Environmental Assessment

For

Proposed Multipurpose Business Building in Ngetkib Hamlet, Airai State

3-Dimensional View of Proposed Project Site

June 4, 2018

Applicant:
Benjamin Yobech

EA Preparer:
KJP Consulting
P.O. Box 419
Koror, Palau 96940
1. EXECUTIVE SUMMARY

The goal of this project is to construct a multipurpose business building in Ngetkib, Airai. The project site is located in a mangrove area and is currently in the process of being reclaimed under EQPB Permit No. PEA-247-15. The fill project area covers roughly 21,000 square meters.

The proposed multipurpose building to be built, covers an area of approximately 90,000 square feet and will have a car park capacity of about 300 cars. A water catchment system with water storage tanks will be constructed to take advantage of water run-off from the roof. Total estimated water capacity of the water tanks is approximately 141,000 gallons which should be able sustain the facility for approximately 2 months. Designs for the roof include increased structural integrity to support the safe installation of solar panels and other needed accessories to harness solar power. To help with storm water run-off grass block will be used, instead of concrete, in some parking stalls.

An environmental evaluation was conducted based on a review of the EA for EQPB Permit No. PEA-247-15 as well as site visits. Vegetation on the project site, before the filling of the site was limited to two Rhizophora mangrove species with a few other plants found on the periphery, beyond the boundary of the site. No noteworthy evidence of wildlife were seen on the site and surrounding areas, with the exceptions of birds. Surveys conducted before the reclamation of the site and after, identified several bird species.

Various potential impacts were evaluated for different phases of the project. Findings are summarized below along with mitigation measures:

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<th>Construction Phase/Responsible Party</th>
<th>Mitigation Measure</th>
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| Climate Change         | Design Phase Contractor/Developer    | • Elevation of structure and associated facilities (parking area and access road) are at level where extreme tide conditions do not affect the facilities function. Consideration should also be made for projected sea level rise so that there are no impacts for the useful life of the project structure and facilities.  
  • Designs for structure and associated facilities should be able to withstand extreme weather events, such as typhoons and floods due to extreme rain events.  
  • Designs for facilities should include self-contained water system that can be used in times of water shortages.  
  • Designs to include connection of an emergency power back-up generator.  
  • Designs to should consider inclusion of renewable energy initiatives such a solar or wind power generation. |
| Air Quality            | Design Phase Contractor/Developer    | • Service all vehicles and equipment on a regular basis to ensure emissions are reduced to a minimum. |
| Water Quality/Sedimentation | Design Phase Contractor/Developer  | • Place silt fences and other physical barriers (e.g. berms) around areas that are to be excavated to limit movement of sediment.  
  • Contain used-water in an area to allow settling of sediments before it is released to surrounding mangrove area.  
  • Re-vegetate exposed soil, especially if to be exposed for a long period of time.  
  • Cover or stabilize material stockpiles. |
| Operational Phase      | Developer                            | • Ensure regular inspection and maintenance of drainage system.  
  • Re-vegetate exposed soil, especially if to be exposed for a long period of time. |
| Solid Waste            | Construction Phase Contractor/Developer | • Waste management policy by contractor for recycling and disposal of solid waste materials is developed. |
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**Proposed Multipurpose Business Building in Ngetkib, Airai**

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<tr>
<th>Phase</th>
<th>Role</th>
<th>Details</th>
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<tr>
<td><strong>Operational Phase</strong></td>
<td><strong>Developer</strong></td>
<td>Recycle containers are placed onsite and clearly marked for waste separation and eventual reuse. Disposal containers will be placed onsite and are disposed at National Landfill on regular basis.</td>
</tr>
<tr>
<td>Sewage</td>
<td><strong>Contractor/Developer</strong></td>
<td>Waste management policy by management for recycling and disposal of solid waste materials is developed. All employees should understand policy. Recycle containers are placed at convenient locations and are clearly indicated for ease of waste separation and eventual reuse. Trash bins are placed on-site at key location and are regularly disposed of at a central collection area for regular disposal at the National landfill. If deemed reasonable, organic waste material should be recycled as food for animals and livestock or to be used as compost.</td>
</tr>
<tr>
<td><strong>Operational Phase</strong></td>
<td><strong>Developer</strong></td>
<td>Contractor ensure designs include easily accessible compartments for inspection and servicing of system. Ensure regular monitoring and inspection of sewer system and surrounding environment. Ensure regular maintenance of septic system (Removal of sludge).</td>
</tr>
<tr>
<td>Hazardous Waste</td>
<td><strong>Contractor/Developer</strong></td>
<td>If stored on-site, hazardous materials should be stored in a manner that would limit contamination of surrounding area due to accidental spill or leakage. Storage site should be secure and access should be limited to only authorized personnel. Ensure all storage containers are properly marked and are in good condition with no leaks. If containers show visible signs of damage or leakage, they should be immediately replaced. Transport and disposal of oil and other hazardous materials should follow all national and state guidelines and/or best practices. Ensure availability of clean up materials at project site, in case of accidental spills at storage area.</td>
</tr>
<tr>
<td><strong>Operational Phase</strong></td>
<td><strong>Developer</strong></td>
<td>The developer does not plan to store any hazardous materials on-site during the operational phase but should store clean up materials in the case of spills from accidents (vehicular, equipment breakdown and etc.).</td>
</tr>
<tr>
<td>Terrestrial Environment</td>
<td><strong>Contractor/Developer</strong></td>
<td>Seek assistance from the Bureau of Agriculture on appropriate species to plant on project site. Have experienced persons/company plant vegetation to ensure proper conditions for growth.</td>
</tr>
<tr>
<td><strong>Operational Phase</strong></td>
<td><strong>Developer</strong></td>
<td>Regularly maintain plants and surrounding area and remove any unknown/unwanted species and dispose of accordingly. When replanting, seek advice from the Bureau of Agriculture to ensure no invasive plants are introduced.</td>
</tr>
<tr>
<td>Marine Environment</td>
<td><strong>Design Phase Contractor/Developer</strong></td>
<td>Project designs should incorporate adequate drainage systems with catch basins to allow settling before release of water into surrounding area.</td>
</tr>
<tr>
<td><strong>Construction Phase</strong></td>
<td><strong>Contractor/Developer</strong></td>
<td>Place silt fences and other physical barriers (e.g. berms) around areas that are to be excavated to limit movement of sediment. Contain used-water in an area to allow settling of sediments before it is released to surrounding mangrove area. Re-vegetate exposed soil, especially if to be exposed for a long period of time. Cover or stabilize material stockpiles.</td>
</tr>
<tr>
<td><strong>Operational Phase</strong></td>
<td><strong>Developer</strong></td>
<td>Ensure regular inspection and maintenance of drainage system. Re-vegetate exposed soil, especially if to be exposed for a long period of time.</td>
</tr>
<tr>
<td>Noise</td>
<td><strong>Construction Phase Contractor/Developer</strong></td>
<td>Contractor should limit working hours to daylight hours. Notify nearby businesses and residences of the project and expected time frame of completion so that they may plan for it. Vehicles and equipment should be serviced and maintained so that are in good working condition.</td>
</tr>
<tr>
<td>Traffic</td>
<td><strong>Design Phase Contractor/Developer</strong></td>
<td>Incorporate a right hand turning lane to the proposed site so that inbound traffic from Koror is not is not restricted.</td>
</tr>
<tr>
<td><strong>Construction Phase</strong></td>
<td><strong>Contractor/Developer</strong></td>
<td>Contractor should avoid moving construction vehicles and equipment to and from project site at peak traffic hours in the morning and evening during the work week. Implement separate vehicle entrance and exit at project site. During periods of increased movement of equipment and vehicles, place a flag person at the entrance and exit to direct traffic.</td>
</tr>
<tr>
<td><strong>Operational Phase</strong></td>
<td><strong>Developer</strong></td>
<td>Management should develop a traffic management plan to be implemented</td>
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### Proposed Multipurpose Business Building in Ngetkib, Airai

**June 2018**

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<th>Actor</th>
<th>Requirements</th>
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<td>Dirt</td>
<td>Construction Phase</td>
<td>Contractor/Developer</td>
<td>Contractor should implement wash pits for vehicles exiting the site to remove any dirt or debris on the tires and under carriage of the vehicles.</td>
</tr>
<tr>
<td>Community Safety</td>
<td>Construction Phase</td>
<td>Contractor/Developer</td>
<td>Contractor should avoid moving construction vehicles and equipment to and from project site at peak traffic hours in the morning and evening during the work week. Implement separate vehicle entrance and exit at project site. During periods of increased movement of equipment and vehicles, place a flag person at the entrance and exit to direct traffic. Contractor should implement 24-hour security at all access points on job-site to limit access to only authorized personnel and vehicles.</td>
</tr>
<tr>
<td>Workers Safety</td>
<td>Construction Phase</td>
<td>Contractor/Developer</td>
<td>Contractor has a safety plan in place for the job site. A safety officer is appointed for the project and is charged with making sure all safety protocols are followed at the worksite. Contractor ensures that all employees have proper gear (helmet, safety boots, eye protection, safety vests and other necessary protective equipment.</td>
</tr>
<tr>
<td>Operation Phase</td>
<td>Developer</td>
<td></td>
<td>Management should develop a traffic management plan to be implemented during peak visiting hours. Management should ensure security is in place outside of business hours to limit access to only authorized personnel and vehicles.</td>
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It is anticipated that this project will result in no significant adverse impacts on the environment including, critical species and habitats, public infrastructure and society (culture, economy and politics).

Anticipated positive impacts for the proposed development include reduced traffic congestion in Koror and the development provides an incentive for migration of households from Koror to Airai and surrounding states.
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3. INTRODUCTION

3.1 Project Background

The project proponent is Mr. Benjamin Yobech. Mr. Yobech has secured a commercial lease from Airai State and intends to build a multipurpose building. His contact details are described below:

Benjamin Yobech
PO Box 229
Koror, Palau 96940

Tel: (680)587-2603

In March or 2018, Mr. Yobech received approval for extension of EQPB permit PEA-247-15. This permit is to fill the current project site in preparation for the erection of a multipurpose business building. The building will be designed and constructed, and managed by Surangel and Sons Co. This multipurpose building will serve as a retail outlet.

The fill phase for the project site will be completed soon, therefore this Environmental Assessment (EA) seeks to build upon the previous EA (for land reclamation) in preparation for the construction of the multipurpose building. Commencement of construction is expected soon after all required permits, including EQPB permits, have been secured.

This Environmental Assessment was prepared by KJP consulting. The lead preparer is an associate with KJP consulting and has over 20 years’ experience in the environment field in Palau, working with National, State and Non-governmental agencies (NGO). The Statement of Accountability is attached as Appendix 1 of this document.

3.2 EA Consultations and Documentation

On May 7, 2018, representatives from the KJP consulting and Surangel and Sons Co. held a scoping meeting with EQPB. In attendance from EQPB were Ms. Soledad R. Lazaro and the Executive Director of EQPB, Ms. Roxanne Blesam.

From the discussions, the proposed design of the waste water treatment facilities was of primary concern. Specifically, the construction of a septic tank and leeching field under the parking lot. The developer/contractor agreed to redesign the sewer system to address the issue. Other items that were discussed and are addressed in this EA include:

- Computation of wastewater volume to determine appropriate size of septic sewer system
- Finalized construction plans and designs
- Project schedule
- Project cost breakdown
- Temporary and permanent mitigation measures for flooding of the main road
- Usage capacity of proposed water catchment system
- Storm-water management

Also from the discussions, it was indicated that since the project site was within a designated commercial development area, community interviews would not be required. It was also specified, that a water quality test would not be necessary due to the nature of the site.
3.3 Assessment of Methodology Used for the Project

A combination of literature reviews, consultations and site assessments/inspections were used to develop this Environmental Assessment. Building plans were reviewed and the developer and proponent were heavily consulted to fully understand details of the project, and to identify any environmental concerns in relation to the project. Qualitative site assessments were carried out and used in conjunction with the EA developed previously (EQPB permit No PEA-247-15) for the fill portion of the project. A combination of archived satellite imagery and recent aerial imagery, from aerial drones, were also used for site assessment and delineation of project site. A bird survey was conducted using approved EQPB protocols by Mr. Bonicacio Eberdong. Survey data can be found in appendix 2.

4. PROJECT OVERVIEW AND DESCRIPTION

4.1 Goals and Objective

EQPB permit No PEA-247-15 allows for land reclamation of the project site. The goal of this EA is to construct a multipurpose building. The proponent and developer intend to build a shopping complex in Airai, which would ease the need for consumers to drive to different retailers for their various needs and would help alleviate traffic congestion in central Koror.

This Environmental Assessment (EA) document has been prepared pursuant to PNC Title 24, the Environmental Quality Protection Act, and the rules and regulations promulgated thereunder, to insure that appropriate consideration of environmental consequences is provided in decision making and processing of permit applications. This document includes the following deliverables:

a) General Description of Planned Development

b) Alternatives

c) General Description of the biological and physical features of the site

d) Anticipated impacts on the site

g) Proposed mitigation measures
4.2 Location of Project

The proposed site is located in Ngetkib Hamlet in Airai State as indicated by the yellow polygon in Figure 1. The project site is located in low lying mangrove area and is centered on the following coordinate 7° 21’ 47.724” N, 134° 30’ 37.238” E.

![Project Vicinity Map - Yellow polygon indicates general location of project site. Image source: WorldView 2 2016, PALARIS](image)

4.3 Total Area to be Disturbed by the Project

The total area of impact is approximately 21,859 m². The project site is within a mangrove area that is in the process of being filled and is adjacent to a major road connecting Koror to Airai. Figure 2 displays a close-up view of the project site before it was filled. Figure 3 shows a recent aerial image (May 11. 2018) of the project site, which shows the reclamation of the project site is close to completion.
Figure 2: Close-up view of project site before fill project. Yellow polygon indicates estimated extent of project site. Source Image: Worldview 2 2016 (PALARIS)

Figure 3: Recent close-up view of project site. Aerial image taken on May 11, 2018. Yellow polygon indicates estimated extent of project site
4.4 Volume and Type of Fill Materials

Upon completion of fill, minor excavation and filling of the site will be needed for construction of the building foundation/footings, sewer system, storm water drainage system, parking area, and access roads. Fill material will be limited to small diameter gravel/rock and soil materials.

4.5 Source of Fill Materials to be used for the Project

The fill material will be sourced from the developer's/contractor’s existing quarry sites. No fill material containing contaminants (i.e. trash, petroleum products, etc.) will be allowed on the site.

4.6 Soil Disposal Site and Method to Dispose Soil/Waste Material

All waste material generated onsite during construction will be taken to the Koror State Sanitary Landfill or other state or nationally-designated, EQPB-permitted waste disposal sites.

4.7 Proposed Development

Figure 4 displays the general layout of the proposed building overlaid on the project site. Along with the multipurpose building, a parking lot and access roads will be constructed. These are briefly described below. Aspects of the buildings water system, wastewater system, electrical system and storm water management system will also be discussed. Detailed construction plans are available in appendix 3.

This proposed development will be designed, constructed and operated by Surangel and Son Co.

Figure 4: General layout of proposed multipurpose building, parking facilities and access roads
**Multipurpose building**

The multipurpose building will be a two-storey structure and will cover approximately 93,600 square feet (360 feet x 260 feet). The structure will be a pre-fabricated steel structure constructed on a concrete foundation. Figure 5 displays a proposed design for the front of the building.

*Figure 5: Front view of proposed multipurpose building*

The main entrance will face the northeast and is parallel to the main road. The front section of the building will house retail space, with a large warehouse located at the rear of the building. The second floor will accommodate office space and is served by stairs and an elevator. A portion of the second floor is designated as open space, and will be used accordingly by management. Figure 6 shows a general layout of the proposed building.

*Figure 6: General layout of proposed building*
Parking Area and Access Road

The parking area will accommodate approximately 320 regular sized automobiles (Figure 7). The parking area will be concrete with the exceptions of the parking stalls to the northeast. Grass blocks will be used in the area to help improve drainage of storm water run-off.

The access roads have been designed to maximize traffic flow within and around the parking area and building (Figure 7). As with the parking area, the roads will be concrete.

The southeast boundary of the projects will use Riprap revetment to control erosion and stabilize the soil. The boundary to the southwest, north, and northeast will employ a U-ditch design, which will not only stabilize the soil but will serve as drainage for surface water run-off.

Figure 7: Parking lot and access road layout
Utilities / Infrastructure

Water System

The multipurpose building will be connected to Airai-Koror water system, which is managed by the Palau Public Utilities Corporation (PPUC). In addition, the project developer will be adding several water catchment tanks with a total capacity 145,416 gallons, which will be used during water shortages. Based on daily employee and customer usage estimates, these tanks should be able to fulfill water usage requirements of the facilities for approximately 2 months. These water tanks will primarily rely on rainwater from catchments on the roof for replenishment. Based on calculations, all 6 water tanks (145,416 gallons) can be refilled in one hour during heavy rainfall. Calculations for water usage can be found in appendix 4.

Electricity

The proposed building will be connected to PPUC’s island-wide power grid, which will be the primary source for electricity. In the case of power outages, the developer plans to install emergency backup generators.

The developer also has plans to implement a renewable energy initiative. The roof has been structurally designed to allow for the installation of solar panels and other necessary equipment to harness solar energy and incorporate it in the building’s electrical grid. Implementation of this initiative will occur at a later date, after the completion of this project.

Sewer system

As this development is located in Airai, the developer and proponent will have to rely on a septic system to manage waste water. Septic systems are usually used in areas where a central sewer system is not available.

A typical septic systems includes a septic tank and a drain field or leeching field. The septic tank is buried underground and usually made of concrete fiberglass or polyethylene (plastic). As waste water enters the septic tank, it digests organic matter and separates floatable materials (oils and grease) and solid waste from the waste water. The effluent is then discharged from the tank into the drain field where it percolates through the soil ultimately discharging via ground water. As the effluent percolates through the soil, coliform bacteria and other harmful materials are naturally removed. The remaining sludge and scum remain in the septic tank and must be removed regularly for the system to operate effectively and efficiently.

Septic systems are not normally designed to be placed under concrete or asphalt surfaces with vehicular traffic as there are concerns that the excessive weight will cause soil compaction, which in turn would damage system components as well as the effluent percolation process.

After numerous consultations with the contractor, their engineers redesigned the system so that system components (septic tank, distribution box, leeching field and pipes) would not be affected if compaction of soil did occur.

Appendix 5 provides detailed drawings of the sewer system. The plans include details on the reinforced septic tank and calculations used in the design. A layout view of the leaching field is
provided along with detailed cross-sectional plans describing the various layers of materials as well as depth and location of the distribution pipes.

**Storm water Drainage**

Several measures have been incorporated to limit the impact of storm water flooding. As part of the building design, a roof gutter system will direct water flow from the roof to water tanks, which will provide water to building. When water tanks are full, the excess water will be channeled to the U-ditch

To prevent flooding, the parking area will be sloped so that water will be able flow into a U-ditches around the project area. Catch basins will be installed along the drainage ditch to allow settling of sediment and debris. At the northeastern side, parking stalls will be surfaced with grass blocks filled with small gravel/rocks. This will allow water flow to reach the soil and permeate through. Figure 8 displays an example of U-ditch design. Run-off calculations and U-ditch design and layout on the project site can be found in appendix 6.

With this project and a recently completed project across the road (Tru Value Hardware), concerns have been raised about flooding of the main road due to the higher elevations of the project sites. One solution is to increase flow by adding an additional pipe next to the current 6-inch pipe that was installed during the construction of Tru Value Hardware. Another idea is to install a larger diameter pipe across road near the southwest corner of the property and have it flow through the drainage ditch on southwestern boundary of the project site. The developer will be assessing these concepts and others, and will implement the most effective solution.

![Figure 8: Example of U-ditch design](image)

**4.8 Description of Project Phases**

**4.8.1 Pre-Construction Phase**

The pre-construction phase has been completed under EQPB permit PEA-247-15. Activities included identification of a contractor, delimitation of lot boundaries (survey of lot), develop and implement required soil erosion measures, and securing source of fill material.

**4.8.2 Construction Phase 1 (Land Reclamation)**

This phase will soon be completed under EQPB permit PEA-247-15. All requirements under the permit have been implemented.
4.8.3 Construction Phase 2 (Building Construction)

The developer has acquired all the necessary materials, equipment and manpower to initiate construction. The construction will commence immediately after fill for the site has been completed and the proponent has attained all required state and national permits/licenses.

Once all the necessary erosion measures (appendix 7 displays sedimentation control plan) are in place, construction will commence by staking out and leveling the project site. The building footings will be laid and the structure will be erected. At this stage, all necessary plumbing and electrical conduits will be installed. The septic system and water system will also be constructed and connected.

Upon completion of the building and auxiliary structures, the surrounding area will be paved with concrete to accommodate parking spaces and access roads. Final stages of construction will involve finishing work such painting, installation of electrical and plumbing fixtures, and etc.

During all stages of construction, the developer will carry out inspections to make sure proper construction procedures are followed to ensure quality and safety of the structures. The developer will also have regular inspections to certify that safety measures are implemented at the job site to ensure safety of construction personnel.

All material waste generated at the project site will be recycled if possible. If not, they will disposed of in accordance with state and national regulations.

4.8.4 Operational Phase

Upon completion of construction, the building will be a retail facility that will be managed and operated by Surangel and Sons Co.

Segregation of waste and recycling will be encouraged. Waste material that cannot be recycled will be disposed of accordingly to state and national regulations.

4.8.5 Abandonment Phase

No abandonment phase is planned

4.9 Project Schedule/Duration of Activity

Construction is expected to take between 6 and 8 month to complete. Ideally, the proponent and developer would like to see completion of the project by early December 2018. The construction schedule can be found in appendix 8.

4.10 Project Cost

The total project cost is estimated at $4,982,060.05.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Requirements</td>
<td>$6,763.00</td>
</tr>
<tr>
<td>Footing and Columns</td>
<td>$1,067,625.00</td>
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</table>
Table 2: Cost breakdown of proposed project

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Roof, Walls, 2nd flood slab</td>
<td>$2,549,003.50</td>
</tr>
<tr>
<td>Finishing (paint, tiles, plumbing)</td>
<td>$383,376.75</td>
</tr>
<tr>
<td>Water and Sewer systems</td>
<td>$288,291.80</td>
</tr>
<tr>
<td>Electrical</td>
<td>$357,000</td>
</tr>
<tr>
<td>Parking Area</td>
<td>$330,000</td>
</tr>
</tbody>
</table>

5. ALTERNATIVES

5.1 The “No Action” Alternative

The “No Action” alternative would result in the site remaining as is, a filled mangrove area. The site would be an environmental “eye sore” and would negate any future direct and indirect revenues to the state and national government via this project.

With the construction of the shopping complex, traffic congestion will most likely be reduced during evening peak hours in Koror. As it stands, current traffic congestion in Koror during late peak hours is mainly due to the bottleneck at the Surangel and WCTC (Ben Franklin) junction, especially during payday weeks. This new shopping location would provide people with an alternative shopping location in Airai, which should significantly reduce congestion.

Completion of the proposed project could also encourage migration of households from Koror to Airai and nearby states, as this project would place a major shopping facility in Airai. Developments, such as stores, schools, and other businesses that provide necessary services are huge incentives if communities are looking to attract new households as they usually offer a less populated environment yet still have the convenience of major stores, gas stations, schools and etc. nearby.

Projects like this, should be encouraged outside of Koror, as they would promote settlement in other states.

5.2 Alternative Sites

The proponent and developer have no alternative sites. They would be forced to look elsewhere for a site that can be accessed conveniently by the general public and large enough to accommodate the proposed project. Based on size requirements and availability of state leases, an alternative site would most likely entail some form of land reclamation.

5.3 Alternative (Others)

Waste Water Treatment

Concerns were raised by EQPB about the initial designs for septic system, specifically about the susceptibility of the leaching field to soil compacting, due to the weight of the concrete surface as well as the weight of vehicles continuously moving over the leaching field. After consultations and reviews of septic systems, the developer and KJP consulting were able to redesign the system. The resulting system is described in appendix 5.
Parking Lot (Grass Blocks)

Initial design plans called for the use drainage ditches at the southwestern boundary of the property, as the only method to handle storm water run-off. After consultations between KJP consulting and the developer/contractor, it was agreed that grass blocks would be used on parking spaces on the northeastern boundary of the project lot. These would allow for additional drainage capacity of storm water run-off.

6. DESCRIPTION OF ENVIRONMENTAL SETTING

Much of the information derived for this section is based on a previous EA that was prepared for the reclamation of the project site, which was approved under EQPB permit PEA-247-15. The reason for this, is that site has already been filled and much of the original mangrove environment is gone. Recent site observation were carried out over the project site, and this was used in combination with information provided from the previous EA to develop this section of the document.

6.1 Physical Environment

6.1.1 Project Vicinity

The site is about 400 meters east of the Palau Japan Friendship Bridge and extends from the main road southeast towards the mangrove (see Figure 2 and 3). Adjacent to the site is the recently constructed Tru Value Hardware store. Bordering the project site to the northeast is the Tmetuchel fill site (KB Shell gas station). To the southwest, is privately owned land known as Ngerbesechel or Mengungau.

Connection to public utilities (electricity and water) should be fairly straightforward as power lines and underground water distribution pipes run parallel to the main road, which borders the project site.

6.1.2 Physical Structures

The project area has a single structure on site that will be demolished to allow for filling of site under EQPB permit PEA-247-15.

6.1.3 Previous Impacts

The project site is a recently reclaimed mangrove area. Based on estimates, approximately 50,000 cubic yards of fill material will have been used for land reclamation under PEA-247-215.

6.1.4 Geology and Soils

According to the 2009 Soil Survey of Palau by the United State Department of Agriculture (USDA), 3 major soil types were identified in the project site prior to the reclamation of the site. Figure 9 displays the location of the 3 soil types superimposed on the project site.
Each of the three soil types are described as defined in the 2009 Soil Survey of Palau.

602- Aimeliik silt loam, 12 to 30 percent slopes

“The Aimeliik component makes up 85 percent of the map unit. Slopes are 12 to 30 percent. This component is on islands, hills. The parent material consists of saprolite derived from basalt, andesite, dacite, volcanic breccia, tuff, or bedded tuff. Depth to a root restrictive layer, abrupt textural change, is 4 to 12 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 65 percent. This soil does not meet hydric criteria.”

617- Ilachetomel-Naniak Complex, 0-1 slopes

“The Ilachetomel component makes up 75 percent of the map unit. Slopes are 0 to 1 percent. This component is on mangrove swamps, islands. The parent material consists of organic deposits derived predominantly from decomposing mangrove roots and litter. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very high. Shrink-swell
potential is low. This soil is very frequently flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 89 percent. This soil meets hydric criteria. The soil has a strongly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component: Naniak (20%)

The Naniak component makes up 20 percent of the map unit. Slopes are 0 to 1 percent. This component is onshores, salt marshes, islands, mangrove swamps, and tidal marshes. The parent material consists of organic deposits and alluvium derived from basalt, andesite, dacite, marine deposits, volcanic breccias, tuff, or bedded tuff. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is very frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, and December. Organic matter content in the surface horizon is about 20 percent. This soil meets hydric criteria. The soil has a moderately saline horizon within 30 inches of the soil surface. The soil has a moderately sodic horizon within 30 inches of the soil surface.

654- Orthents-Urban land complex, 0 to 50 percent slopes

“Component: Typic Udorthents (45%)

The Typic Udorthents component makes up 45 percent of the map unit. Slopes are 0 to 50 percent. This component is on ridges on hills, islands, leveled land, and scalped areas. The parent material consists of human transported material derived from either saprolitic volcanic rocks or limestone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 10 percent. This soil does not meet hydric criteria.

Component: Urban land (40%)

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous "

With the recent fill, the project site is now mainly composed of the “654- Orthents-Urban land complex, 0 to 50 percent slopes”, soil type

6.1.5 Freshwater Resources

No surface water resources can be found at the project site or within the vicinity.
6.1.6 Marine Resources/Hydrography

Though the site is within a mangrove area, seawater inundation rarely occurs. Based on documentation, inundation only occurs at the seaward edge of the property during extreme high tides.

6.1.7 Topography/Elevation

Upon completion of the fill phase the site will be level with an elevation of approximately 6.6 feet above Mean Sea Level (MSL).

6.1.8 Air Quality

Air quality is good with some impact from traffic. The site is parallel to the main road which serves as the only access road for people from Babeldaoob going to and from Koror and vice versa.

6.2 Biological Environment

6.2.1 Terrestrial/Marine Flora

Two species of mangrove plants were found in and around the project site. *Rhizophora mucronata* commonly known as “Red Mangrove” was found in abundance throughout the site. In figure 10, an example of *R. mucronata* is shown. *Rhizophora apiculata* was not as abundant, and was found interspersed within the area Figure 11 shows an example of *R. apiculata*.

Figure 10: Examples of *Rhizophora mucronata*
6.2.2 Terrestrial/Marine Fauna

**Birds**

In the previous EA (filling of site) 20 birds were observed in the project area. The total included observations of the following species:

<table>
<thead>
<tr>
<th>Species</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micronesian Fruit Dove</td>
<td>2</td>
</tr>
<tr>
<td>Kingfisher</td>
<td>3</td>
</tr>
<tr>
<td>Starlings</td>
<td>3</td>
</tr>
<tr>
<td>Chestnut Munia/Kanaria</td>
<td>6</td>
</tr>
<tr>
<td>Honeyeaters/Chesisebangiau</td>
<td>2</td>
</tr>
<tr>
<td>Kuid</td>
<td>2</td>
</tr>
<tr>
<td>Chicken</td>
<td>2</td>
</tr>
</tbody>
</table>

*Table 3: Total bird count from EA for EQPB permit PEA-247-15*

Another bird survey was conducted recently (5/14/18) at the project site, using the EQPB Protocol for Bird Diversity Surveys. This survey was conducted in an undisturbed area, adjacent of the project site. A total of 16 bird species were identified, this total includes 6 migrant species. Species observed during the 15 minute observation period include:

- Palau Fruit Dove
- Micronesian Starling
- Palau Swiftlet
- Dusky White-eye
- Palau Fantail
- Palau Flycatcher
- Micronesian Honeyeater
Cicadabird
• Collared Kingfisher
• Morning Bird

Migrant species observed include the following:

• Whimbrell
• Tattler
• Stint
• Pacific Golden Plover
• Crab Plover
• Little Egret

The surveyor noted that these migrant species were observed along edges of the project site, where there was an accumulation of water. Data from this recent bird survey can be found in appendix 2.

Invertebrates

The previous EA reported that there were no evidence of mangrove crabs at the project site. The author explained that crabs prefer areas that remain wet after the tide recedes. Given that the project area remains dry except for extreme high tides, mangrove crab burrow are not expected in the general area.

Insects

Mosquitos were prevalent during site visits, especially towards the evening. Spiders and butterflies were documented in the previous EA.

Mammals

A couple of stray dogs were on seen on site during one of the site visits. Other than that, no other mammals were seen. The previous EA did report signs of pig tracks in the mud.

Reptiles

As with the previous EA, no signs or indications of crocodiles, snakes or any other reptiles were seen at the project site.

6.2.3 Endangered, Threatened and/or Rare Species

No endangered, threatened or rare species were observed at the project sites.

6.3 Socio-cultural, Economic and Political Environment

6.3.1 Socioeconomic Environment

In its present condition the site has little socio-economic value.
6.3.2 Land Ownership and Use

The proposed multipurpose building site is considered Airai State public land. The Airai State Public Lands Authority has approved the use of this site by the proponent.

6.3.3 Cultural and Traditional Features

The proponent and the developer are in the process of obtaining clearance from the Historic Preservation Office. The proponent received historical clearance for the filling of site, therefore it is anticipated that there will be no issues for this phase of the project.

6.3.4 Traffic

Traffic in this area can be moderate to heavy depending on the day and time. This road is the only thoroughfare for people in Babeldaob to access Koror and for people in Koror to access Babeldaob.

6.3.5 Noise

Increased noise levels at the site are mainly due to vehicles and equipment involved in the ongoing reclamation project as well as the through traffic on the main road.

7. ASSEMENT OF IMPACTS AND MITIGATION MEASURES

In this section, potential impacts to physical, biological and social environments are assessed for different stages of construction and operational phase. Mitigation measures are proposed for the assessed impacts.

It is anticipated that this project will result in no significant impacts on the environment including, critical species and habitats, public infrastructure and society (culture, economy and politics).

7.1 Physical Environment

7.1.1 Climate Change Impacts

Potential climate change impacts to Palau likely include, increased sea level, increased frequency of intense rainfall events, increased typhoon intensity and increased drought intensity. Design and planning of project structures and associated infrastructure should take into consideration the associated impacts of climate change and implement the following measures:

Design Phase

- Elevation of structure and associated facilities (parking area and access road) are at level where extreme tide conditions do not affect the facilities function. Consideration should also be made for projected sea level rise so that there are no impacts during useful life of the project structure and facilities.
• Designs for structure and associated facilities should be able to withstand extreme weather events, such as typhoons and floods due to extreme rain events.

• Designs for facilities should include self-contained water system that can be used in times of drought.

• Designs to include connection of an emergency power back-up generator.

• Designs to should consider inclusion of renewable energy initiatives such a solar or wind power generation.

7.1.2 Air Quality

During the construction phase, the contractor will have numerous vehicles and equipment on site, which will be emitting a gases composed of Nitrogen (N2), Water Vapor (H2O), Carbon Dioxide (CO2), Carbon Monoxide (CO), unburnt hydrocarbons, and nitrous oxides. Though CO2 is a greenhouse gas, the amount to be emitted at the project site should not be substantial enough to warrant significant mitigation measures. The levels of the other emissions (CO, hydrocarbons and nitrous oxides) will be very low and will not have substantial impacts on air quality at the site. In any case, the following measures should be implemented:

**Construction Phase**

• Contractor should service all vehicles and equipment on a regular basis to ensure emissions are reduced to a minimum.

**Operational Phase**

• Management should regularly serve all company vehicles and equipment to ensure efficiency and reduction of emissions.

7.1.3 Water Quality/Sedimentation

As the project site is located on a fill site in a mangrove zone, the probability of sediment run-off into the surrounding mangrove area is high. As mentioned earlier in the document, sea water inundation tends to occur only at extreme high tides, therefore the use of water quality measurements as a basis to measure mitigation efforts, will not work at this site. To reduce the impacts at the different stages of construction, the following mitigation measures can be applied:

**Design Phase**

• Project designs should incorporate adequate drainage systems with catch basins to allow settling before release of water into surrounding area.

**Construction Phase**

• Place silt fences and other physical barriers (e.g. berms) around areas that are to be excavated to limit movement of sediment.
• Contain used-water in an area to allow settling of sediments before it is released to surrounding mangrove area.

• Re-vegetate exposed soil, especially if to be exposed for a long period of time.

• Cover or stabilize material stockpiles.

Operational Phase

• Ensure regular inspection and maintenance of drainage system.

• Re-vegetate exposed soil, especially if to be exposed for a long period of time.

7.1.4 Solid Waste

At all stages of the construction and operational phase, solid waste will be produced. A recycling program to reduce and re-use materials should be implemented. Any waste materials that cannot be recycled should be disposed according to state and national regulation. The following mitigation measures can be applied to reduce impacts of solid waste:

Construction Phase

• Waste management policy by contractor for recycling and disposal of solid waste materials is developed.

• Recycle containers are placed onsite and clearly marked for waste separation and eventual reuse.

• Disposal containers will be placed onsite and are disposed at National Landfill on regular basis

Operational Phase

• Waste management policy by management for recycling and disposal of solid waste materials is developed. All employees should understand policy.

• Recycle containers are placed at convenient locations and are clearly indicated for ease of waste separation and eventual reuse.

• Trash bins are placed on-site at key location and are regularly disposed of at a central collection area for regular disposal at the National landfill.

• If deemed reasonable, organic waste material should be recycled as food for animals and livestock or to be used as compost.
7.1.5 Sewage

The septic system design for the proposed project calls for placement of the septic tank, distribution box and leeching fields under a paved concrete parking structure. This due to a lack of space on the project site. The system has been designed to allow for concrete structures over the various system component but it still should be monitored regularly due to the proximity of the site to the marine environment. With the current design, the probability of contamination into the marine environment and surrounding areas is fairly low.

It should be noted that the developer (Surangel and Sons Co.) also operates and manages the largest construction company in Palau with years of experience constructing and repairing various infrastructure including septic systems, therefore any structural or operational issues related to the normal function of the sewer system, can be quickly attended to.

Regardless, the following mitigation measures should be adopted.

Design Phase

- Contractor ensure designs include easily accessible compartments for inspection and servicing of system.

Operational Phase

- Ensure regular monitoring and inspection of sewer system and surrounding environment.
- Ensure regular maintenance of septic system (Removal of sludge and scum).

7.1.6 Hazardous Materials

Hazardous materials on the project site during construction would mainly be fuel (gasoline and diesel) and oils. Accidental spills would greatly impact the surrounding soils and adjacent mangrove environment. To mitigate any impacts by hazardous materials, the following should be implemented:

Construction Phase

- If stored on-site, hazardous materials should be stored in a manner that would limit contamination of surrounding area due to accidental spills or leakage.
- Storage site should be secure and access should be limited to only authorized personnel.
- Ensure all storage containers are properly marked and are in good condition with no leaks. If containers show any visible signs of damage or leakage, they should be immediately replaced.
- Transport and disposal of oil and other hazardous materials should follow all national and state guidelines and/or best practices.
- Ensure availability of clean up materials at project site, in case of accidental spills at storage area.
• Ensure vehicles and equipment are inspected regularly for fuel or oil leaks. At the first indication of leakage, the equipment or vehicle should not be permitted to continue work on the job site until it has been repaired.

Operational Phase

• The developer does not plan to store any hazardous materials on-site during the operational phase but should store clean up materials in the case of spills from accidents (vehicular, equipment breakdown and etc.)

7.2 Biological Environment

7.2.1 Terrestrial Environment

The project site is currently devoid of all vegetation. Project design includes plans to plant vegetation in the parking area and any open soil areas around the multipurpose facility. This will help with the aesthetics of the facility and provide soil erosion control. To protect against the introduction of any invasive or species the following should be implemented:

Construction Phase

• Seek assistance from the Bureau of Agriculture on appropriate species to plant on project site.

• Have experienced persons/company plant vegetation to ensure proper conditions for growth.

Operational Phase

• Regularly maintain plants and surrounding area and remove any unknown/unwanted species and dispose of accordingly.

• When replanting, seek advice from the Bureau of Agriculture to ensure no invasive plants are introduced.

7.2.2 Marine Environment

The probability of erosion and sedimentation is greatest during the pre-construction phase due to clearing of vegetation and exposure of soil and less likely during the operational phase when exposed surfaces are usually covered by concrete, asphalt or vegetation. Mitigation recommendations for the marine environment include the following:

Design Phase

• Project designs should incorporate adequate drainage systems with catch basins to allow settling before release of water into surrounding area.
Construction Phase

- Place silt fences and other physical barriers (e.g. berms) around areas that are to be excavated to limit movement of sediment. Silt fence design found in appendix 8.
- Contain used-water in an area to allow settling of sediments before it is released to surrounding mangrove area.
- Re-vegetate exposed soil, especially if to be exposed for a long period of time.
- Cover or stabilize material stockpiles.

Operational Phase

- Ensure regular inspection and maintenance of drainage system.
- Re-vegetate exposed soil, especially if to be exposed for a long period of time.

7.3 Socio-cultural, Economic and Political Environment

7.3.1 Noise

Noise levels are expected to increase significantly during the construction phase, due to use of machinery and equipment. Increased noise levels will be expected at nearby businesses (Tru-Value, NDBP and KB Shell Gas Station). Fortunately, there are no residences in the immediate vicinity but depending on type of equipment and machinery used, noise levels may increase slightly at Ngetkib residences nearest to the project site. Commuters traveling to and from Koror, will also be impacted by the noise levels. To limit noise impacts the following mitigation measures are suggested:

Construction Phase

- Contractor should limit working hours to daylight hours.
- Notify nearby businesses and residences of the project and expected time frame of completion so that they may plan for it.
- Vehicles and equipment should be serviced and maintained so that are in good working condition.

7.3.2 Traffic Congestion

The road adjacent to the project is the only road that connects Airai and the rest of Babeldaob to Koror and vice versa. During the construction phase of the project, commuters will be impacted by movement of construction vehicles and equipment to and from the project site. In the operational phase, traffic in the area will significantly increase due consumers and shoppers visiting the store. Below are recommendation’s to reduce the impacts of traffic congestion:

Design Phase
• Incorporate a right hand turning lane to the proposed site so that inbound traffic from Koror is not restricted.

Construction Phase

• Contractor should avoid moving construction vehicles and equipment to and from project site at peak traffic hours in the morning and evening during the work week.

• Implement separate vehicle entrance and exit at project site.

• During periods of increased movement of equipment and vehicles, place a flag person at the entrance and exit to direct traffic.

Operational Phase

• Management should develop a traffic management plan to be implemented during peak visiting/shopping hours.

7.3.3 Dirt

The tracking of dirt and buildup of debris on the road is a major nuisance to commuters on the road. The public works department of both Airai state and the national government have limited capacity to regularly clean the roads, therefore the contractor should be responsible to clean the roads within the vicinity of the project site. To reduce on the road the following measures should be implemented:

Construction Phase

• Contractor should implement wash pits for vehicles exiting the site to remove any dirt or debris on the tires and under carriage of the vehicles.

7.3.4 Community Safety

Potential impacts to the community include increased traffic in the vicinity of the construction site due to transportation of construction materials and equipment which could potentially lead to more vehicular accidents or incidents. Another is, unauthorized access of the site (e.g. Kids accessing site to play with equipment, people accessing site to view project and etc.), which raises the issue of safety community members and liability to the contractor and building management. To limit these impacts the following measure are suggested:

Construction Phase

• Contractor should avoid moving construction vehicles and equipment to and from project site at peak traffic hours in the morning and evening during the work week.

• Implement separate vehicle entrance and exit at project site.

• During periods of increased movement of equipment and vehicles, place a flag person at the entrance and exit to direct traffic.
• Contractor should implement 24-hour security at all access points on job-site to limit access to only authorized personnel and vehicles.

Operational Phase

• Management should develop a traffic management plan to be implemented during peak visiting/shopping hours.

• Management should ensure security is in place outside of business hours to limit access to only authorized personnel and vehicles.

7.3.5 Worker Safety

With the inherent dangers of a construction site, worker safety is vital and requires continuous vigilance and adherence to all safety protocols. As part of the on-site safety procedures, the contractor should appoint a safety officer to train workers on safety protocols and to keep the worksite safe by conducting regular safety inspection. Proposed mitigation measures include the following:

Construction Phase

• Contractor has a safety plan in place for the job site.

• A safety officer is appointed for the project and is charged with making sure all safety protocols are followed at the worksite.

• Contractor ensures that all employees have proper gear (helmet, safety boots, eye protection, safety vests and other necessary protective equipment).

8. Environmental Management and Monitoring Plan

Erosion and sediment control infrastructure should be monitored frequently, especially during extreme weather conditions. When site conditions change the erosion and sediment controls should be modified accordingly. Though site location is in a mangrove area, inundation at the site only occurs at extreme high tides, therefore water quality testing might not be suitable as a basis for measuring erosion control effectiveness. Along with thorough observational inspections, other suitable test may have to be implemented with guidance from EQPB. If any indication arises, demonstrating decreased water quality, infrastructure will be modified to address point sources of pollution on site under guidance and approval of EQPB, the contractor and Airai State Government.
9. REFERENCES

Environmental Quality Protection Board, February 2013. “EQPB Regulations”.

Environmental Quality Protection Board, August, 2015. “Updated Earth Moving Regulations”.

Horsley Witten Group, Inc.


10. APPENDICIES

Appendix 1 - Statement of Accountability
Appendix 2 – Bird Survey Results
Appendix 3 – Construction Plans/Design
Appendix 4 – Water Consumption Calculations
Appendix 5 – Sewer System Design and Calculations
Appendix 6 – Surface Run-off Calculations and Drainage Design
Appendix 7 – Erosion/Sedimentation Control Plan
Appendix 8 – Construction Schedule