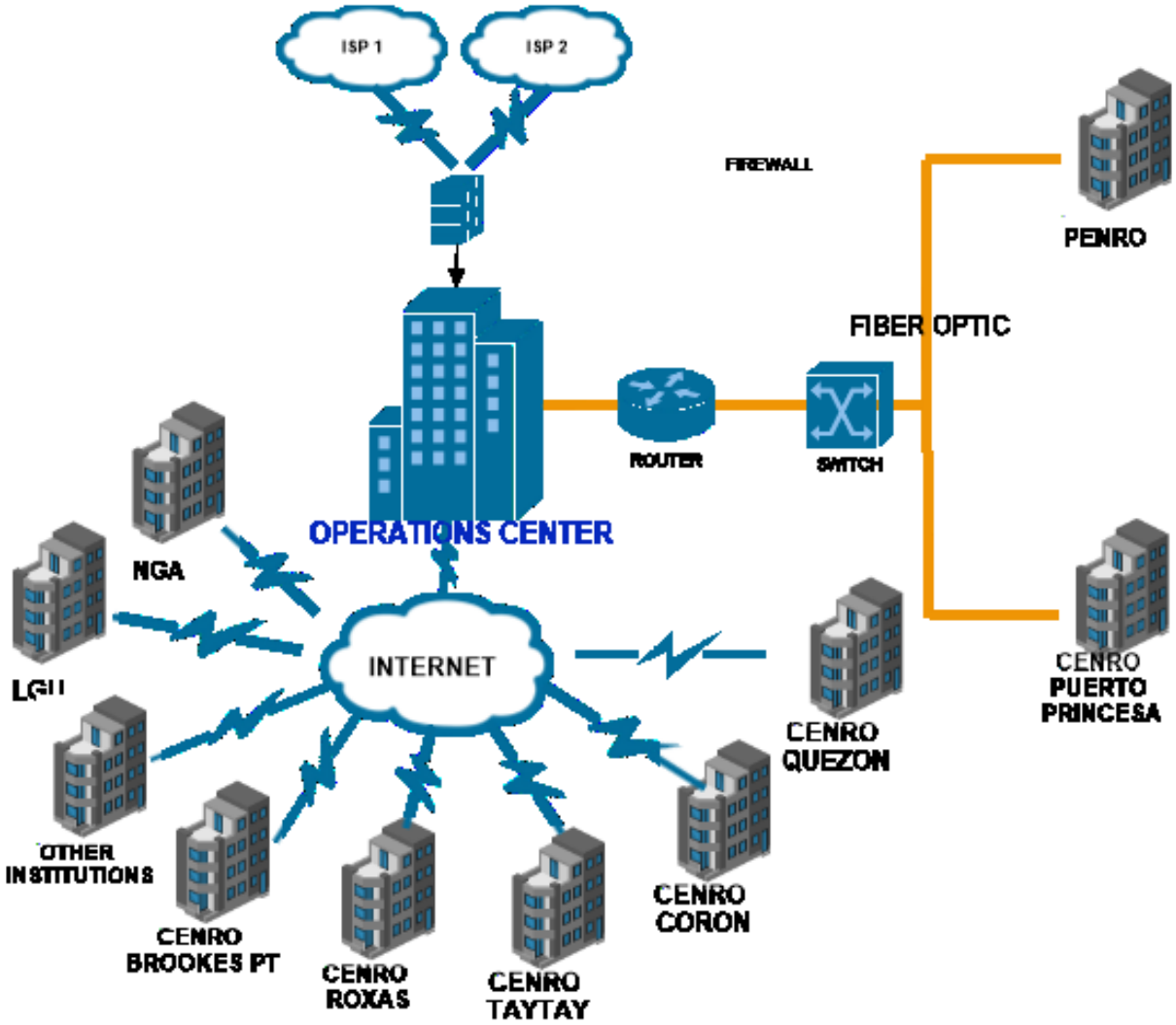
	Proposed Budget	2022	2023				2024			
		Q3	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
b.5 Trainings and Certifications										
Data Science and Visualization	**100,000.00**								100,000.00	
Advanced GIS Mapping	100,000.00								100,000.00	
Complete Drone Pilot/Operator Training	200,000.00								200,000.00	
Aerial Photography	100,000.00								100,000.00	
Surveillance Operations Training for Law Enforcers	200,000.00								200,000.00	
Remote Sensing	200,000.00								200,000.00	
SUB-TOTAL	**900,000.00**	**-**	**-**				**-**		**900,000.00**	
GRAND TOTAL	**49,868,500.00**	**1,100,000.00**	**6,400,000.00**	**-**	**-**	**-**	**15,500,000.00**	**23,988,500.00**	**1,890,000.00**	**990,000.00**

Salaries subject to change per DENR CO Memo No. 2021-856

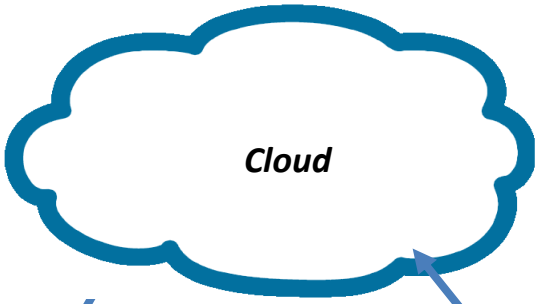
Appendix E Diagram showing near real-time monitoring of forest patrolling activities



Appendix F Proposed Network Topology



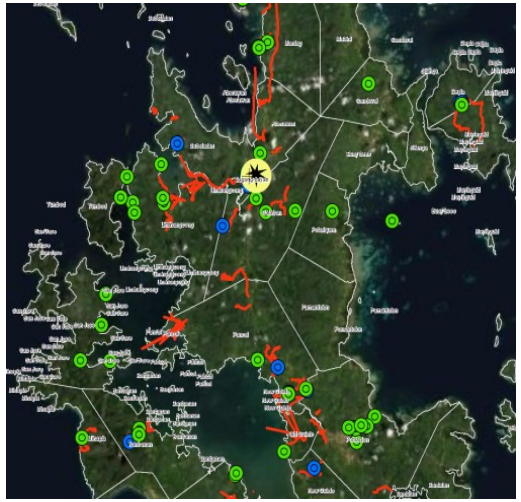
Appendix G Data Transmission Protocol during forest patrolling



Device or equipment to transmit:
Near real-time location
Threats observed while patrolling
Spot apprehension
Alerts/notifications during distress

Actual forest patrolling

- Immediate response during distress
- Decision of head of office during apprehension
- Last known location of forest patrollers



View at the Operations Center

Operations Center

Data analytics, Data Visualization, Mapping

Storage
(Physical & Cloud)

Appendix H Map showing Apprehensions, Threats Observed and Ferocious act in 2019 and 2021