

Alternative Site Analysis for International Container Transshipment Terminal (ICTT)

Details of Alternative Sites

Following Four alternative sites were examined for the development of ICTT Project facilities for selection of the most suitable site based on the multicriteria analysis.

- *Alternative Site 1 – Galathea Bay*
- *Alternative Site 2 – Casuarina Bay*
- *Alternative Site 3 – Anderson Bay*
- *Alternative Site 4 – Pemayya Bay*

The location of the four alternate sites in the Great Nicobar Island is shown in following **Figure-1**

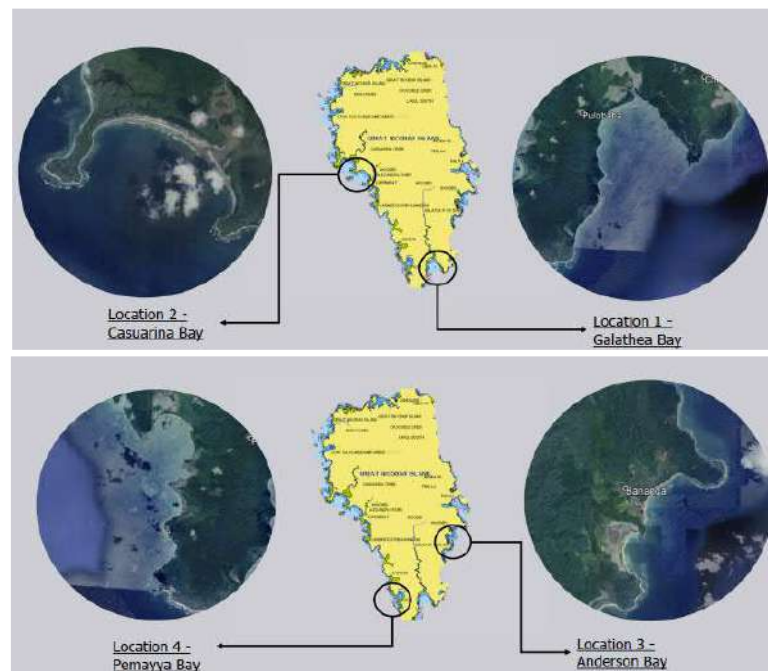


Figure :1 Alternative Site Locations (Galathea, Casuarina, Anderson & Pemayya Bay)

The harbour layouts at each of the above alternative sites have been developed considering the direction of waves, water depths to minimize dredging and also ensuring at the same time that the breakwater does not extend to deeper waters that would increase the cost of development.

Alternative Site 1 – Galathea Bay

This site is located near the southernmost tip of the Great Nicobar Island and is only – km away from the mainline shipping route. The sea bed contours are steep and the water depths of 20 m and 30 m are available within a distance of 2.3 km and 3.6 km from the shoreline respectively. The site offers the water area of about 517.60 hectares between shoreline and the 20 m contour which could be optimally utilised for the development of the harbour facilities. The site is away from any habitation.

The indicative layout of the container Transshipment port is presented in **Figure 2**.

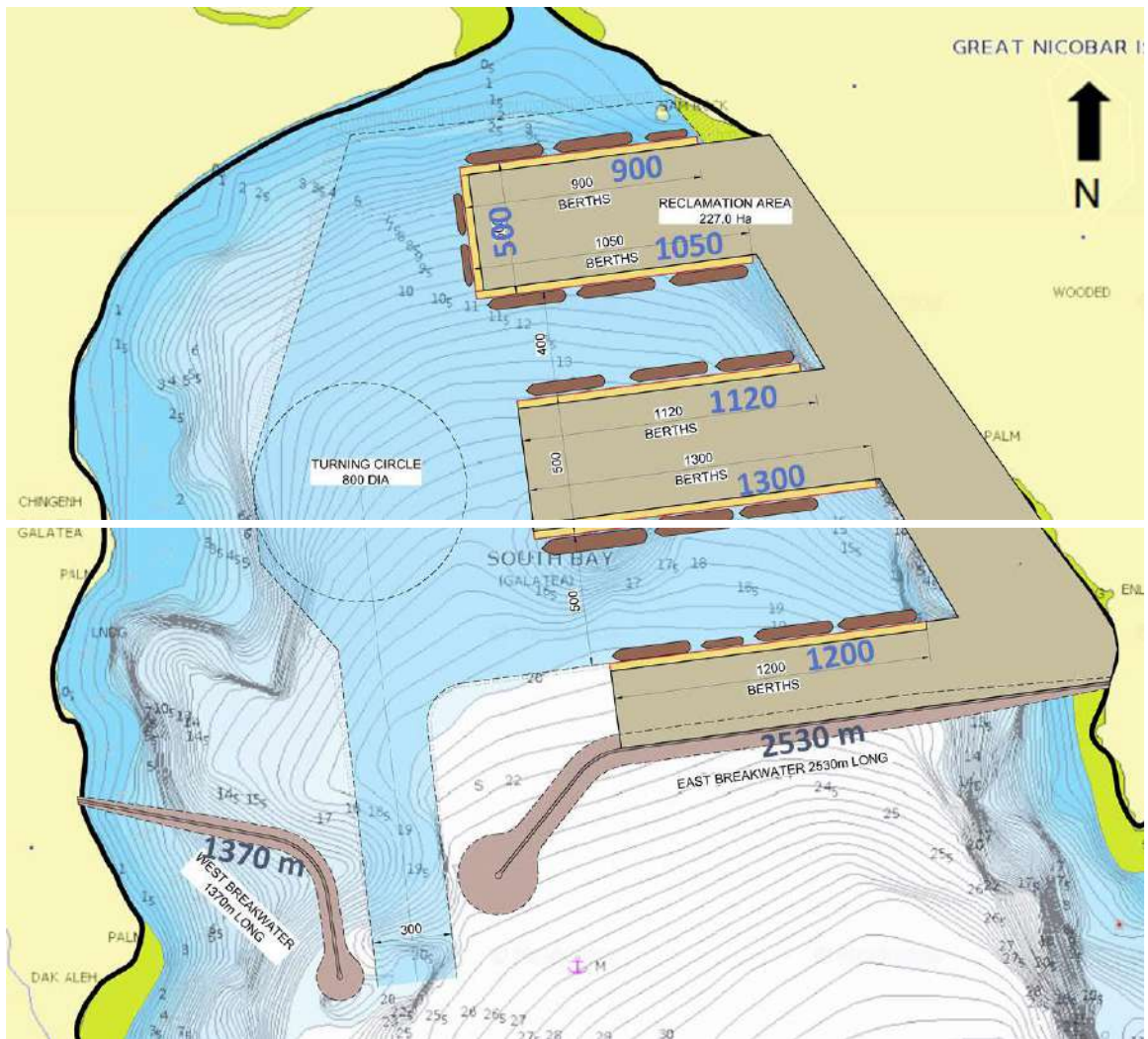


Figure 2: Galathea Bay Location – Proposed Layout (Site 1, Selected Site)

It could be observed that about 6.07 km of total berth length is possible to be developed on the western side of the bay. Two breakwaters of length 2.53 km and 1.37 km respectively provide round the year wave tranquillity. The port would be developed in phased manner and the berths would be added as per the traffic growth. However, the breakwaters would need to be fully constructed at the initial phase only.

Alternative Site 2 – Casuarina Bay

The site is away from any habitation. Further this area falls outside Phase 1 boundary and is away from the overall development plan of the Nicobar Island. Entire Area falls under ICRZ Zone 1A. The site can offer adequate Harbour area, but it would involve slightly higher dredging as compared to site 1 which eventually leads to higher risk of involving rock dredging.

The indicative layout of the container transshipment port is presented in **Figure 3**

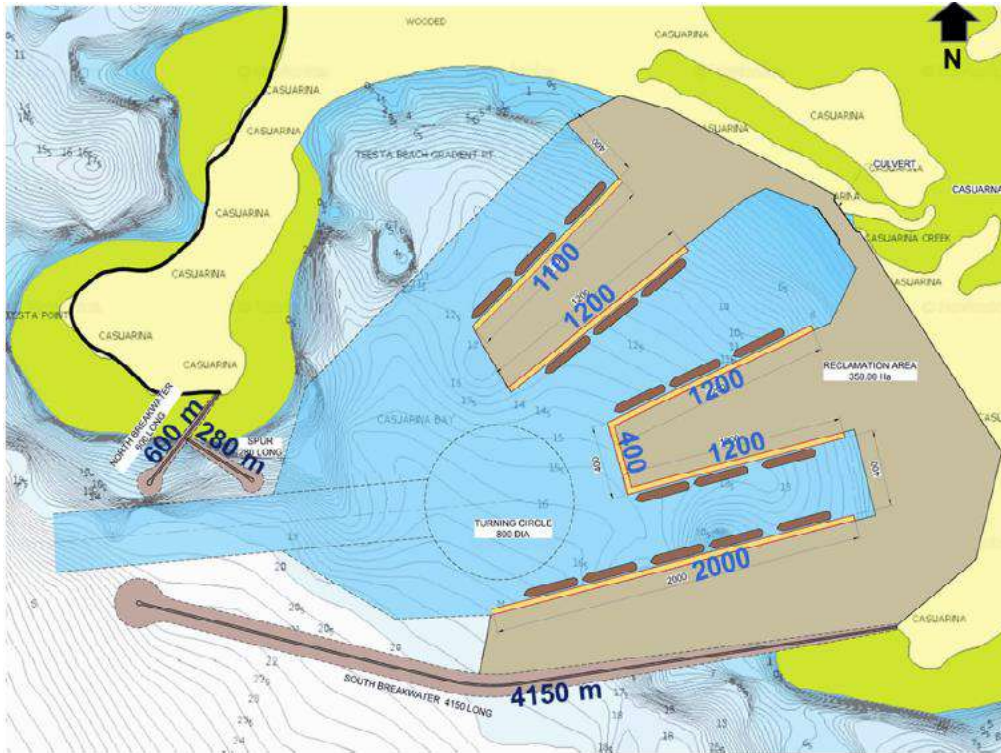


Figure 3: Casuarina Bay Location – Proposed Layout (Site 2)

Two breakwaters of length 4.150 km and 0.88 km respectively provide round the year wave tranquillity. The port would be developed in phased manner and the berths would be added as per the traffic growth.

Alternative Site 3 – Anderson Bay

The site is located in a creek just south of Campbell Bay. The area of the creek is very much limited and therefore lot of hill cutting would be needed to create the required harbour area. Further the entire site is relatively exposed to the sea and thus would require longer breakwaters. The site is close to the habitation near Campbell bay. Entire Area falls under ICRZ Zone 1A.

The indicative layout of the container transshipment port is presented in **Figure 4**.

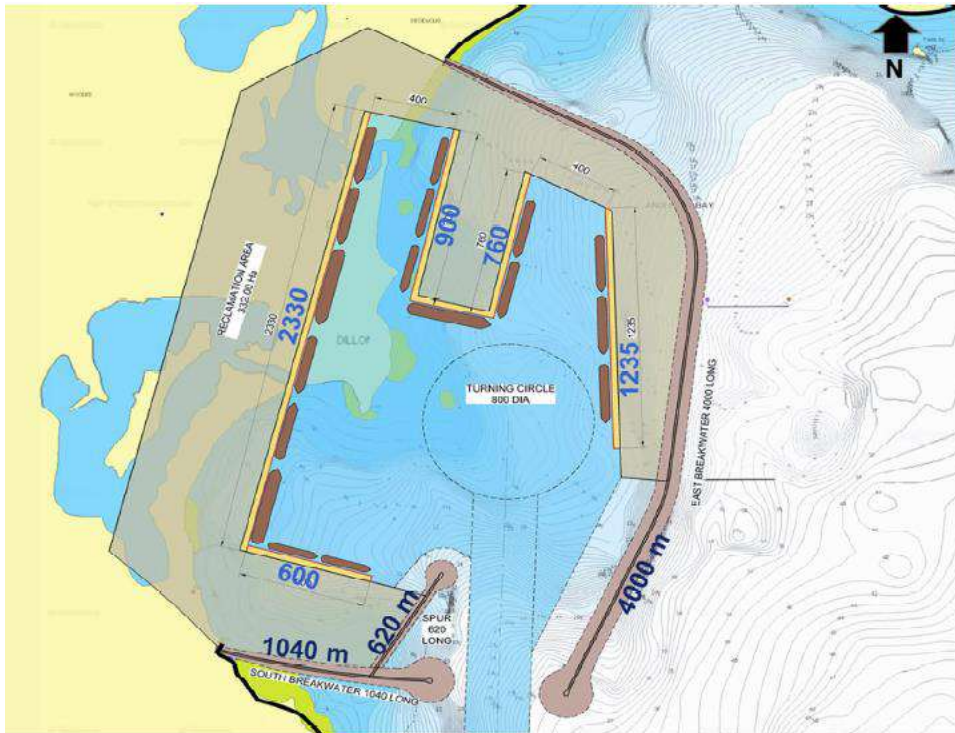


Figure-4: Layout of the Container Transshipment Port (Site 3)

Two breakwaters of length 4.00 km and 1.660 km respectively provide round the year wave tranquillity. The port would be developed in phased manner and the berths would be added as per the traffic growth.

Alternative Site 4 – Pemayya Bay

The area of the creek is very much limited and therefore lot of hill cutting would be needed to create the required harbour area. Further the entire site is relatively exposed to the sea and thus would require longer breakwaters.

The site is away from any habitation. Further this area may conflict with the proposed Naval facilities planned near the Indira Point. Only small part of the area falls under ICRZ Zone 1A.

The indicative layout of the container transshipment port is presented in **Figure 5**.

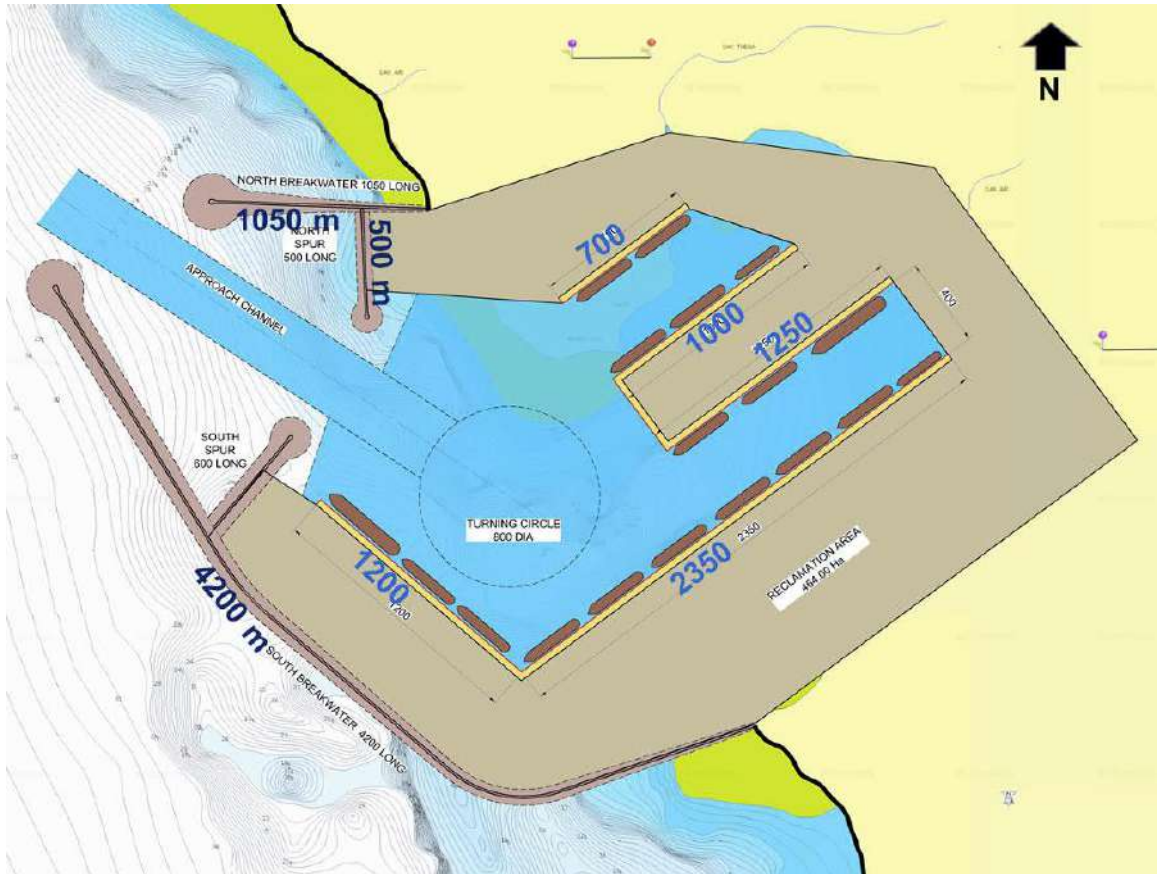


Figure 5: Pemayya Bay Location – Proposed Layout (Site 4)

Two breakwaters of length 4.20 km and 1.55 km respectively provide round the year wave tranquillity. The port would be developed in phased manner and the berths would be added as per the traffic growth.

Multicriteria Analysis of Alternative Sites

All the proposed alternative sites were evaluated using Multicriteria Analysis as presented in **Table 1**.

The comparison and site evaluation was carried out considering the various factors and the outcome of the evaluation is given in.

Table-1: Comparative Analysis for Alternate Sites

| Sr No. | Factor Description | Galathea Bay | Casuarina Bay | Anderson Bay | Pemayya Bay |
|--------|--|---|--|---|---|
| 1 | Proximity to shipping routes | Closest to the International Shipping line (only 40 km away) | Additional distance of 35 km from Site 1 | Additional distance of 25 km from Site 1 | Additional distance of 15 km from Site 1 |
| 2 | Cost Risks | Minimal | Risk of rock dredging higher as compared to site 1 | Significant as hills have to be cut for creating the harbour basin. Presence of rock would make dredging very expensive | Significant as hills have to be cut for creating the harbour basin. Presence of rock would make dredging very expensive |
| 3 | Land Development | Requires Reclamation of Land to develop Onshore Storage facilities. Minimal hill cutting is required | Reclamation Required is slightly more as compared to Galathea Bay. Minimal hill cutting is envisaged | Reclamation required is less than in Galathea bay. However significant hill cutting is involved | Reclamation required is slightly more than in Galathea Bay. Hill cutting required is maximum of all locations |
| 4 | Dredging Requirement | Sufficient water depth is available close to shore. Minimal dredging is required | Shallower water depths near to shore. Dredging volume required is slightly more than Galathea bay but less than Anderson and Pemayya bay | Shallower water depths near to shore. Significant volume of dredging required. Dredging required is max among all locations | Shallower water depths near to shore. Significant Dredging required. It is more than Galathea bay and Casuarina bay |
| 5 | Breakwaters | Small length of breakwaters required. | Length of breakwater is more than Galathea bay but less than Anderson bay and Pemayya bay | Length of breakwaters is significantly more than the length required for Galathea bay | Length of breakwaters required is max of all locations |
| 6 | Environmental Issues | Marine Sanctuary. Entire Area falls under ICRZ Zone 1A | Area falls under ICRZ Zone 1A. Area within biosphere reserve and Campbell National Park | Area falls under ICRZ Zone 1A | Very Small area as compared to other locations falls under ICRZ Zone 1A |
| 7 | Gel with Overall development plan | The location gels well with the overall development plan .However its proximity with the proposed air strip needs to be confirmed as the 100m high cranes falls within the runway funnel zone | Location falls outside Phase 1 boundary and is very far from proposed township at Campbell bay. | Rehabilitation issues. Site more suitable for township development | Development is restricted. It may overlap with the defence land |

Recommended Transshipment Port Layout

It could be observed from above that Transshipment Port site at Galathea appears to be the best in terms of minimal investment for Phase 1 development and on overall considerations for technical, environmental and financial parameters and thus selected for further detailed evaluation (Figure-6).

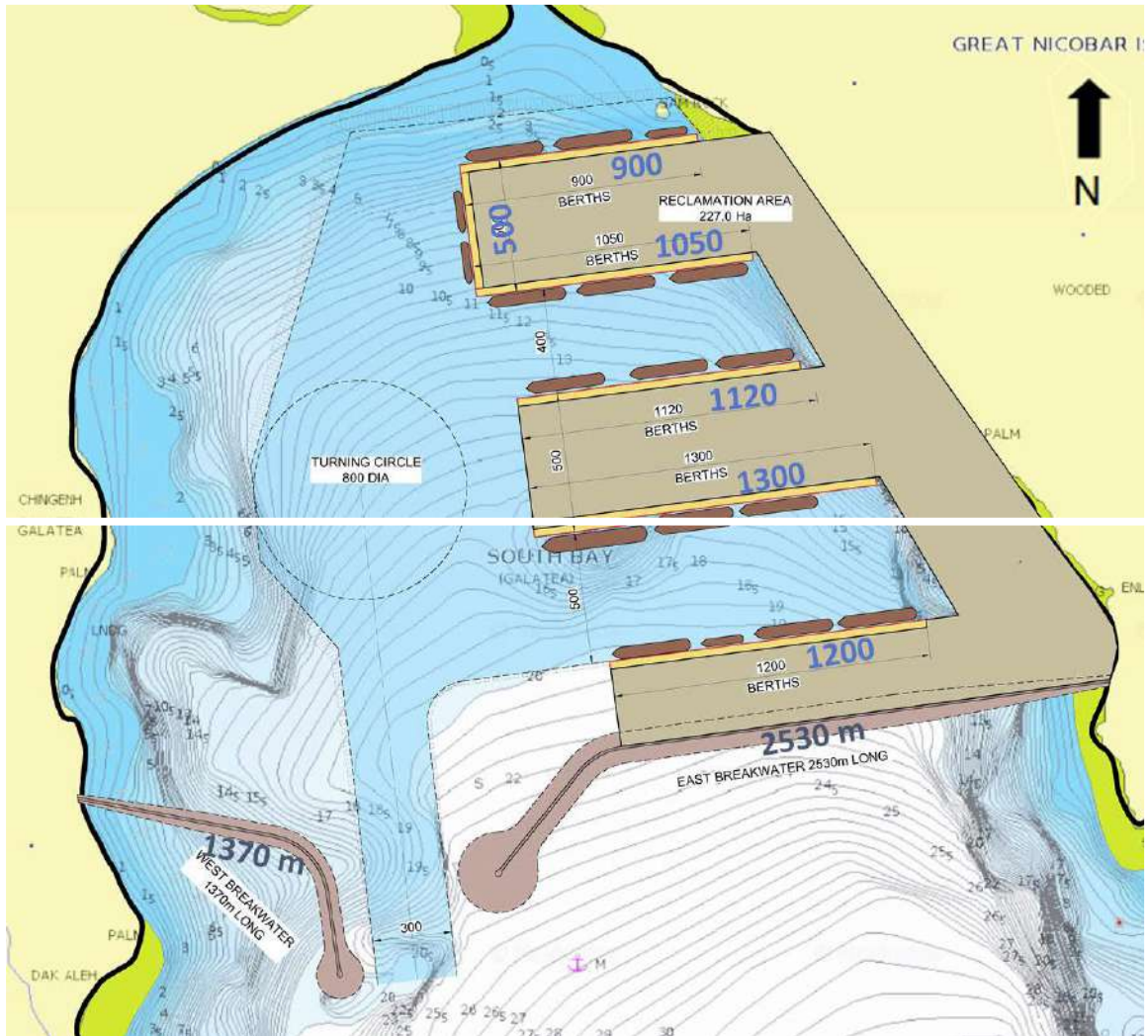


Figure 6: Galathea Bay Location – Recommended Master Plan Layout

II) Alternate Site Assessment Airport Project

The primary major factors deciding the site selection for an airport are as under: -

1. Open, Longitudinal, fairly level and well drained site.
2. Prevailing wind to be facilitating operations.
3. Obstructions to Air Navigation.
4. Environmental concerns, National Parks, Tribal areas etc
5. Earthwork Economics

Based on above parameters three sites were identified which partially met the requirements of establishing an Airport site.

- a. North Site – Ranganatha Bay
- b. Central Site – Existing Runway of INS Baaz
- c. Southern Site- Shastri Nagar

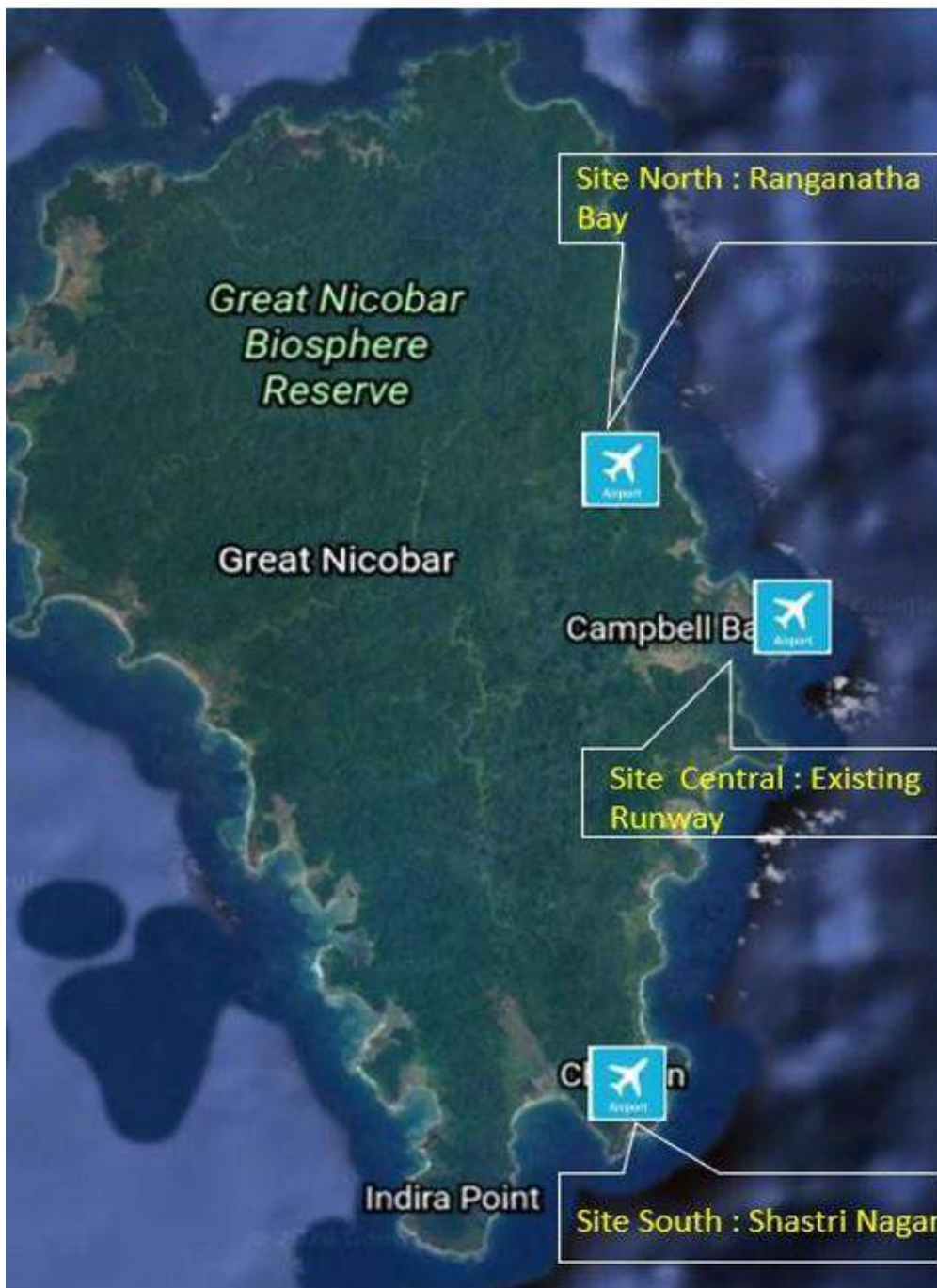


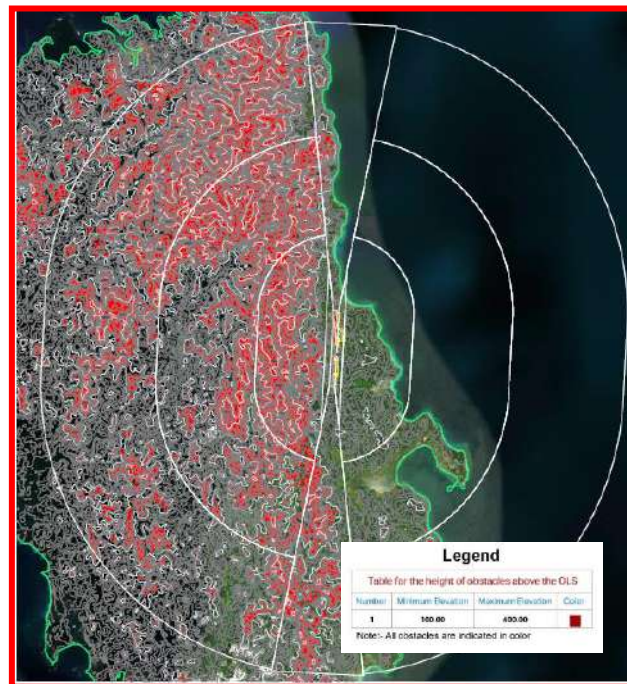
Figure-7: Alternative Sites for Airport

North Site

Topography: The site is approx. 4200 m long, running along the length of a seasonal stream which runs South to North and discharges in sea at its North end. The site lies in the catchment area of the Ridge line on the West and few high isolated knolls on the East. Number of spurs jets out from mother ridge into the valley from both the side which need to be erased in the event of selecting this site.

Wind Direction: The site is oriented in North South direction approximately and hence suitable for preferred Runway orientation.

Obstruction to Air Navigation: The site is towered by ridge line running North- South which is over 100 m high, and thus penetrating into the obstacle limiting surface of Inner Horizontal Surface, Conical Surface and Outer Horizontal Surface.



Air Approaches to the Site:

- a. Approach from North. The approach is over Sea and mostly clear except for some obstructions on the coastline.
- b. Approach from South. The approach from South is obstructed and hampered by hill features which lie right in the Approach surface. These hills are serious obstructions to approaching aircraft and will endanger safe flying operations.

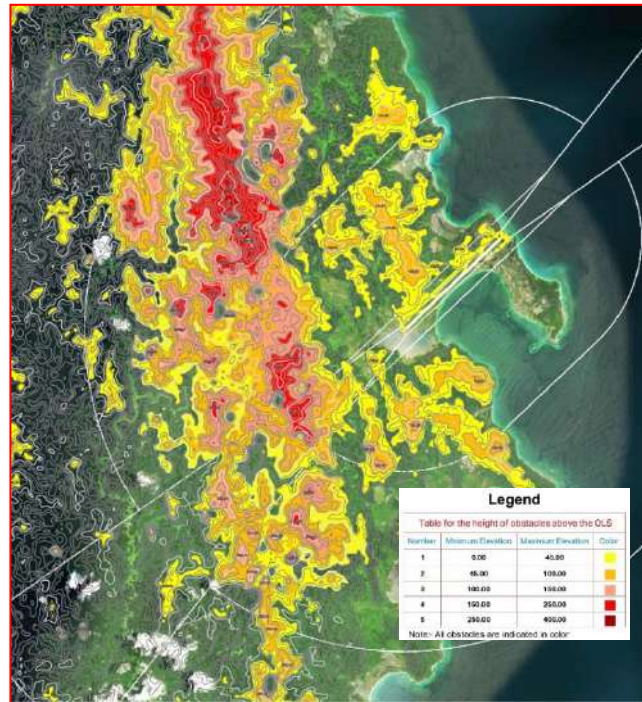
Airport Availability: Due to the restrictions of approach from South, the Airport could be approached from Single direction only; hence, the airport will be available for operations only when the Wind is from third quadrant or is in calm realm. Thus, the availability of airport would be about 50% of the time.

Central Site

Topography: The site is the existing Runway of Indian Navy. The runway is about 1000 m long and has to be extended to about 4000 m to make widebody aircraft operations possible. The site is dominated by a hill feature in the North and the southern edge is the shore of Campbell Bay. The site has very limited scope for future expansion and will not be able to accommodate the required infrastructure for an International Airport. This site if, extended would run through the existing habitation and split the settlement into two parts.

Wind Direction: The site is oriented in North- East to South- West direction and hence suitable for preferred Runway orientation.

Obstruction to Air Navigation: The site is dominated by a hill feature on the North which over 80 m high thus penetrating the Inner Horizontal obstacle limiting Surface & Conical Surface. Similarly, the approach and take off surfaces are also hindered.



Air Approaches to the Site:

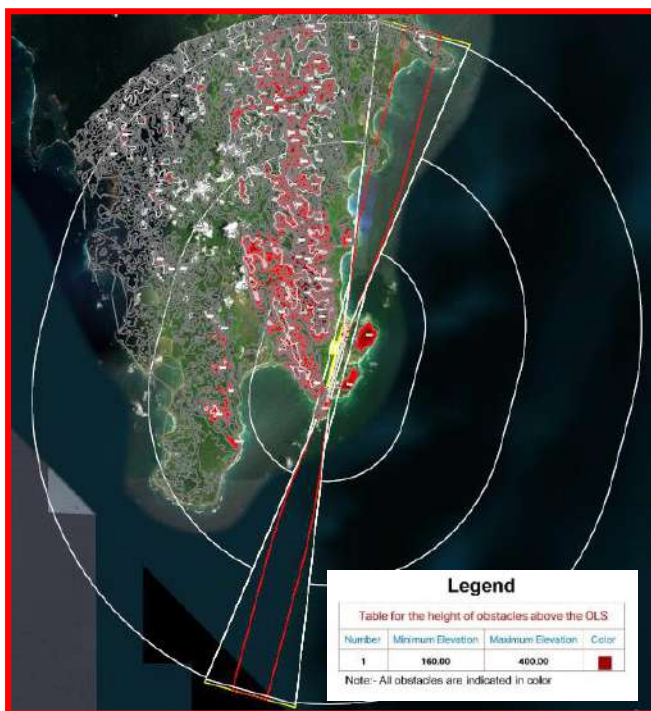
- Approach from North- East. The approach is over Sea and is mostly clear.
- Approach from South. The approach from South is obstructed and hampered by hill features which lie right in the Approach surface. These hills are serious obstructions to approaching aircraft and will endanger safe flying operations.
- Airport Availability: Due to the restrictions of approach from South, the Airport could be approached from Single direction only; hence, the airport would be available for operations only when the Wind is from third quadrant or calm realm. Thus, the availability of airport would be about 50% of the time.

South Site

Topography: The site is approx. 4000 m long, running along a flat open patch. The site is dominated by a 100 m high ridge line on the West and has two isolated knolls on the East. A few of spurs jets out from either direction which can be levelled in the event of selecting this site. The site has tidal area jetting inside which would need to be filled and levelled. A part of the tidal area could be developed into a Sea Jetty for High speed boats connecting the Airport with the Port and Campbell bay. Establishing of approach lights, ILS etc for the first runway and providing full length second runway (if required in future) will require some reclamation of land on North and South.

Wind Direction: The site is oriented in North South direction approximately and hence suitable for preferred Runway orientation.

Obstruction to Air Navigation There exists a dominating ridge line on West of the site running North- South with some heights over 100 m thus penetrating the obstacle limiting surface of Inner Horizontal Surface and Conical Surface. However, this ridge line also separates the Airport and the proposed port site and provides a buffer zone between the two. The site proposed as a major Sea Port across the ridge line at Galathea Bay will have tower cranes installed for loading and unloading of ships; these cranes will also be an obstacle, however, their potential as an obstacle needs to be assessed by Airport Authority of India as these will lie in the shadow of the separating ridge line. Suitable and appropriate ATM procedures need to be established by AAI for safe navigation if this site is selected.



Air Approaches to the Site:

- a. Approach from North: The approach is over Sea and is mostly clear.
- b. Approach from South: The approach is over Sea and mostly clear except for some levelling on the Coastline and reclamation of land. Obstacle Limitation Surface (OLS) Airport Availability: The airport is available from both the approaches and hence is assessed that it will be available for over 95 % of time which is a requirement of International Civil Aviation Organisation (ICAO).

Multi criteria Analysis of Alternative Sites

All the proposed alternative sites were evaluated using Multicriteria Analysis as presented in **Table-2**.

Table-2: Analysis of Alternative Sites

| S.No | Description | Site Characteristics | | |
|------|----------------------------------|---|---|------------------------------------|
| | | Site N | Site C | Site S |
| 1 | Approx. Length of Land available | 4200 m | 3900 m | 4000 m |
| 2 | Approaches | Only North | Only NE | Both |
| 3 | Obstructions to Air Navigation | High ridge lines Venturi effect | Small Hill on North | Hills on W Port Cranes |
| 4 | Favorable wind direction | Airport available only 50% time in year | Airport available only 50% time in year | Airport available 95% time in year |
| 5 | Earth Work Economics | Most Expensive | Intermediate | Least expensive |
| 6 | Access by | | | |
| a | Road | Yes | Yes | Yes |
| b | Speed Boats | No | Yes | Yes |
| c | Sea Aerodrome | No | No | Yes |

The map showing the selected site location (site s) is shown in **Figure-8**. The map showing selected airport site is shown in **Figure-9**

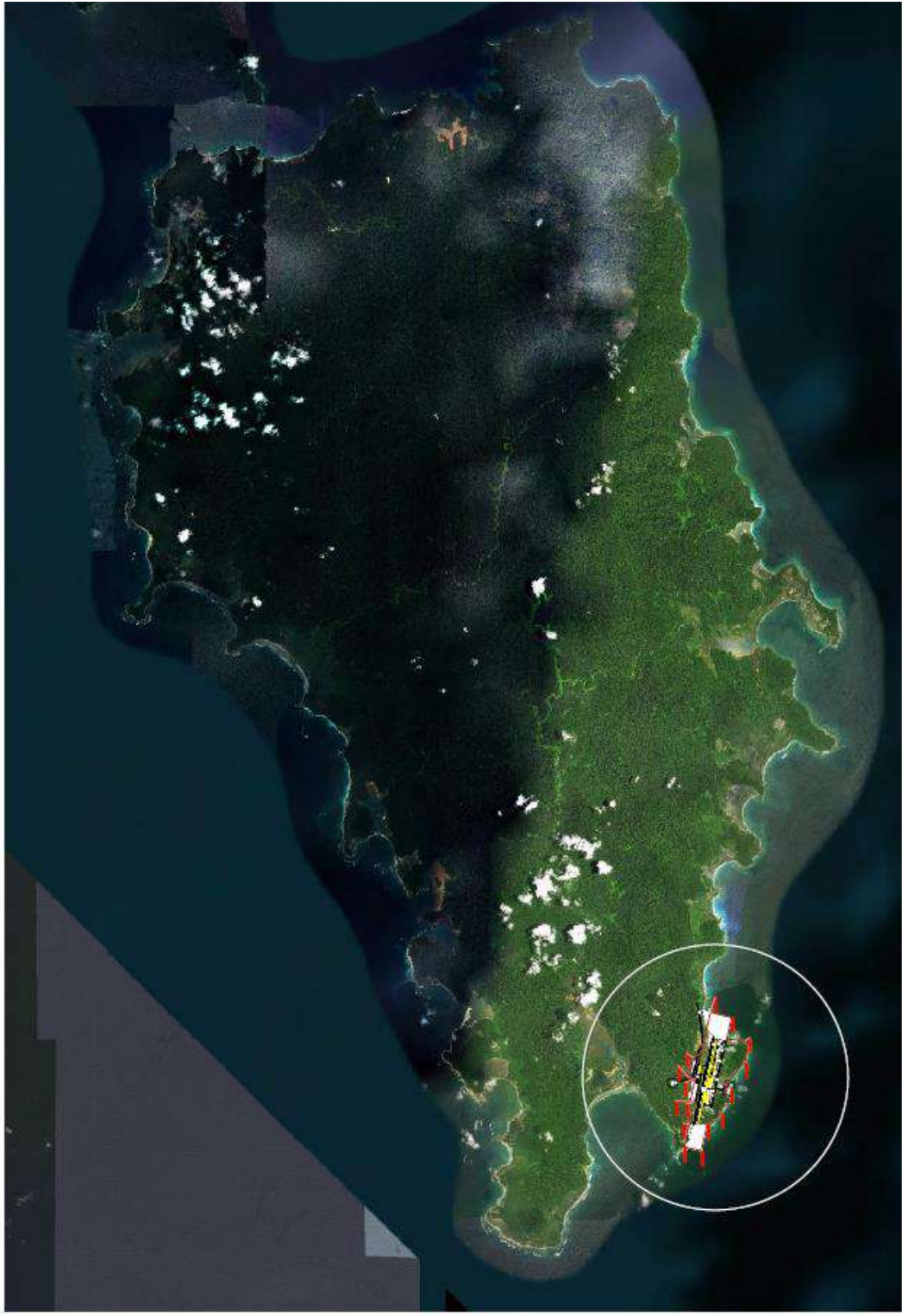


Figure 8- Map showing the selected site location (Site s)



Figure-9 Map Showing selected airport site

III) Alternative Sites examined for Power Plant

Three alternative sites were examined for the proposed LNG power plant. The alternative sites are Option 1-Near Campbell bay, Option 2-Near Shastry Nagar and Option 3-Near port. The alternate sites are shown in **Figure-10**. The selected site is option 3 which is near to the ICTT facility. Layout Plan is shown in **Figure-11**.

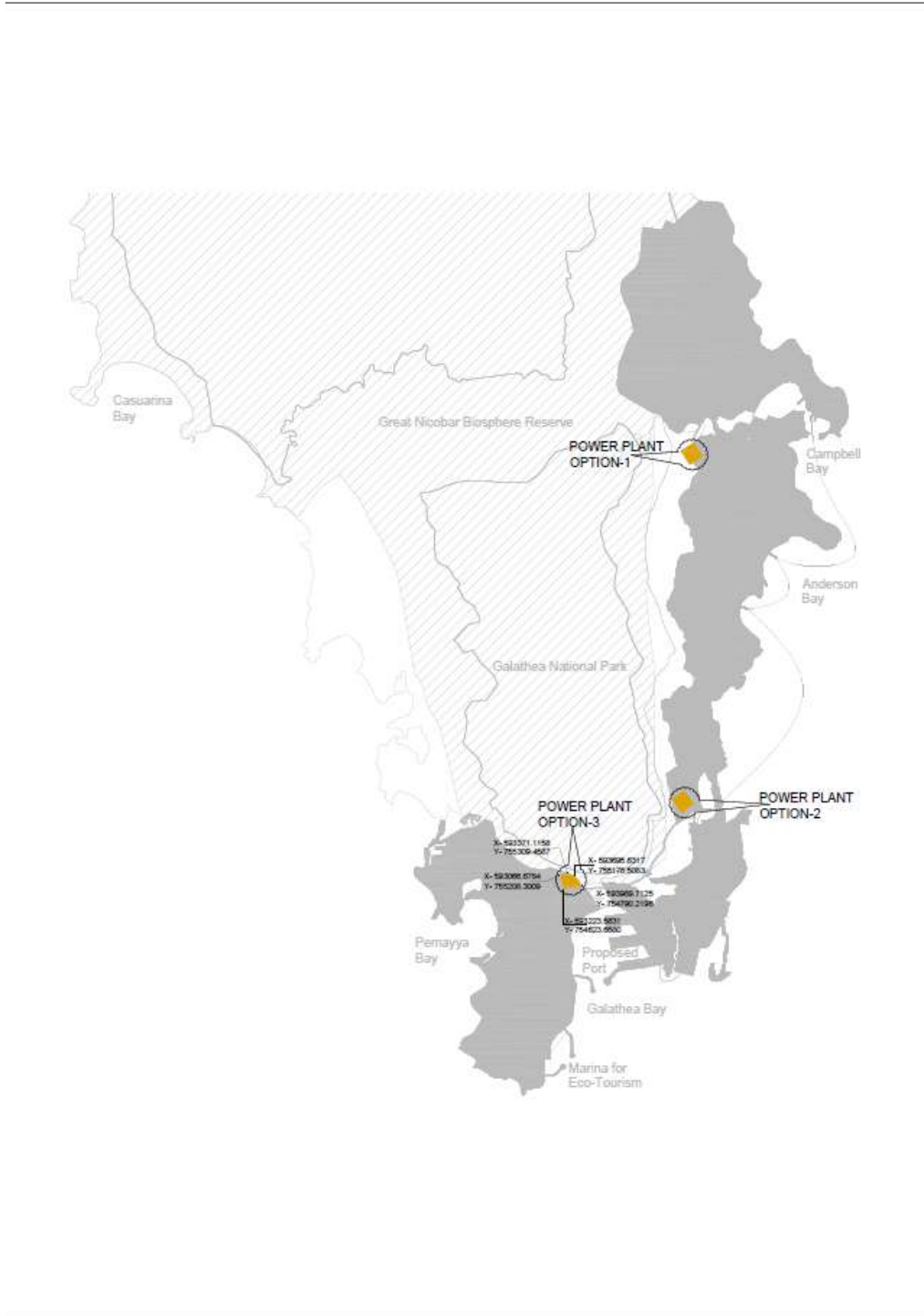


Figure-10 Alternate Sites for Power Plant

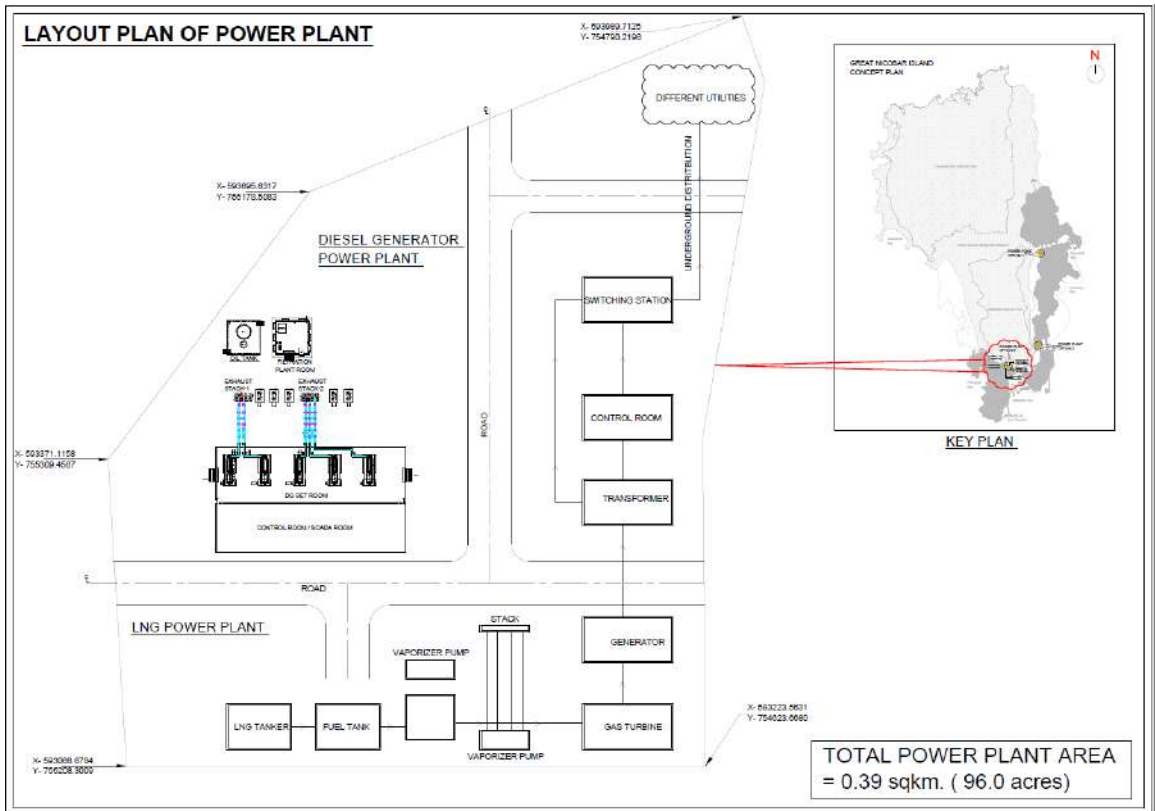


Figure-11 Layout Plan of Power Plant

IV) Township and Area Development Project

No Alternative sites were examined for Township and Area Development project as it will cater to the needs of integrated development projects and will boost Eco tourism resulting Socio-economic growth of local populace.