

Chapter 3

ARCHITECTURE PROGRAMMING ANALYSIS

3.1. Building Function Analysis and Programming

a. User characteristics and capacity

- User characteristics

- Main user

As the main function of the building, the main user of the building are marine biologist or researchers or scientist from organization and university such as:

- Indonesian Institute of Sciences (LIPI)
- Conservation International (CI)
- Commonwealth Scientific and Industrial Research Organization.

- Supporting user

As a supporting function, the other user for this building are domestic tourists and foreign tourists and students from all ages and genders that came to visit the area for entertainment and education purposes.

- Manager

According to Association of Zoos & Aquariums, an aquarium facility should be managed by:

- ❖ Director, Chief Operating Officer

Develops the facility operation and plans and executes government policies.

- ❖ Assistant Director

Assists the director and takes charge of the facility during the director's absence.

- ❖ Finance Manager/Director

Manages the facility's finances.

- ❖ General Curator

Keeps track of the facility's animal collection and animal staff.

❖ Animal Curator

Keeps track of certain portion of the facility's animal collection.

❖ Veterinarian

Manages healthcare program for the animals in the facility and health records.

❖ Veterinary Technician

Assists the veterinarian and provides care to the animals under the supervision of the veterinarian.

❖ Registrar

Manages animal records and transports in the facility.

❖ Curator/Coordinator/Director of Research

Supervises research projects for the community and publishes articles in journals.

❖ Curator/Coordinator/Director of Conservation

Supervises the facility conservation activities for the government and conservation organizations.

❖ Conservation Biologist

Assist the management of animal collection and research in the facility by providing scientific and technical assistance.

❖ Head Keeper/Aquarist

Supervises the facility's keepers by training and scheduling.

❖ Senior Keeper/Aquarist

Provides primary animal care the facility.

❖ Keeper/Aquarist

Provides daily animal care in the facility such as diet preparation, cleaning, exhibit maintenance, and record keeping.

❖ Operations Director/Manager

Responsible for the daily operation of the institution's physical plant and equipment.

❖ Curator of Exhibits

Creates exhibits and assists in the design of graphics.

❖ Curator of Horticulture

Provides botanical collection for animals and daily maintenance of the facility's grounds.

❖ Curator of Education

Plans and executes the facility's educational programs.

❖ Public Relation/Affair Manager/Director

Promotes the facility, can furthermore about its mission and programs to the public by the media.

❖ Development Director

Develops fund raising activities such as writing grant proposals, attracting sponsors, and soliciting donations.

❖ Marketing Director/Manager

Creates advertisements or others to increase public awareness of the facility.

❖ Special Event Manager/ Coordinator

Develops and executes events to attract visitors throughout the year.

❖ Membership Director/Manager

Manages the facility's membership for families or individuals and develops a members-only special events.

❖ Gift Shop Manager

Manages staff and products of the shop.

❖ Visitor Service Manager

Supervises the staff that that provides public facilities such as food stalls and restrooms.

❖ Personnel Manager/Director

Manages all personnel matters including payroll, insurance, and tax matters.

- ❖ Volunteer Coordinator
 - Recruits and maintains volunteers or docents activities.
- ❖ Volunteer
 - Various duties including teaching educational programs, sharing conservation message leading tours, staffing special events, diet preparation, small animal care, creating enrichment items, office help, answering general guest questions, and more.
 - Additional manager is furthermore needed to manage the supporting facility.
- ❖ Librarian
 - Manages books in library, furthermore provides visitor service in the library
- ❖ Receptionist
 - Provides visitor information to the users of the facility.
- ❖ Mechanic
 - Provides maintenance and repairs for the facilities, such as transportations, plumbing, equipment, etc.
- ❖ Booking Clerk
 - Sells tickets for visitors in the facility.
- ❖ Chef
 - Provides daily meal for both the staff and visitor in the facility.
- ❖ Waiter
 - Serves meals for the people in the facility.
- ❖ Security
 - Maintains the safety of the users in the facility.
- ❖ Janitor
 - Keeping the facility clean.
- User capacity

Table 2. User capacity analysis
(Source: Personal analysis)

User	Capacity
Main User	
Head Researcher	1
Researcher	10
Supporting User	
Visitors	190
Manager	
Director Operating Officer	1
Assistant Director	1
Finance Director	1
General Curator	1
Animal Curator	1
Veterinary Technician	2
Registrar	1
Director of Conservation	1
Conservation Biologist	8
Head Aquarist	1
Senior Aquarist	5
Aquarist	15
Operation Director	1
Curator of Exhibits	1
Curator of Horticulture	1
Curator of Education	1
Public Relation Manager	1
Development Director	1
Marketing Director	1
Special Events Coordinator	1
Membership Director	1
Gift Shop Manager	5
Visitor Services Manager	4
Personnel Director	1
Volunteer Coordinator	1
Volunteer	5
Librarian	3
Receptionist	2
Mechanic	6
Booking Clerk	4
Theatre Operator	3
Chef	5
Waiter	5
Security	6
Janitor	15

Total	313
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b. Activity study

- Movement activity

Based on the users description, the following is the list of activities of the users and the facilities that are needed for each activity.

Table 3. Movement activity analysis
(Source: Personal analysis)

User	Activity	Facility
Main user		
Researchers	Arriving	Visitor boat docks
	Signing up	Lobby
	Having breakfast, lunch, and dinner	Cafeteria
		Restaurant
	Making preparations	Public locker room
	Taking a shower	Public shower room
	Changing clothes	Public locker room
	Collecting and transporting animals	Boat docks
		Hangar
		Heliport
		Acclimatization area
	Observing animal conditions and behaviours	Benthic quarantine area
		Semi pelagic quarantine area
		Pelagic quarantine area
	Isolating animals for research	Isolation area
	Research of animals, forensic research, and dissection	Necropsy room
	Research of diseases	Histopathology laboratory
	Sea monitoring	Computer laboratory
	Research of water quality	Water quality laboratory
	Literature study	Library
Equipment preparation	Vehicle storage	
	Equipment storage	
Urination and defecation	Restroom	
Going home	Visitor boat docks	

Supporting user		
Visitors	Arriving	Visitor boat docks
	Having breakfast and lunch	Restaurant
	Shopping gifts	Gift shop
	Ticket	Lobby
	Exhibition visit	Exhibition area
	Watching educational movies and videos	Mini theatre
	Urination and defecation	Restroom
	Going home	Visitor boat docks
Manager		
Director Operating Officer	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Director office
		Break room
		Cafeteria
	Making preparations	Director office
	Changing clothes	Director office
	Working	Director office
	Meeting with other managers	Meeting room
	Resting and taking a break	Director office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Assistant Director	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Assistant director office
		Break room
		Cafeteria
	Making preparations	Director office
	Changing clothes	Director office
	Working	Director office
	Meeting with other managers	Meeting room
	Resting and taking a break	Assistant director office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Finance Director	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Finance director office
		Break room

		Cafeteria
	Making preparations	Finance director office
	Changing clothes	Finance director office
	Working	Finance director office
	Meeting with other managers	Meeting room
	Resting and taking a break	Finance director office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
General Curator	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	General curator office
		Break room
		Cafeteria
	Making preparations	General curator office
	Changing clothes	General curator office
	Working	General curator office
	Supervising animal collection and management staff	Boat docks
		Hangar
		Acclimatization area
		Benthic quarantine area
		Semi pelagic quarantine area
		Pelagic quarantine area
		Isolation area
	Meeting with other managers	Meeting room
	Resting and taking a break	General curator office
Break room		
Courtyard		
Urination and defecation	Manager restroom	
Going home	Boat docks	
Animal Curator	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	General curator office
		Break room
		Cafeteria
	Making preparations	Manager locker room
	Changing clothes	Manager locker room
	Working	General office
	Managing animal collection	Boat docks
		Hangar
Acclimatization area		
Benthic quarantine area		

		Semi pelagic quarantine area
		Pelagic quarantine area
		Isolation area
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Veterinarian	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Veterinary office
		Break room
		Cafeteria
	Making preparations	Veterinary office
	Taking a shower	Manager shower room
	Changing clothes	Veterinary office
	Working	Veterinary office
	Supervising animal collection	Acclimatization area
	Isolating animals for research	Isolation area
	Recondition of live animals	Necropsy room
	Research of live animals	CT examination room
		CT control room
		X-ray examination room
	Research of deceased animals, forensic research, and dissection	Necropsy room
	Research of diseases	Histopathology laboratory
	Literature study	Library
	Meeting with other managers	Meeting room
	Resting and taking a break	Veterinary office
		Break room
		Courtyard
Urination and defecation	Manager restroom	
Going home	Boat docks	
	Hangar	
Veterinary Technician	Arriving	Boat dock
	Signing up	General office
	Having breakfast, lunch, or dinner	Veterinary office
		Break room
		Cafeteria
	Making preparations	Veterinary office
	Taking a shower	Manager shower room
	Changing clothes	Veterinary office
Working	Veterinary office	

	Supervising animal collection	Acclimatization area
	Isolating animals for research	Isolation area
	Recondition of live animals	Necropsy room
	Research of live animals	CT examination room
		CT control room
		X-ray examination room
	Research of deceased animals, forensic research, and dissection	Necropsy room
	Research of diseases	Histopathology laboratory
	Literature study	Library
	Meeting with other managers	Meeting room
	Resting and taking a break	Veterinary office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Registrar	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Registration office
		Break room
		Cafeteria
	Making preparations	Registration office
	Changing clothes	Registration office
	Working	Registration office
	Meeting with other managers	Meeting room
	Resting and taking a break	Registration office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
Director of Research	Arriving	Boat docks
		Heliport
		Hangar
	Signing up	General office
	Having breakfast, lunch, and dinner	Research office
		Break room
		Cafeteria
	Making preparations	Research office
	Changing clothes	Research office
	Working	Research office
	Supervising researchers and staff	Boat docks
Hangar		
Heliport		
Acclimatization area		

		Benthic quarantine area	
		Semi pelagic quarantine area	
		Pelagic quarantine area	
		Isolation area	
		Necropsy room	
		Histopathology laboratory	
		Computer laboratory	
		Water quality laboratory	
		Library	
	Meeting with other managers	Meeting room	
	Resting and taking a break	Registration office	
		Break room	
		Courtyard	
Urination and defecation	Manager restroom		
Going home	Boat docks		
Director of Conservation	Arriving	Boat docks	
		Heliport	
		Hangar	
	Signing up	General office	
	Having breakfast, lunch, and dinner	Conservation office	
		Break room	
		Cafeteria	
	Making preparations	Conservation office	
	Changing clothes	Conservation office	
	Working	Conservation office	
	Supervising researchers and staff	Arriving	Boat docks
			Hangar
			Heliport
Acclimatization area			
Benthic quarantine area			
Semi pelagic quarantine area			
Pelagic quarantine area			
Isolation area			
Necropsy room			
Histopathology laboratory			
Computer laboratory			
Water quality laboratory			

		Library
	Meeting with other managers	Meeting room
	Resting and taking a break	Registration office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
Conservation Biologist	Arriving	Boat docks
		Heliport
		Hangar
	Signing up	General office
	Having breakfast, lunch, and dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Taking a shower	Manager shower room
	Changing clothes	Manager locker room
	Collecting and transporting animals	Boat docks
		Hangar
		Heliport
		Acclimatization area
	Observing animal conditions and behaviours	Benthic quarantine area
		Semi pelagic quarantine area
		Pelagic quarantine area
	Isolating animals for research and rehabilitation	Isolation area
	Research of animals, forensic research, and dissection	Necropsy room
	Research of diseases	Histopathology laboratory
	Sea monitoring	Computer laboratory
	Research of water quality	Water quality laboratory
	Literature study	Library
	Equipment preparation	Vehicle storage
Equipment storage		
Urination and defecation	Manager restroom	
Going home	Boat docks	
	Hangar	
Head Aquarist	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, and dinner	Head aquarist office
		Break room
	Cafeteria	

Senior Aquarist	Making preparations	Manager locker room
	Taking a shower	Manager shower room
	Changing clothes	Manager locker room
	Working	Head aquarist office
	Supervising and training with aquarists	Boat docks
		Hangar
		Acclimatization area
		Benthic quarantine area
		Semi pelagic quarantine area
		Pelagic quarantine area
		Isolation area
	Food preparation room	
	Meeting with other managers	Meeting room
	Resting and taking a break	Registration office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, and dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Taking a shower	Manager shower room
	Changing clothes	Manager locker room
	Working	General office
	Collecting and transporting animals	Boat docks
		Hangar
		Acclimatization area
	Observing animal conditions and behaviours	Benthic quarantine area
Semi pelagic quarantine area		
Pelagic quarantine area		
Isolating animals for research and rehabilitation	Isolation area	
Feeding animals and aquarium maintenance	Benthic quarantine area	
	Semi pelagic quarantine area	
	Pelagic quarantine area	
Animal feeding preparation	Food preparation room	

	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
Aquarist	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, and dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Taking a shower	Manager shower room
	Changing clothes	Manager locker room
	Working	General office
	Collecting and transporting animals	Boat docks
		Hangar
		Acclimatization area
	Observing animal conditions and behaviours	Benthic quarantine area
		Semi pelagic quarantine area
		Pelagic quarantine area
	Isolating animals for research and rehabilitation	Isolation area
	Feeding animals and aquarium maintenance	Benthic quarantine area
		Semi pelagic quarantine area
		Pelagic quarantine area
	Animal feeding preparation	Food preparation room
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
Courtyard		
Urination and defecation	Manager restroom	
Going home	Boat docks	
Operation Director	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Operation office
		Break room
		Cafeteria
	Making preparations	Operation office
	Changing clothes	Operation office
	Working	Operation office
	Overseeing daily operation	Boat docks
Heliport		
Hangar		

		Acclimatization area
		Benthic quarantine area
		Semi pelagic quarantine area
		Pelagic quarantine area
		Isolation area
		Computer laboratory
		Vehicle storage
		Equipment storage
	Meeting with other managers	Meeting room
	Resting and taking a break	Finance director office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Curator of Exhibits	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Management locker room
	Changing clothes	Management locker room
	Working	General office
	Exhibition setting	Exhibition area
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
Curator of Horticulture	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Management locker room
	Changing clothes	Management locker room
	Working	General office
	Green area managing	Green area
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks

Curator of Education	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Management locker room
	Changing clothes	Management locker room
	Working	General office
	Educating people	Exhibition area
		Mini theatre
	Green area managing	Green area
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Public Relation Manager	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Public relation office
		Break room
		Cafeteria
	Making preparations	Public relation office
	Changing clothes	Public relation office
	Working	Public relation office
	Meeting with other managers	Meeting room
	Resting and taking a break	Public relation office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
Development Director	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Development office
		Break room
		Cafeteria
	Making preparations	Development office
	Changing clothes	Development office
	Working	Development office
	Meeting with other managers	Meeting room
	Resting and taking a break	Development office
		Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
Marketing Director	Arriving	Boat docks
	Signing up	General office

	Having breakfast, lunch, or dinner	Marketing office
		Break room
		Cafeteria
	Making preparations	Marketing office
	Changing clothes	Marketing office
	Working	Marketing office
	Meeting with other managers	Meeting room
	Resting and taking a break	Marketing office
		Break room
		Courtyard
Urination and defecation	Manager restroom	
Going home	Boat docks	
Special Events Coordinator	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Changing clothes	Manager locker room
	Working	General office
	Events management	Lobby
		Exhibition area
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Membership Director	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Membership office
		Break room
		Cafeteria
	Making preparations	Membership office
	Changing clothes	Membership office
	Working	Membership office
	Events management	Lobby
		Exhibition area
	Meeting with other managers	Meeting room
	Resting and taking a break	Membership office
		Break room
Courtyard		
Urination and defecation	Manager restroom	
Going home	Boat docks	
Gift Shop Manager	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
Cafeteria		

	Making preparations	Manager locker room	
	Changing clothes	Manager locker room	
	Working	General office	
	Gift shop product management	Gift shop	
	Meeting with other managers	Meeting room	
	Resting and taking a break	Break room	
		Courtyard	
	Urination and defecation	Manager restroom	
	Going home	Boat docks	
Visitor Services Manager	Arriving	Boat docks	
	Signing up	General office	
	Having breakfast, lunch, or dinner	Break room	
		Cafeteria	
	Making preparations	Manager locker room	
	Changing clothes	Manager locker room	
	Working	General office	
	Supervising public facilities	Lobby	
		Ticket counter	
		Exhibition area	
		Mini theatre	
		Control booth	
		Restaurant	
		Gift shop	
		Meeting with other managers	Meeting room
		Resting and taking a break	Break room
			Courtyard
	Urination and defecation	Manager restroom	
	Going home	Boat docks	
	Personnel Director	Arriving	Boat docks
Signing up		General office	
Having breakfast, lunch, or dinner		Personnel office	
		Break room	
		Cafeteria	
Making preparations		Personnel office	
Changing clothes		Personnel office	
Working		Personnel office	
Meeting with other managers		Meeting room	
Resting and taking a break		Personnel office	
		Break room	
		Courtyard	
Urination and defecation		Manager restroom	
Going home	Boat docks		
Volunteer Coordinator	Arriving	Boat docks	
	Signing up	General office	
	Having breakfast, lunch, or dinner	Volunteer room	
		Break room	

		Cafeteria
	Making preparations	Volunteer room
	Changing clothes	Volunteer room
	Working	Volunteer room
	Scheduling visitors	Lobby
		Exhibition area
	Meeting with other managers	Meeting room
	Resting and taking a break	Volunteer room
		Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
Volunteer	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Volunteer room
		Break room
		Cafeteria
	Making preparations	Volunteer room
	Changing clothes	Volunteer room
	Working	Volunteer room
	Scheduling visitors	Lobby
		Exhibition area
	Meeting with other managers	Meeting room
	Resting and taking a break	Volunteer room
		Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Receptionist	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Changing clothes	Manager locker room
	Providing visitor information	Lobby
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Mechanic	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
Changing clothes	Manager locker room	

	Fixing vehicles	Boat docks
		Heliport
		Hangar
	Fixing equipment	Vehicle storage
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	
Booking Clerk	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Changing clothes	Manager locker room
	Selling tickets	Ticket counter
	Fixing equipment	Vehicle storage
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
	Theatre Operator	Arriving
Signing up		General office
Having breakfast, lunch, or dinner		Break room
		Cafeteria
Making preparations		Manager locker room
Changing clothes		Manager locker room
Running videos or movies		Control booth
Theatre maintenance		Mini theatre
Meeting with other managers		Meeting room
Resting and taking a break		Break room
		Courtyard
Urination and defecation		Manager restroom
Going home		Boat docks
Chef		Arriving
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Changing clothes	Manager locker room
	Cooking	Kitchen
		Cafeteria kitchen
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard

	Urination and defecation	Manager restroom
	Going home	Boat docks
Waiter	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Changing clothes	Manager locker room
	Serving meals	Kitchen
		Restaurant
		Cafeteria kitchen
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
Urination and defecation	Manager restroom	
Going home	Boat docks	
Security	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Changing clothes	Manager locker room
	Monitoring the facility	Security room
	Meeting with other managers	Meeting room
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
	Going home	Boat docks
Janitor	Arriving	Boat docks
	Signing up	General office
	Having breakfast, lunch, or dinner	Break room
		Cafeteria
	Making preparations	Manager locker room
	Changing clothes	Manager locker room
	Cleaning	All rooms
	Garbage management	Garbage room
	Garbage transport	Boat docks
	Resting and taking a break	Break room
		Courtyard
	Urination and defecation	Manager restroom
Going home	Boat docks	

- Movement flow analysis
 - Main user

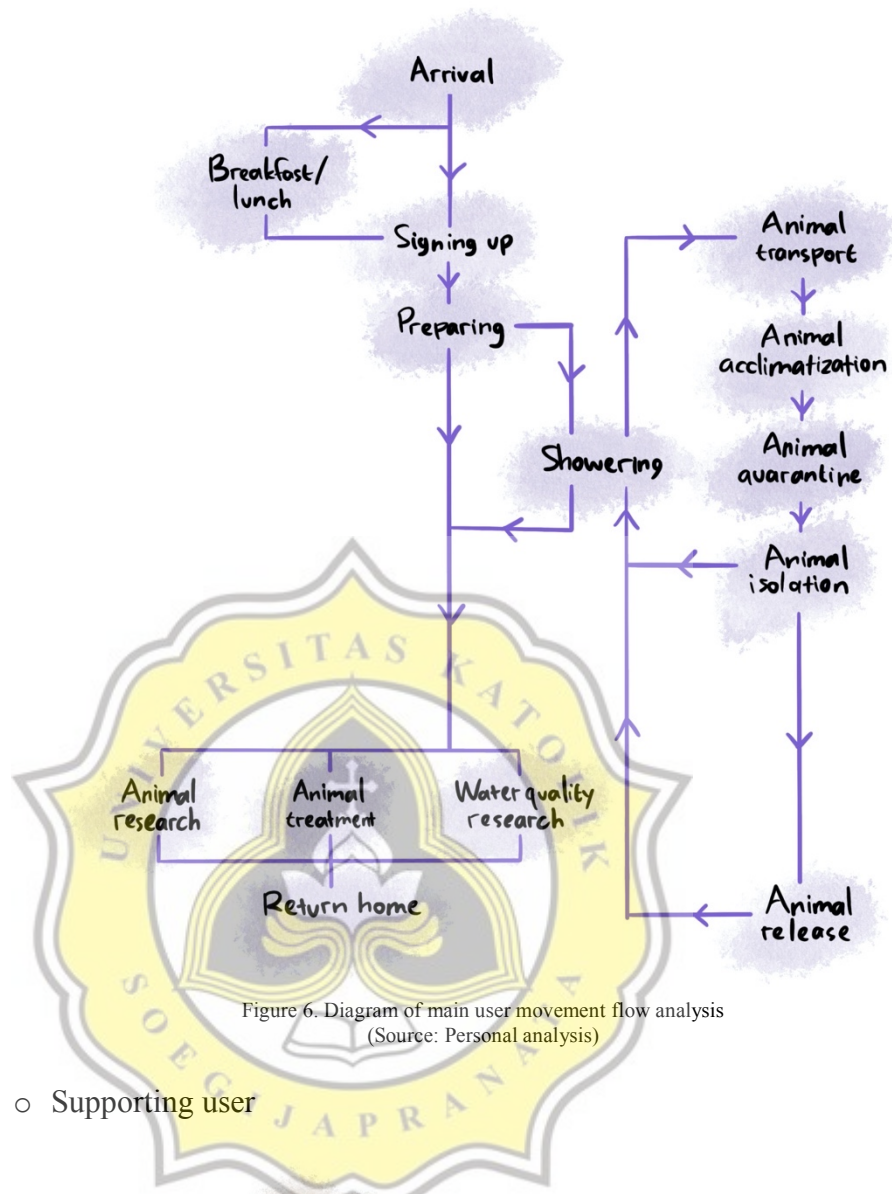


Figure 6. Diagram of main user movement flow analysis
(Source: Personal analysis)

o Supporting user

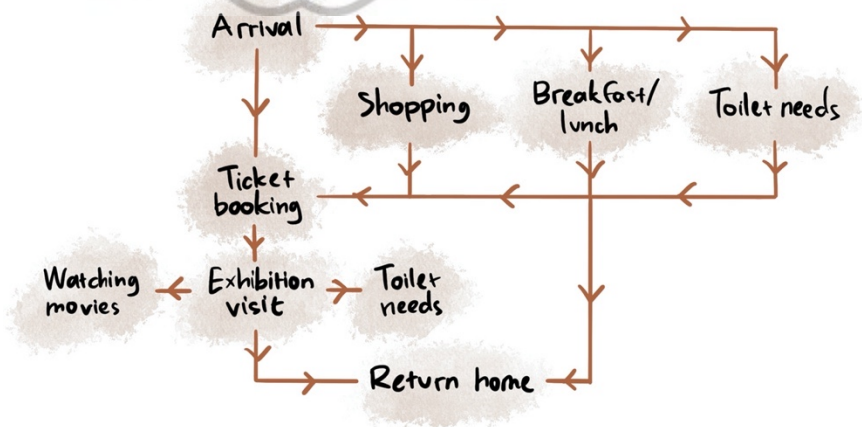


Figure 7. Diagram of supporting user movement flow analysis
(Source: Personal analysis)

- Manager

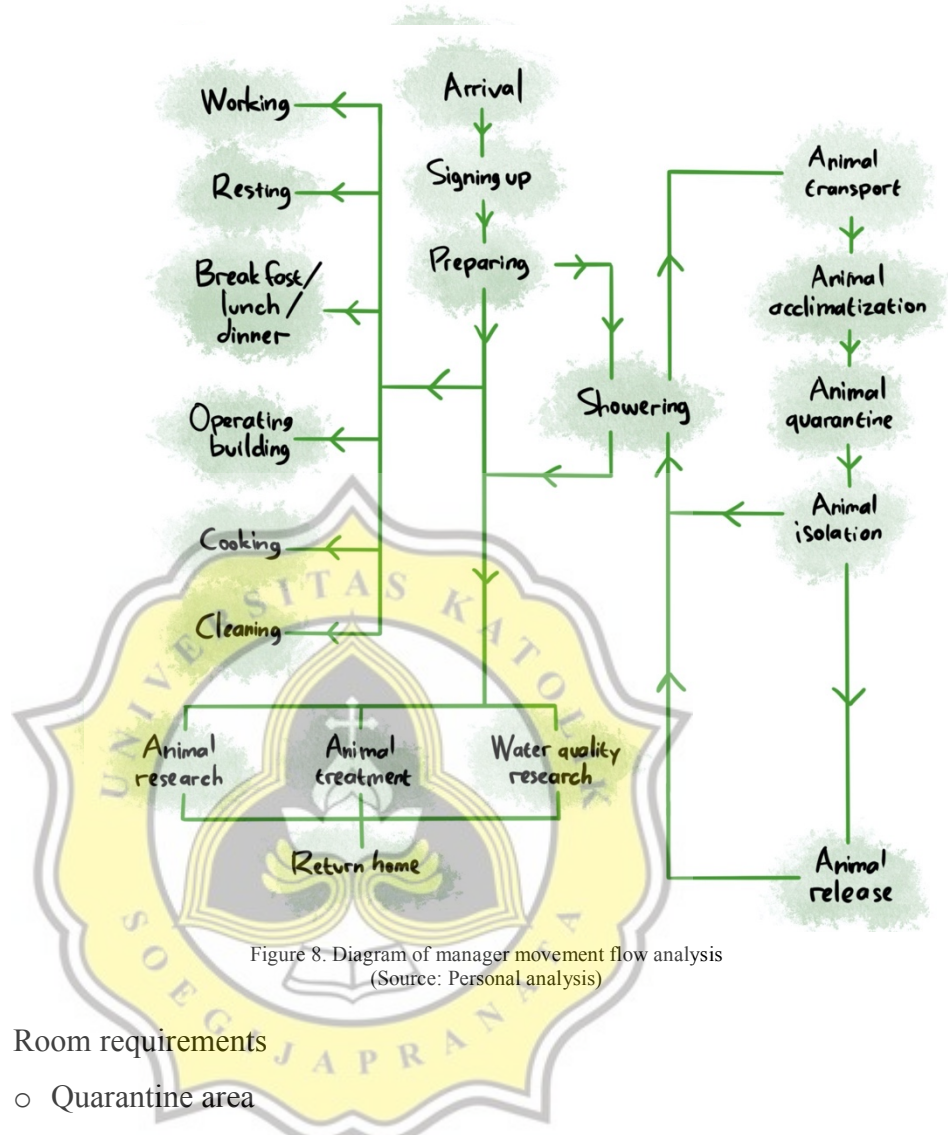


Figure 8. Diagram of manager movement flow analysis
(Source: Personal analysis)

- Room requirements
 - Quarantine area
 - ❖ Quarantine tanks should use either materials: (Smith et al, 2004)
 - Concrete



Figure 9. Tennesse Aquarium concrete tank
(Source: www.astekcomposites.com)

- Excellent for large aquariums due to its strength and its low cost volume.
 - Polyvinyl pipe (PVC) penetrations through cast concrete tank walls can cause leakages, therefore some form of mechanical water-stop should be incorporated into pipe stubs prior to pouring the concrete.
 - Drilling should be avoided as possible as it can expose the steel bar to the tank water and thus corrosion.
 - Limited by cost and logistics to relatively simple shapes (e.g., rectangular), as they must be formed and cast in place.
- Fiber Reinforced Plastic (FRP)



Figure 10. Advanced Aquarium Technologies (AAT) Prefabricated FRP Tanks
(Source: www.advanced-aquariums.com)

- Considered as an excellent choice for tank construction, having several advantages over concrete.
- Inherently strong when molded into the shape of a tank, especially when the tank is cylindrical and/or incorporates a flange at the top, and usually requires no other reinforcing other than the incorporated woven fiberglass mesh or chopped

- Matting, while odd-shaped, tall, or long tanks may require additional structural support, provided by a steel skeleton wrapped within the FRP or, alternatively, structurally robust pultruded FRP shapes may be employed.
 - PVC pipe penetrations through FRP tank walls are facilitated by FRP pipe fittings, and present little risk of leakage.
 - Depending on size, FRP tanks are usually less expensive than concrete tanks.
 - FRP tanks can be partially buried to improve structural strength and provide easier staff access to the interior of the tank.
 - FRP tanks can be cast in one piece from a mold or assembled from pre-fabricated panels. If they are pre-fabricated off-site, consider access into the quarantine and holding facility for their final installation. Pre-fabricated panels require bolting and then sealing with either fiberglass resin or silicone. Some pre-fabricated panel tanks are effectively expandable (i.e., by adding straight wall sections between rounded end sections to form a large oval, or by adding additional sections to the top of the walls).
 - Pre-fabricated panel tanks can be pulled apart relatively easily and relocated and assembled for use elsewhere.
- **Waterproofing and Tank Coatings**
- Concrete tanks can be designed and constructed to be completely watertight, although it is recommended that an additional waterproofing material (e.g., Vandex, Vandex International, Ltd., Switzerland) or a post-cure internal tank coating (e.g., Polibrid, Polibrid Coatings, Inc., Brownsville, Texas, USA) be applied. The effectiveness of waterproofing treatments relies on a high-quality design and construction of concrete substrates.

- FRP should be readily painted with epoxy paints or molded with a coloured gel-coat due to its dense plastic. In some cases it may be desirable to coat the interior walls of the tank to produce a smoother, longer-lasting, and non-toxic interior finish, or to colour the walls with blue, which mimic the oceanic environment to assist animal acclimatization. Blue colours can mimic the oceanic environment, or, might be preferred for quarantine and holding tanks. If internal coatings are used, they should be completely non-toxic upon curing and compatible with the tank construction materials.
- The addition of a soft vinyl boundary wall or a curtain of air bubbles, suspended inside the tank wall, may furthermore be used to denote the outer wall for disorientated animals.
- The use of substrate on tank bottoms may be warranted for some batoids, but is generally not recommended in quarantine or holding tanks.
- ❖ All tanks must have windows for a clear view of the animals inside therefore injured animals won't swim unnoticed. Windows should be using acrylic material, which is considered the ideal material for its advantage such as polishable if scratched and be made into any shape.
- Acclimatization and isolation pool
 - ❖ It is recommended for the pools to have a false floor that capable withstanding both the sharks and husbandry personnel that can be raised clear of water.
 - ❖ Acclimatization and isolation pool should be divided using water tight doors and independent LSS from the tank as it will provide more isolation of animals for disease treatment and control.
- Husbandry support areas
 - ❖ Husbandry support areas should include

- Food preparation area with a walk-in freezer, high capacity refrigerator, stainless steel sinks and tables.
 - Water quality laboratory.
 - Office for animal record and fire protected file storage.
 - Necropsy room
 - Dive locker with showers and storage.
 - Separate storage for husbandry and seasonal collecting equipment.
- ❖ A boat storage area is needed especially in colder climates
- Heating, ventilation, and air conditioning
 - ❖ Air conditioning should be available to respond most climates and furthermore to provide a safer, comfortable, and productive space, and save tremendous wear and tear on the building and equipment from condensation.
 - ❖ Record keeping, necropsy, and laboratory areas should be dry.
 - Lighting
 - ❖ Skylights should be available, especially over the tanks as they provide natural lighting thus can be controlled via louvers or shade cloth.
 - ❖ During the night, artificial lighting is needed and should be able to adjusted, controlled, and manipulated for husbandry procedures. Types of artificial lighting that could be used are fluorescent, incandescent, and metal vapor-arc lamps.
 - Security
 - ❖ A perimeter fence should be implemented around the entire quarantine and isolation facility
 - ❖ Electronic surveillance system should be available and modified to include simple LSS alarms such as water flow switches, water level switches, electrical power status, fire alarm, and burglar alarm.
 - ❖ Camera systems should be installed and accessed via the internet.

❖ An emergency electricity generator, with an automatic power transfer switch and adequate fuel supply should be available.

- Activity impact

Activities in the building can result in the development of education program to educate people both domestic and international. Shark recovery will furthermore happen due to shark husbandry activities and research activities by the users.

c. Space analysis

- Room capacity analysis

Table 4. Room capacity analysis
(Source: Personal analysis)

Facility	Capacity	Total Capacity
Indoor Area		
Lobby	47 x All users 2 x Receptionist 1 x Security	50
Main area		
Acclimatization area	1 x Head Researcher 10 x Researcher 1 x General Curator 1 x Animal Curator 1 x Veterinarian 2 x Veterinary Technician 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Head aquarist 1 x Senior aquarist 10 x Aquarist 1 x Operations Director 1 x Volunteer Coordinator 1 x Volunteer	35
Benthic quarantine area	1 x Head Researcher 10 x Researcher 1 x General Curator 1 x Animal Curator 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Head Aquarist 1 x Senior Aquarist	27

	5 x Aquarist 1 x Operations Director 1 x Volunteer Coordinator 1 x Volunteer	
Semi pelagic quarantine area	1 x Head Researcher 10 x Researcher 1 x General Curator 1 x Animal Curator 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Head Aquarist 1 x Senior Aquarist 5 x Aquarist 1 x Operations Director 1 x Volunteer Coordinator 1 x Volunteer	27
Pelagic quarantine area	1 x Head Researcher 10 x Researcher 1 x General Curator 1 x Animal Curator 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Head Aquarist 1 x Senior Aquarist 5 x Aquarist 1 x Operations Director 1 x Volunteer Coordinator 1 x Volunteer	27
Isolation area	1 x Head Researcher 10 x Researcher 1 x General Curator 1 x Animal Curator 1 x Veterinarian 2 x Veterinary Technician 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Head Aquarist 1 x Senior Aquarist 10 x Aquarist 1 x Operations Director 1 x Volunteer Coordinator 1 x Volunteer	35
Food preparation room	1 x Head aquarist 1 x Senior aquarist 5 x Aquarist	7

Water quality laboratory	1 x Head Researcher 10 x Researcher 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Volunteer Coordinator 1 x Volunteer	17
Necropsy room	1 x Head Researcher 10 x Researcher 1 x Veterinarian 2 x Veterinary Technician 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Volunteer Coordinator 1 x Volunteer	19
CT examination room	1 x Veterinarian 2 x Veterinary Technician	3
CT control room	1 x Veterinarian 2 x Veterinary Technician	3
X-ray examination room	1 x Veterinarian 2 x Veterinary Technician	3
Histopathology laboratory	1 x Head Researcher 10 x Researcher 1 x Veterinarian 2 x Veterinary Technician 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Volunteer Coordinator 1 x Volunteer	19
Computer laboratory	1 x Head Researcher 10 x Researcher 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Operation Director 1 x Volunteer Coordinator 1 x Volunteer	18
Public locker room	1 x Head Researcher 10 x Researcher	11
Public shower room	1 x Head Researcher 10 x Researcher	11
Library	1 x Head Researcher 10 x Researcher 1 x Veterinarian 2 x Veterinary Technician 1 x Director of Research	23

	1 x Director of Conservation 2 x Conservation Biologist 1 x Volunteer Coordinator 1 x Volunteer 3 x Librarian	
Vehicle storage	1 x Head Researcher 5 x Researcher 4 x Conservation Biologist 5 x Aquarist 1 x Operations Director 3 x Mechanic	19
Equipment storage	1 x Head Researcher 5 x Researcher 4 x Conservation Biologist 5 x Aquarist 1 x Operations Director	16
Supporting Area		
Ticket counter	4 x Booking clerk 1 x Visitor Services Manager	5
Exhibition area	70 x Visitor 1 x Curator of Exhibits 1 x Special Events Coordinator 1 x Volunteer Coordinator 4 x Volunteer	77
Mini theatre	33 x Visitor 1 x Curator of Education 1 x Visitor Services Manager 3 x Theatre Operator	38
Control booth	2 x Theatre Operator 1 x Visitor Services Manager	3
Restaurant	36 x Visitor 3 x Waiter 1 x Visitor Services Manager	40
Kitchen	3 x Chef 2 x Waiter	5
Gift shop	9 x Visitor 3 x Gift shop manager 1 x Visitor Services Manager	13
Male restroom	9 x Visitor 1 x Janitor	10
Female restroom	9 x Visitor 1 x Janitor	10
Male accessible restroom	1 x Visitor	1
Female accessible restroom	1 x Visitor	1

Management Area		
Director office	1 x Director Operating Officer 4 x All manager	5
Assistant director office	1 x Assistant Director 4 x All manager	5
Financial office	1 x Finance Director 4 x All manager	5
General curator office	1 x General Curator 4 x All manager	5
Veterinary office	1 x Veterinarian 2 x Veterinary Technician 4 x All manager	7
Registration Office	1 x Registrar 4 x All manager	5
Research office	1 x Director of Research 4 x All manager	5
Conservation office	1 x Director of Conservation 4 x All manager	5
Head aquarist office	1 x Head Aquarist 4 x All manager	5
Operation office	1 x Operations Director 4 x All manager	5
Public relation office	1 x Public Relation Manager 4 x All manager	5
Development office	1 x Development Director 4 x All manager	5
Marketing office	1 x Marketing Director 4 x All manager	5
Membership office	1 x Membership Director 4 x All manager	5
Personnel office	1 x Personnel Director 4 x All manager	5
Volunteer room	1 x Volunteer Coordinator 5 x Volunteer 4 x All manager	5
General office	5 x Senior Aquarist 15 x Aquarist 1 x Curator of Exhibits 1 x Curator of Horticulture 1 x Curator of Education 1 x Special Events Manager 2 x Gift Shop Manager 4x Visitor Services Manager 5 x All manager	35
Meeting room	30 x All manager	30
Manager locker room	20 x All manager	20

Manager shower room	1 x Veterinarian 2 x Veterinary technician 2 x Conservation Biologist 1 x Head aquarist 1 x Senior aquarist 10 x Aquarist	17
Break room	30 x All manager	30
Cafeteria	30 x All manager	30
Cafeteria kitchen	2 x Chef 1 x Waiter	3
Manager male restroom	9 x All managers 1 x Janitor	10
Manager female restroom	9 x All managers 1 x Janitor	10
Security room	5 x Security	5
Janitor closet	5 x All manager	5
Garbage room	5 x Janitor	5
Mechanical electrical room	10 x All manager	10
Outdoor Area		
Visitor boat docks	20 x All users	20
Boat docks	1x Head Researcher 10 x Researcher 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Head Aquarist 1 x Senior Aquarist 5 x Aquarist 1 x Operations director 3 x Mechanic 3 x Janitor	29
Heliport	1 x Head researcher 2 x Researcher 1 x Director of Research 1 x Director of Conservation 1 x Conservation Biologist 1 x Operations director 1 x Mechanic	8
Hangar	1x Head Researcher 10 x Researcher 1 x Director of Research 1 x Director of Conservation 2 x Conservation Biologist 1 x Head Aquarist 1 x Senior Aquarist 5 x Aquarist	26

	1 x Operations director 3 x Mechanic	
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- Room requirements analysis

Below is the list of total area and requirements needed for each facilities. All circulation calculated will be based on Time Saver Standard for Building Type Second Edition:

- 5%-10% : Minimum circulation
- 20% : Requirement of large area circulation
- 30% : Physical comfort demand
- 40% : Psychological comfort demand
- 50% : Specific activities demand
- 70%-100% : Circulation with lots of activity

- Lobby

Table 5. Lobby area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Reception desk	3.5m x 1.42m = 1.47m ²	1	1.47m ²
User	0.63m x 0.63m = 0.4m ²	50	20m ²
Total			21.47m ²
Circulation			100%
Total			42.94m ²

- Acclimatization area

Table 6. Acclimatization area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Acclimatization tank	12.9m ²	1	12.9m ²
User	0.63m x 0.63m = 0.4m ²	35	14m ²
Total			26.9m ²
Circulation			70%
Total			45.73m ²

- Benthic quarantine area

Table 7. Benthic quarantine area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Quarantine tank	15m x 6.25m = 93.75m ²	1	93.75m ²
User	0.63m x 0.63m = 0.4m ²	27	10.8m ²
Total			104.55m ²
Circulation			70%
Total			177.74m ²

○ Semi pelagic quarantine area

Table 8. Semi pelagic quarantine area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Quarantine tank	31.2m x 13m = 405.6m ²	1	405.6m ²
User	0.63m x 0.63m = 0.4m ²	27	10.8m ²
Total			416.4m ²
Circulation			70%
Total			707.88m ²

○ Pelagic quarantine area

Table 9. Pelagic quarantine area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Quarantine tank	51.6m x 21.5m = 1,109.4m ²	1	1,109.4m ²
User	0.63m x 0.63m = 0.4m ²	27	10.8m ²
Total			1,120.2m ²
Circulation			70%
Total			1,904.34m ²

○ Isolation area

Table 10. Isolation area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Isolation tank	12.9m ²	1	12.9m ²

User	0.63m x 0.63m = 0.4m ²	35	14m ²
Total			26.9m ²
Circulation			70%
Total			45.73m ²

○ Food preparation room

Table 11. Food preparation room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Walk in freezer	2.4m x 2.4m = 5.76m ²	1	5.76m ²
High capacity refrigerator	0.9m x 0.8m = 0.72m ²	1	0.72m ²
Sink	1.2m x 0.6m = 0.72m ²	2	1.44m ²
Table	1.8m x 0.8m = 1.44m ²	2	2.88m ²
User	0.63m x 0.63m = 0.4m ²	7	2.8m ²
Total			13.6m ²
Circulation			60%
Total			21.76m ²

○ Water quality laboratory

Table 12. Water quality laboratory area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Grossing station	1.52m x 0.88m = 1.33m ²	5	6.65m ²
Formalin dispenser	0.76m x 0.7m = 0.53m ²	1	0.53m ²
Ventilated cabinet	1m x 0.6m =0.6m ²	5	3m ²
Lab desk	1.82m x 1.92m = 3.49m ²	5	17.45m ²
Counter	0.91m x 0.61m = 0.56m ²	8	4.48m ²
User	0.63m x 0.63m = 0.4m ²	17	6.8m ²
Total			38.91
Circulation			60%
Total			62.27m ²

○ Necropsy room

Table 13. Necropsy room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Grossing station	1.52m x 0.88m = 1.33m ²	5	6.65m ²
Dissection table	1.07m x 0.75m = 0.8m ²	2	1.6m ²
Walk in freezer	2.4m x 2.4m = 5.76m ²	1	5.76m ²
Sink	1.2m x 0.6m = 0.72m ²	2	1.44m ²
Counter	0.91m x 0.61m = 0.56m ²	9	5.04m ²
User	0.63m x 0.63m = 0.4m ²	19	7.6m ²
Total			28.09m ²
Circulation			60%
Total			44.94m ²

○ CT examination room

Table 14. CT examination room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
CT scan	4m x 1.3m = 5.2m ²	1	5.2m ²
Counter	0.91m x 0.61m = 0.56m ²	3	1.68m ²
User	0.63m x 0.63m = 0.4m ²	3	1.2m ²
Total			8.08m ²
Circulation			60%
Total			12.93m ²

○ CT control room

Table 15. CT control room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Desk and chair	1.52m x 1.37m = 2.08m ²	1	2.08m ²

File cabinet	0.41m x 0.5m = 0.21m ²	3	0.63m ²
User	0.63m x 0.63m = 0.4m ²	3	1.2m ²
Total			3.91m ²
Circulation			60%
Total			6.26m ²

○ X-ray examination room

Table 16. X-ray examination room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Digital x-ray	2.2m x 1.16m = 2.55m ²	1	2.55m ²
Counter	0.91m x 0.61m = 0.56m ²	3	1.68m ²
User	0.63m x 0.63m = 0.4m ²	3	1.2m ²
Total			5.43m ²
Circulation			60%
Total			8.69m ²

○ Histopathology laboratory

Table 17. Histopathology laboratory area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Biosafety cabinet	1.2m x 0.77m = 0.92m ²	2	1.84m ²
Lab desk	1.82m x 1.92m = 3.49m ²	3	10.47m ²
Counter	0.91m x 0.61m = 0.56m ²	9	5.04m ²
User	0.63m x 0.63m = 0.4m ²	19	7.6m ²
Total			24.95m ²
Circulation			60%
Total			39.92m ²

○ Computer laboratory

Table 18. Computer laboratory area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
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Lab desk	1.82m x 1.92m = 3.49m ²	3	10.47m ²
User	0.63m x 0.63m = 0.4m ²	18	7.2m ²
Total			17.67m ²
Circulation			60%
Total			28.27m ²

○ Public locker room

Table 19. Public locker room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Locker	0.3m x 0.52m = 0.17m ²	6	1.02m ²
Locker seat	2m x 0.5m = 1m ²	2	2m ²
User	0.63m x 0.63m = 0.4m ²	11	4.4m ²
Total			7.42m ²
Circulation			40%
Total			10.38m ²

○ Public shower room

Table 20. Public shower room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Shower	0.9m x 1.2m = 1.08m ²	6	6.48m ²
User	0.63m x 0.63m = 0.4m ²	11	4.4m ²
Total			10.88m ²
Circulation			40%
Total			15.23m ²

○ Library

Table 21. Library area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Bookshelf	1.84m x 0.6m = 1.1m ²	16	17.6m ²

Reference desk	1.5m x 1.79m = 2.69m ²	1	2.69m ²
Table	1m x 1.21m = 1.21m ²	22	26.62m ²
User	0.63m x 0.63m = 0.4m ²	23	9.2m ²
Total			56.11m ²
Circulation			80%
Total			100.1m ²

○ Vehicle storage

Table 22. Vehicles storage area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
AUVs (Jaguar)	1.9m x 0.34m = 0.65m ²	8	5.2m ²
AUVs (REMUS)	1.6m x 0.19m = 0.3m ²	8	2.4m ²
AUVs (Spray glider)	2.13m x 1.01m = 2.15m ²	8	17.2m ²
Workbench	1.5m x 1.36m = 2.04m ²	2	4.08m ²
Inspection table	1.82m x 0.8m = 1.47m ²	2	2.94m ²
Storage rack	1m x 0.6m = 0.6m ²	4	2.4m ²
Desk	1.52m x 1.37m = 2.08m ²	2	4.16m ²
User	0.63m x 0.63m = 0.4m ²	19	7.6m ²
Total			45.98m ²
Circulation			60%
Total			73.57m ²

○ Equipment storage

Table 23. Equipment storage area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Air compressor	1.6m x 0.83m = 1.33m ²	1	1.33m ²
Diving equipment rack	1.5m x 1.79m = 2.69m ²	5	13.45m ²

Inspection table	1.82m x 0.8m = 1.47m ²	2	2.94m ²
User	0.63m x 0.63m = 0.4m ²	16	6.4m ²
Total			24.12m ²
Circulation			60%
Total			38.59m ²

○ Ticket counter

Table 24. Ticket counter area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Desk	1.52m x 1.37m = 2.08m ²	3	6.24m ²
Counter	0.91m x 0.61m = 0.56m ²	3	1.68m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			9.92m ²
Circulation			40%
Total			13.89m ²

○ Exhibition area

Table 25. Exhibition area area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total area
Display case	0.91m x 0.48m = 0.44m ²	20	8.8m ²
Food cart	1.2m x 0.6m = 0.72m ²	3	2.16m ²
Couch	2.2m x 0.9m = 1.98m ²	8	15.84m ²
User	0.63m x 0.63m = 0.4m ²	77	30.8m ²
Total			136.8m ²
Circulation			100%
Total			273.6m ²

○ Mini theatre

Table 26. Mini theatre area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Seat	0.54m x 0.67m = 0.36m ²	32	11.52m ²
User	0.63m x 0.63m = 0.4m ²	38	15.2m ²
Total			26.72m ²
Circulation			100%
Total			53.44m ²

○ Control booth

Table 27. Control booth area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Storage rack	1m x 0.6m = 0.6m ²	2	1.2m ²
Desk	1.52m x 1.37m = 2.08m ²	2	4.16m ²
User	0.63m x 0.63m = 0.4m ²	3	1.2m ²
Total			6.16m ²
Circulation			40%
Total			8.62m ²

○ Restaurant

Table 28. Restaurant area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Cashier counter	2.4m x 0.8m = 1.92m ²	1	1.92m ²
Dining table (Rounded)	1.8m x 1.8m = 3.24m ²	5	16.2m ²
Dining table (Rectangular)	1.83m x 1.8 m = 3.29m ²	5	16.45m ²
User	0.63m x 0.63m = 0.4m ²	40	16m ²
Total			50.57m ²
Circulation			80%
Total			91.03m ²

○ Kitchen

Table 29. Kitchen area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Stove	1.2m x 0.7m = 0.84m ²	1	0.84m ²
Grill	1.2m x 0.7m = 0.84m ²	1	0.84m ²
Deep fryer	0.4m x 0.76m = 0.34m ²	1	0.34m ²
Oven	1.68m x 0.84m = 1.41m ²	1	1.41m ²
Steamer	0.71m x 0.65m = 0.46m ²	1	0.46m ²
Walk-in freezer	2.4m x 2.4m = 5.76m ²	1	5.76m ²
Table	1.8m x 0.8m = 1.44m ²	1	1.44m ²
Sink	1.2m x 0.6m = 0.72m ²	1	0.72m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			13.79m ²
Circulation			60%
Total			18.86m ²

○ Gift shop

Table 30. Gift shop area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Cashier counter	2.4m x 0.8m = 1.92m ²	1	1.92m ²
Display rack (Rounded)	0.91m x 0.91m = 0.83m ²	2	1.66m ²
Display rack (Rectangular)	1.2m x 0.45m = 0.54m ²	8	4.32m ²
Display table (Rounded)	0.91m x 0.91m = 0.83m ²	3	2.49m ²
Display table (Rectangular)	1.83m x 0.76m = 1.39m ²	5	6.95m ²
User	0.63m x 0.63m = 0.4m ²	13	5.2m ²
Total			22.54m ²
Circulation			80%
Total			40.57m ²

○ Male restroom

Table 31. Male restroom area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Water closet	0.9m x 1.5m = 1.35m ²	3	4.05m ²
Urinal	0.48m x 0.27m = 0.13m ²	4	0.52m ²
Sink	0.91m x 0.45m = 0.41m ²	4	1.64m ²
User	0.63m x 0.63m = 0.4m ²	10	4m ²
Total			10.21m ²
Circulation			40%
Total			14.29m ²

○ Female restroom

Table 32. Female restroom area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Water closet	0.9m x 1.5m = 1.35m ²	4	5.4m ²
Sink	0.91m x 0.45m = 0.41m ²	4	1.64m ²
User	0.63m x 0.63m = 0.4m ²	10	4m ²
Total			11.04m ²
Circulation			40%
Total			15.46m ²

○ Male accessible restroom

Table 33. Male accessible restroom area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Water closet	0.9m x 1.5m = 1.35m ²	1	1.35m ²
Sink	0.91m x 0.45m = 0.41m ²	1	0.41m ²
Wheelchair	0.64m x 1.07m = 0.68m ²	1	0.68m ²
User	0.63m x 0.63m = 0.4m ²	1	0.4m ²

Total	2.84m ²
Circulation	40%
Total	3.98m ²

○ Female accessible restroom

Table 34. Female accessible restroom area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Water closet	0.9m x 1.5m = 1.35m ²	1	1.35m ²
Sink	0.91m x 0.45m = 0.41m ²	1	0.41m ²
Wheelchair	0.64m x 1.07m = 0.68m ²	1	0.68m ²
User	0.63m x 0.63m = 0.4m ²	1	0.4m ²
Total			2.84m ²
Circulation			40%
Total			3.98m ²

○ Director office

Table 35. Director office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	2	1.24m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			7.33m ²
Circulation			60%
Total			11.73m ²

○ Assistant director office

Table 36. Assistant director office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

○ Financial office

Table 37. Financial office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

○ General curator office

Table 38. General curator office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
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L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

○ Veterinary office

Table 39. Veterinary office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	3	4.47m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	7	2.8m ²
Total			10.49m ²
Circulation			60%
Total			16.78m ²

○ Registration office

Table 40. Registration office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²

File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

○ Research office

Table 41. Research office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

○ Conservation office

Table 42. Conservation office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²

Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

o Head aquarist office

Table 43. Head aquarist office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

o Operation office

Table 44. Operation office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²

Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

○ Public relations office

Table 45. Public relations office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

○ Development office

Table 46. Development office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²

User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

o Marketing office

Table 47. Marketing office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

o Membership office

Table 48. Membership office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²

Circulation	60%
Total	10.74m ²

○ Personnel office

Table 49. Personnel office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	1	1.49m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
Display rack	1.2m x 0.45m = 0.54 m ²	2	1.08m ²
Wardrobe	1.2m x 0.52m = 0.62m ²	1	0.62m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			6.71m ²
Circulation			60%
Total			10.74m ²

○ Volunteer room

Table 50. Volunteer room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	5	7.45m ²
Water dispenser	0.31m x 0.33m = 0.1m ²	1	0.1m ²
Couch	1.45m x 0.76m = 1.1m ²	1	1.1m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			10.65m ²
Circulation			60%
Total			17.04m ²

○ General office

Table 51. General office area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	1.8m x 1.41m = 1.49m ²	22	32.78m ²
Water dispenser	0.31m x 0.33m = 0.1m ²	2	0.2m ²
Couch	1.45m x 0.76m = 1.1m ²	2	2.2m ²
User	0.63m x 0.63m = 0.4m ²	35	14m ²
Total			49.18m ²
Circulation			60%
Total			78.69m ²

○ Meeting room

Table 52. Meeting room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
L shaped desk	4.25m x 1.5m = 6.38m ²	2	12.76m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
User	0.63m x 0.63m = 0.4m ²	30	12m ²
Total			25.18m ²
Circulation			60%
Total			40.29m ²

○ Manager locker room

Table 53. Manager locker room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Locker	0.3m x 0.52m = 0.17m ²	10	1.7m ²
Locker seat	2m x 0.5m = 1m ²	6	6m ²
User	0.63m x 0.63m = 0.4m ²	20	8m ²
Total			7.42m ²
Circulation			40%
Total			10.38m ²

○ Manager shower room

Table 54. Manager shower room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Shower	0.9m x 1.2m = 1.08m ²	6	6.48m ²
User	0.63m x 0.63m = 0.4m ²	17	6.8m ²
Total			13.28m ²
Circulation			40%
Total			18.59m ²

○ Break room

Table 55. Break room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Dining table (Rounded)	1.8m x 1.8m = 3.24m ²	2	6.48m ²
Water dispenser	0.31m x 0.33m = 0.1m ²	2	0.2m ²
Refrigerator	0.91m x 0.91m = 0.83m ²	1	0.83m ²
Counter	0.91m x 0.61m = 0.56m ²	15	8.4m ²
Couch	1.45m x 0.76m = 1.1m ²	2	2.2m ²
Coffee table	1.18m x 0.78m = 0.92m ²	2	1.84m ²
User	0.63m x 0.63m = 0.4m ²	30	12m ²
Total			31.95m ²
Circulation			60%
Total			51.12m ²

○ Cafeteria

Table 56. Cafeteria area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Cashier counter	2.4m x 0.8m = 1.92m ²	1	1.92m ²
Dining table (Rounded)	1.8m x 1.8m = 3.24m ²	5	16.2m ²

Dining table (Rectangular)	1.83m x 1.8 m = 3.29m ²	5	16.45m ²
Water dispenser	0.31m x 0.33m = 0.1m ²	4	0.4m ²
User	0.63m x 0.63m = 0.4m ²	30	12m ²
Total			46.97m ²
Circulation			80%
Total			84.54m ²

o Cafeteria kitchen

Table 57. Cafeteria kitchen area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Food Warmer	1.13m x 0.42m = 0.47m ²	1	0.47m ²
Stove	1.2m x 0.7m = 0.84m ²	1	0.84m ²
Grill	1.2m x 0.7m = 0.84m ²	1	0.84m ²
Deep fryer	0.4m x 0.76m = 0.34m ²	1	0.34m ²
Oven	1.68m x 0.84m = 1.41m ²	1	1.41m ²
Steamer	0.71m x 0.65m = 0.46m ²	1	0.46m ²
Walk-in freezer	2.4m x 2.4m = 5.76m ²	1	5.76m ²
Table	1.8m x 0.8m = 1.44m ²	1	1.44m ²
Sink	1.2m x 0.6m = 0.72m ²	1	0.72m ²
User	0.63m x 0.63m = 0.4m ²	3	1.2m ²
Total			13.46m ²
Circulation			60%
Total			21.54m ²

o Manager male restroom

Table 58. Manager male restroom area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Water closet	0.9m x 1.5m = 1.35m ²	3	4.05m ²

Urinal	0.48m x 0.27m = 0.13m ²	4	0.52m ²
Sink	0.91m x 0.45m = 0.41m ²	4	1.64m ²
User	0.63m x 0.63m = 0.4m ²	10	4m ²
Total			10.21m ²
Circulation			40%
Total			14.29m ²

○ Manager female restroom

Table 59. Manager female restroom area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Water closet	0.9m x 1.5m = 1.35m ²	4	5.4m ²
Sink	0.91m x 0.45m = 0.41m ²	4	1.64m ²
User	0.63m x 0.63m = 0.4m ²	10	4m ²
Total			11.04m ²
Circulation			40%
Total			15.46m ²

○ Security room

Table 60. Security room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Desk	1.52m x 1.37m = 2.08m ²	5	10.4m ²
File cabinet	0.41m x 0.5m = 0.21 m ²	2	0.42m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			12.82m ²
Circulation			60%
Total			20.51m ²

○ Janitor closet

Table 61. Janitor closet area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Mop sink	0.61m x 0.91m = 0.55m ²	1	0.55m ²
Shelves	0.91m x 0.46m = 0.42m ²	2	0.42m ²
Cart	0.76m x 1.22m ² = 0.93m ²	1	0.93m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			3.9m ²
Circulation			60%
Total			6.24m ²

○ Garbage room

Table 62. Garbage room area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Garbage container	2.11m x 1.27m = 2.68m ²	6	16.08m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			18.08m ²
Circulation			40%
Total			25.31m ²

○ Visitor boat docks

Table 63. Visitor boat docks area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Speedboat with station	6.6m x 14.8m = 97.68m ²	4	390.72m ²
User	0.63m x 0.63m = 0.4m ²	20	8m ²
Total			398.72m ²
Circulation			60%
Total			637.95m ²

○ Boat docks

Table 64. Boat docks area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Research ship with station	13.2m x 51.7m = 682.44m ²	2	1,364.88m ²
Speedboat with station	6.6m x 14.8m = 97.68m ²	4	390.72m ²
User	0.63m x 0.63m = 0.4m ²	29	11.6m ²
Total			1,767.2m ²
Circulation			60%
Total			2,827.52m ²

○ Heliport

Table 65. Heliport area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Helicopter	9.6m x 9.6m = 92.16m ²	1	92.16m ²
User	0.63m x 0.63m = 0.4m ²	8	3.2m ²
Total			95.36m ²
Circulation			60%
Total			152.58m ²

○ Hangar

Table 66. Hangar area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Speedboat	13m x 3m = 39m ²	3	117m ²
Speedboat with station	6.6m x 14.8m = 97.68m ²	2	195.36m ²
Forklift	4.23m x 1.25m = 5.29m ²	1	5.29m ²
User	0.63m x 0.63m = 0.4m ²	26	10.4m ²
Total			328.05m ²
Circulation			60%
Total			524.88m ²

○ Courtyard

Table 67. Courtyard area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
User	0.63m x 0.63m = 0.4m ²	30	12m ²
Total			12m ²
Circulation			100%
Total			24m ²

○ Energy server area

Table 68. Energy server area analysis
(Source: Personal analysis)

Facility	Area	Capacity	Total Area
Energy server	4.5m x 2,46m = 11.07m ²	2	22.14m ²
User	0.63m x 0.63m = 0.4m ²	5	2m ²
Total			24.14m ²
Circulation			40%
Total			33.8m ²

● Room dimensions analysis

Table 69. Area dimension analysis
(Source: Personal analysis)

Facility	Area	Unit	Total Area
Indoor Area			
Lobby	42.94m ²	1	42.94m ²
Total			42.94m ²
Main Area			
Acclimatization area	45.73m ²	1	45.73m ²
Benthic quarantine area	177.74m ²	1	177.74m ²
Semi pelagic quarantine area	707.88m ²	1	707.88m ²
Pelagic quarantine area	1904.34m ²	1	1,904.34m ²
Isolation area	45.73m ²	1	45.73m ²
LSS area	664.49m ²	1	664.49m ²
Food preparation room	21.76m ²	1	21.76m ²
Water quality laboratory	62.27m ²	1	62.27m ²

Necropsy room	44.94m2	1	44.94m2
CT examination room	12.93m2	1	12.93m2
CT control room	6.26m2	1	6.26m2
X-ray examination room	8.69m2	1	8.69m2
Histopathology laboratory	39.92m2	1	39.92m2
Computer laboratory	28.27m2	1	28.27m2
Public locker room	10.38m2	1	10.38m2
Public shower room	15.23m2	1	15.23m2
Library	100.1m2	1	100.1m2
Vehicle storage	73.57m2	1	73,57m2
Equipment storage	38.59m2	1	38.59m2
Male restroom	14.29m2	1	14.29m2
Female restroom	15.46m2	1	15.46m2
Total			4,038.57m2
Supporting Area			
Ticket counter	13.89m2	1	13.89m2
Exhibition area	273.6m2	1	273.6m2
Mini theatre	53.44m2	1	53.44m2
Control booth	8.62m2	1	8.62m2
Restaurant	91.03m2	1	91.03m2
Kitchen	18.86m2	1	18.86m2
Gift shop	40.57m2	1	40.57m2
Male restroom	14.29m2	2	28.58m2
Female restroom	15.46m2	2	30.92m2
Male accessible room	3.98m2	2	7.96m2
Female accessible room	3.98m2	2	7.96m2
Total			575,43m2
Manager Area			
Director office	11.73m2	1	11.73m2
Assistant director office	10.74m2	1	10.74m2
Financial office	10.74m2	1	10.74m2

General curator office	10.74m2	1	10.74m2
Veterinary office	10.74m2	1	10.74m2
Registration office	10.74m2	1	10.74m2
Research office	10.74m2	1	10.74m2
Conservation office	10.74m2	1	10.74m2
Head aquarist office	10.74m2	1	10.74m2
Operation office	10.74m2	1	10.74m2
Public relations office	10.74m2	1	10.74m2
Development office	10.74m2	1	10.74m2
Marketing office	10.74m2	1	10.74m2
Membership office	10.74m2	1	10.74m2
Personnel office	10.74m2	1	10.74m2
Volunteer room	10.74m2	1	10.74m2
General office	78.69m2	1	78.69m2
Meeting room	40.29m2	1	40.29m2
Manager locker room	10.38m2	1	10.38m2
Manager shower room	18.59m2	1	18.59m2
Break room	51.12m2	1	51.12m2
Cafeteria	84.54m2	1	84.54m2
Cafeteria kitchen	21.54m2	1	21.54m2
Security room	20.51m2	1	20.51m2
Janitor closet	6.24m2	1	6.24m2
Manager male restroom	14.29m2	2	28.58m2
Manager female restroom	15.46m2	2	30.92m2
Garbage room	25.31m2	1	25.31m2
Mechanical electrical room	422.73m2	1	422.73m2
Total			1,024.61m2
Outdoor Area			
Visitor boat docks	637.95m2	1	637.95m2
Boat docks	2,827.52m2	1	2,827.52m2
Heliport	152.58m2	1	152.58m2
Hangar	32.,05m2	1	328.05m2

Courtyard	24m ²	4	96m ²
Energy server area	33.8m ²	1	33.82m ²
Greenhouse	88.95m ²	1	88.95m ²
Total			4,164.85m ²
Total			9,846.4m ²
Circulation			20%
Total			11,815.68m ²

Therefore the total area of the building is 11,815.68 square metre.

- Room requirements

- Quarantine area

- ❖ The tank size of the facility for average sharks should be calculated by using Klay's formula which is $12(Z)$ long x $5(Z)$ wide x $2.5(Z)$ deep (Smith et al, 2004), where Z refers to the maximum expected TL of a captive shark in the facility.

- ❖ The tank shape of the facility can be either one of the following:

- Rectangular tanks

- Common and inexpensive to build.
 - Corners should be chamfered to large radius bends as it can trouble the sharks' acclimatization.

- Cylindrical tanks

- Has been proven successful with many species.
 - Should be large enough to allow sharks to swim with their complete sequences. If a shark is subjected to these unsuitable conditions, they will hug the wall creating inefficiencies in oxygen transfer across the gills (Klay, 1977) and causing external abrasions to the shark's skin, with a risk of infection.
 - Varies including roundabouts, racetracks, or doughnuts, where the center of the tank is a structure designed to provide a circular path for the animals. The center structure can be exhibit décor to hide LSS components, holding areas, etc or serve as a visitor's viewing area.

- Provides an endless column of water where sharks will not turn until they find an obstacle, resulting in the sharks failing to constantly swim in the intended direction.

- Dumbbell tanks

- Has been proven successful for swim-glide swimming patterns.

- Freeform tanks

Other tank designs are acceptable as long as they have sufficiently large horizontal dimensions and corners greater than right-angles.

- ❖ An additional space is needed between tanks for transporting animals and lifting equipment.
- ❖ Tanks should provide raised catwalks, around the perimeter for easy access of cleaning and feeding procedure.
- ❖ Tanks must be attached together with acclimatization and isolation pool for husbandry procedures.
- Introduction/acclimatization and isolation pool
 - ❖ The pool should be able to accommodate the largest anticipated species.
 - ❖ Before the main tank, introduction pool should be separated by a mesh gate when in use, for medical treatments requiring the use of chemicals, the gate should be watertight and the pool plumbed to allow for variable water depth.
 - ❖ Pool dimensions should be three times the total length (TL) of the 3largest specimen held and at least 3 m long x 3 m wide.
 - ❖ Pool water depth should be 0.5-1.0 m to allow a safe working level for staff and sufficient water for swimming sharks.
 - ❖ The pool should have curved or 45° angle (to the plane of the wall) corners to accommodate shark swimming patterns.
- Building
 - ❖ Building should be accessed easily during animal transport using trucks, trailers, and boats.

- ❖ Loading bays should be close to the quarantine tanks.
- ❖ Building should provide an internal driveway with doors at the end of the building for forklifts or an overhead crane rail for animal transport.

d. Room structuring

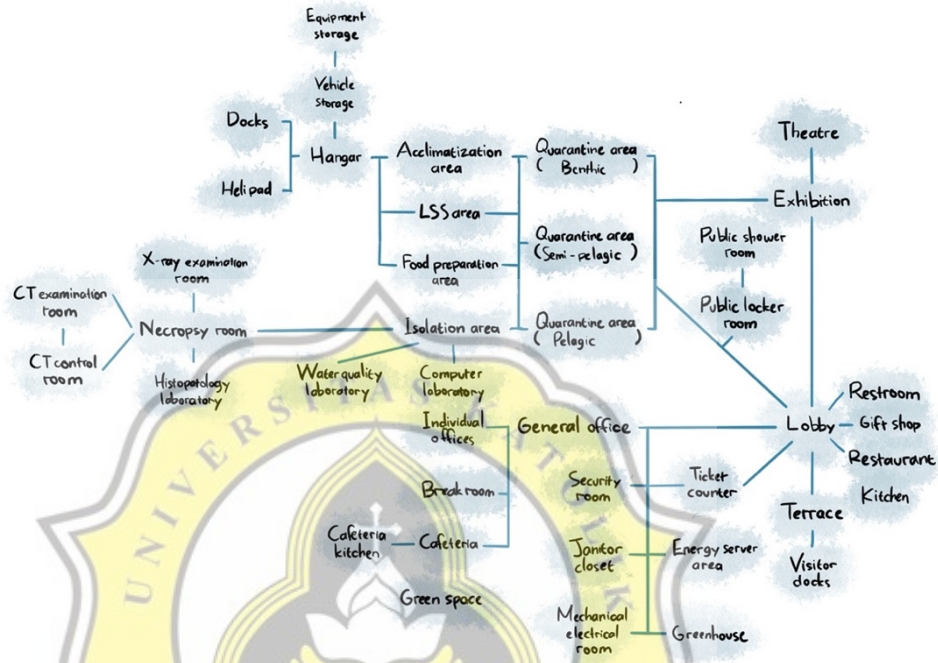


Figure 11. Diagram of room structure
(Source: Personal analysis)

3.2. Site

The chosen site is located near the end of Wayag Island, Raja Ampat Regency, with an area of 15,625 square metre.



Figure 12. Building site
(Source: Google earth and personal analysis)



Figure 13. Site documentation 1
(Source: NatureFootage, 2019)



Figure 14. Site documentation 2
(Source: NatureFootage, 2019)



Figure 15. Site documentation 3
(Source: NatureFootage, 2019)

The site is chosen due to many dive location around the site. The type of corals furthermore affect the building, with fringing corals, it is best to avoid the seashore.

3.3. Man-Made Environment Analysis

a. Surrounding building analysis

The site is not surrounded by any kind of building, however a group of diving sites is located surrounding the site:

- Far Out Rock
- Figure Eight Rock
- Ridge Rock
- Two Hump Rock

The island itself doesn't have any human settlement, it only has a ranger station for patrols to prevent illegal activity.

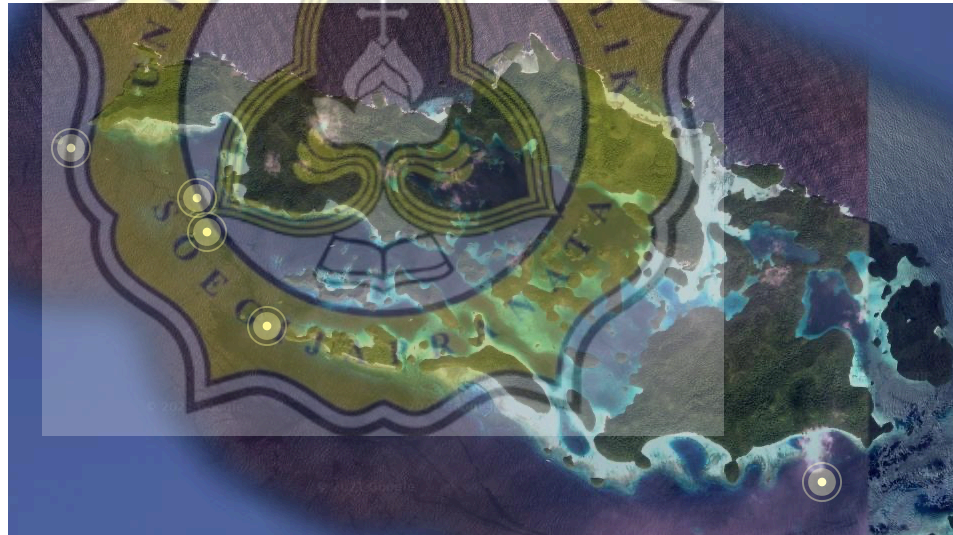


Figure 16. Diving sites near the site
(Source: dive.site)

b. Transportation and utility

- Transportation

The site can only be accessed by sea transportation such as speedboats where people usually comes from Waisai which take six to eight hours. Other than that, people can furthermore rent a speedboat to go straight from Sorong to Wayag for a five-hour journey. There are

furthermore patrol boats to prevent illegal fishing in the area. For research, People can furthermore use helicopters to monitor the ocean condition.

- Utility

The site has no electricity, no clean water, no communication, no waste management, and no drainage.

- Regulations

Since the site is located at the sea, there are no regulations regarding the site. However according to Book of Data and Information on Featured Products in Raja Ampat Regency, West Papua Province in the year 2017, the development of zonation for Raja Ampat Regency has already been planned:

No.	Kluster	Arahan Pengembangan
1	Pulau Waigeo dan sekitarnya	1. Pusat Pemerintahan 2. Agro Industri 3. Wisata dan Riset Sumberdaya Alam Hayati 4. Infrastruktur Regional
2	Pulau Mansuar dan sekitarnya	Wisata Bahari
3	Pulau Ayau dan sekitarnya	1. Kelautan 2. Kawasan Perbatasan
4	Pulau Misool dan sekitarnya	1. Agropolitan 2. Budidaya Kelautan
5	Pulau Kofiau, Boo dan sekitarnya	1. Pusat Riset Ekosistem Perairan 2. Budidaya Pertanian dan Perikanan 3. Konservasi
6	Pulau Batanta, Salawati dan sekitarnya	1. Kawasan Pertambangan 2. Agrobisnis 3. Kehutanan
7	Pulau Gag dan sekitarnya	1. Pertambangan 2. Budidaya Kelautan 3. Kehutanan
8	Pulau Wayag dan sekitarnya	Wisata dan Riset Kelautan

Figure 17. Raja Ampat Zonation Planning 2011-2030
(Source: Book of Data and Information on Featured Products in Raja Ampat Regency 2017)

3.4. Natural Environment Analysis

a. Climate analysis

- Temperature

Temperature in the area mainly at 27°C, with maximum temperature at 28°C in November and December while the minimum temperature at 25.6°C in July.

Table 70. Average temperature by month in Raja Ampat Regency
(Source: Statistics Indonesia Raja Ampat Regency)

Month	Temperature (°C)
January	27.9
February	27.6
March	27.8
April	27.9
May	27.8
June	26.7
July	25.6
August	25.9
September	26.2
October	26.8
November	28.0
December	28.0

- Humidity

Humidity in the area mainly at 89% with range of 81.5%-89.7%. With the maximum temperature of 28°C, the site is classified as a suitable class for human habitation.

Table 71. Average humidity by month in Raja Ampat Regency
(Source: Statistics Indonesia Raja Ampat Regency)

Month	Humidity (%)
January	83.1
February	81.6
March	81.5
April	85.1
May	86.2
June	89.6
July	89.7
August	88.5
September	84.8
October	88.0
November	82.7

December	81.7
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- Atmospheric pressure

The highest mb of atmospheric pressure occurs in September at 1,001.4 mb while the lowest occurs in November at 1,008.6 mb.

Table 72. Average atmospheric pressure by month in Raja Ampat Regency
(Source: Statistics Indonesia Raja Ampat Regency)

Month	Atmospheric pressure (mb)
January	1,009.0
February	1,011.0
March	1,009.6
April	1,008.9
May	1,009.5
June	1,009.5
July	1,010.2
August	1,010.5
September	1,011.4
October	1,009.4
November	1,008.6
December	1,008.5

- Wind velocity

The highest wind velocity occurs in September at 7.48 mph while the lowest occurs in May at 4.72 mph. Using Beaufort wind scale, 7.48 mph wind velocity are classified as light breeze. Meanwhile the 4.72 mph wind velocity are furthermore classified as light breeze wind.

Table 73. Average wind velocity by month in Raja Ampat Regency
(Source: BPS Kabupaten Raja Ampat)

Month	Wind velocity (knot)	Wind velocity (mph)
January	4.5	5.18
February	5.0	5.75
March	4.6	5.29
April	4.2	4.83
May	4.1	4.72
June	4.9	5.64
July	5.2	5.98
August	6.2	7.13
September	6.5	7.48
October	4.5	5.19
November	4.7	5.41

December	4.2	4.83
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- Duration of sunshine

The sun shine mostly for 6 hours. The longest shine would take place in November at 7.7 hours while the fastest shine occurs at July for 3.9 hours.

Table 74. Average sunshine duration by month in Raja Ampat Regency
(Source: BPS Kabupaten Raja Ampat)

Month	Duration of sunshine (hour)
January	6.1
February	6.4
March	7.0
April	5.7
May	6.5
June	4.4
July	3.9
August	4.2
September	6.6
October	5.7
November	7.7
December	6.3

b. Landscape analysis

- Ocean wave

Tide analysis in this report could determine the use of tidal energy for the building and furthermore its structure. Below is the table revealing the maximum and minimum tide in the sea of Wayag.

Table 75. Average wave height and direction by month in Raja Ampat Regency
(Source: BPS Kabupaten Raja Ampat)

Month	Height	Direction
January	2-2.5	Northeast
February	1.5-2	Northeast
March	1.25-1.5	Northeast
April	1-1.25	Northeast
May	0.5-0.75	Northeast
June	0.5-0.75	Southeast
July	1-1.25	Southeast
August	0.75-1	Southeast
September	0-0.5	Southeast
October	0-0.5	Northeast
November	0-0.5	Northeast
December	0.75-1	Northeast

Using Douglas sea scale, the maximum height of ocean wave of the site is at 2-2.5 metre, classified as a moderate sea, happens in January. The minimum height of ocean wave in the site is at 0-0.5 metre which is classified as a smooth sea surface occurs in September until November.

- Ocean current

According to Raja Ampat Regency Coastal Resource Atlas, the ocean current of the site is at the average of 0,11 m/s. The current direction is the same with the ocean wave analysis.

- Tide

The highest tide in the area occurs in December at 0.853 metre. The lowest tide furthermore happens in December at -0.846 metre.

Table 76. Highest and lowest tide by month in Raja Ampat Regency
(Source: Geospatial Information Agency and personal analysis)

Month	High tide (m)	Low tide (m)
January	0.759	-0.771
February	0.715	-0.733
March	0.769	-0.737
April	0.826	-0.817
May	0.841	-0.833
June	0.800	-0.803
July	0.752	-0.764
August	0.697	-0.718
September	0.679	-0.697
October	0.774	-0.756
November	0.850	-0.830
December	0.853	-0.846

- Bathymetry

Water depth in the site ranges between 10 metre to 25 metre, the site itself has a depth of 10 metre from the ocean surface making it a Littoral zone.



Figure 18. Wayag Island bathymetric map
 (Source: National Oceanic and Atmospheric Administration)

- **Vegetation**

The many vegetation habitats of Wayag Island that can be found are:
 (Mangubai et al. 2012)

- **Mangroves**

Mangroves can be found in the coastal areas of the island, and many are still in good conditions.



Figure 19. Mangroves in Wayag Island, Raja Ampat
(Source: www.alamy.com)

- Seagrass beds

Seagrass can be found on estuarine, coastal, reef flats and deep water area of the site.

- Coral reefs

The type of habitat of coral reefs recorded are the type of fringing reefs, exposed and semi exposed found at 8-10 m depth from the ocean surface. The coral reefs itself consists of hard coral, soft coral.

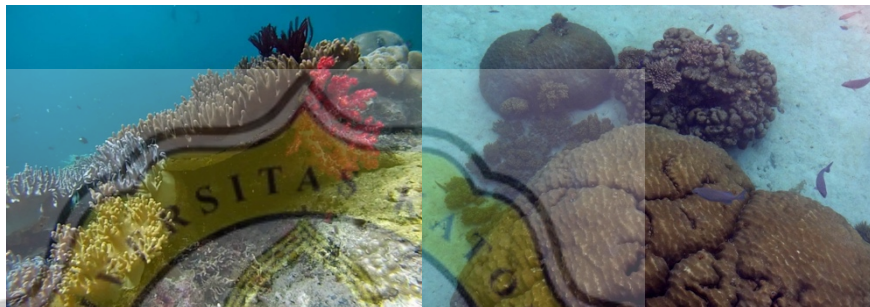


Figure 20. Soft and hard corals in Wayag Island, Raja Ampat
(Source: www.fatgirldoestheworld.com)

