Environmental Impact Assessment (EIA)

Atlantis School, Car Park and Nature Preserve Project Paradise Island, BAHAMAS

Undertaken for

Atlantis Holdings Limited

One Casino Drive,
P. O. Box N - 4777
Paradise Island
Nassau Bahamas

Prepared by

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1.0 Executive Summary

Russell Craig and Associates Ltd was contracted by Atlantis Holdings Limited to undertake an Environmental Impact Assessment (EIA) on 22.93 acres of private lands owned by the company, and situated on Paradise Island Drive, Paradise Island. The land has been zoned as green space, with designated low to medium density residential and commercial zoning adjacent to the property by the Department of Physical Planning. Island Hotel Company Ltd intends to develop the property by constructing a single story 61,000 sq. ft school to cater to 150 school students to residents of Paradise Island, along with the development of a public parking site and a nature reserve. This EIA documents the existing site conditions and outlines environmental management and mitigation strategies to offset the habitat/vegetation removals/losses associated with the developments.

Biological Baseline Studies

Botanical, Avian, and hydrological investigations took place on December 7th, 8th 14th 15th 2024, to document existing biological conditions. A summer avian study was repeated on 22nd June 2025, to compare the species diversity between the summer and winter seasons.

Some ninety-one (91) plant species were recorded, of which ten (10) are protected under the Forestry (Declaration of Protected Trees) Order, 2021. Tree heights range from four (4) feet in the lowest canopy, up to 60 feet in the highest canopy level. Dominant and high-abundance plant species included gum elemi, mahogany, mountain fig trees, thatch palms, and sabal palm trees.

Based on an analysis of sample plots data collecting on the number of protected trees on site, only six (6) protected trees fell within the sample plot radius, and included Thatch Palm, Sabal Palm, Silver Top Palm, Gum-Elemi, Mahogany and Silk Cotton species. The highest number of trees (inclusive of mature, juvenile, saplings and seedlings) in the entire parcel are Sabal Palm at 3135 trees, followed by Thatch Palm at 2255 trees, Gum elemi at 1155 trees, Silver Palm at 880 trees, Silk Cotton at 825 trees and lastly Mahogany at 605 trees. A mitigation strategy calls for the translocation (if practical) of selected protected species from the school site and car park, into the nature reserve is recommended to offset the removal of these species during construction of school building and public parking Lot, and associated infrastructure.

Four (4) invasive species was identified, with the Australian pine (Casuarina) being the most abundant throughout the project site. The Bahamas national invasive species strategy (2013) calls for the control/eradication of all invasive species.

The site is home to many avian species. A total of thirty-two (32) avian species were recorded during the winter session notably resident pine warblers, migratory warblers, the endemic Bahama woodstar, and other visiting migratory bird species. Moderate impacts to the species9 natural habitat will occur because of the school development and the public parking lot.

The projected school building footprint of some 61,000 sq ft represents approximately 40% of the total area of the site (total of 1.6 acres) to be removed from its natural vegetation. When combined with associated infrastructural works (roads, footpaths, water and sewerage system, etc.), the total footprint could reach up to 50% of total area of land. Additionally, the natural habitat for birds and other wildlife will be impacted. The overall rating (Severity of Impact) of the school project on the natural environment is **Moderate.** Mitigation measures proposed to offset the negative effects and loss of natural, native vegetation include the removal, staging, and replanting, where practical/feasible, of protected trees that fall within the footprint of the new road reservations and school building construction. Those trees removed can be staged at the nursery site at Atlantis until ready for transplantation back on the school site in strategic locations. Where relocation is not feasible, trees (native flowering and protected trees) should be replanted at a ratio of 2 to 1 within landscaped areas on the school site. Removal of casuarina species Australian Pine (*Casuarina equisetifolia, and glauca*), and other identified invasives from the property site is strongly recommended. In areas where landscaping is being undertaken to plant native, protected and endemic species, maintain the existing vegetation (50% to 60% of total area) so that they continue to function as wildlife corridors. It is anticipated that once school construction activities are completed, resident wildlife, and avian species will return.

Continuous and consistent site inspections, along with strong communication between the environmental manager and the Developer, are critical to ensuring compliance with recommended environmental mitigation strategies. The Environmental Management Plan (EMP), once developed, with its monitoring checklist, is the mechanism to document onsite practices, provide recommendations, and take corrective actions, where necessary.

Environmental Impacts

Impacts were viewed in the context of how the physical environment will be impacted by both the infrastructural developments (electricity, water supply, waste management infrastructure, and school construction) separately, utilizing qualitative criteria (i.e., nature, type, likelihood, scale, duration, reversibility, and significance) to assess impact.

The criterion of severity is used to measure the magnitude of impact an event has on the environment (i.e., terrestrial, fauna, wildlife, coastal, marine, visual and aesthetics, hydrology, soils, and socio-economic, etc.). Severity in this circumstance was given ratings of 1 for low impact, 3 for medium impact and 5 for high impact.

The most direct impact of the development will be the removal of 40% to 50% of the natural vegetation (school site and car park) and any existing wildlife associated. To mitigate this loss, Atlantis intends to relandscape the school site with native flowering plants and protected trees to re-attract avian and wildlife back to the area. Additionally, to enhance and beautify the natural wetland to be used as a nature trail for eco-tourism and to retain the botanical and avian species. Additionally, the magnitude of severity of the overall impact to the natural and physical environment was scaled as **Medium** on the terrestrial landscape and **Low** on the natural wetland features.

Noise levels and air quality impacts are expected to increase once construction activities commence (during normal working hours), hence a **moderate** rating, but these will be temporary once construction works have ended.

As there will be no construction on the coastal/marine environment, located to the North of the Property. It is projected that there will be No negative impact on these ecosystems in the Medium to Long Term.

Socio-economic Impacts

The project construction timeline for the Atlantis School project is anticipated to be some two years, with a total investment cost of some **BSD 10,000,000.00,** with a far-reaching, long-term beneficial impact on the economy of Paradise Island.

The projected construction and permanent jobs are estimated at 50-100 people.

Key Mitigation Measures and Recommendations

Terrestrial:

- Relocate, where practical, the protected species identified (***Table 3.1)*** from the footprint of the new road reservations and school building construction, and car park development activities. Removed trees can be staged at the nursery site at Atlantis until ready for transplanting on site.
- Remove all invasive casuarina species, especially Australian Pine (*Casuarina equisetifolia, Melaleuca, and brazillian pepper*), from the property site.
- In areas where landscaping is being undertaken to plant native, protected, and endemic species at a ratio of 2 to 1.
- Maintain the existing vegetation (50% to 60% of total area) so that it continues to function as wildlife corridors.

Avian:

- Once all construction activities are completed, with reduced noise levels, it is expected that birds will return.
- Adequate natural vegetation areas exist (50% to 60% of total landscape), whereby birds can forage and roast.
- Protected trees identified along areas subject to construction activities will be surveyed and flagged for removal (a permit will be required from the Forestry Unit, Ministry of the Environment and Natural Resources, under the Forestry Act, 2010), or to be maintained, where feasible.

Air Quality and Noise:

- Employment of BEST management practices about construction methods, to minimize the emission of dust that can impair air quality.
- Maintain construction equipment to ensure air quality is not impaired.
- Construction workers will wear appropriate PPE (i.e., earplugs or earmuffs).
- High Noise levels will cause animals and birds to migrate elsewhere; however, once construction activities are completed, the animals and birds will return.

Solid and Hazardous Waste:

- Solid waste generation will be limited to construction waste and vegetation removal from the school building footprint and the car park.
- Vegetation removed will be reused/mulched for landscaping purposes

- Solid and hazardous waste will be placed in containers and properly disposed of following Department of Environmental Health Services (DEHS) regulations and standards.
- Invasive species and debris, along with construction waste to be disposed of Island to avoid inadvertent spread to Paradise Island.

Fire and Hurricane Preparedness:

- Prepare a Fire Control and Prevention Plan, with detail steps to prevent, contain and control fires during construction and operation of the school.
- The school administrators and employees will follow fire requirements of the Bahamas Building Code.
- A Hurricane Preparedness and Contingency Plan will be developed in the event Paradise Island is impacted by a storm or hurricane (to include evacuation protocols, emergency and health provisions and recovery strategies).

Occupational Health and Safety:

- All workers will be provided with appropriate Protective Personal Equipment (PPE).
- All workers will receive training in the proper handling of equipment, before starting work on property.
- There will be regular enforcement of occupational health and safety protocols on a weekly basis.

Environmental Management Plan

Environmental management integrates environmental policies and planning initiatives to address various environmental issues that are affecting an area. Environmental management attempts to prevent potential adverse environmental impacts, and to identify appropriate resolutions. Appropriate environmental management seeks to avoid, minimize, and control adverse impacts to the land, wetlands and atmospheric environments, human health, and safety. Where it is not possible to avoid adverse impacts, then best management practices should be utilized to mitigate environmental and human harm.
The Environmental Management Plan (EMP) will detail the best environmental and safety practices for the Atlantis school project in all phases.

Public Interactions/Communications

An important consideration that must be factored into the planning process for the Atlantis School project is to have in place an effective public relations/communication strategy. This is necessary to inform and to gather feedback from residents living in proximity to the school, and other commercial entities on Paradise Island, of the plan for the proposed school development, nature reserve, and car park. To advise them on the socio-economic and environmental impacts, and how any adverse impacts will be mitigated. A Public consultation Town Hall meeting will be held, under the auspices of the DEPP, to garner feedback from the general public on the project.

Conclusions:

Based on the existing baseline conditions (pristine natural high density Dry Broadleaved Evergreen Formation) identified in the assessment, and the projected construction of a 61,000 sq ft school buildings, and car park construction (representing approximately 40% of total land area) with associated infrastructure, the overall impact, and the degree of severity on the physical environment is projected as **moderate.** It is anticipated that with proper planning, application of BEST management practices, and Mitigation Measures outlined in a completed Environmental Impact Assessment (EIA), when fully incorporated within a comprehensive Environmental Management Plan (EMP), if conscientiously implemented, will minimize in the short to medium-term the negative impacts identified, from the project development through to school operations, and nature reserve nature trail utilization by visitors and residents.

2.0 Description of Proposed Project and Scope

2.1 Description of Proposed Project

2.1.1 Conceptual Master Plan

Location

The proposed Atlantis school site is located on Paradise Island, North of the Eastern District of New Providence Island, on a moderately elevated land surface with a significantly high density of Dry Broadleaved Evergreen (DBEF) vegetative cover. The school site is located at Latitude 25. 49 53.71= N and Longitude 77 189 40.07 and comprises three parcels (4.0 acres for school development, a revised reduced public car lot from 2.2 acres to 1.92 acres; and 16.73 acres nature reserve) and runs from East to West along the South side of Paradise Island Drive, and bounded to the East by 8The One & Only Ocean Club Four Seasons9 and due West by property said to owned by Compass Suites. ***Figure 2.1*** below provides a general map of New Providence Island, with an inset plan of Paradise Island, and *Figure 2.2* shows the project site location on Paradise Island.

Figure 2.1: General Location of Map of New Providence with Paradise Island (Source: Google Maps 2025).

Figure 2.2: *Depicts Project Site and Relation to Paradise Island Environs. (Source: Google Maps 2025)*

Atlantis School Project

Atlantis Holdings Limited proposes to construct a single story eco-friendly 61,000 sq. ft school, ***(Figures 2.4 to 2.10 and Appendix - A)*** situated on 4.0 acres of private land ***(Figure 2.3)***, to cater to 150 school students who are residents of Paradise Island.

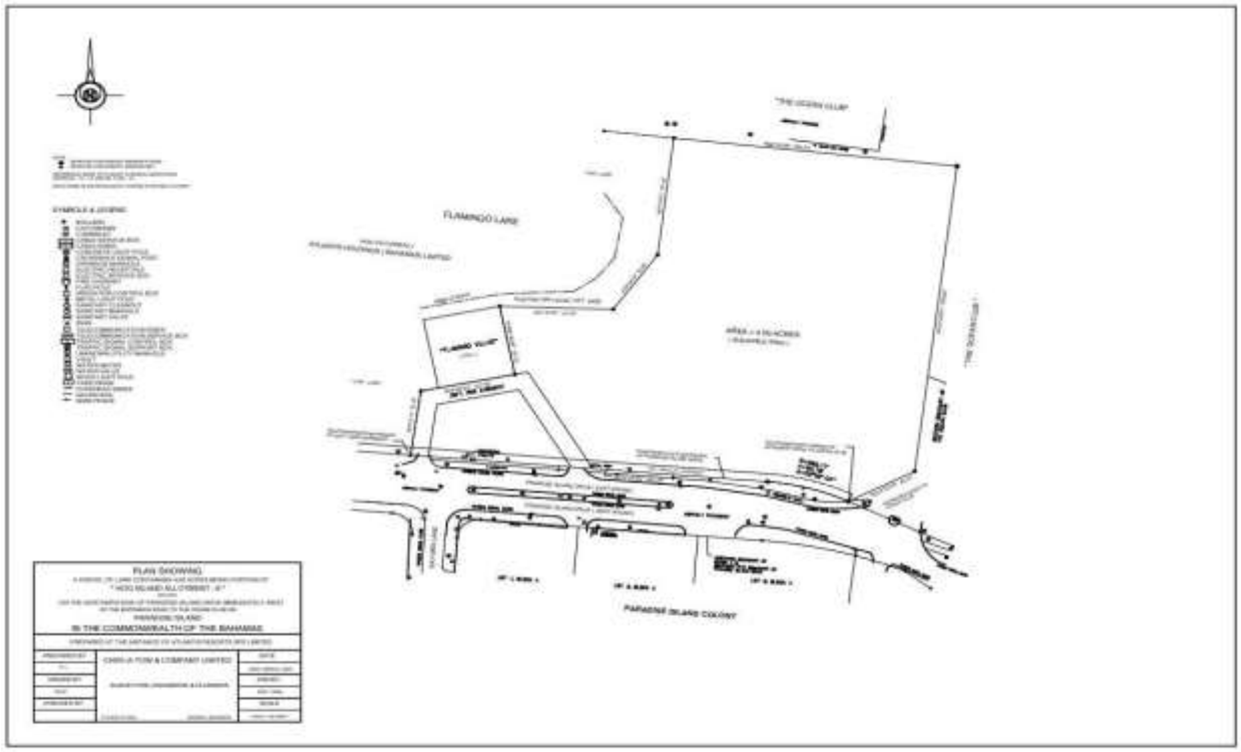


***Figure 2.3**: Survey plan depicting site for School Building (4.0 acres)*

Figure 2.4

Figure 2.5

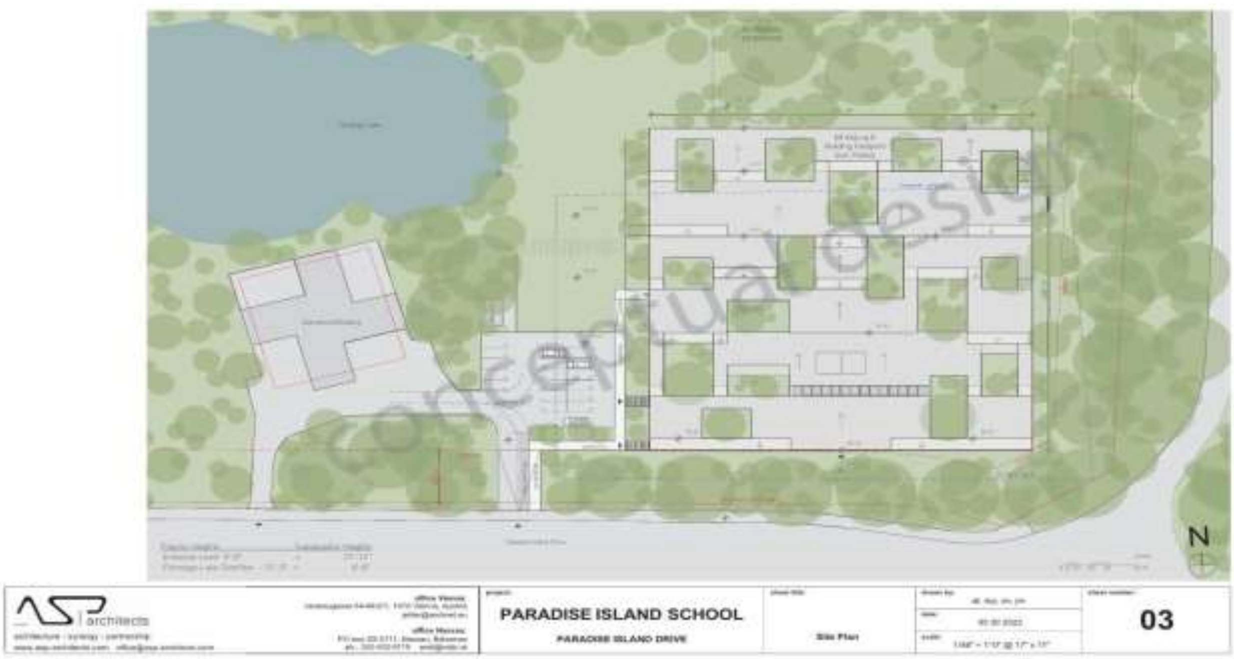


Figure 2.6

Figure 2.7

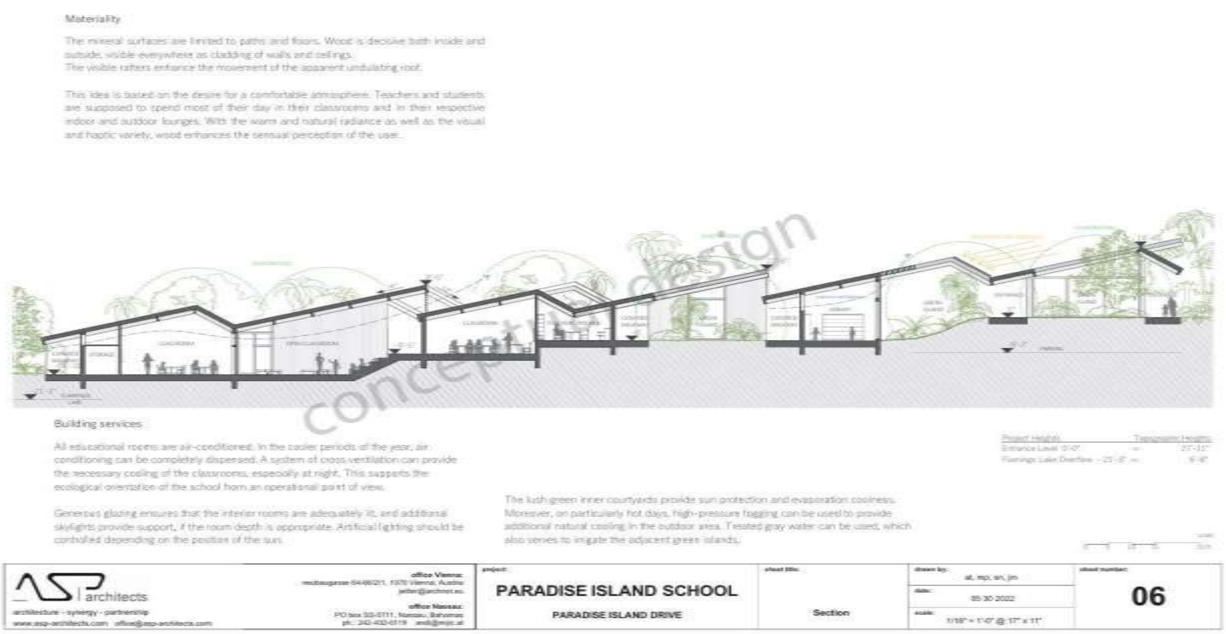


Figure 2.8

Figure 2.7

Figure 2.10

Paradise Wild: Wildlife Viewing and Nature Trail

Flamingo Lake and the surrounding wetlands and coppice habitat are natural treasures to be protected and promoted. The appeal of a wilderness area and wildlife viewing in the midst of Paradise Island development is immeasurable. Atlantis Holding Ltd proposes the creation of an authentic natural area 4 a native restoration and wildlife showcase that reveals the true beauty of The Bahamas, comprising 16.73 acres, ***(See***

Figure 2.11). while also offering visitors a place to exercise. The intent is to change the name from <Flaming Lake= to ***Paradise Wild,*** which is indicative of the site9s connection to Paradise Island, as well as its natural appeal ***(see Appendix B for more details).*** A summary of key activities to be undertaken include:

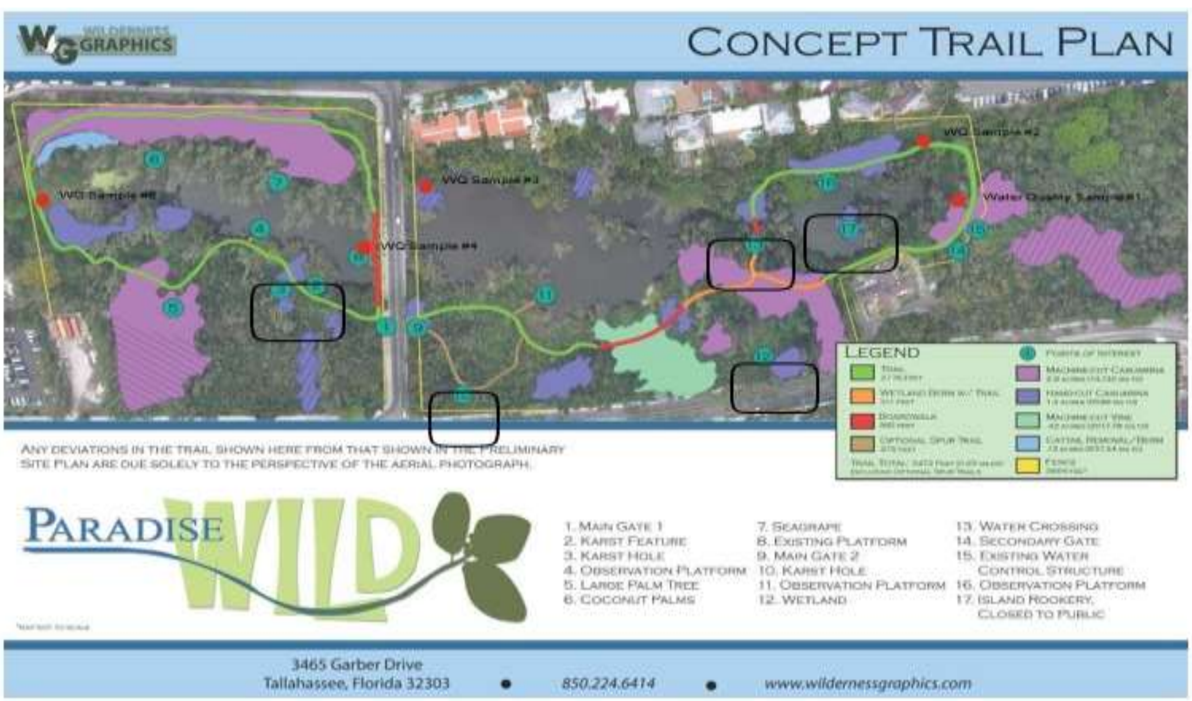
Phase 1: Clearing of all trails securing the area with fencing, an entry gate, signage, replanting. Four key areas for restoration include:

RA1: Northern shore of the western lake 3 where there is significant casuarina growth, introducing a native arboretum, coastal berm or orchid walk.

RA2: Removal of large debris south of the western lake 3 mulching from chipping on casuarinas stems and replanting.

RA4: Significant patches of invasives situated on the southern shore of the Eastern Lake, site of berm/boardwalk.

Cattail Removal/Berm Western Lake 3 cattail removed could be used to build up the berm in narrow spots, plantings or use of visual blocks to obstruct parking low view.



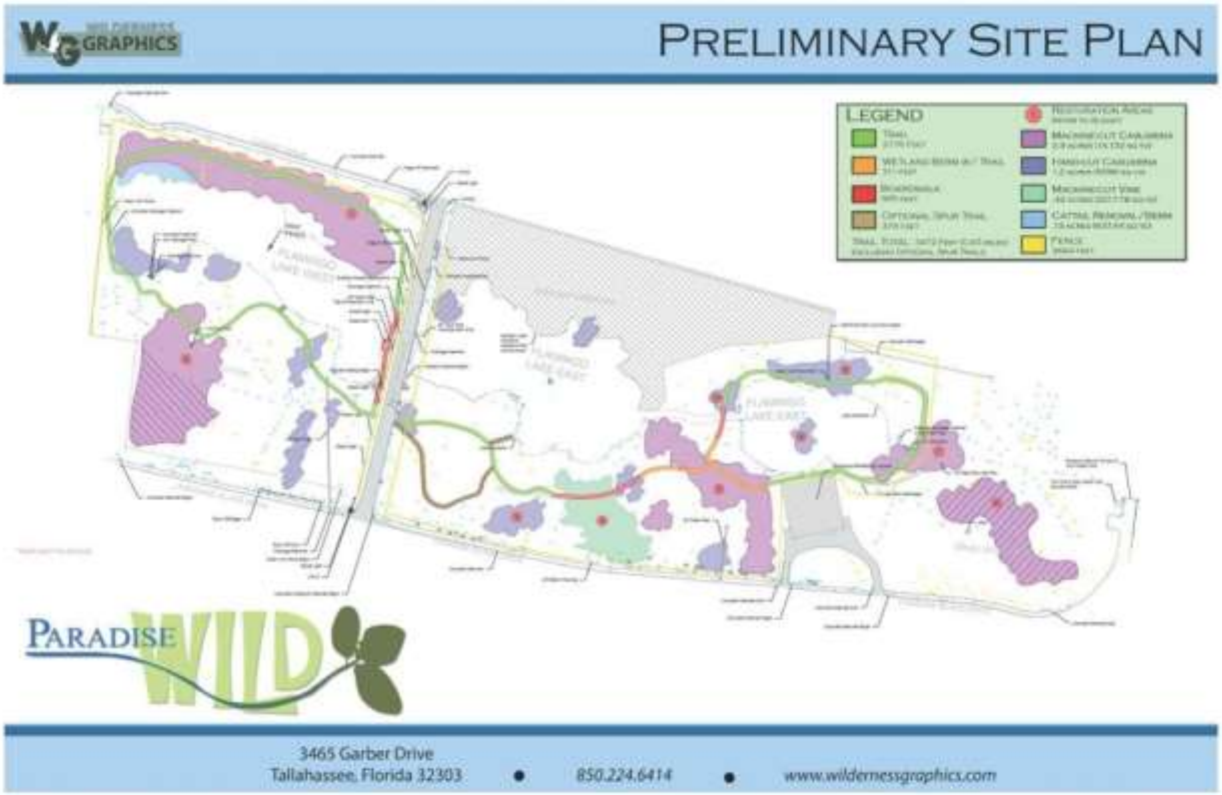


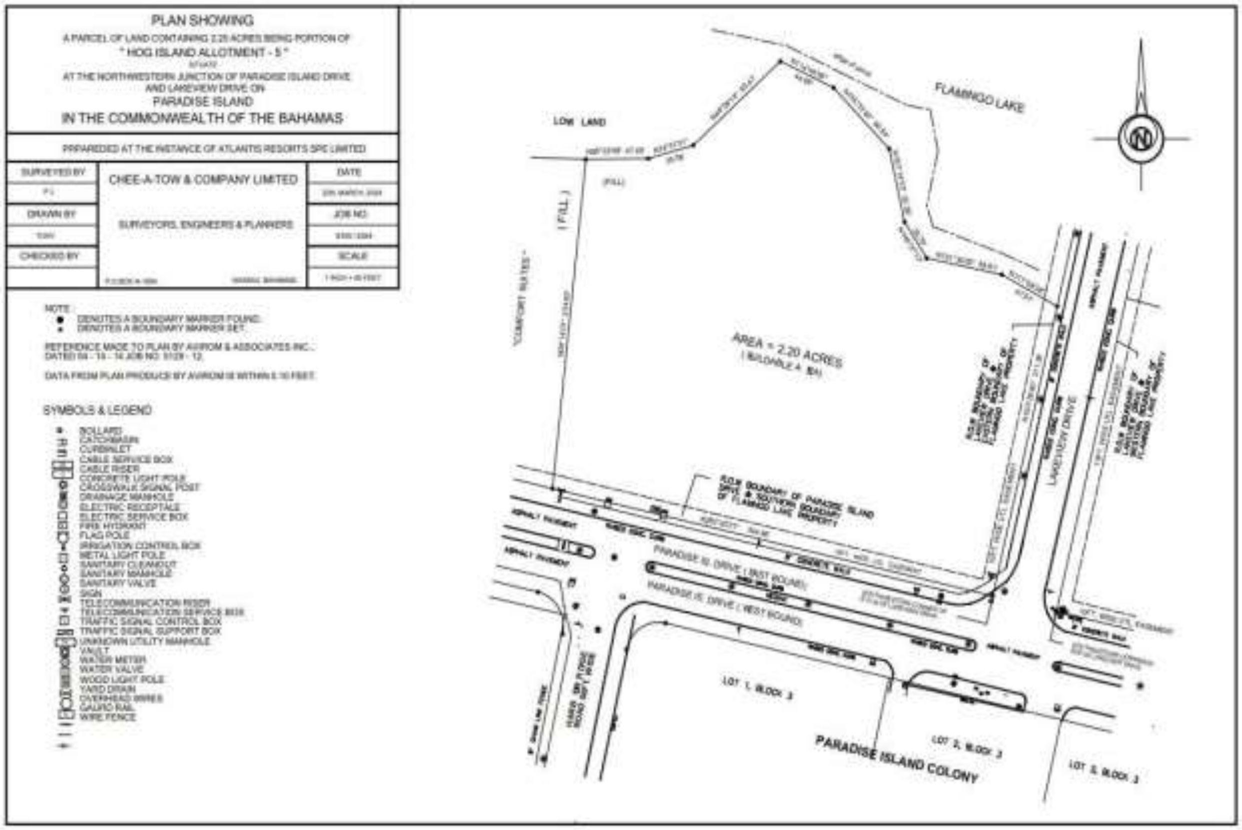
***Figure 2.11**: Conceptual nature trial plan and site plan for nature reserve*

Public Parking Site:

Complementary to the School development is the creation of a public parking site, comprising 1.9 acres (a reduction from the original 2.2 acres), situated at the Western parcel of the property. The images below (***Figure 2.12a &b***) show the old survey plan design of 2.2 acres, whereas ***Figure 2.13*** depicts the new survey design reducing the acreage size to 1.932 acres.

Given the increasing demand for parking on Paradise Island and the additional commercial developments planned over the next few years, Atlantis Holding Ltd has thoughtfully revised and reduced the proposed parking development site to be a minimum of 60 feet from the lake ***(Figure 2.13)***, a far distance away from the mangrove edge. Hence, total protection of the wetlands and sensitive areas. No mangroves or wetlands will be impacted on the revised site.

It should also be noted that the proposed parking space is for use by the wider Paradise Island community. The school development will have its parking. As parking demand grows in the years ahead, Atlantis anticipates replacing the surface parking lot with a multi-story parking facility, as depicted in ***Figure 2.14a &b.***



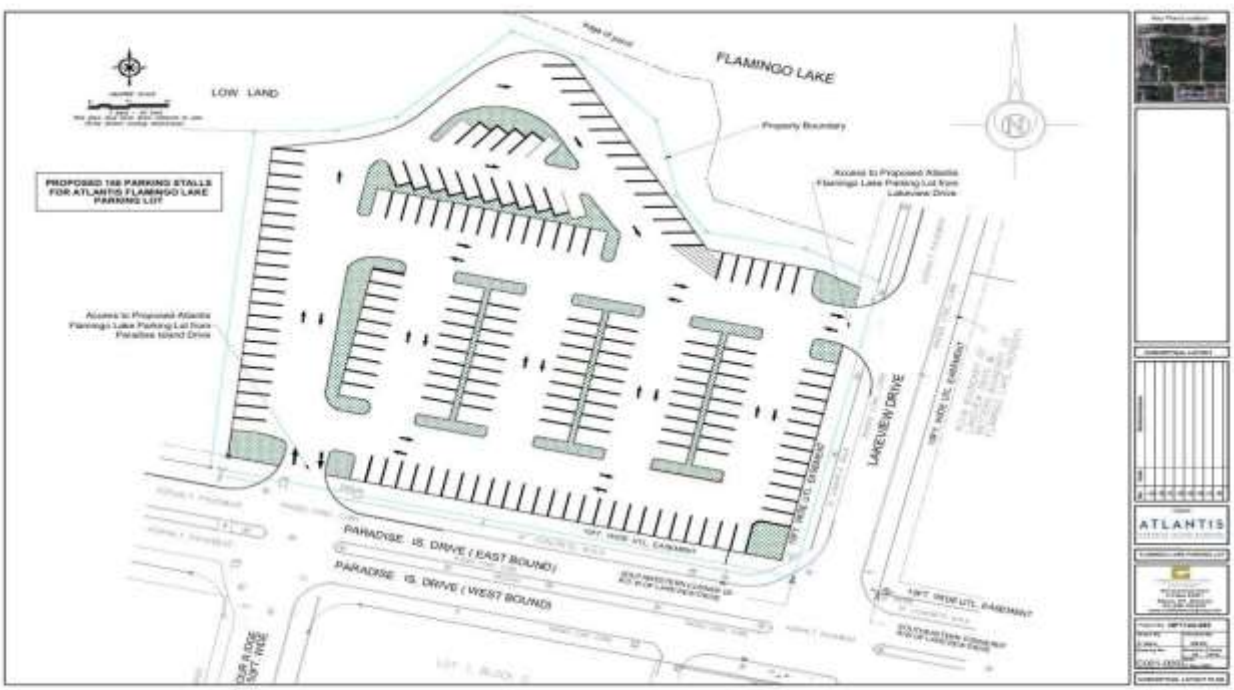


__Figure 2.12 a & b__: Survey Plans depicting old public parking boundary and layout of parking slots (2.2 acres)

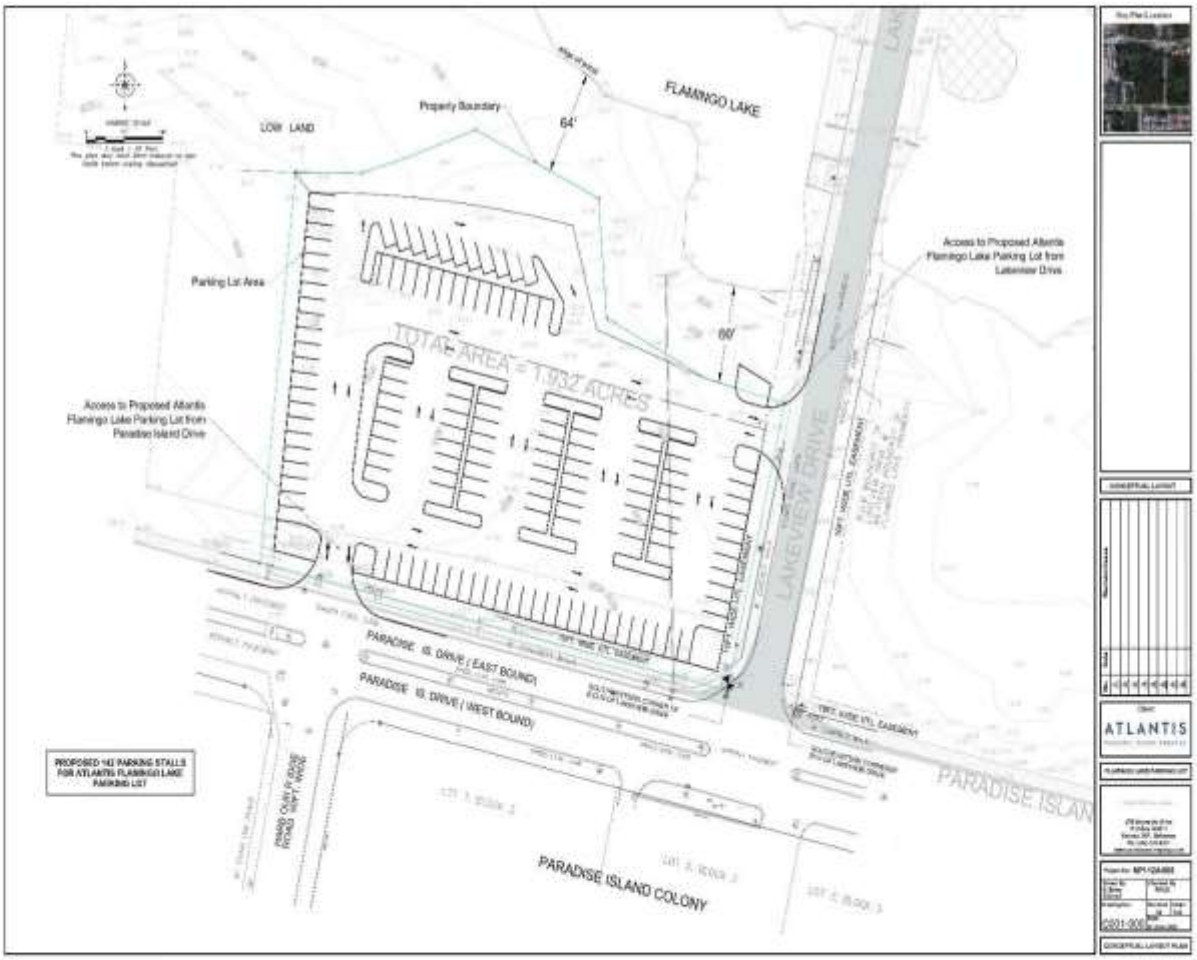


Figure 2.13: Survey Plans Depicting New Public Parking Boundary and Layout of Parking Slots (1.9 acres)

New Conceptual Drawing and Architectural Design

Figure 2.14 a& b: Conceptual Drawing Plan of Parking Area Layout.

2.1.2 Economic Benefits and Impact

The school project, along with the development of the natural reserve (nature trail system, interpretive centre, etc) public car park, and associated infrastructures will represent an investment in The Bahamas of more than **BSD $10,000,000.00** by Atlantis Holdings Ltd, and will further contribute to the economic vibrancy of Paradise Island. By creating between 50-100 construction jobs and permanent jobs for Bahamians and related service providers, this project will provide an economic stimulus and will further contribute to significant inflows/ remittances to the Government from custom duties, Value Added Tax (VAT), National Insurance Board contributions (NIB) and Real Property Tax (RPT).

2.2 Description of Alternatives

2.2.1 The <No-action= Alternative

With these type developments, there is always the <No Action= Alternative. In these circumstances, the <No Action= alternative would keep property in the same undeveloped position currently, unless sold to another buyer. With no new constructions under consideration, this would eliminate the intended purpose for the property. Any economic activity, employment opportunities on Paradise Island gained through construction jobs, permanent jobs, investment injections, would be missed and lost.

2.2.2 Other Alternatives Considered

The properties are privately owned, with a minimal development footprint.

The site selection was based on:

- The land was available for the proposed usage.
- The size of the project and its moderate negative environmental impact on the environment, made it ideal to accommodate the project components.

3.0 Baseline Description of Affected Environment

3.1 Geographical Location

The proposed Atlantis school site is located on Paradise Island, situated at Latitude 25. 49 53.71= N and Longitude 77 189 40.07 North of the Eastern District of New Providence Island, and comprises three parcels (4.0 acres for school development, 1.932 acres for a public car lot; and 16.73 acres nature reserve) and runs from East to West along the South side of Paradise Island Drive, and bounded to the East by 8The One & Only Ocean Club Four Seasons9 and due West by property said to owned by Compass Suites.

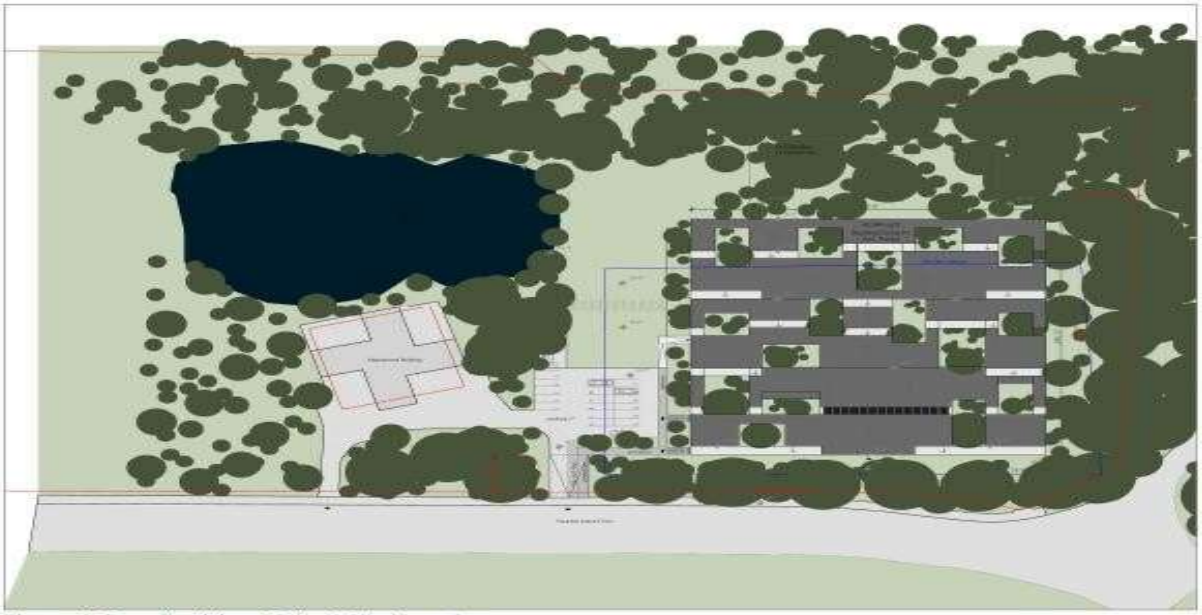


Figure 3.0: General layout (footprint) of the Atlantis School and its relations to the Flamingo East Lake and environs.

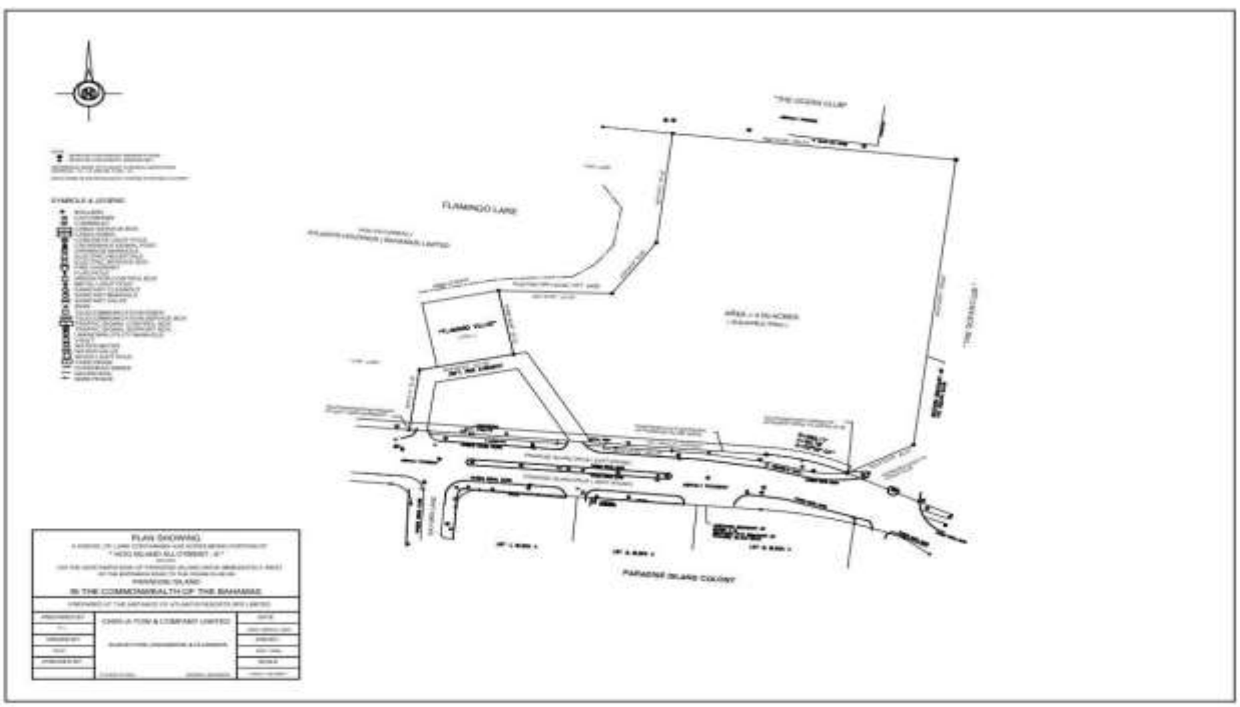


Figure 3.1: Survey plan depicting site for School Building (4.0 acres)

3.2 Land Use

Presently, the area proposed for the Atlantis School consists of a high-density Dry Broadleaved Evergreen Formation (DBEF) vegetation, and existing land use is that of <Green space= forming part of a natural

Wetland ecosystem (Flamingo Lakes East). The lake and natural vegetation area are proposed to be developed into a nature reserve with a trail system**,** complementary to the school ***(Figure 2.11).*** Otherwise, there are no future substantive developments anticipated in the immediate study area that will have a proximate and direct impact on the proposed school access in the immediate future. General land use in the vicinity of the study area is that of low/medium density Commercial and Residential Zoning by the Department of Physical Planning.

3.3 Physical Environment

3.3.1 Climate

The Bahamas9 climate is classified as sub-tropical, and is influenced by the sea, particularly the Gulf Stream to the west. The northern Bahama Islands experience cooler winters and higher amounts of rainfall compared to the southern islands, with drier conditions. According to Sealy, (2006), New Providence can expect some 57.1 inches of rainfall and 137 rain days annually, with highest amounts during the months of May to November. Temperatures are mild throughout the year and the average varies from the low 70s F during the winter, to the low and high 80s F during the summer; with extreme temperatures occasionally falling below low 60 F or rising above the low 90s F. Prevailing winds, coming from the Northeast in winter and from the Southeast in summer, lend a cooling influence to a generally humid atmosphere, with average wind speed recorded at eight (8) knots. The chain of islands lies within the Hurricane Belt, and hurricanes pose a great threat during the period of June to November and have occasionally caused great human mortality and property destruction.

3.3.1.1 Hurricanes

The Bahamas is affected by hurricanes from June 1st to November 30th. The most recent hurricane to affect New Providence was Hurricane Matthew, which made landfall in October 2016 and was classified as a Category 4 hurricane. The island experienced sustained periods of hurricane-force winds, with the southern and eastern coastal areas experiencing storm surges and coastal flooding up to eight (8) feet in places.

On 1st September 2019 Hurricane Dorian passed to the northwest of New Providence, in which the island received heavy rain and strong winds for several days, with flooding in low-lying areas. The hurricane directly hit Marsh Harbor, Abaco, with Category 5 Hurricane winds up to 300 km per hour, and damaged or destroyed most buildings in the townships. It then moved westerly, impacting the eastern end of Grand Bahama, before turning north away from the Bahamas. The destruction was most severe and telling, with the loss of human life, property, infrastructure, and natural vegetation.

Between 1859 and 2019, according to datasets from the Coastal Services Center (National Oceanic and Atmospheric Administration), seventy-two (72) tropical disturbances (tropical storms and hurricanes) have come within 50 nautical miles of Nassau, New Providence. This data suggests that New Providence, and by extension, Paradise Island, is highly likely to receive a direct hit from a hurricane event in any given year.

3.3.2 Topography

The site for the school development, nature reserve and car parking lot site is dominated by Dry Broadleaved Evergreen Species of high density, with some tree height reaching up to 60 feet. Much of the terrain is in its original natural state, which is evident by the high-density broadleaved vegetation. The subject property is between 15.98-Feet (4.87-m) to 16.50-Feet (5.02-m) Elevation and 1.9-Feet (0.57-m) above Mean Sea Level (Datum reference is to the East Paradise Island Bridge Datum).

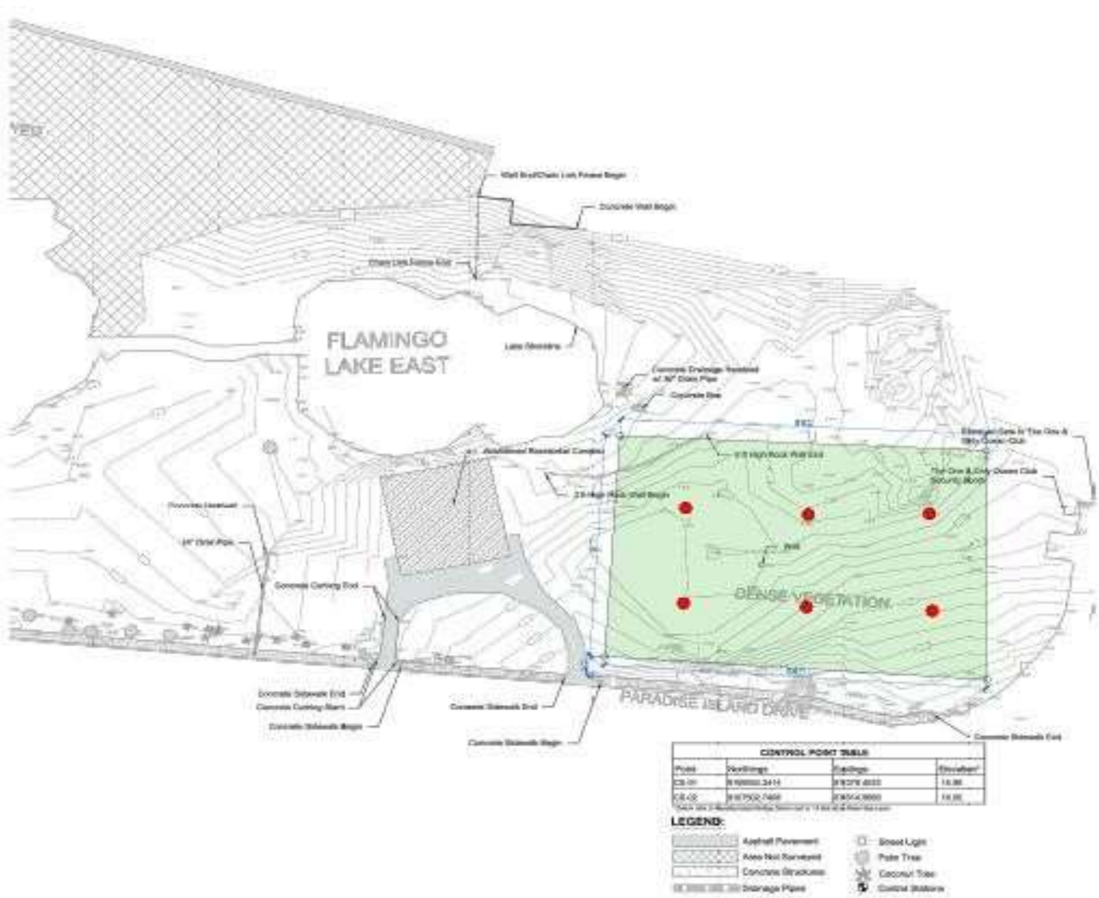


Figure 3.2: *Topographic Map Of Proposed school site showing Location of geotechnical borings*

Figure 3.3: Photo Depicting interior of school site with Mountain Figs Above Canopy.

Figure 3.4: Photo depicting Southern Interior of school site leading into natural Wetland Habitat.

Figures 3.5 & 3.6: *Photo depicting vegetation along the interior of the school site property.*

3.3.3 Hydrogeology and soils

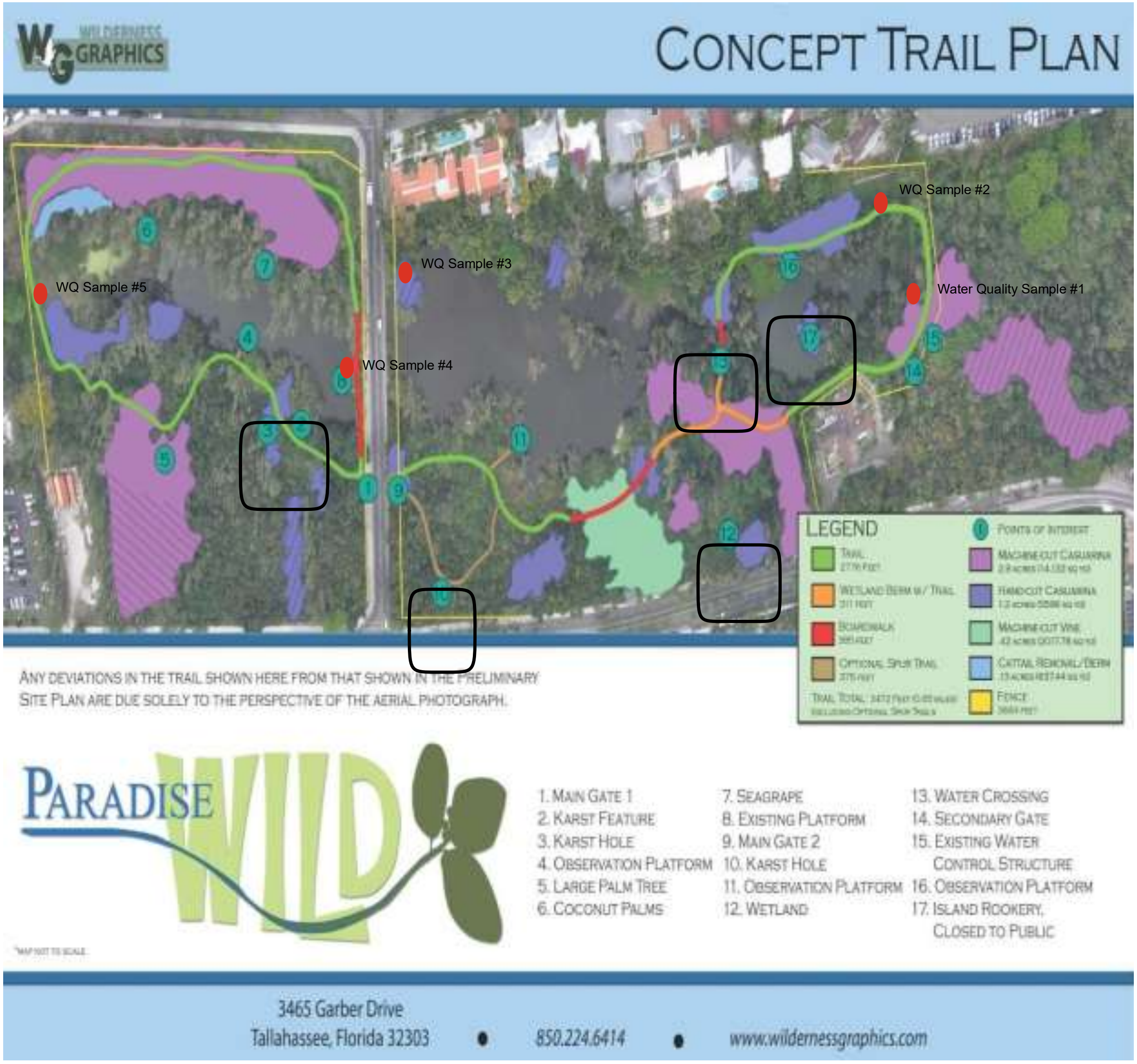
The proposed 22.93-Acre (9.28-Hectare) site on Paradise Island, located North of the Eastern District of New Providence Island, on a moderately elevated land parcel with significant vegetative cover. The site is proposed to be expanded / co-joined with the Atlantis Wilderness Site. During the months of December2024 | January-2025, site visits for hydrological review & specified water sample collection and analysis were undertaken ***(AEES, 2025***).

The groundwater resources of the Commonwealth of the Bahamas comprise the fresh, brackish, saline and hyper saline waters found in the subsurface and in the lakes and ponds that intercept the land surface. There is a direct connection of the landform to the marine/coastal environment, separated by a mangrove vegetation buffer / wetlands (8Flamingo Lake9) to the North of the proposed 8Atlantis School Site9.

Salinity levels of water are expressed in parts per million (ppm) or milligrams per litre (mg/l) of the chloride content in the water, which is a constituent of the total dissolved solids. For the purposes of this particular site and the proposed water use, the ranges of salinity follow:

Water Description	**Dissolved Solids**
Fresh	Less than 1,500-mg/l
Brackish	1,500 3 3,000-mg/l
Salt	More than 3,000-mg/l
Saline	More than 30,000-mg/l

Figure 3.7: Photo of Flamingo Lakes located within the proposed site.



Per John A. Bowleg, PE - Water Consultant for AEES

4 Initial Water Quality (WQ) Sample Sites

Other Hydrogeological Areas that may warrent WQ Sampling

Figure 3.8: Nature Trail Design

Source: Wilderness Graphics Concept Plan, Wildlife Viewing & Natural Trail Flamingo Lake, PI (Apr-2015 | Revised Aug-2022)

Figure 3.9 *– Site Photo of 8Flamingo Lake- East9 near the 8Concrete Drainage Headwal(School Site)*

Figures 3.10 & 3.11: *– Inner Drainage Overflow Structure (3.11) and Outer Drainage Overflow Structure (3.12) – School site.*

Flamingo Lake – East Area near the East 8Concrete Drainage Headwall9 (Dec-2024)

Site Location

Water Quality, near Culvert (Dec-11-2024)

Figure 3.12: *Site Conditions, near the Drainage Headwall (Dec-11-2024)(school site)*

At present, the water quality analysis focuses on the ecological impact to the area (Biological Oxygen Demand), and not any specific required site remediation activities [potential Detergents | Oil & Grease | Hydrocarbon (Fuel)].

This area require additional reviews / specific water quality analysis, for environmental remediation activities. In December 2024, it was apparent that in addition to laundry/wash flows, suspected oil & grease are also being introduced to the wetland area via this Eastern culvert. Prior disclosed that these drainage structures may terminate at the 8Eastern Laundry Facility9 for the Paradise Island Hotels

Areas of Concern: Possible Drainage (Unknown Source) to the Wetland Area (Jan-2025)

Figure 3.13 D*rainage from the West, looking toward RIU Parking | Atlantis Convention Center (Jan-2025)*

Figure 3.14: *Drainage from the East (Jan-2025)*

Figure 3.15: *Previous Oil Containment Devices*

Additional culverts are directed to the wetland area, from surrounding developed areas. Presumed that the wetland area was prior utilized as part of the surrounding development(s) stormwater management control. Several additional drainage culverts terminate at the Flamingo Lake Wetland Area. The wetlands are bounded by an active car park area to the NE (for One & Only, Ocean Club Resort), and also to the West (for the RIU Resort).

Table 3.1. – Wetland Water Quality @ Site, Flamingo Lakes (Dec-2024 | Jan2025) (Source AEES, 2025)

Laboratory Test	#1 Wetland Water	#2 Wetland Water	#3 Wetland Water	#4 Wetland Water	#5 Wetland Water	Drinking Water Regulatory Limits #
GPS Coordinates	25° 4955= N 77°18942= W	25° 4956= N 77°18942= W	25° 4957= N 77°18951= W	25° 4957= N 77°18952= W	25° 4959= N 77°18957= W	-----
Chemical pH	6.71	7.26	7.75	7.74	7.37	6.5 to 8.5
Total Dissolved Solids – ppm [TDS]	584	371	284	195	213	1,200
Sodium Chloride – ppm [Salinity]	225	135	75	45	45	600 250(desirable)
Total Hardness – ppm	25.98	27.12	29.37	28.25	33.89	<200
Appearance	Cloudy	Green Particles	Particles	Particles	None	Clear
Odor	Fishy	Mossy	None	None	None	None
Nitrate – ppm	4.9	6.0	1.5	1.4	0.7	10 2.0(desirable)
Turbidity – FNU	125	65	7	6	0.0	5.0 0.0(desirable)

Bacterial	WW#1	WW#2	WW#3	WW#4	WW#5	Regulatory #
Coliform/100ML	TNTC	TNTC	TNTC	TNTC	178	None
Fecal Coliform/100ML	TNTC	41	TNTC	TNTC	13	None

Note: Recommended data review of any detected compounds is per SW-II for Bathing, Contact Water Sports and Commercial Fishing Regulations: SW-II Coastal Water Regulations" refers to a set of water quality standards designated for coastal waters primarily used for bathing, contact water sports, and commercial fishing. Where "SW-II" signifies the "Secondary Water Quality" class for coastal areas, specifying permissible limits for parameters like pH, dissolved oxygen, fecal coliform count, and biochemical oxygen demand to ensure the water is safe for these recreational and fishing activities [**pH:** Should be within a range of 6.5 to 8.5, **Fecal Coliform:** Limited counts per100ml], but no specific limits for **TDS** | **Salinity**]. *Source: https://mpcb.gov.in/sites/default/files/water-quality/standards-protocols/CoastalwaterStandards.pdf*

DATA (DEC-2024 | JAN-2025)

The environmental (wetland water) quality results collected from the project site are presented in **Table 3.1.** above. No soil samples were taken (or required), as an available water sample matrix was easily accessible for collection & analysis.

The water quality for the wetland samples (for TDS, Salinity, & Total Hardness) is outside the WHO standard for drinking water, but acceptable for aquatic life. Alternative municipal water supplies are available within the project limits for drinking purposes. Low levels of nitrate (0.7 to 6.0-mg/L) & iron (0.07 to 1.41-mg/L) were observed for the sample results, along with low (<200-mg/L) levels of total hardness.

Iron, while naturally occurring in the environment and within the World Health Organization9s (WHO) Drinking Water Limit, should not exceed 1.0-mg/L. Where slight nutrient loading plus iron occurs, there is also the possibility of iron iron-reducing bacterium {<obtains its energy by oxidation of ferrous iron or reduced inorganic sulfur compounds. Iron/sulfur reducing bacteria is often associated with the production of a 8slime9 that can become a nuisance, blocking irrigation lines and filters.

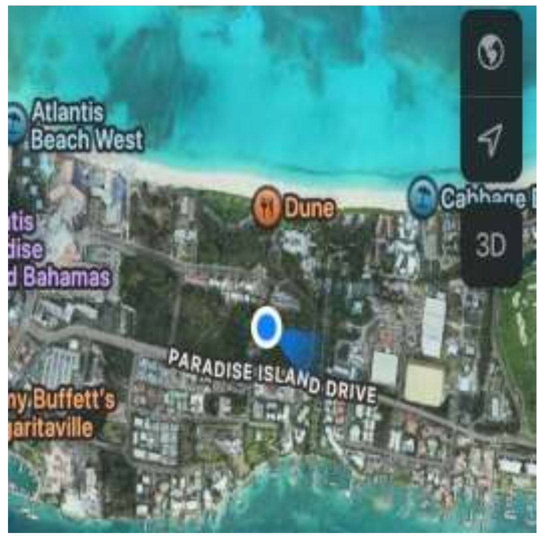
Total coliform | fecal coliform bacterium was detected in all the collected samples. Biological Oxygen Demand (BOD) within the Flamingo Lake 3 East Area of concern (WW#1) was 157-mg/L (ppm). General BOD levels for different types of water are: 1.) **Drinking water**: Has a BOD level of 132 ppm, 2.) **Moderately clean water**: Has a BOD level of 335 ppm, and 3.) **Polluted water**: Has a BOD level of 639 ppm. **Sample WW#1 BOD is more than 25x the level of a 8typical9 polluted source.**

Note: All wetland samples were collected 0.5 to 1Ft below surface. Water quality for the wetland samples (for TDS, Salinity & Total Hardness) are within the WHO standard for drinking water, but solely acceptable for aquatic life.

TNTC = Too-Numerous-To-Count, or <numerous amounts of coliform and fecal coliform bacteria=, which are <indicators of disease-causing organisms= were detected for the samples. The nitrate content or influence from septic | sewerage for the water samples ranged from 0.7 to 6.0-mg/L. All subsequent environmental quality data indicates that the Western areas 0.7 to

1.5mg/L) are not as influenced / affected by nutrient loading, as with the Eastern areas (4.9 to 6.0-mg/L). Fecal coliform(s) detected may be attributed to water fowl | wetland habitat. **For the ecological (8wetland9) water samples:** <Chemically, all of the minerals fell within standards for potable water.= All sample data is compared to the permissible limits of the WHO standards for 8potable water9. Acceptable levels of nitrate & iron (0.07 to 1.41-mg/L) were observed; along with low levels of total hardness. Turbidity level

Atlantis [Wetland] Water/Sample #1 (WW#1)



Site Photo

Sample Site Location

NAME: AEES Consultants LLC DATE: January 14th, 2025

LOCATION: WW#1 EMAIL: jbowleg@aeesconsultants.com

LAB TEST	UNIT	RESULT	DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Bacteria				
COLIFORM	cfu/100ml	*TNTC	NONE	NONE
FECAL COLIFORM	cfu/100ml	*TNTC	NONE	NONE
NON-COLIFORM	cfu/100ml	0		
*TNTC-TOO NUMEROUS TO COUNT				
Chemical				
pH	n/a	6.71	6.5 – 8.5	6.5 – 8.5
TOTAL DISSOLVED SOLIDS (TDS)	mg/L	584	500	1,200
SODIUM CHLORIDE	mg/L	225	250	250(desirable)
TOTAL HARDNESS	mg/L	25.98	100	<200
NITRATE	mg/L	4.9	10.00	10.00
IRON	mg/L	*1.41	0.3	0.5
APPEARANCE		Cloudy	CLEAR	CLEAR
ODOR		Fishy	NONE	NONE
CHLORINE RESIDUAL	mg/L	NIL	4.0	5.0
TURBIDITY-FNU	FNU	*125	5.0FNU	5.0FNU
NOTE: W.H.O. - WORLD HEALTH ORGANIZATION				
NOTE: E.P.A.-ENVIRONMENTAL PROTECTION AGENCY				

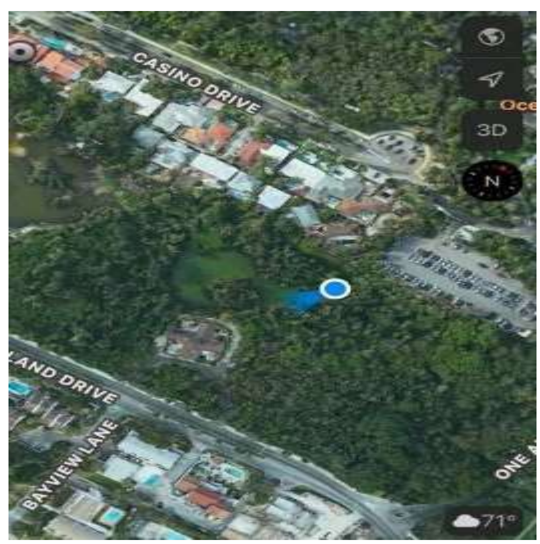
COMMENTS:

Numerous amounts of coliform and fecal coliform bacteria were isolated in the water sample. Coliform bacteria are indicators of disease-causing organisms and fecal coliform indicates sewer contamination.

Chemically, both the iron and turbidity levels far exceeded the maximum permissible limits for potable water.

Atlantis [Wetland] Water/Sample #2 (WW#2)

Site Photo



Sample Site Location

NAME: AEES Consultants LLC **DATE:** January 14th, 2025

LOCATION: WW#2 **EMAIL:** jbowleg@aeesconsultants.com

LAB TEST	UNIT	RESULT	DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Bacteria				
COLIFORM	cfu/100ml	***TNTC**	NONE	NONE
FECAL COLIFORM	cfu/100ml	***41**	NONE	NONE
NON-COLIFORM	cfu/100ml	0		
*TNTC-TOO NUMEROUS TO COUNT				
Chemical				
pH	n/a	7.26	6.5 – 8.5	6.5 – 8.5
TOTAL DISSOLVED SOLIDS (TDS)	mg/L	371	500	1,200
SODIUM CHLORIDE	mg/L	135	250	250(desirable)
TOTAL HARDNESS	mg/L	27.12	100	<200
NITRATE	mg/L	6	10.00	10.00
IRON	mg/L	***0.56**	0.3	0.5
APPEARANCE		Green Particles	CLEAR	CLEAR
ODOR		Mossy	NONE	NONE
CHLORINE RESIDUAL	mg/L	NIL	4.0	5.0
TURBIDITY-FNU	FNU	***65**	5.0FNU	5.0FNU
NOTE: W.H.O. - WORLD HEALTH ORGANIZATION				
NOTE: E.P.A.-ENVIRONMENTAL PROTECTION AGENCY				

COMMENTS:

Both coliform and fecal coliform bacteria were isolated in the water sample. Coliform bacteria are indicators of disease-causing organisms and fecal coliform indicates sewer contamination.

Chemically, both the iron and turbidity levels exceeded the maximum permissible limits for potable water.

Atlantis [Wetland] Water/Sample #3 (WW#3)

Site Photo

Sample Site Location

NAME: AEES Consultants LLC **DATE:** January 14th, 2025

LOCATION: WW#3 **EMAIL:** jbowleg@aeesconsultants.com

LAB TEST	UNIT	RESULT	DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Bacteria				
COLIFORM	cfu/100ml	*TNTC	NONE	NONE
FECAL COLIFORM	cfu/100ml	*TNTC	NONE	NONE
NON-COLIFORM	cfu/100ml	0		
*TNTC-TOO NUMEROUS TO COUNT				
Chemical				
pH	n/a	7.75	6.5 – 8.5	6.5 – 8.5
TOTAL DISSOLVED SOLIDS (TDS)	mg/L	284	500	1,200
SODIUM CHLORIDE	mg/L	75	250	250(desirable)
TOTAL HARDNESS	mg/L	29.37	100	<200
NITRATE	mg/L	1.5	10.00	10.00
IRON	mg/L	0.07	0.3	0.5
APPEARANCE		Particles	CLEAR	CLEAR
ODOR		None	NONE	NONE
CHLORINE RESIDUAL	mg/L	Nil	4.0	5.0
TURBIDITY-FNU	FNU	*7	5.0FNU	5.0FNU
NOTE: W.H.O. - WORLD HEALTH ORGANIZATION				
NOTE: E.P.A.-ENVIRONMENTAL PROTECTION AGENCY				

COMMENTS:

Numerous amounts of coliform and fecal coliform bacteria were isolated in the water sample. Coliform bacteria are indicators of disease-causing organisms and fecal coliform denotes sewer contamination.

Chemically, all of the minerals fell within standards for potable water. However, the turbidity level slightly exceeded the maximum permissible limits for potable water due to the suspended particles.

Atlantis [Wetland] Water/Sample #4 (WW#4)

Site Photo

Sample Site Location

NAME: AEES Consultants LLC **DATE:** January 14th, 2025

LOCATION: WW#5 **EMAIL:** jbowleg@aeesconsultants.com

LAB TEST	UNIT	RESULT	DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Bacteria				
COLIFORM	cfu/100ml	*178	NONE	NONE
FECAL COLIFORM	cfu/100ml	*13	NONE	NONE
NON-COLIFORM	cfu/100ml	0		
*TNTC-TOO NUMEROUS TO COUNT				
Chemical				
pH	n/a	7.37	6.5 – 8.5	6.5 – 8.5
TOTAL DISSOLVED SOLIDS (TDS)	mg/L	213	500	1,200
SODIUM CHLORIDE	mg/L	45	250	250(desirable)
TOTAL HARDNESS	mg/L	33.89	100	<200
NITRATE	mg/L	0.7	10.00	10.00
IRON	mg/L	0.06	0.3	0.5
APPEARANCE		None	CLEAR	CLEAR
ODOR		None	NONE	NONE
CHLORINE RESIDUAL	mg/L	Nil	4.0	5.0
TURBIDITY-FNU	FNU	0.0	5.0FNU	5.0FNU
NOTE: W.H.O. - WORLD HEALTH ORGANIZATION				
NOTE: E.P.A.-ENVIRONMENTAL PROTECTION AGENCY				

COMMENTS:

Both coliform and fecal coliform bacteria were isolated in the water sample. Coliform bacteria are indicators of disease-causing organisms and fecal coliform denotes sewer contamination.

Chemically, all of the minerals fell within standards for potable water.

3.3.3.2 RECOMMENDATIONS | CONCLUSIONS

The limited hydrogeological | water quality survey involved the confirmation of groundwater, any freshwater resources, and influence to wetlands on/near the project site, and the status of these resources. Recommendations have been made on minimizing negative impacts to these resources at the Atlantis School & Wilderness Site(s).

- The groundwater lens configuration of the Atlantis School Site is best described as brackish to salt water.
- Relevant to the environmental impact to the groundwater / water resources / hydrology / water quality / wetlands: the project construction operations were determined/confirmed to be MINOR - MODERATE / SHORT TERM. The continued operation of a school site on the property was determined to be MINOR / LONG TERM. Additional areas of concern are the potential drainage sources into the Wetland Area.
- Storm surge effects to the project site were determined to be MINOR - MODERATE / LONG TERM.
- Additional reviews for potential influence of the <Eastern Laundry facility= to the water quality of the <Flamingo Lake 3 East= may be required.

- Additional hydrological data reviews may be required for impact of the project development to the adjacent wetland area(s).

3.3.4 Air Quality

Presently, there are no sources of air pollution or poor air quality on the project site, as it is currently undeveloped, with an existing residential building. According to the World Health Organization’s 2018 Fact Sheet No 313, the air quality in the Bahamas is considered moderately unsafe. The most recent data indicates the country’s annual mean concentration of PM2.5 is 17 g/m3, exceeding the recommended maximum of 10 g/m3.

3.3.5 Geotechnical Survey Findings

A summary of key points arising from the Geotechnical Survey Report by BRON ***(See Appendix – D)*** are as follows:

Figure 3.16: *Showing Boring Locations for Geotechnical Survey (Source: BRON, 2021)*

3.3.5.1 Subsurface Profile

The subsurface was consistently dense to very dense. The average soil consistency observed was very dense. B6 exhibited a less dense layer at approximately 20ft below ground surface. This layer is still medium dense, with an SPT of 34. Therefore, it is not considered to be a hazard.

3.3.5.2 Ground Water

The depth of the water surface beneath ground elevation was measured at the time of testing. The salinity of the water was not tested. Only boreholes 2, 5 and 6 progressed deep enough to allow for measurement of the water table. Tides in the region occur semidiurnally, meaning 2 high tides and 2 low tides occur over a 24hour period. The tidal range is on the order of 3 ft on average. Other factors which may affect water surface elevations are the effects of hurricanes or other severe weather events, including heavy rainfall and storm surge.

3.3.5.3 Lateral Earth Pressures

Proposed finish floor elevations will dictate the lateral earth pressures acting on stem walls, and thus strip footings. The width of the footings will be largely dependent on the finish floor elevations, and transition to existing grade. Footings will need to be sized accordingly to resist overturning and sliding.

3.3.5.4 Bearing Capacity

The bearing capacity for strip footings was calculated using the SPT values for the first sample at each borehole. Shallow foundations could be designed with soil contact pressures on the order of 8,000 psf. Settlements on the order of 3/4 inch to 1 inch are estimated.

3.3.5.5 Footing Geometry

The upper soil layers are Very Dense. Minimum footing depths should be 18= for continuous footings and isolated pad footings. Minimum footing widths for strip should be 24=. Minimum footing widths for isolated pad footings should be 24=.

3.3.5.6 Fill Placement and Compaction

Based on the existing ground elevations and consistency, fill material will likely be required to backfill the foundation within the footprint of the proposed buildings.

Fill material should consist of inorganic granular soils free from deleterious materials and should be approved by our firm. The backfill should have a maximum particle size of 3 inches. Limestone fill material should be placed in lifts not thicker than 12 inches. Lifts should be moisture conditioned as required. Each lift should be compacted to field dry densities of not less than 95 percent of the material9s maximum dry density as determined by the Modified Proctor Compaction Test (ASTM D-1557).

The fill and backfill material must be placed under qualified engineering inspection and each lift must be tested to ensure conformance with the project specifications. In restricted areas where a small compactor must be used, the lift thickness should be reduced to 6 inches.

3.3.5.7 Trenches

Utility trenches should be located such that the bottom of the trench does not intersect a 1:1 slope projected downward from nearby footing bearing surfaces.

3.3.6 Noise

The typical noise levels of highway traffic normally range from 70 to 80 dB (Decibels) at 15 meters (50 feet) from the highway. For comparison, a lawnmower, blender, and hairdryer are over 85 dB (Decibels). These levels affect many people, interrupting concentration, and limiting the ability to carry on a conversation.

During the construction of Paradise Island School, it is expected there will be increases in both noise levels from heavy machinery and the air quality will likely decrease due the expected dirt particulates that will filter into the atmosphere from construction work being undertaken.

3.3.7 Traffic Impact

A Traffic Impact Assessment (TIA) ***(See Appendix – B)*** was undertaken by Caribbean Civil Group (CCG) to determine the impacts if any, and the mitigation thereof according to the requirements of the Ministry of Works & Utilities (MOWU) and the Town Planning Committee (TPC). The findings revealed the proposed site for the school located on Paradise Island is situated in the southcentral region of the Island, accessible solely by Paradise Island Drive via an existing ingress and egress. The study incorporated the projected primary trips during the peak hour period based on research and historical data collected at other similar elite private schools within the Island of New Providence.

The proposed site will be situated fronting Paradise Island Drive in proximity to the Ocean Club Road, the Four Seasons Resort access. The study area intersections are indicated in **Figure 3.17** to **Figure 3.24.**

Figure 3.17: *Site Location on Paradise Island Drive*

Figure 3.18: *Paradise Island Drive & Flamingo*

Figure 3.19*: Paradise Island Drive & Harbour Ridge*

Figure 3.20: *Paradise Island Drive & Lakevie*

Figure 3.21: *Paradise Island Drive & Bayview*

Figure 3.22: *Paradise Island Drive & Ocean Club*

Figure 3.23: *Paradise Island Drive & Cloister West*

Figure 3.24: *Paradise Island Drive & Cloister*

3.3.7.1 Impacts

Based on the traffic capacity analysis and engineering judgment, it was determined that there would be no significant impact to the study area by the proposed school fronting the Paradise Island Drive corridor. Notwithstanding, the impacts that would require intervention will be the potential U-Turning movements at the end of the center median before the Ocean Club Road intersection and traffic calming the speeds observed between the Ocean Club Road intersection and Lakeview Drive as noted in ***Appendix B.***

3.3.7.2 Mitigation

The potential mitigation for the impacts is identified and as follows: upgrade the Ocean Club Road intersection and provide traffic calming measures within the school zone.

3.3.7.3 Recommendations/Conclusions

The recommendation is to upgrade the Ocean Club Road intersection to a roundabout with an Inscribed Circle Diameter (ICD) of 90 feet minimum to 110 feet maximum and to install speed tables in proximity to the proposed ingress. Upgrading to a roundabout will realize a crash modification factor (CMF) of 0.65 (CMF ID: 209), which will enhance the LOS and reduce delays. The installation of traffic calming measures such as speed tables to control speeds will realize a CMF of 0.6 (CMF ID: 132) within the school zone.

The TIA took into account the trips generated by the proposed School fronting Paradise Island Drive, located on Paradise Island. The analysis indicated that the impacts to the proposed study area will be insignificant.

However, to assist with improved, safety traffic flows and reduction of delays, it is recommended to upgrade the Ocean Club Road intersection with a roundabout of minimum 90-110 ICD. Additionally, install additional traffic calming measures on Paradise Island Drive to manage speeds within the school zone.

3.4 Natural Environment

Studies with respect to botanical, avian and biodiversity were undertaken over an initial four-day period (7th & 8th December 2023, and 14th & 15th December 2024). The objective, to map and assess the flora diversity, (inclusive of a protective tree species survey), identify any invasive species, fauna and abundance and identify associated biodiversity.

3.4.1 Terrestrial Surveys

3.4.1.1 Methodology

The 22.93-acre parcel of land was ground truced (walking) along the entire boundaries. Using Areces et al. (1990), all vegetation identified were recorded and used to compile a species list. Corell and Corell (1982) and the website for the Leon Levy Plant Preserve (Eleuthera) http://www.levypreserve.org/_m1810/Plants-Scientific-Name was used for Plant taxonomy. Invasive species encountered was referenced and identified, in accordance with the National Invasive Species Strategy (2013) for eradication or control. The presence and abundance of protected trees were undertaken, listed in accordance with the Forestry (Declaration of Protected Trees) Order 2021. Using survey plan of proposed property, a systematic grid approach was adopted. A total of 4 computer generated sample plots were established with (4) quadrants sampled in each plot for the purposes of botanical data collection and analysis. Each sample plot centre chosen for data collection was georeferenced (GPS coordinates), with a fixed radius of 8 meters established. Tally counts were made of all flora species identified (diversity) and categorized as trees, shrubs, and herbs. Overall estimation of species abundance of protected trees was determined (an expansion factor was used with calculations extrapolation

over the 22.93 acres). Firstly, the tally count for each plant species was totalled per plot, then averaged over the four plots for an overall plot average per acre, next the plot average per species was extrapolated to the property acreage (less wetland area). **Figures 3.27 through Figure 3.32** depicts the location of the sample plots from which field data was collected, along with a summary of the findings for the plant species identified, with summary totals.

3.4.2 Vegetation Map

Figure 3.26 below depicts a vegetation map of the 22.93 acre tract of land. Of note is the dominant vegetation type of Dry Broadleaved Evergreen Formation (DBEF), comprising the entire site acreage, and its relation to the Flamingo Lakes East (Buttonwood Formation) situated Northwest of school site. An abundant residence (private property) is situated due West of school site. **Table – 3.2** clearly identifies the species diversity found on the site.

Figure 3.25*: Depicts the project site comprising the <Dry Broadleaved Evergreen Formation (DBEF)= vegetation type, the Natural Wetlands along with the boundaries separating the nature trail and development areas.*

3.4.3 Vascular Plant Diversity

Based on survey analysis, a total of 91 plant species were identified from the entire site ***(Table 3.2),*** in comparison to 80 species within the nature reserve area of 16.73 acres ***(Table 3.3).*** This number represents most of the species on site, and one can conclude that the list is a fair representation of the extent of dominance of native and species versus ornamentals on site.

Table 3.2: Vascular plant species recorded on entire property. (22.93 acres)

		Status			
Botanical Name	**Common Name**	**N**	**NN**	**P**	**I**
Heliotropium curassavicum	Pond bush	√			
Anemia adiantifolia	Pineland fern	√			
Bidens alba	Shepherd needle		√		
Bromeliaceae	Bromeliad				
Bursera simaruba	Gum Elemi			√	
Caladium bicolor	White spindle flower				
Cassytha filformis	Love vine	√			
Chrysobalanus icaco	Coco plum		√		
Clitoria ternatea	Butterfly Pea flower				
Coccoloba uvifera	Seagrape		√		
Colubrina arborescens	Soap bush	√			
Conocarpus erectus	Buttonwood			√	
Ipomoea pescaprae	Railroad vine (bayhop)	√			
Jacquinia keyensis	Joewood			√	
Leucaena leucocephala	White leadtree (jumbay)	√			
Lysiloma latisiliquum	Wild tamarind			√	
Melaleuca quinquenervia	Paperbark tree				√
Alkali sacaton	Donkey grass		√		
Pinus caribaea	Pine			√ √	

Ranunculus spp.	Buttercup				
Rhynhcospora floridensis	White-top sedge		√		
Sabal palmetto	Sabal palm			√	
Salvia greggii	Native sedge				
Schinus terebinthifolia	Brazilian pepper				√
Schizachyrium scop arium	Sawgrass	√			
Sideroxylon salicifolium	Willowbustic	√			
Sphagneticola trilobata	Creeping Oxeye	√			
Trema lamarckiana	Pain in back	√			
Turnera ulmifolia	Buttercup				
Typha latifolia	Common Cattail				√
Cocos nucifera	Gold Coconut Palm		√		
Anona glabara L.	Pond Apple		√		
Bidens alba	Shepherd's Needle		√		
Pueraria montana	Kudzu Vine		√		
Casuarina equisetifolia	Causarina				√
Morinda citrifolia	Noonie		√		
Pisonia aculeata	Haul Back		√		
Ipomoea indica	Morning Glory		√		
Leucanthemum vulgare	Wild Oxe-Eye Daisy	√			
Mucuna pruriens	Monkey Tamarind		√		
Terminala catappa	Asain Almond Tree		√		

Ricinus communis	Castor Bean Plant		√		
Mangifera indica	Mango Tree		√		
Jasminum officinale	Jasmine Vine		√		
Senna bicapsularis	Sennas (Christmas Bush)		√		
Bletilla striata	Bletia Orchid			√	
Nymphaeaceae Spp.	Pond Lillies		√		
Piscidia piscipula	Eddie Tree		√		
Cassytha filiformis	Love Vine		√		
Ficus carica	Fig Tree		√ √		
Epipremnum aureum	Money Vine				
Adiantum capillus-veneris	Maiden Hair Fern		√		
Coccoloba diversifolia	Pidgeon Plum	√			
Metopium toxiferum	Poison Wood	√			
Smilax havanensis	Chaney Briar	√			
Swietenia mahagoni	Mahogany			√	
Delonix regia	Poinciana		√		
Bougainvillea glabra	Bougainvillea				
Clusia rosea	Signature Tree		√		
Cyperus alternifolius	Umbrella Plant				
Melaleuca spp.	Melalleuca				
Leucothrinax morrisii	Thatch palm			√	
Chiococca alba	Snow-Berry		√		
Coccothrinax argentata	Silver-Top Palm	√			

Picramnia pentandra	Snake Plant				
Guapira discolor	Small Leaf Blolly			√	
Tecoma stans	Yellow Elder	√			
Cladium mariscus	Saw Grass		√		
Roystonea borinquena	Royal Palm		√		
	Cherry Tree		√		
Thouinia discolor	Quicksilver		√		
	Silver Sap		√		
Axonopus spp.	Carpet Grass		√		
Ceiba pentandra	Silk Cotton Tree			√	
Pisum sativum	Pea Plant	√			
Celastraceae spp.	Spindle Flower		√		
Asystasia gangetica	Chinese Violet		√		
Asparagus densiflorus	Foxtail Fern	√			
Phoenix roebelenii	Dwarf Date Palm		√		
Dracaena reflexa	Song Of India Plant		√		
	Bracken Fern	√			
Ixora coccinea	West Indian Jasmine		√		
Hibiscus rosasinensis	Wild Hibiscus	√			
Adiantum peruvianum	Dollar Fern	√			
Urochloa spp.	California Grass		√		
Eugenia axillaris	White Stopper		√		
Pandanus utilis	Screw Pine		√		
Pithecellobium keyense	Rahms horn	√			
Momordica charantia	Cerassee	√			

Allamanda schottii	Allamanda Vine		√		
Vitis munsoniana	Wild Grape		√		
Ficus glumosa	Mountain Fig		√		
N = Native, NN = Non-Native, P = Protected, I = Invasive					

Table 3.3: Vascular Plant Species Found Recorded in Nature Reserve Area (16.73 acres)

		Status			
Botanical Name	**Common Name**	**N**	**NN**	**P**	**I**
Heliotropium curassavicum	Pond bush	√			
Anemia adiantifolia	Pineland fern	√			
Bidens alba	Shepherd needle		√		
Bromeliaceae	Bromeliad				
Bursera simaruba	Gum Elemi			√	
Cassytha filformis	Love vine	√			
Chrysobalanus icaco	Coco plum		√		
Clitoria ternatea	Butterfly Pea flower				
Coccoloba uvifera	Seagrape		√		
Colubrina arborescens	Soap bush	√			
Conocarpus erectus	Buttonwood			√	
Ipomoea pescaprae	Railroad vine (bayhop)	√			
Jacquinia keyensis	Joewood			√	

Leucaena leucocephala	White leadtree (jumbay)	√			
Lysiloma latisiliquum	Wild tamarind			√	
Melaleuca quinquenervia	Paperbark tree				√
Alkali sacaton	Donkey grass		√		
Pinus caribaea	Pine			√ √	
Ranunculus spp.	Buttercup				
Rhynhcospora floridensis	White-top sedge		√		
Sabal palmetto	Sabal palm			√	
Salvia greggii	Native sedge				
Schinus terebinthifolia	Brazilian pepper				√
Schizachyrium scop arium	Sawgrass	√			
Sideroxylon salicifolium	Willowbustic	√			
Trema lamarckiana	Pain in back	√			
Typha latifolia	Common Cattail				√
Cocos nucifera	Gold Coconut Palm		√		
Anona glabara L.	Pond Apple		√		
Bidens alba	Shepherd's Needle		√		
Casuarina equisetifolia	Causarina				√
Morinda citrifolia	Noonie		√		
Pisonia aculeata	Haul Back		√		
Ipomoea indica	Morning Glory		√		
Leucanthemum vulgare	Wild Oxe-Eye Daisy	√			

Mucuna pruriens	Monkey Tamarind		√		
Terminala catappa	Asain Almond Tree		√		
Ricinus communis	Castor Bean Plant		√		
Mangifera indica	Mango Tree		√		
Jasminum officinale	Jasmine Vine		√		
Senna bicapsularis	Sennas (Christmas Bush)		√		
Bletilla striata	Bletia Orchid			√	
Nymphaeaceae Spp.	Pond Lillies		√		
Piscidia piscipula	Eddie Tree		√		
Cassytha filiformis	Love Vine		√		
Ficus carica	Fig Tree		√		
Epipremnum aureum	Money Vine		√		
Adiantum capillus-veneris	Maiden Hair Fern		√		
Coccoloba diversifolia	Pidgeon Plum	√			
Metopium toxiferum	Poison Wood	√			
Smilax havanensis	Chaney Briar	√			
Swietenia mahagoni	Mahogany			√	
Delonix regia	Poinciana		√		
Clusia rosea	Signature Tree		√		
Melaleuca spp.	Melalleuca				
Leucothrinax morrisii	Thatch palm			√	
Chiococca alba	Snow-Berry		√		
Coccothrinax argentata	Silver-Top Palm	√			

Picramnia pentandra	Snake Plant				
Guapira discolor	Small Leaf Blolly			√	
Tecoma stans	Yellow Elder	√			
Cladium mariscus	Saw Grass		√		
Thouinia discolor	Quicksilver		√		
	Silver Sap		√		
Axonopus spp.	Carpet Grass		√		
Ceiba pentandra	Silk Cotton Tree			√	
Pisum sativum	Pea Plant	√			
Celastraceae spp.	Spindle Flower		√		
Asystasia gangetica	Chinese Violet		√		
	Bracken Fern	√			
Hibiscus rosasinensis	Wild Hibiscus	√			
Adiantum peruvianum	Dollar Fern	√			
Urochloa spp.	California Grass		√		
Eugenia axillaris	White Stopper		√		
Pandanus utilis	Screw Pine		√		
Pithecellobium keyense	Rahms horn	√			
Momordica charantia	Cerassee	√			
Allamanda schottii	Allamanda Vine		√		
Vitis munsoniana	Wild Grape		√		
	Mountain Fig		√		
N = Native, NN = Non-Native, P = Protected, I = Invasive					

3.4.4 Protected Trees Species Identified

A total of twelve **(12)** Protected tree Species was identified from field surveys on the property, which include noted species such as, Gum elemi (*Bursera simaruba)*, Buttonwood (*Conocarpus erectus),* Joewood (*Jacquinia keyensis),* Wild Tamarind *(Lysiloma latisiliquum),* Pine Tree (*Pinus caribaea),* Buttercup (*Ranunculus spp.),* Sabal Palm (*Sabal palmetto),* Bletia Orchid (*Bletilla striata),* Mahogany (*Swietenia mahagoni),* Thatch Palm (*Leucothrinax morrisii),* Silk Cotton Tree (*Ceiba pentandra)* and Small Leaf-Blolly *(Guapira discolor).*

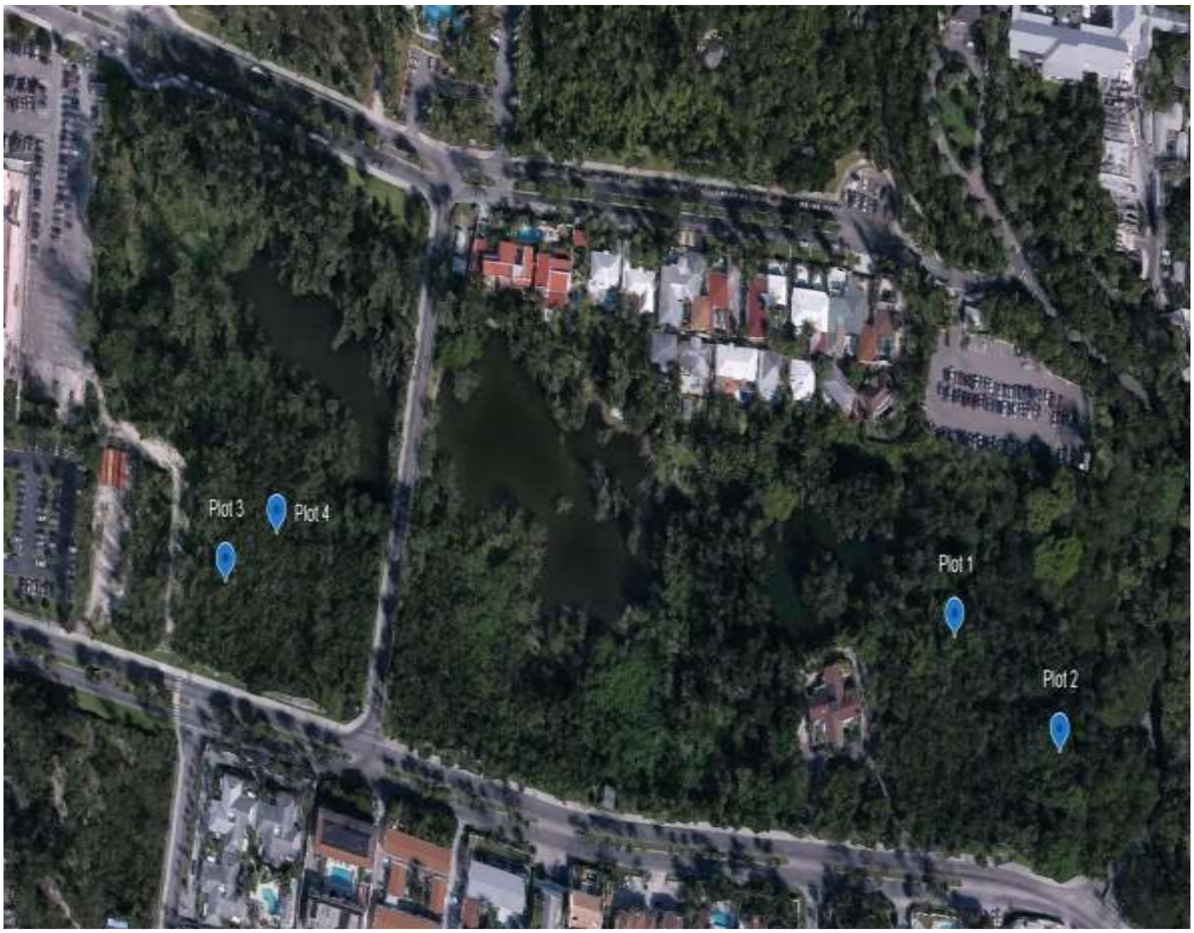


Figure 3.26*: Showing Various Sample Plot Locations subject to sample survey (Google Earth, 2025)*

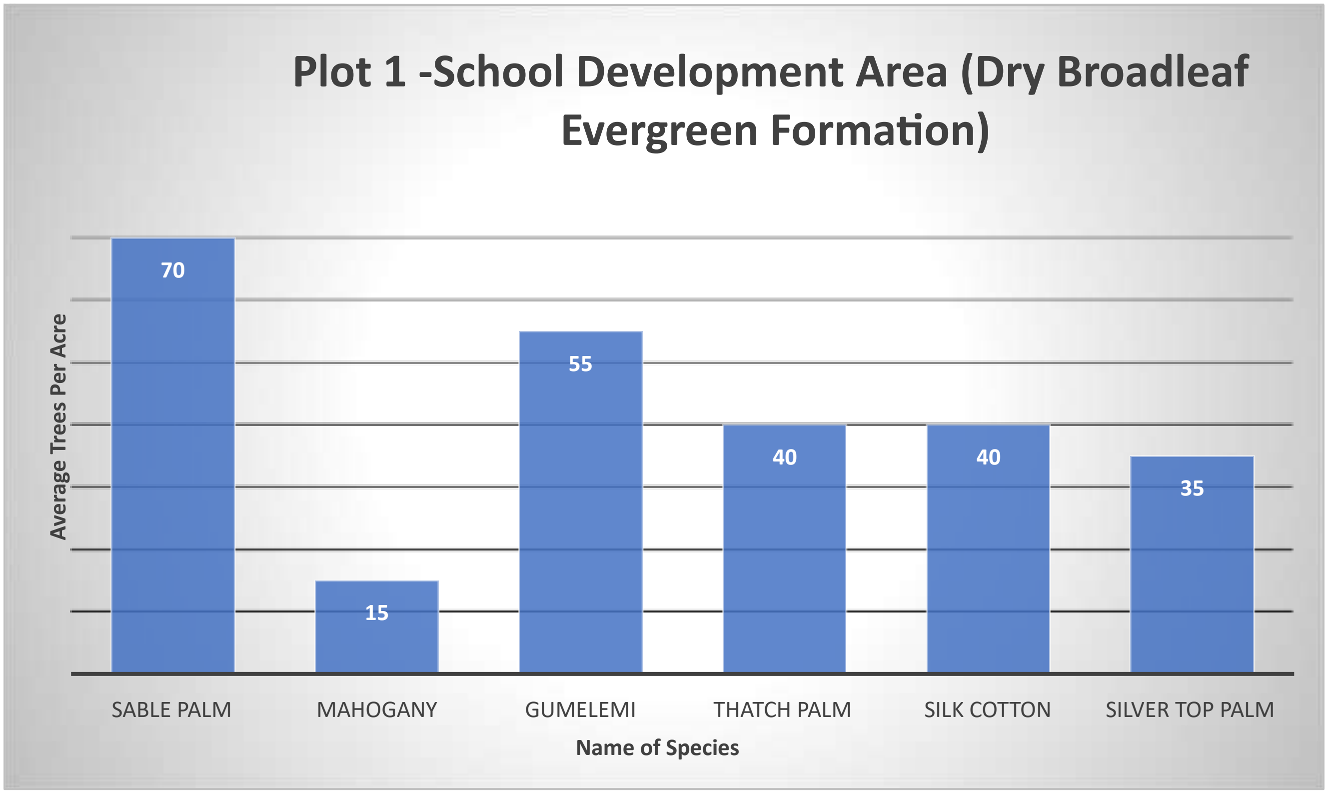


Figure 3.27: *Showing Plot 1 Protected Trees Chart.*

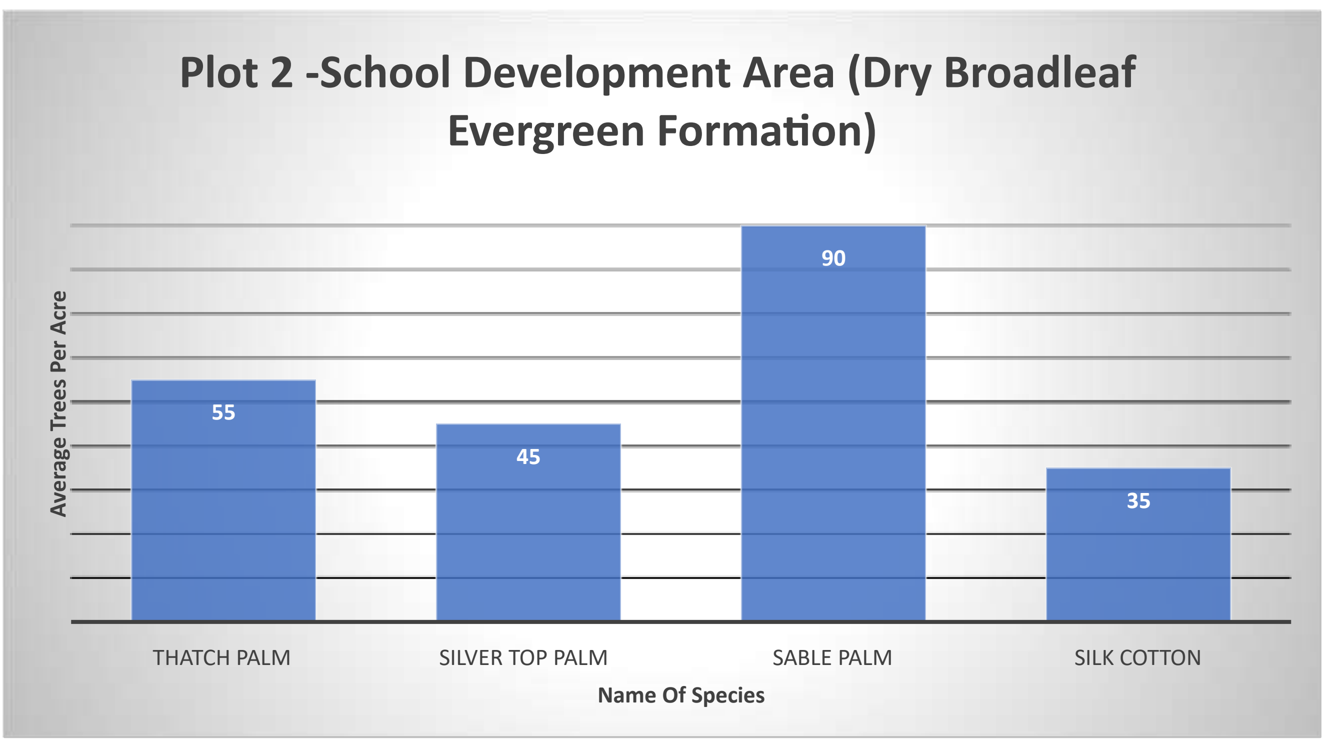


Figure 3.28: *Showing Plot 2 Protected Trees Chart.*

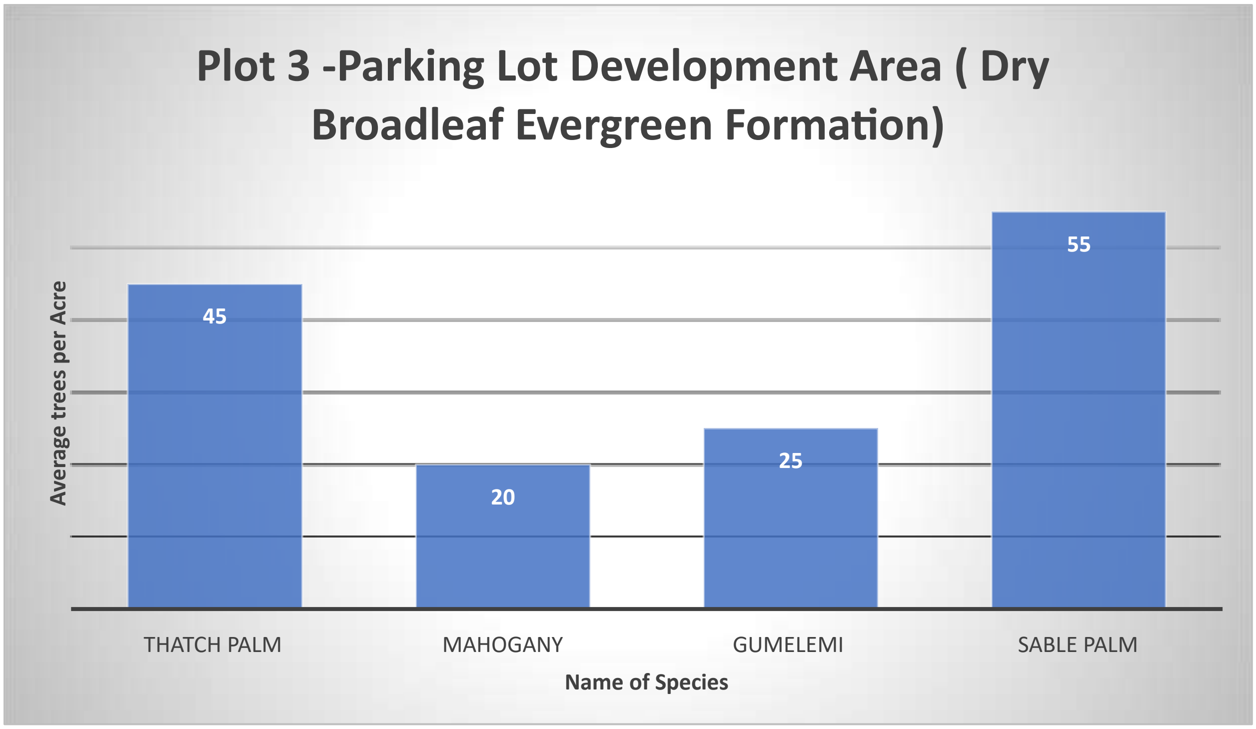


Figure 3.29: Showing Plot 3 Protected Trees Chart

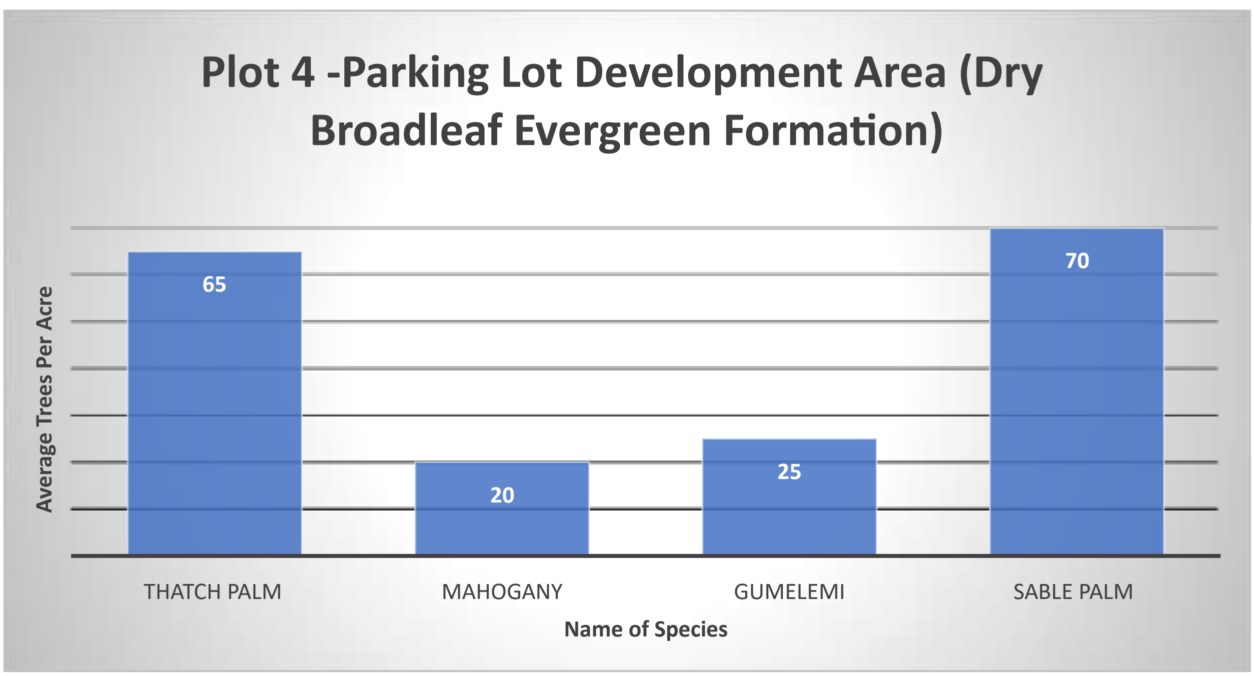


Figure 3.30: Showing Plot 4 Protected Trees Chart.

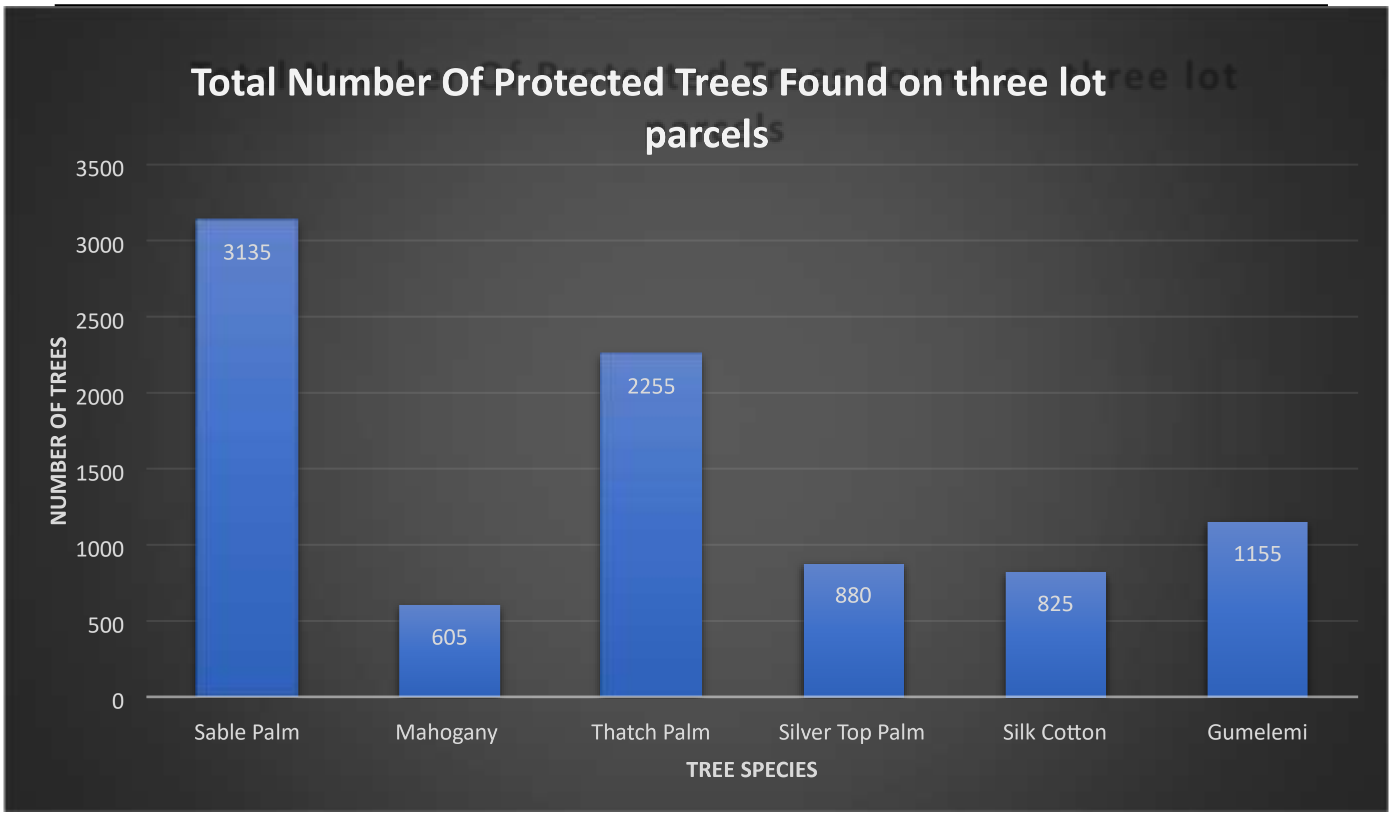


Figure 3.31*: Chart Depicting the total number of protected trees found within the 22.93-acre parcel.*

Figures 3.32 to 3.41 depicts some protected species and invasives found on the property. The Total Number of Protected Trees found on the parcel was extrapolated at **8,855.**

3.4.5 Invasive Species

A total of four (4) invasive species were observed and listed ***(Table 3.4)***. The National Invasive Species Strategy (2013) outlines recommendations for effective management of all invasive species.

Table 3.4: Invasive species listed and found on the project site.

Botanical Name	Common Name	Presence on Site	Recommendations for Control
Casuarina equisetifolia	Australian Pine	Numerous recorded along the full area of site with high canopy	Control
Melaleuca quinquenervia	Paperbark Tree	Numerous individuals on the interior of the site	Eradication
Schinus terebinthofolius	Brazilian pepper	Numerous individuals recorded within the property as well as along the boundaries	Eradication

Typha latifolia	Common Cattail	Numerous recorded along the wetland portion of the parcel.	Control

Figure 3.32: *Sabel Palm*

Figure 3.33*: Silk Cotton Plant*

Figure 3.34*: Thatch Palm*

Figure 3.35*: Christmas palm*

Figure 3.36: *Money Vine*

Figure 3.37: *Bougainvillea*

Figure 3.38: *Mahogany Tree*

Figure 3.39: *Signature Plant*

Figure 3.40: *Invasive Casuarina Tree situated in the top canopy level*

Figure 3.41: Gumelemi Tree situated in the Upper Canopy level

3.5 Avian Assessment Surveys

Four avian surveys were conducted on 7th, 8th, 14th & 15th December 2024 to identify the presence, abundance, and habitat utilization of the avian species found within the boundaries of the project site. A Summer avian study took place on 22nd June 2025. with results depicted in Table 3.6

3.5.1 Methodology

The assessment consisted of four days of active avian observations, commencing from 8 am to 5 pm each day. The number of species were recorded in the abundance categories, Single (1), Few (2 3 10), and Many (11 3 100). Final abundance estimates were compiled. The IUCN categories were used to determine the Status of each species identified. **Table 3.5** below shows the Winter survey sessions period findings.

3.5.2 Avian Survey Results

A total of thirty-two (32) species were recorded during the winter session. **(Table 3.5),** whereas nineteen (19) species were recorded in the summer session **(Table 3.6).**

Table – 3.5. Avian observations – (Winter Sessions)

TABLE KEY		
Range	**Status**	**Habitat**
PRB = Permanent Resident Breeding	**LC** = Least Concern (Conservation 3 IUCN)	**FW** = Freshwater
WRN = Winter Resident Non-Breeding	**NT** = Near Threatened (Conservation 3 IUCN)	**IU** = Interior Upland
SRB = Summer Resident Breeding	**E** = Endemic	**HA** = Human Altered
	I = Introduced	**FO** = Fly Over

		CS = Coastal Shore
		RS = Rocky Shore
		SS = Sandy Shore
		TF = Tidal Flats
		W = Wetlands
		S = Saline

Common Name	Scientific Name	Range	Status	Observation Winter Session 7th and 8th December 2024	Observation Winter Session- 14th and 15th December 2024	Habitat Utilization
American Redstart	*Setophaga ruticilla*	WRN/E	LC	M	F	IU
Bahama woodstar	*Nesophlox evelynae*	PRB/E	LC	M	-	IU
Bahama yellowthroat	*Geothlypis rostrata*	PRB/E	LC	M	M	FO
Bananaquit	*Coereba flaveola bahamensis*	PRB	LC	F	F	FO
Black & white warbler	*Mniotilta varia*	WRN	LC	F	F	FO
Blue Egret		PRB	LC	F	F	W
Cape may warbler	*Setophaga tigrina*	WRN	LC	F	F	IU
Cat bird (Gray)	*Dumetella carolinensi*	WRN	LC	F	M	FO
Glossy Ibis	*Plegadis falcinellus*	PRB	LC	F	F	HA
Ground dove	*Colombina passerine*	PRB	LC	M	M	HA
Mocking bird	*Mimus gundlachii*	PRB	LC	M	M	FO/IU
Oven bird	*Seiurus aurocapilla*	WRN	LC	F	M	IU
Palm warbler	*Dendroica palarum*	WRN	LC	M	M	FO
Prairie Warbler		PRB	LC	-	F	FO
Pine warbler	*Setophaga pinus*	PRB	LC	F	-	HA

White- crown pigeon	*Patagioenas leucocephala*	PRB	NT	M	M	FO/IU
White Egret		PRB	LC	M	M	IU/W
Yellowthroat warbler	*Geothlypis rostrata*	PRB	LC	M	M	W/HA
Imperial Dove	*Ducula spp.*	PRB	LC	M	M	HA
Green Heron	*Butorides virescens*	PRB	LC	M	M	W
Clapper Rail	*Rallus crepitans*	PRB	LC	F	F	W/IU
Great Blue Heron	*Ardea herodias*	PRB	LC	F	F	FO
Cuban Pee wee	*Contopus caribaeus*	PRB	LC	-	M	FO
Short Billed Dowitcher	*Limnodromus griseus*	PRB	V	F	M	W
Long Nosed Dowitcher	*Limnodromus scolopaceus*	WRN	NT	F	-	W
Pied-billed Grebe	*Podilymbus podiceps*	PRB	LC	M	M	W
Black Throated Blue Warbler	*Setophaga caerulescens*	WRN	LC	F	-	FO
West Indian Woodpecker	*Melanerpes supercillaris*	WRN	LC	F	-	IU
Smooth Billed Annie	*Crotophaga ani*	PRB	LC	F	M	HA
Bahama Mockingbird	*Mimus gundlachii*	PRB/E	LC	M	M	IU
YellowRomped Warbler	*Setophaga coronata*	WRN	LC	F	F	IU
Frigate Bird	*Fregata magnificens*	PRB	LC	F	-	W
TOTAL SPECIES				**32**	**32**	

Table 3.6: Avian observations – (Summer Sessions)

TABLE KEY		
Range	**Status**	**Habitat**
PRB = Permanent Resident Breeding	**LC** = Least Concern (Conservation 3 IUCN)	**FW** = Freshwater
WRN = Winter Resident Non-Breeding	**NT** = Near Threatened (Conservation 3 IUCN)	**IU** = Interior Upland
SRB = Summer Resident Breeding	**E** = Endemic	**HA** = Human Altered
	I = Introduced	**FO** = Fly Over
		CS = Coastal Shore
		RS = Rocky Shore

Common Name	**Scientific Name**	**Range**	**Status**	**Observation** Summer Session June 22 nd 2025 2024	**Habitat Utilization**
Bahama woodstar	*Nesophlox evelynae*	PRB/E	LC	M	IU
Mourning Dove	*Zenaida macroura*	PRB	LC	M	FO/IU
Black- Faced Grassquit	*Melanospiza bicolor*	PRB	LC	F	IU
Red Legged Thrush	*Turdus plumbeus*	PRB	LC	F	IU
Gray Kingbird	*Tyrannus dominicensis*	SRB	LC	M	IU/FO
Loggerhead Kingbird	*Tyrannus caudifasciatus*	PRB	LC	F	IU
Laughing Gull	*Leucophaeus atricilla*	PRB	LC	F	F/O
Least Grebe	*Tachybaptus dominicus*	PRB	LC	M	W

Northern Moorhen	*Gallinula chloropus*	I	LC	M	W
urasian Dove	***Streptopelia decaocto***	PRB	LC	M	F/O
Cat bird (Gray)	*Dumetella carolinensi*	WRN	LC	F	FO
Ground dove	*Colombina passerine*	PRB	LC	M	HA
Oven bird	*Seiurus aurocapilla*	WRN	LC	F	IU
White- crown pigeon	*Patagioenas leucocephala*	PRB	NT	M	FO/IU
White Egret		PRB	LC	M	IU/W
Green Heron	*Butorides virescens*	PRB	LC	M	W
Great Blue Heron	*Ardea herodias*	PRB	LC	F	FO
Smooth Billed Ani	*Crotophaga ani*	PRB	LC	M	IU
Bahama Mockingbird	***Mimus gundlachii***	PRB	LC	M	IU/FO
TOTAL SPECIES				**19**	**19**

Figure 3.42: *White Ibis*

Figure 3.43*: Eurasian Dove*

Figure 3.44: *White Crowned Pidgeon*

Figure 3.45*: Bahama Mockingbird*

Figure 3.46*: Green Heron*

3.5.3 Range

The geographical area where birds are consistently found is referred to as their Range. Birds classified as migrants have seasonal range, whereas restricted species on some islands or in a region year-round.

- **Permanent Resident Breeding (PRB)**: refers to resident species that live and breed all year round throughout the Bahamas. On the project site, twenty-one out of the thirty-two species (65%) found on the property were PRB (Winter session), versus 79% PRB for the Summer session survey.

- **Winter Resident Non-breeding (WRN):** refers to the annual non-breeding fall/winter (generally October to April) migrants to the Bahamas from North America. The majority of the WRN birds leave by the end of April for their home states during spring or summer. Nine species were observed as Winter Residents.
.
- **Summer Resident Breeding (SRB)**: refers to species that breed in the Bahamas during the summer months (April to October), then return to other regions the rest of the year. SRB includes both land and sea birds. Only one SRB species (Gray Kingbird) was observed during the summer study.

3.5.4 Endemic Species

Birds found in the Bahamas are referred to as Endemic. The Bahama woodstar *(Nesophlox evelnae)*, the Bahama Mockingbird (*Mimus gundlachii),* and *the* Bahama Yellowthroat (*Geothlypis rostrata),* were the endemic species found.

3.5.5 Conservation Status

a. **Protected species**: All species observed are protected under the Wild Birds Protection Act, Chapter 249 (Statute Law of The Bahamas).
b. **Endangered:** None of the species recorded is classified as endangered.
c. **Species of Concern**: Near Threatened (NT) by the IUCN classifies a species that may be considered threatened with extinction in the near future, although presently not qualified for the threatened status. The White-crowned pigeon *(Patagioenas leucocephala)*, currently designated as near-threatened status, was observed during the surveys.

3.5.6 General Discussion

The dominance of the PRB species along with some WRN species during Avian surveys confirms the adaptation of the species to sites of high biodiversity, abundance of food resources, and the varied vegetation types for roasting and breeding purposes. Species abundance is correlated with the size of the site, where on larger sites greater abundance of species is likely, versus small sites. During the survey, it was noted that a high percentage of the birds observed were in the interior areas and flyovers, versus a smaller percentage in the human-altered environment. This could be due to the excessive noise and human activity along the boundary of the parcel. Also important is the timing of the surveys. Bird Surveys should be carried out in the summer and winter months to have a representative sample of species associated with the seasons.

3.6 Biodiversity Assessment

In addition to the Botanical and Avian studies, any animals, insects, reptiles, amphibians, and other living creatures observed were recorded as either Single (1), Few (2 3 10), or Many (11 3 100). **Table 3.6** provides a summary of the observations. **Figures 3.47 to 3.52 b**elow show images of the observed species

. Table 3.6: Summary of observed wildlife from the project site

Common Name	Scientific Name	Abundance
Yellow Butterfly	*Colias sp.*	M
Monarch Butterfly	*Danaus phexippus*	M
Black Dragon Fly	*Trames sp.*	M
Brown Anole	*Anolis sagrei*	M
Curly tailed lizard	*Leiocephalus carinatus*	M
Feral Cat	*Felis catus*	F
Common Snail	*Cornu aspersum*	M
Banana Spider	*Trichonephila clavipes*	M
Termite	*Isoptera spp.*	M
Honeybee	*Apis mellifera*	M
Paper Wasp	*Polistes dominula*	M

***Figure 3.47 & Figure 3.48**: Feral Cats*

Figure 3.49: *Termite Mound*

Figure 3.50*: Banana Spider*

Figure 3.51*: Curly Tailed Lizard*

Figure 3.52: *Paper wasp nest found underneath thatch palm.*

3.7 National Parks and Protected Areas

New Providence Island has a total of five (5) National Parks, which includes the Clifton Heritage Park managed by the Clifton Heritage Authority; the Retreat, the Primeval Forest National Park, Bonefish Pond National Park, and Harold & Wilson Ponds National Park, under the management of the Bahamas National Trust (BNT). The Clifton Heritage Park located on the western tip of New Providence, protects 250 acres of intact broadleaved coppice forest, where there are remnants of the historical and cultural heritage of three important groups that had an influence on the country: the Lucayans, the Loyalists and Africans.

Primeval Forest National Park protects 7.5 acres of undisturbed old-growth broadleaved coppice forest and is representative of the early hardwood forests of the Bahamas. Located in southwestern New Providence.

Bonefish Pond National Park is a mangrove ecosystem on the shores of Southern New Providence, Bonefish Pond protects 1,235 acres of important coastal wetlands.

Harrold & Wilson Ponds National Park protects 250 acres of vital wetland habitats for birdlife in New Providence. Surrounded by development, these freshwater wetlands are internationally recognized as Important Bird Areas. Harold & Wilson Ponds National Park is currently closed to the public.

The Retreat is an area of eleven (11) acres botanic gardens, showcasing rare and exotic palms, cycads and intact native broadleaved coppice ecosystem and flowering plants, located on Village Road. The site once housed the headquarters of the Bahamas National Trust.

3.8 Socio-economic Aspects

3.8.1 Population

According to the Population Census 2022 ***(Table 3.7),*** the population of The Bahamas was 399,314. Residents included all people regardless of their legal status, with a growth of 13.62 % over the past decade. New Providence experienced the largest increase in population and is the most populous island in The Bahamas, containing more than 70% of the total population. It is the location of the national capital city of Nassau, whose boundaries coincide with the island, and had a population of 296,522 (20.38% change) from 2010 of 50,193.

Table 3.7: *Population Census Bahamas (2022 Census data), Bahamas National Statistics Institute***.**

Island	**Population**		**Ch ınge**	
Years	2010	2022	Actual	%
All Bahamas	351,461	399,314	47,853	13.62
New Providence	246,329	296,522	50,193	20.38

3.8.2 Economy

Tourism

According to the Central Bank of the Bahamas' June 2023 Report (Q2/2023), foreign tourist arrivals grew by 45.2% to 2.4 million. Further, tourism output continued to strengthen, supported by increases in high-value air segments and sea traffic. Statistics by Nassau Airport Development (NAD) Company revealed a continued rebound in stopover visitors (US departures grew by 21.4% (87.1% of passengers, while international departures advanced by 10.1%).

Construction

The Construction Sector (Q2/2023) was undergirded by several new and ongoing foreign direct investment projects.

Employment

In terms of employment, according to The Bahamas National Statistics Institute Labour Survey for May 2023, the unemployment rate decreased by 70 basis points to 8.8% in May 2023. The number of self-employed persons grew by 5.0% to 34,095 compared to May 2019 (the last Labour Force Survey). However, the number of employed persons reduced by 6.8% to 200,17 compared to 2019. The number of discouraged workers rose by 2.3%. The jobless rate in New Providence fell by 50 basis points to 8.9% compared to May 2019.

Prices

Average inflation moderated to 3.6% from 5.6% compared to 2022, which reflected the pass-through effect of higher global oil prices and costlier imports.

3.8.3 Transportation

The Atlantis School Development will be accessed by travelling west on Paradise Island Drive. There is no active public transportation available on Paradise Island. Access to the school and nature reserve can be traversed by private vehicle only. A Public Parking Lot proposed to the West of the school site would bring added relief for the short parking spaces available on the Island.

3.9 Cultural Resources

Cultural resources represent the national patrimony and are of interest, and include:

- Archaeological sites of pre-European native people
- Archaeological sites of European and recent cultures
- Ruins
- Historic structures
- Cemeteries and any human burial sites
- Landscape features and sites of traditional cultural importance

Bahamian culture is an amalgam of its African and European heritage influenced by the peoples of the Caribbean and the Americas. Nassau, the Capital, situated in New Providence, was originally known as Charlestown. It was laid out and renamed Nassau in 1695 by Nicholas Trott, the most successful Proprietor Governor, in honor of the Prince of Orange-Nassau who became William III of England. Because of its natural deep harbor, New Providence was singled out as the most suitable seat for the Government.

3.10 Touristic and Recreational Areas

A large majority of tourists who visit the Bahamas either as stopover visitors or cruise passengers end up vacationing in New Providence, with Nassau being the Capital. New Providence has significant touristic and recreational landmarks and activities for the enjoyment of visitors and locals alike. Notable among these are the arts, including painting, sculpture, and photography, as well as crafts, which have blossomed into several prominent institutions devoted to their cultivation.

Art and crafts can be seen at a variety of galleries, including the National Art Gallery, located in a mansion overlooking Nassau Harbour. The Department of Archives preserves public and private records and makes them accessible to the public. The Antiquities, Monuments and Museums Corporation regulates and controls antiquities, monuments, museums, and archaeology. The Bahamas Historical Society, in Nassau, operates a museum and publishes a scholarly journal. Visitors can enjoy the Native straw market downtown Nassau for native straw works (handmade baskets of native straw, etc.), native wood carvings, in addition to local shops in the Nassau for tee shirts, fine jewelry, native rums and souvenirs. Locals and tourists alike use the Goodman9s Bay Public Beach (west of Goldwynn Resort and Residences) for public recreation and beach activities, in addition to other public beach locations in New Providence.

3.11 Waste

The sustainable management of all waste requires an understanding of all sources of waste (i.e., solid and liquid).

3.11.1 Solid Waste streams

All solid waste generated and collected will be disposed of in the New Providence Ecology Park Waste Disposal Site at Tonique Williams Darling Highway.

3.11.2 Liquid Waste streams

Wastewater generated from the school site will be disposed of in the Lift station on Paradise Island and into the sewerage treatment facility for Paradise Island.

3.12 Utilities

3.12.1 Potable water

The source of water will be derived from Paradise Island Utilities potable water.

3.12.2 Electricity

The project development will receive electricity supply from the national grid (BPL). There will also be back up generation capacity. Solar panels will be erected on the roofs of the school building as well as on the roof of the car Parking facility, to contribute to the use of renewables, energy conservation, and efficiency for the project.

3.12.3 Fuel storage and distribution

Fuel storage will be in the form of day tank storage on site in a predetermined, protected, and secure location.

3.12.4 Construction & Material Sources

All building material for the construction of the school, parking lot, and nature trail respectively, will be derived locally, or imported from the USA, and stored in 40 ft containers.

4.0 Legal Aspects

All projects developed within the boundaries of the Commonwealth of the Bahamas are subject to compliance with national laws, regulations, international conventions, and guidelines. Additionally, Developers must consider, when relevant, mitigation measures, international financial guidelines, and World Bank environmental, health, and safety (EHS) guidelines

4.1 Local Legislation and Policies

Tables 4.1 and 4.2 depict the local legislations and policies that are relevant to the physical and natural environment and may apply to the project.

Table 4.1 highlights local legislations

Antiquities, Monuments and Museum Act, 1998	<An Act to provides for the preservation, conservation, restoration, documentation, study and presentation of sites and objects of historical, anthropological, archaeological and paleontological interest, to establish

	a national Museum, and for matters related therewith…=
Disaster Preparedness and Response Act, 2006	<An Act to provide for the effective organization of the mitigation of, preparedness for, response to and recovery from emergencies and disasters…=
Road Traffic Act, 1962	<An Act to declare, amend and codify the law relating to motor vehicles, and to provide for the regulation of traffic on roads and of motor vehicles…=
Agriculture and Fisheries Act, 1964	<An Act to provide for the supervision and development of agriculture and fisheries in the Bahamas…=
Fisheries Resources (Jurisdiction and Conservation) Act	An Act to make provision with respect to the conservation and management of the fishery resources of the Bahamas and to extend the limits of the jurisdiction of the Bahamas over such fisheries resources and for matters connected therewith…=
Water and Sewerage Corporation Act, 1976	An Act to establish a Water and Sewerage Corporation for the grant and control of water rights, the protection of water resources, regulating the extraction, use and supply of water, the disposal of sewage and for connected purposes…=
Building Regulations, 1971	An Act to regulate the construction, altercation and repair of buildings, provide for the re-instatement or removal of dangerous or dilapidated buildings, to authorize the publication of a building code and for purposes connected therewith…=
Environmental Planning and Protection Act, 2019	An Act to establish the department of environmental planning and protection; to provide for the prevention or control of pollution, the regulation of activities, and the administration, conservation, and sustainable use of the environment; and for connected purposes=
Environmental Planning and Protection (Extension of Application) Order, 2020	An Order to extend the Environmental Planning and Protection Act, 2019 throughout the territory of the Bahamas, including every island and cay and to define procedures for proposed projects, monitoring and compliance, and the certificate of environmental clearance.
Environmental Impact Assessment Regulations, 2020	The regulations describe the procedure for proposed projects and requirements to apply and receive a Certificate of Environmental Clearance from the Department of Environmental Planning and Protections.
Bahamas Protected Areas Fund Act 2014	The Act establishes the BPAF as a Fund to ensure sustainable financing for protected areas in the Bahamas. The Fund allows for the solicitation of funds and donations from the Caribbean Biodiversity Fund, to fund protected areas in the country.

Conservation and Protection of the Physical Landscape of the Bahamas Act, 1997	An Act to make provision for the conservation and protection of the physical landscape of the Bahamas. The Act contains pats regarding administration, regulation of excavation and landfill operations, provisions governing dangerous excavations, landfill operations, quarries or mines, zoning of the Bahamas for the purposes of quarrying and mining operations, and general entries.
Environmental Health Service Act, 1987	<An Act to promote the conservation and maintenance of the environment in the interest of health, for proper sanitation in matters of food and drink and generally, for the provision and control of services, activities and other matters connected therewith…=
Environmental Health Services (Collection and Disposal of Waste) Regulations, 2004	Section 18 speaks to removal of construction waste and section 19 speaks to industrial waste disposal.
Forestry Act, 2010	An Act to provide for the conservation and control of forests and for matters related thereto;
Forestry Regulations, 2014	Provides for the application for a permit to harvest protected trees
Forestry (Amendment) Regulations, 2021	Amends the Forestry Regulations, 2014 to provide for reduced to be payable for royalties for the granting of licences, permits for the salvaging of damaged forest due to natural disasters, hurricane, or tornados.
Forestry (Amendment) Regulations 2023	An amendment to the First Schedule to increase fees for the harvesting of protected trees
Forestry (Declaration of Protected Trees) Order, 2021	An Order which increases the list of trees protected from a previous eleven (11) to some one hundred and twentyseven (127) trees/plants.
Planning and Subdivision Act 2010	The Act governs development and planning, both from terrestrial and marine landscapes. It applies to both New Providence and the Family Islands and the Port area of Grand Bahama. While the Act is comprehensive, no formal land use plans have been developed
Wild Animals Protection Act 1968	The Act prohibits the taking, capturing, or hunting of any wild animal without a permit.
Bahamas Public Parks and Public Beaches Authority 2014	The Act allows the authority to control, plan, design, develop, administer, manage and maintain public parks and public beaches; to conserve their natural beauty and topography, propagate, protect, and preserve animals, plants and other organisms in those areas.

Bahamas National Trust Act 1959	The Act provides the BNT with the mandate to promote the preservation of lands, buildings, underwater areas, and areas of natural interest. The Act also empowers the BNT to identify sites for protection and to administer areas declared protected; and manages national parks.
Wild Birds Protection Act 1959	The Act prohibits the taking, capturing, and hunting of any wild bird without a permit. It protects birds and eggs during the closed season. The Act also permits the Minister to establish wild bird reserves

Table 4.2 National Environmental Policies

Relevant National Environmental Policies	Summary
National Policy for Adaptation to Climate Change 2005	The policy outlines a framework to meet the goals and objectives of the United Nations Framework Convention on Climate Change (UNFCCC). Where the Bahamas committed itself to reducing greenhouse gases and address the impacts of climate change
National Invasive Species Strategy for the Bahamas, 2013	The initial policy was drafted in 2003, but subsequently updated in 2013, as part of a GEF funded project (MITIASIC) Mitigation the Threats of Invasive Alien Species in the Insular Caribbean; and sets out a management strategy for the control and eradication of invasive species
National Biodiversity Strategy and Action Plan, 1999	The Action plan calls the Bahamas to conserve biodiversity and pursue sustainable development. It further highlights the role of biodiversity in the social and environmental context and recommends measures to ensure its compatibility with future developments.

4.2 International legislation and Conventions of relevance

Table 4.3 depicts international conventions that are of relevance to the project, and regards must be made.

Table 4.3 International Conventions enforced in the Bahamas.

International Convention/Organization	Summary
Cartagena Convention. Ratified: June 24, 2010	The Convention provides for the legal framework for cooperation in the wider Caribbean region. Three technical agreements apply: ● Protocol for co-operation in combating oil spills. ● Protocols for specially protected areas and wildlife (SPAW); ● Protocol concerning pollution from land-based sources and activities (LBS).

Convention on Biological Diversity. Signed: June 12, 1992	The convention has three main goals: ● Conservation of biodiversity. ● Sustainable use of components of biodiversity. ● The fair and equitable sharing of the benefits arising out of the utilization of genetic resources (ABS)
Convention on Wetlands of International Importance (RAMSAR Convention) Signed: June 7, 1997	Known as the RAMSAR convention. The convention provides the framework for the international protection of wetlands as contributors for avifauna which do not adhere to international borders.
Convention to Combat Desertification and Drought. Signed November 10, 2000	The Convention provides for sustainable development by addressing social and economic issues that directly impact land degradation.
United Nations Framework Convention on Climate Change. Signed: June 1992 Kyoto Protocol Signed: April 9, 1999 Paris Agreement Ratified: August 22, 2016	The Bahamas is a signatory to this convention. It establishes a framework with the aim to stabilize atmospheric greenhouse gases. The Kyoto Protocol was developed under the UNFCCC to provide emissions targets and timelines for developed countries. The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

4.3 Government Institutions

Table 4.4 summarizes the key government and non-government policy and statutory agencies, their responsibilities relevant to the project with respect to aspects of approvals and permitting, and the EIA Process.

Table - 4.4: Key Governmental and Non-governmental Agencies with responsibilities

AGENCY	SUMMARY OF RESPONSIBILITIES
Bahamas Investment Authority (BIA)	● A <one-stop shop= agency to reduce bureaucratic delays for domestic and international investors, seeking Government approval for development projects in the Bahamas

Ministry of the Environment and Natural Resources (MTENR)	● To manage, protect and conserve all land, water, and other tangible resources of the Bahamas, and have regard to the environmental, economic, and social benefits that may confer on the Bahamas. ● Give advice on proposals from the private and public sectors that would significantly affect the Bahamas. ● Overseas conservation of wild animals, birds and plants, and forests. ● It administers the Wild Birds and Wild Animals Protection Acts.
Department of Environmental Planning and Protection (DEPP)	● To promote best practices in environmental management and to minimize harm to the environment. ● Administer the EIA process, coordinate the public review of EIAs, and various national plans for natural resource management. ● Promoting and enforcing compliance with the Environmental Planning and Protection Act, 2019
Forestry Unit (FU)	● Sustainable management, conservation, control, and development of the natural forest resources on state lands. ● Promotion and regulation of forest industries. ● Regulate the commercial utilization of the natural forest resources. ● Protection of trees that are rare and of historical significance.
Department of Environmental Health Services (DEHS)	● Environmental control, solid waste collection and disposal of domestic, commercial and construction waste ● Enforcement of industrial regulation, public health guidelines, enforcing public sanitation. ● Evaluate the effectiveness of pollution control measures to protect the health and safety of workers. ● Issuance of effluent discharges and emission permits

Department of Fisheries (DOF)	● Oversees and enforces fisheries regulations and the establishment of Marine Reserves and Marine Protected Areas (MPAs)
Department of Local Government (DLG)	● Implements the provisions of the local government Act, thus ensuring sound and sustainable family island development
Ministry of Tourism and Aviation (MTA)	● Promotion of the tourism industry of the Bahamas ● Encourage visitor arrivals by air and by sea throughout the Bahamas
Ministry of Public Works and Utilities (MPW)	● Overseas and maintains physical infrastructure in the country. ● Responsible for building controls and Regulations
Disaster Reconstruction Authority (DRA)	● <Ensures that adequate preparedness and mitigation measures and response and recovery mechanisms are established to counteract the impact of natural, man-made and technological hazards…=
Department of Physical Planning (DPP)	● Administers the Planning and Subdivision Act, 2010, which includes the preparation of land use plans for the islands. ● Controls development of the natural and built environments, via zoning.
Water and Sewerage Corporation (WSC)	● optimizes the development of the country9s water resources and water quality control. It shares with DEHS the responsibility for monitoring water quality. ● Issue water supply franchises to developers, especially where the supply of water is impractical for the government or its agencies
Department of Labour	● Regulates Health and Safety under the Health and Safety at Works Act, 2002. ● conducts inspections at workplaces to ensure adequate worker safety and regulations compliance

Bahamas National Trust (BNT)	● Established as a non-government entity (nonprofit) by the BNT Act 1959. ● To manage national parks and protected areas, historic preservation, public awareness, and environmental outreach

5.0 Anticipated Environmental Impacts of the Proposed Project

5.1 Impact Assessment Methodology

It is important to recognize that Residential and Commercial development on small islands requires a process of risk and impact assessment that is standardized and objective. These tools are accepted for impacts that involve:

- degradation of terrestrial and marine species
- Where land-based sources of pollutants are introduced, and
- freshwater and nutrients are introduced to the island hydrology.

The appropriate tool in this circumstance will involve a series of questions and appraisal, ranking and then prioritizing the potential risks and hazards.

5.1.1 Assessment Criteria Tool

Qualitative Assessment Criteria will be used to rank a source of activity for its environmental impact. With each phase and component described, evaluated for impacts, then mitigation measures are outlined **(Tables 5.1, 5.2 and 5.3)**. Significance level overall will be measured as:

Significant 3 high impact, sufficient intensity, and duration to generate significant change(s), predominantly irreversible naturally. Site affected in the long term.

Moderate 3 an effect for a limited time over the affected area, site condition is temporarily altered, naturally reversible in the medium term.

Negligible 3 effect is barely evident, short duration, site not altered, naturally reversible in the short term.

Severity Criteria Tool

Severity of an environmental impact is another tool used to measure the magnitude of impact an event has on the environment. Severity is usually given the numerical rating of 1 for low impact, 3 for medium impact and 5 for high impact. Factors that are measured for severity would include negative effects on flora and fauna, impact on wildlife, effects on air and water, noise, visual, and short-term vs long term recovery of the environment, among others **(Table 5. 3).**

Table 5.1 Qualitative Assessment Criteria for Impact Assessment

Qualitative Criteria	Choices	Description
Nature	• Direct • Indirect	Does origin/source activity Directly or Indirectly act on the environmental target (species or natural community)
Type	• Positive Negative •	Positive implies species or natural community will have a higher likelihood of persistence with increased viability. Negative implies the opposite
Likelihood	• Not Likely • Potential • Certainly	Not Likely 3 10% chance of impact occurring. Potential 3 10 to 70%. Certainty 3 impact has greater than 70% chance of occurring.
Scale	• Specific habitats • Island environs • Regional National • internationally or	Restricted to specific habitats. Impact that impacts the entire project site. Regional Impacts (New Providence Island) International Impacts refer to CITIES species
Duration	• Temporary Long-term •	Temporary 3 impacts last less than three years. Long-term 3 more than three years
Reversibility	• Reversible or • Irreversible	Reversible 3 impacted species or natural communities will recover. Irreversible 3 species or natural communities lost to project site, and impact should be mitigated

5.2 Impacts to the Physical Environment

Pre-construction/construction activities and project operation activities being reviewed as part of the impacts are outlined below:

1.0 *Pre-Construction/Construction Phase*: ○ Site preparation and construction of Infrastructure:

- ✦ Basic infrastructure for electricity generation
- ✦ Installation of water and sewerage infrastructure

2.0 Construction of school building foundations, car park walls structures, and nature trail system *Project Operation Phase:*

○ Property Management

- ✦ Landscaping maintenance
- ✦ Invasive species management

5.2.1. Impact Assessment for Site Preparation and Infrastructure Development

Table 5.2: Summary of impact matrix developed for site preparation and infrastructure development (Atlantis school, car park and nature reserve, Paradise Island)

Qualitative Criteria	Choices	Description
Nature	Direct	Direct impact on 4.0 acres of property for school development, 1.932 acres for a car park, and 16.73 acres for a nature preserve. Use of concrete and sheet steel pilings, building footings, and columns.
TYPE	Positive Negative	With the development of a 16.73-acre nature trail, much of the parcel ecosystem is retained for habitat utilization and ecotourism. The clearing of the 1.932-acre site for the public car park, and the 60% vegetation losses due to school construction on the 4-acre site will have a moderate impact in larger context. negatively imp
Likelihood	Certainty	Impacts and benefits will be the result once the actions outlined are completed
Scale	Island Environs	Removal of Invasive Species (Australian Pine 3 casuarina, Melaleuca and Brazilian pepper), will help reduce seed sources on the island.
Duration	Long Term	The native plant communities within the wetland nature reserve will be stabilized and enhanced with the development of the nature trail system, with additional replanting of native and protected tree species.
Reversibility	Irreversible	Natural ecological processes will be maintained.

Overall Significance	Moderate	Impact is visible in context on the school site with 60% vegetation loss. The Site conditions will be altered with the construction of the school and the clearing of vegetation from the parking lot. Identified protected trees will be translocated and staged at Atlantis nursery and reintroduced to the school site and nature reserve. Additionally, New landscaping with native flowering plant species will encourage the return of wildlife and biodiversity. The development of a nature trail system will
		maintain all existing wetland ecosystems in the vicinity of the school site

Table - 5.3: Summary of Environmental Impacts based on Severity.

Terrestrial	3	Removal of 60% vegetation from the school site and 100% from the car park will impact the natural landscape, resulting in the loss of vegetation. However, coastal or dune vegetation species will not be affected.
Biodiversity (wildlife)	3	Due to the moderate footprint of the project development, the associated biodiversity (i.e., land animals, birds nesting sites) displacement impact is moderate. Hence, biodiversity impact is expected to be moderate, given the change in land use for the construction footprint of buildings and other related infrastructures on the school site will be offset by the development of the Paradise Wild nature trail system, with additional protected trees and native plants transplanted on the 16.73-acre wetland site
Marine	1	As there is no development on the marine environment, there will be no impact on the benthic environment, biodiversity, and water quality in the vicinity of the land-based project
Avifauna	3	Noise levels generated by project activities may deter birds from utilizing sites temporarily, and birds and animals may return once construction activities are completed.
Visual and Aesthetics (Positive)	3	Construction of school, etc., will enhance the visual and aesthetic of the project, given the low density of the school and eventual removal of all construction waste. Debris not removed adequately and timely, impairs the visual and aesthetic of the site for extended periods. The Nature trail system, with its improvements, will bring additional aesthetics to the surrounding area.

Coastal	1	The coastal environment situated due north of the project site (Beach Strand vegetation and dune formations) will not be impacted by project activities and will remain in its natural state.
Hydrological	3	The limited hydrogeological, water quality survey involved the confirmation of groundwater, any freshwater resources, and the influence on wetlands on/near the project site, and the status of these resources. Recommendations have been made on minimizing negative impacts to these resources at the Atlantis School & Wilderness Site(s). ***(See Appendix – C: Bowleg, 2025).*** ○ The groundwater lens configuration of the Atlantis School Site is best described as brackish to salt water. **(Bowleg, 2025)**
		○ Relevant to the environmental impact to the groundwater / water resources / hydrology / water quality / wetlands: the project construction operations were determined/confirmed to be MINOR - MODERATE / SHORT TERM. The continued operation of a school site on the property was determined to be MINOR / LONG TERM. Additional areas of concern are the potential drainage sources into the Wetland Area. **(Bowleg, 2025**) ○ Storm surge effects to the project site were determined to be MINOR - MODERATE / LONG TERM. Additional hydrological data reviews may be required for impact of the project development to the adjacent wetland area(s). **(Bowleg, 2025)**
Erosion/Sedimentation	1	There is the potential for soil erosion and sedimentation. However, the risk of higher levels of erosion will be minimized; as such, the current drainage and runoff characteristics will not be changed.
Air Quality	3	Construction activities and the use of associated equipment can generate significant volumes of dust that impair the air quality and impact human health. There will be a need to employ adequate management techniques to reduce the impact on human health.
Noise	3	Noise levels tend to rise during construction activities, disturbing birds and animal species. Birds are likely to be displaced and leave the area, particularly where their nesting sites are disturbed. Human health is impacted by elevated noise levels. According to the CDC (2019), prolonged loud noise level exposure above 70dB may cause hearing damages.

Solid & Hazardous Waste	1	Solid waste that is not adequately disposed of can be an eyesore. In the case of hazardous waste, these can pose a threat to wildlife and human health through attracting pests, which are disease vectors. Hazardous waste not properly managed can also result in penetration into the soil, groundwater resources, and marine environment (pollution).
Occupational Health and Safety	5	There are risks of workers not wearing protective personal equipment (PPE). Additionally, the risk is high for the improper use of equipment and materials and non-compliance with standard safety protocols and procedures. Consequently, there could be physical damage and potential loss of human lives.
Fire & Hurricane	3	The risk of fires from construction activities is reduced by good housekeeping, training in fire and safety practices. As the Bahamas falls within the North Atlantic Hurricane Belt, the season commences on June 1 to November 31. The risk of New Providence being affected by a hurricane in any given year is relatively high. Hence the need
		for a Hurricane Preparedness and Recovery Plan.

5.2.2 Socio-economic Impacts

Table 5.4 below summarizes the socio-economic impacts that are likely to occur from the school project, based on the Severity of Impact Criteria

Table – 5.4: Summary of Socio-economic Impacts based on Severity Criteria

Factor	Severity of Impact	Impact Description
Land Use	5	Any development that brings change to the natural landscape will impact that landscape to a certain degree. The existing land use for the project site is green space. The Atlantis School Project development will retain a significant percentage of the natural vegetation.
Economic ***(beneficial)***	5	The Atlantis school project anticipates contributing to the local community of Paradise Island. Projected investment is pegged at ten million dollars (**BSD$10,000,000.00).** • Employment of 50-100 Bahamian construction workers for 2 to 3 years. • NIB contributions for Employees • VAT to the Government • Real Property Tax to Government The overall economic impact on the Paradise Island Area and, by extension New Providence Island will be significantly positive.
Cultural	1	No cultural resources were identified during field studies, and hence no impacts.

6.0 Proposed Mitigation Measures

Mitigation is how negative impacts identified are minimized, offset, or averted. This can be achieved through project design, restoration of disturbed areas, operational techniques, preventative management plans, and compensation for unavoidable impacts.

Table 6.1 below summarizes the mitigation measures recommended to minimize or eliminate any negative environmental impacts that may arise during the project development cycle.

Table - 6.1: Summary of Environmental Mitigation Measures

Terrestrial	• Relocate protected species identified within the footprint of school building prior to construction activities, to be replanted within the nature reserve site, and school site in strategic locations. • Removal of all the invasive casuarina species Australian Pine (*Casuarina equisetifolia*), melaleuca and Brazilian pepper species*)* • In areas where landscaping is undertaken to plant native and endemic species. • The development of the nature reserve (16.73 acres) with an enhanced nature trail system ***(see Figure 2.11 & Appendix - B)***, will be augmented with additional protected species and native flowering plants. • Use drone surveys to monitor land use changes, vegetation cover, and shoreline integrity.
Biodiversity	• There will be clearing of vegetation for development of the 1.932-acre parking lot, and 60% vegetation losses due to school construction on the 4-acre site using heavy equipment and bulldozers. This action will negatively impact vegetation and associated biodiversity. • New landscaping and enhanced nature trail system development will introduce all native and flowering plants to attract avian species and increase biodiversity in the area.

Marine wetlands	• Continuous monitoring to check water quality levels to track any changes in nitrogen, phosphorus, turbidity, salinity, EC, and pH during and after the construction of the school, to ensure water quality is not impacted. ***(See Appendix F),*** This is preventing any further contamination of the wetlands. • Eliminate drainage of effluent into the wetlands from the nearby laundry facilities via the eastern culverts and other pollutant sources. ***(See Appendix – G)*** • Ensure that effective strategies, administrative, technical, and mechanical, are implemented to prevent households, hazardous and waste runoff, and other potential drainage sources are being diverted away from the Wetland Area, where practical, into the existing Paradise Island Stormwater system, to improve the water quality of the wetlands. • Create/enhance vegetative buffer zones around the lake and wetland to filter runoff and reduce pollutant entry • Develop a Spill Response Strategy to minimize the risk of pollutant discharges to Flamingo Lakes, into the sensitive, closed-basin water
	body situated on Paradise Island ***(See Appendix F***). Prevention measures include the installation of hydrodynamic separators, grease interceptors, permeable pavement systems, bunded storage, and spill alarms. Operationally, chemical inventories, SOPs, and scheduled inspections will reduce the likelihood of incidents. All sites will segregate incompatible materials and maintain clear access to emergency equipment.
Avifauna	• Once all construction activities are completed, with reduced noise levels, it is expected that birds will return. • In areas where landscaping is being undertaken to plant native flowering species and endemic species to attract the return of avian species. • An enhanced nature trail system and the introduction of native species within the design of the nature trail system of the reserve will attract avifauna
Visual and Aesthetics	• Proper management and timely disposal of solid waste. • Use only native, endemic plant and tree species within landscaped areas of development. No invasive plant species to be established on property. • Nature Trail system on the reserve area will produce positive aesthetics and encourage bird watching and ecotourism, educational interpretative center within the area.
Coastal	• The coastal area will not be directly affected by the development of the Atlantis School Project, car park development, or nature reserve.

Hydrological	• Use of existing storm water drainage system to absorb and filter storm water, will better manage surface water runoff, thus improving water flow in the area.
	• Adequate fuel and chemical management practices on site would ensure groundwater resources are not negatively impacted.
	• Implement a stormwater management plan (***See Appendix G***). This management plan would:
	  • Maintain separation between stormwater and sewage systems
	  • Store hazardous materials (e.g., fuels, paint, cement) in covered and bunded zones
	  • Implement best practices during all construction phases including:
	    - Use of silt traps and sediment basins
	    - Topsoil conservation
	    - Rapid revegetation of disturbed areas
	    - Dust suppression and traffic minimization in buffer areas - Ensure all exposed surfaces are vegetated or stabilized postconstruction

Traffic	• A Traffic Impact Assessment (TIA) has been performed ***(See Appendix – C)*** and incorporated within the EIA, to determine impacts on the project area and to provide mitigations. These Include: • **Paradise Island Drive & the Ocean Club Road & Bayview Lane East eastbound U-turn movements:** It is highly recommended that this intersection be converted to a roundabout with a minimum 90 feet - 110 ICD in lieu of a median cut to accommodate right-turning movements egressing the school. • A roundabout would reduce delay by 65%. A roundabout control will reduce the vehicle conflicts from 32 to 8 (75%) and pedestrian conflicts from 24 to 8 (67%). The conversion to a roundabout at this location will realize a clear improvement in safety, as mentioned above. Using the empirical bayes methodology, a CMF of 0.65 (CMF ID: 209) should be realized by this conversion. This would also allow for aesthetic gateway treatment at the Ocean Club Resort access (CCG, 2023) • Furthermore, and equally important motorists egressing the proposed School with a westbound destination will make a U-Turn just west of this existing intersection where the center median ends impacting traffic flow and safety on Paradise Island Drive & the Ocean Club **Paradise Island Drive Speeds:** • In addition to the existing speed table located approximately 90 feet east of the proposed egress, an additional speed table is

	recommended to be installed about 100 feet west of the school ingress to manage speeds along Paradise Island Drive fronting the school campus. The speed tables will realize a CMF of 0.6 (CMF ID: 132) as a result of the managed speeds within this zone. • Additional offsite parking for workers. • A traffic management plan will be provided to manage heavy construction equipment. • Site access points will be managed & clear and effective signage will be in place.

7.0 Public Consultation Process

A Public Consultation exercise (Public Virtual/In-person Town Meeting with Report) will be conducted under the auspices of the Department of Environmental Planning and Protection, and per the EIA Regulations, 2020. This is necessary to inform and to gather feedback from residents living in proximity to the school, and other commercial entities on Paradise Island, of the plan for the proposed school development, nature reserve, and car park.

8.0 Environmental Management Plan (EMP)

An EMP will be prepared for the project (drafted as a Standalone Document) and will cover the mitigation measures and monitoring. A draft outline and components are cited below. The EMP will be fully developed following No Objection to the EIA. Upon receipt of the No Objection to the EMP, the project will be issued a Certificate of Environmental Clearance (CEC) by the Department of Environmental Planning and Protection (DEPP). The CEC issuance would allow construction activities for the project to commence.

Executive Summary

A summary of the development project and proposed mitigation measures outlined.

1.0 Introduction Overview of project and location. Objectives of the EMP and scope with respect to mitigation measures.

2.0 Project Description

Project is described, with location, inclusive of project master plan.

3.0 Organization Chart and Communication Plan
4.0 Register of Significant Environmental Aspects
5.0 Environmental Legislation
6.0 Proposed Mitigation Measures

Mitigation measures are detailed as in project EIA, specifically in relation to the following:

6.1 Terrestrial

6.2 Biodiversity

6.3 Marine

6.4 Avifauna

6.5 Visual and Aesthetics

6.6 Coastal

6.7 Hydrological

6.8 Erosion/Sedimentation

6.9 Air Quality

6.10 Noise

6.11 Solid and Hazardous Waste

6.12 Fire and Hurricane

6.13 Occupational Health and Safety

6.14 Fire Control

6.15 Invasive Species Control

6.16 Traffic Control

7.0 Environmental Monitoring

7.1. Environmental Monitoring Checklist

7.2. Environmental Reporting

8.0 Conclusions

Conclusions remarks on implementing recommended mitigation measures.

9.0 References

Citation of reference materials used in EMP preparation.

10.0 Emergency Response Plans

10.1 Fire Control Plan

10.2 Invasive Species Control Plan

9.0 Conclusions Regarding Environmental Acceptability of the Proposed Project

Detailed and comprehensive baseline studies were undertaken in the assessment of the existing botanical, avian and biological and marine resources of the Atlantis School Development site on Paradise Island Drive, Paradise Island. The result is an environmental impact assessment (EIA) document which details the impacts that the medium-low-density development of the single story 61,000 sq. ft school to cater to 150 school students to residents of Paradise Island, along with the development of a public parking site and a nature reserve.

The conceptual Masterplan prepared by the developers underscores their commitment to environmental conservation and resource sustainability with a low carbon footprint in the developmental phases of the project. Innovation in the use of renewable energy technology (solar panels for power generation) and the development of a nature reserve around the surrounding area keeps the integrity of the biodiversity within the surrounding area. These innovations allow for a low to moderate impact on the existing environment, during construction and operational phases of the project.
With a projected capital investment of **BSD $10,000,000**, it is anticipated that the economic impact for Paradise Island and by extension New Providence Island will be boosted significantly. This boost will include new construction jobs, new entrepreneurial opportunities to provide goods and services, and additional new permanent jobs on the Island. The long-term sustainable effect will be a positive impact for the local economy.

It is anticipated that with proper planning, application of BEST management practices, and Mitigation Measures outlined in the EIA, incorporated within a comprehensive Environmental Management Plan (EMP), if conscientiously implemented, will minimize in the long term any negative impacts identified from project development through to operations.

10.0 Recommendations

The following recommendations are highlighted below to underscore and reinforce the significance of understanding the measures necessary at minimizing the negative impacts on the existing environment, from the project development stages on to the operational phase.

a) Ensure that BEST management practices are employed during the construction phases, including practices that prevent soil erosion and sediment runoff.
b) Remove all invasive species (Australian pine, Melaleuca and Brazilian pepper species) from area, in accordance with the National Invasive Species Strategy 2023.
c) Planting and establishment of only native flowering species within new landscape areas.
d) Translocate selected protected tree species from school footprint landscapes, and car park site, to be staged at the Atlantis nursery for replanting within nature reserve.
e) Use of solar panels and batteries on roof top of school and car parking lot infrastructure to supplement power generation via BPL
f) Ensure stormwater management principals are incorporated in the design for surface water runoff away from the wetland reserve area, thus preventing contamination and pollution of wetlands.
g) Continuous monitoring to check water quality levels to track any changes in turbidity, salinity, Ec, and pH during and after construction to ensure water quality is not impacted.
h) Ensure offsite parking for construction workers away from the project site, to reduce possible traffic congestion on Paradise Island Drive.

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12.0 Appendices

Appendix A: Atlantis School Project Master Plans Project Drawings

DESIGN IDEA

Architecture - Natural Space

The property is located on a retention area overgrown with dense vegetation. This part of Paradise Island enhances the archaic image of a tropical island covered with lush vegetation in a functioning ecological system. This section is one of the last semi-natural spaces on Paradise Island.

Every type of development should be seen with regard to this special characteristic of the property, every intervention must be aware of the ecological impact and carefully deal with the remaining natural space.

Under these conditions, we propose a single-storey building complex which is towered over by the tall vegetation and therefore is hardly noticeable by the surrounding public space. The buildings are terraced in order to leave the sloping terrain unchanged in its natural characteristics. The embedding in the natural space should enable every classroom and every common room to have a view to nature.

Common rooms and corridors are not enclosed, only covered. Gatherings, joint activities and informal learning take place in these outdoor areas.

Aerial view from west

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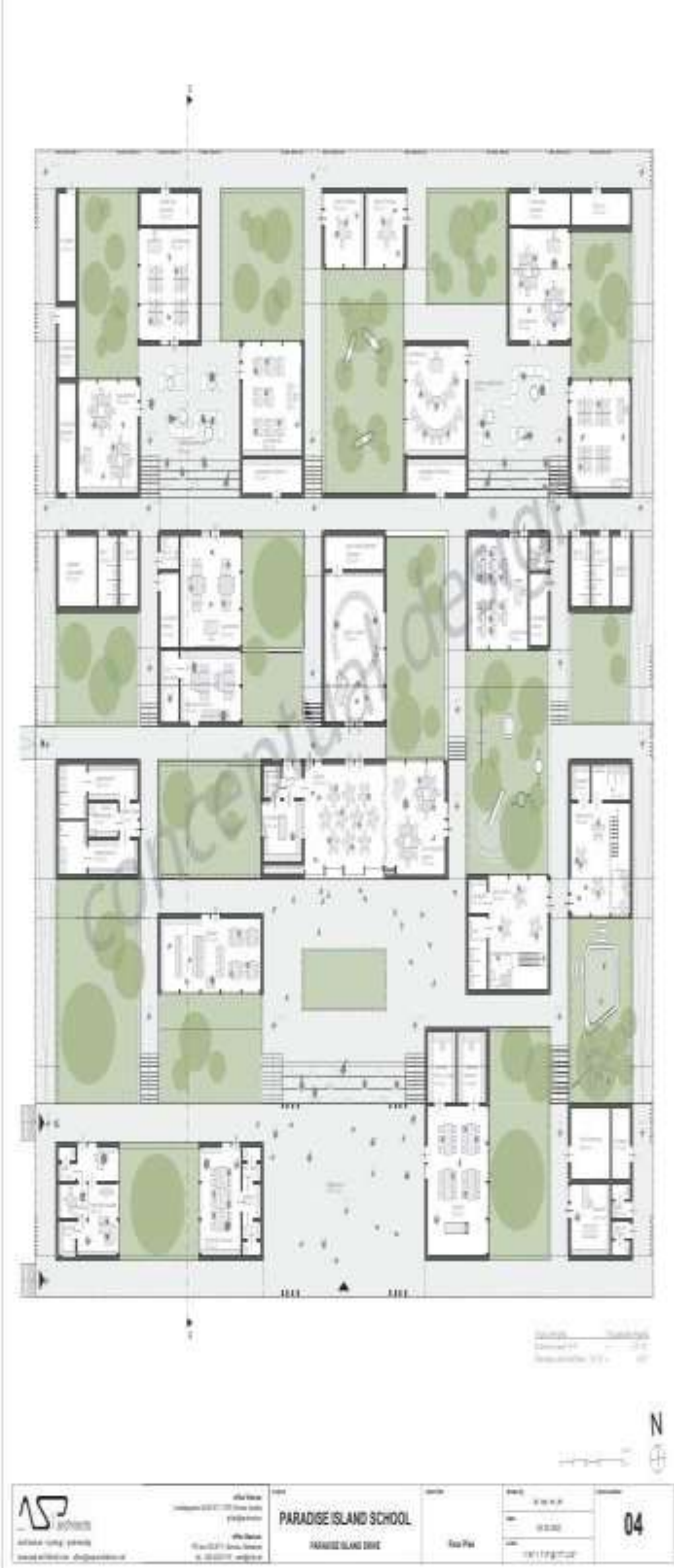
PO box SS-5711, Nassau, Bahamas
project:
PARADISE ISLAND SCHOOL
PARADISE ISLAND DRIVE
sheet title:
Site Plan
drawn by:
date:
scale:
sheet number:
03


N
PARADISE ISLAND SCHOOL
04

Pedagogical concept/Organization

Modern pedagogy negates frontal teaching. Learning concepts such as modular teaching, open classrooms, flipped classrooms and similar reformatory pedagogical concepts support informal learning and promote working in groups. For this a diverse range of space in the form of learning landscapes must be provided.
Four classrooms are grouped around a common room. The latter is used multifunctionally: it serves as a group room, informal learning room and a break room. Moreover, one additional group room is offered per cluster.

The modular design of the clusters enables system-compliant expansion with additional classrooms to the north. Pavilions can be added by respecting the grid, the roof can be extended according to the undulating movement.

The preschool classes face each other and are located at the east end of the building.
These learning landscapes are supplemented by special classrooms. In the immediate vicinity of the school entrance is the principal and the teachers' area.

The auditorium is the entrance, waiting and pick-up area, break area, informal meeting place, a place for events and a retreat area at the same time. Playability is possible in several directions. The canteen opens up to the auditorium and can therefore be expanded in terms of capacity.

The natural space is omnipresent due to the green courtyards. This is an expression of a nature-loving attitude and supports the socio-ecological development process of the students.

Cluster organization
Aerial view from north east

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Materiality

The mineral surfaces are limited to paths and floors. Wood is decisive both inside and outside, visible everywhere as cladding of walls and ceilings.
The visible rafters enhance the movement of the apparent undulating roof.

This idea is based on the desire for a comfortable atmosphere. Teachers and students are supposed to spend most of their day in their classrooms and in their respective indoor and outdoor lounges. With the warm and natural radiance as well as the visual and haptic variety, wood enhances the sensual perception of the user.

Building services

All educational rooms are air-conditioned. In the cooler periods of the year, air conditioning can be completely dispensed. A system of cross ventilation can provide the necessary cooling of the classrooms, especially at night. This supports the ecological orientation of the school from an operational point of view.

Generous glazing ensures that the interior rooms are adequately lit, and additional skylights provide support, if the room depth is appropriate. Artificial lighting should be controlled depending on the position of the sun.

The lush green inner courtyards provide sun protection and evaporation coolness. Moreover, on particularly hot days, high-pressure fogging can be used to provide additional natural cooling in the outdoor area. Treated gray water can be used, which also serves to irrigate the adjacent green islands.

Project Heights		Topographic Heights
Entrance Level 0'-0"	=	27'-11"
Flamingo Lake Overflow -21'-3"	=	6'-8"

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project:
PARADISE ISLAND SCHOOL
PARADISE ISLAND DRIVE

sheet title:
Section

drawn by:
al, mp, sn, jm

date:
05 30 2022

scale:
1/16" = 1'-0" @ 17" x 11"

sheet number:
06

Elevation West

Elevation East

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Green islands fill the space between the pavilions
and interweave the school building with the green environment

View to administration pavilion

Covered walkways connect the
pavilions

View to teachers' pavilion and Aula in the back

architects

architecture - synergy - partnership

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ph.: 242-432-6119 andi@mijc.at

project:	sheet title:	drawn by:	sheet number:
PARADISE ISLAND SCHOOL PARADISE ISLAND DRIVE	Visualization	al, mp, sk, jm date: 05.30.2022 scale:	08

View to science pavilion from above

View to science pavilion from below

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All classrooms are oriented to the green islands

		project:	sheet title:	drawn by:	sheet number:
architects architecture - synergy - partnership www.asp-architects.com office@asp-architects.com	office Vienna: neubaugasse 64-66/2/1, 1070 Vienna, Austria peter@archnet.eu office Nassau: PO box SS-5711, Nassau, Bahamas ph.: 242 432 6119	PARADISE ISLAND SCHOOL PARADISE ISLAND DRIVE	Visualization	al, mp, sn, jm date: 05 30 2022 scale:	10

Main entrance Aula

A generous roof provides shadow over the seating steps in the Aula

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Closing the roof opening in order to use the entire space of the Aula

Playability of the Aula

Extention of the mensa

View from the mensa to the main entrance

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Classroom orientated to the south with structural sunprotection

Music room

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Green island in front of music pavilion

The undulating roof follows the topography of the terrain

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The covered paths frame the green islands and provide shade for the users

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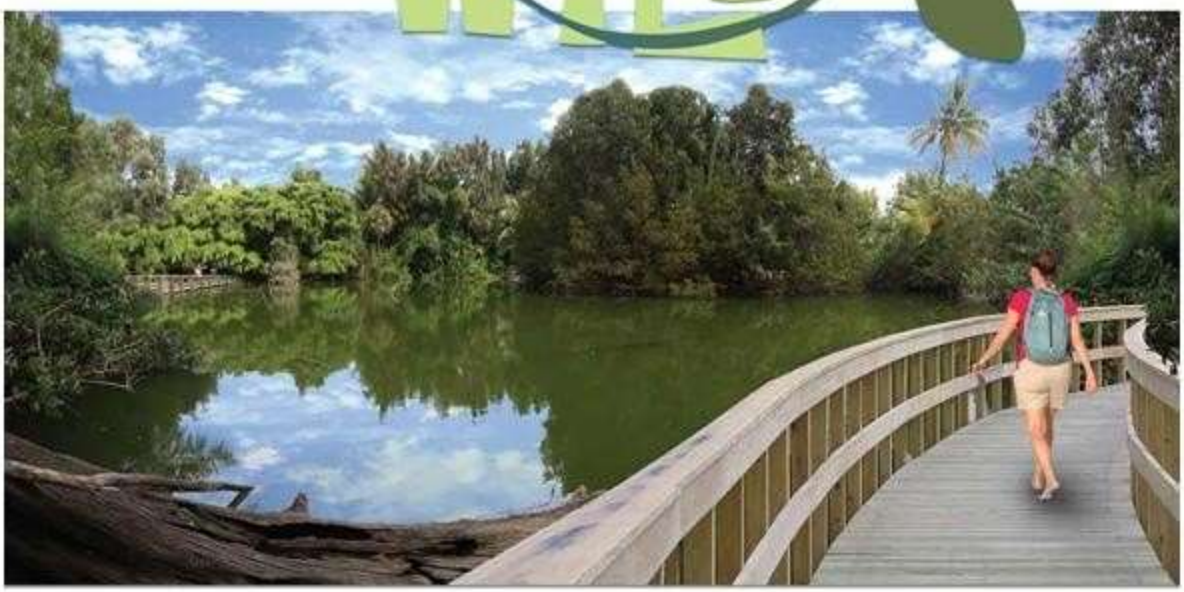
Appendix - B: Paradise Wild Nature Reserve and Trail Plan

APRIL 2015
REVISED AUGUST 2022

PARADISE WILD



WILDLIFE VIEWING & NATURAL TRAIL

FLAMINGO LAKE

PARADISE ISLAND
NASSAU, THE BAHAMAS

WILDERNESS GRAPHICS

Prepared by: Wilderness Graphics
Tallahassee, Florida 32303
www.wildernessgraphics.com

PROJECT BACKGROUND

Wilderness Graphics completed a concept plan in 2008 for the development of a natural trail and wildlife viewing amenities at Flamingo Lakes on the Atlantis property, Paradise Island, Bahamas. Wilderness Graphics was contacted in 2014 to continue planning and implementation of the program and created this Preliminary Plan in April 2015. Wilderness Graphics was contacted again in 2022 and is pleased to present this updated Preliminary Plan.

Wilderness Graphics staff visited the site in December 2014 and, again, in March 2015. Ground truthing was done, which required extensive bushwhacking into the overgrown interior. The acreage was assessed and flagged for the best possible trail locations. Invasive and native plant species were identified. GPS coordinates were logged for points of interest and areas of concern, and photographs were taken.

Wilderness Graphics also met with local contractors and experts and continued consultations upon our return to our Florida offices. Pericles Maillis of the Bahamas National Trust offered extensive information and recommendations on Bahamian flora and fauna. Caribbean Civil Group was contracted and conducted a complete site survey, the results of which were incorporated into the Preliminary Site Plan on page 5. Wilderness Graphics has confirmed that the site has had no significant changes since this survey was completed in 2015.

Wilderness Graphics was back on site in November 2015 to begin implementation of the trail. Minimal clearing and preliminary trail marking were started; however, work was halted by Atlantis on November 19, 2025. Wilderness Graphics has confirmed that the areas that were cleared at that time have regrown in the ensuing years.

A UNIQUE EXPERIENCE

Flamingo Lake and the surrounding wetland and coppice habitat are natural treasures to be protected and promoted. The appeal of a wilderness area and wildlife viewing in the midst of Paradise Island development is immeasurable.

Our site visit in 2015 included a tour of the Baha Mar trail system. Though attractive, this outdoor venue offers visitors a pristinely landscaped vision of The Bahamas. To set the Atlantis property apart, we recommend creating an authentic natural area — a native restoration and wildlife showcase that reveals the true beauty of The Bahamas, while also offering visitors a place to exercise.

We also recommend a name change. "Flamingo Lake" can be misleading, as no flamingos are present. We have coined the name *Paradise Wild*, which reveals the site's connection to the island as well as its natural appeal.

PRELIMINARY PLAN

Following our assessments and surveys and considering planned and future land use as well as budgets, we are pleased to present the attached general layout for the Paradise Wild trail system.

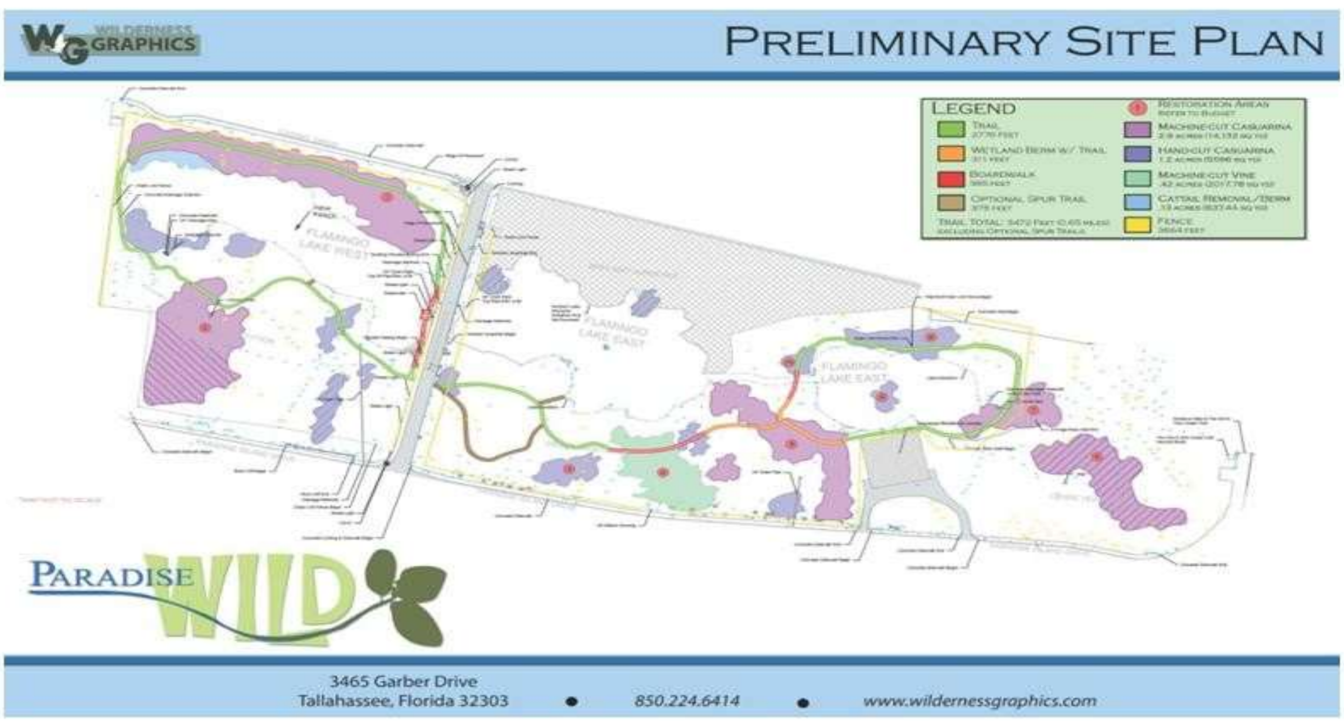
This is not a final map but rather a preliminary plan based on work to date. The most effective strategy for final trail development will be to walk the trails as they are blazed in order to expertly locate the route that is most feasible, appealing, and cost-effective. This will allow the identification of particular trees to remove, protected trees around which the trail will be rerouted, as well as those that may be moved and replanted. This strategy will minimize excessive clearing and the necessity for extra replanting, as well as safeguard protected species. We have learned that, when left unmanaged, overzealous destruction can ensue. It is understood that a Certificate of Environmental Clearance will be secured by Atlantis before work begins.

To accommodate budgets, we propose two project phases. Phase 1 would include all trail clearing and building to maximize effort. Securing the area with fencing and entry gates would also be important in Phase 1, as well as some signage. Replanting, additional signage. and optional features could be spread over two phases.

PARADISE WILD


WILDERNESS GRAPHICS
CONCEPT TRAIL PLAN
LEGEND
TRAIL
2776 FEET
WETLAND BERM W/ TRAIL
311 FEET
BOARDWALK
OPTIONAL SPUR TRAIL
275 FEET
POINTS OF INTEREST
MACHINE-CUT CASUARINA
HAND-CUT CASUARINA
MACHINE-CUT VINE
CATTAIL REMOVAL/BERM
FENCE
3664 FEET
ANY DEVIATIONS IN THE TRAIL SHOWN HERE FROM THAT SHOWN IN THE PRELIMINARY SITE PLAN ARE DUE SOLELY TO THE PERSPECTIVE OF THE AERIAL PHOTOGRAPH.
PARADISE WILD
1. MAIN GATE 1
2. KARST FEATURE
3. KARST HOLE
4. OBSERVATION PLATFORM
5. LARGE PALM TREE
6. COCONUT PALMS
7. SEAGRAPE
8. EXISTING PLATFORM
9. MAIN GATE 2
10. KARST HOLE
11. OBSERVATION PLATFORM
12. WETLAND
13. WATER CROSSING
14. SECONDARY GATE
15. EXISTING WATER CONTROL STRUCTURE
16. OBSERVATION PLATFORM
17. ISLAND ROOKERY, CLOSED TO PUBLIC
3465 Garber Drive
Tallahassee, Florida 32303
850.224.6414
www.wildernessgraphics.com

4


WILDERNESS GRAPHICS
PRELIMINARY SITE PLAN
LEGEND
TRAIL
WETLAND BERM W/ TRAIL
BOARDWALK
OPTIONAL SPUR TRAIL
RESTORATION AREAS
MACHINE-CUT CASUARINA
HAND-CUT CASUARINA
MACHINE-CUT VINE
CATTAIL REMOVAL/BERM
FENCE
FLAMINGO LAKE WEST
FLAMINGO LAKE EAST
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www.wildernessgraphics.com

5

RESTORATION AREAS

Our surveys and ground truthing revealed that more extensive vegetation and invasive species removal and native replanting will be required than speculated in 2008. Our plan includes vegetation removal for trail blazing as well as selective invasive removal by hand throughout the site.

Ten zones, noted as Restoration Areas on the Preliminary Site Plan, will require particular attention. Note that those indicated with hatching are no longer within the scope of this project. Some areas are large; some are small. Some may require little invasive removal, while others may need extensive work. This work has been estimated but cannot be accurately determined at this point.

Four of the ten Restoration Areas have been identified as requiring significant effort:

RA1 Northern shore of the western lake – significant *Casuarina* growth. Pericles Maillis recommended that a native arboretum, coastal berm, or orchid walk could be replanted here. This has been included in the budget, with larger trees estimated.

RA2 Large debris pile south of the western lake – mainly concrete and steel. Will bury with soil and mulch from invasive chipping, and replant. *This may no longer lie within the scope of this project.*

RA4 Southern shore of eastern lake – significant patch of invasives Site of berm/boardwalk, which may cover some bare areas.

Cattail Removal/Berm western lake — will take significant effort and has not been included in the budget at this time. If accomplished, cattails removed could be used to build up berm along western fence line in narrow spots, plantings or visual block are needed to obstruct parking lot view.

6

REPLANTING

Please note that replanting pricing is based not only on the size of the Restoration Area but also on tree size. Some areas will require more mature specimens at the outset, while others can be replanted with smaller trees that will fill in over time. Fast-growing species have been identified for larger restored areas. The edge of the lake could be enhanced with plantings of giant leather fern and other brackish wetland native plants, such as sawgrass. These additions would create a more exotic, tropical setting. The purchase of replacement native vegetation is a matter of timing, as not all species may be available at the time of project implementation. Salvaging and replanting of natives from within the site is also anticipated.

Proper watering of replanted specimens will be important, thus planting during the rainy season from May through November is critical. Temporary drip irrigation systems are included with water provided by Atlantis water truck.

TRAILS

For the trail surface, it was suggested that something other than rock be used. However, considering elevations and runoff, we recommend building a solid trail base of a membrane layer for weed control covered with compacted pea rock for stability. Over time, this will become covered with leaves and other vegetation debris, forming a natural surface that requires little maintenance.

A natural limestone border may be included in areas.

Trail spurs will lead to the water's edge, offering visitors views of the pond. Experts have suggested that shoreline access be limited to minimize wildlife disturbance.

Boardwalk construction will be required to cross lowland expanses. In one area, a berm with culverts is recommended instead. Extensive *Casuarinas* in this area will be removed and chipped to construct a solid base of dirt and mulch under the layered trail surface. Invasives will be chipped and used throughout the site for trail construction and will be particularly important for berm building. During trail building, other areas may be considered for berms instead of boardwalks.

The trail will provide a view of an island in the eastern lake, which will be closed to the public to allow native duck and other native bird nesting.

SAFETY

Perimeter fencing will be needed to ensure safety. A six-foot-high fence is planned: decorative black steel fencing in those areas that are visible from the road and chain link fencing with added tension wires along the top to prevent climbing in those areas that are hidden by vegetation.

New fencing will connect with existing chain link fencing that runs along Paradise Island Drive to the south of the western lake (see the Preliminary Site Plan), pending inspection.

Three locking gates will allow entry onto the trail. Two Main Entry Gates along Lakeview Drive will provide access to the eastern and western trail loops. A roofed entry kiosk at each of these two locations will create a welcoming gateway during daylight hours when the trail is open. Each entry kiosk will feature a metal door that will roll up under the roof when the trail is open and will roll down and lock securely when the trail is closed. Solid metal panels on either side of the kiosk will prevent climbing.

A Secondary Gate will allow access to the eastern trail loop from the proposed Paradise Island School property. This gate will not be accessible to the general public and will remain locked. It will be unlocked by instructors to allow school groups to pass and relocked after entry.

Provisions should be made for safe crossing of Lakeview Drive. Atlantis should consider a zebra-striped crosswalk and roadway signage to connect the two entry points across Lakeview Drive and warn motorists to watch for pedestrians.


WILDERNESS GRAPHICS
ENTRY GATES
SIGNS AND 3D BRANCHES TO BE POWDER-COATED ALUMINUM OR LOCAL WOOD
MAIN GATE
PARADISE WILD
ROLL-UP METAL LOCKING SECURITY DOOR
10'-6"
8'-0"
METAL SECURITY DOOR TO ROLL UP INTO ROOF
SECONDARY GATE
10'-0"
PARADISE WILD

SIGNAGE

Gateway Entrance Signs

Signage has been designed for the Main Entry Gates. These artistic yet simple "Paradise Wild" signs will attract users to enter the park while blending beautifully with the surrounding natural setting. They could be constructed of durable powder-coated aluminum or from wood removed from the site.

Trailhead Signs

Each entry point will display trail signage, offering an overview of the park with rules and information and a large map indicating mileage. This will allow visitors to make an informed decision about which direction to head and the distance required to reach the nearest exit.

Educational Signs

The site will be a significant draw for visitors with an interest in nature and wildlife. In addition, it can support use by tour groups and school groups, such as students from the proposed Paradise Island School. To create a full visitor experience and promote an appreciation of the importance of the site, **interpretive signs** are vital.

Possible subjects include: Native Habitats, Mangrove and Buttonwood Wetlands, Water and Wetland Wildlife, Coppice Forest, and Coppice Wildlife.

Distinct educational experiences should also be developed, utilizing smaller **trail signs** and perhaps guide booklets.

Birdwatching

One of the most remarkable features of the site seems to be the abundance of bird life that is distinctive to The Bahamas in close proximity to the highly visited resorts.

- A succession of signs of interest to **serious birders** could include species whose ranges are limited to tropical zones and the Caribbean, including smooth-billed ani, thick-billed vireo, whitecheeked pintail, and white-crowned pigeon.

- **Shorebirds** are more numerous in the east lake, where a series of signs could educate students as to the variety of species.
- More **migratory birds** will likely be drawn to the improved habitat, and a program could be devoted to the miracle of migration and the many species that pass through each season.

Native Plants

- Educational opportunities should include a series on **bush medicine** or traditional cultural uses of plants. This could be planned for the north side of the western lake or, better yet, by including a spur trail through the existing native coppice south of the eastern lake.
- A native orchid, *Oeceodades maculata*, occurs on the site, and with the addition of native bromeliads and terrestrial orchids, an **epiphyte experience** could be developed at either location.
- The north side of the western lake along Casino Drive East could also be restored as a coastal strand of seagrape, gumbo limbo, and low shrubs, providing a perfect **coastal walk** educational experience.

Additional Signs

Small signs should be added to ask visitors to **"Please stay on the trail."**

Some **poisonwood** exists within the site. Specimens near the trail should be tagged with a universal "no touch" sign. An accompanying trail sign could educate visitors as to the hazard of this native to people but its value to wildlife.

A few small **wayfinding** signs may be needed at trail junctions.

Some signs, such as wayfinding and "stay on the trail," could be fashioned from wood removed from the site.

*Note that signage has been estimated and included in the budget; however, these numbers will be planned as the project progresses. Once trails have been blazed, effective location and content identification can be conducted.

FUTURE CONSIDERATIONS

Optional Features

Elements that would add greatly to the visitor experience and should be considered for subsequent phases include:

- Additional spur trails leading to observation platforms near the water would provide areas for tour and school groups to gather for educational programs.
- Solar-powered water features would help aerate the lakes as well as attract birds.
- Outdoor spotting scopes would allow visitors a closer view of wildlife.
- Benches installed at locations with shade and/or views of the lake would offer respite.
- A trail guide or a series of environmental education guides could offer further information about natural features and wildlife or be keyed to trail-sign experiences.

Note that pricing for these features assumes inclusion in Phase 1 or Phase 2 to optimize shipping and installation.

Invasive Wildlife

It has been recommended that the large populations of tilapia and turtles in the lake be managed. Consultation with the Bahamas National Trust has revealed that the turtles are hybrids and not native species. They are also believed to prey on native ducklings. It is recommended that both the turtle and tilapia populations be regularly culled.

ADDITIONAL BUDGET REMARKS

Please note that VAT has been included; however, import duties have not. The educational signage may fall under Section X Chapter 49 of The Bahamas Tariff Schedule – Printed Matter: 4911.9120 Photographs, 4911.9930 Visual teaching aids and/or 4911.9940 Other. It has also been suggested that some items may fall under the Hotel Encouragement Act. Features would be most effectively purchased directly by Atlantis, as the system for purchase, shipping, and importation is already in place.

Appendix – C: Paradise Island School Traffic Impact Assessment

Document History

Revision	Revision Date	Issue Date	Revision Description	Key Author
Rev-00	11 October 2022	11 October 2022	Final Report - Revised based on final peer review	Ray R. McKenzie, FITE, FASCE, FAPETT, P.E.

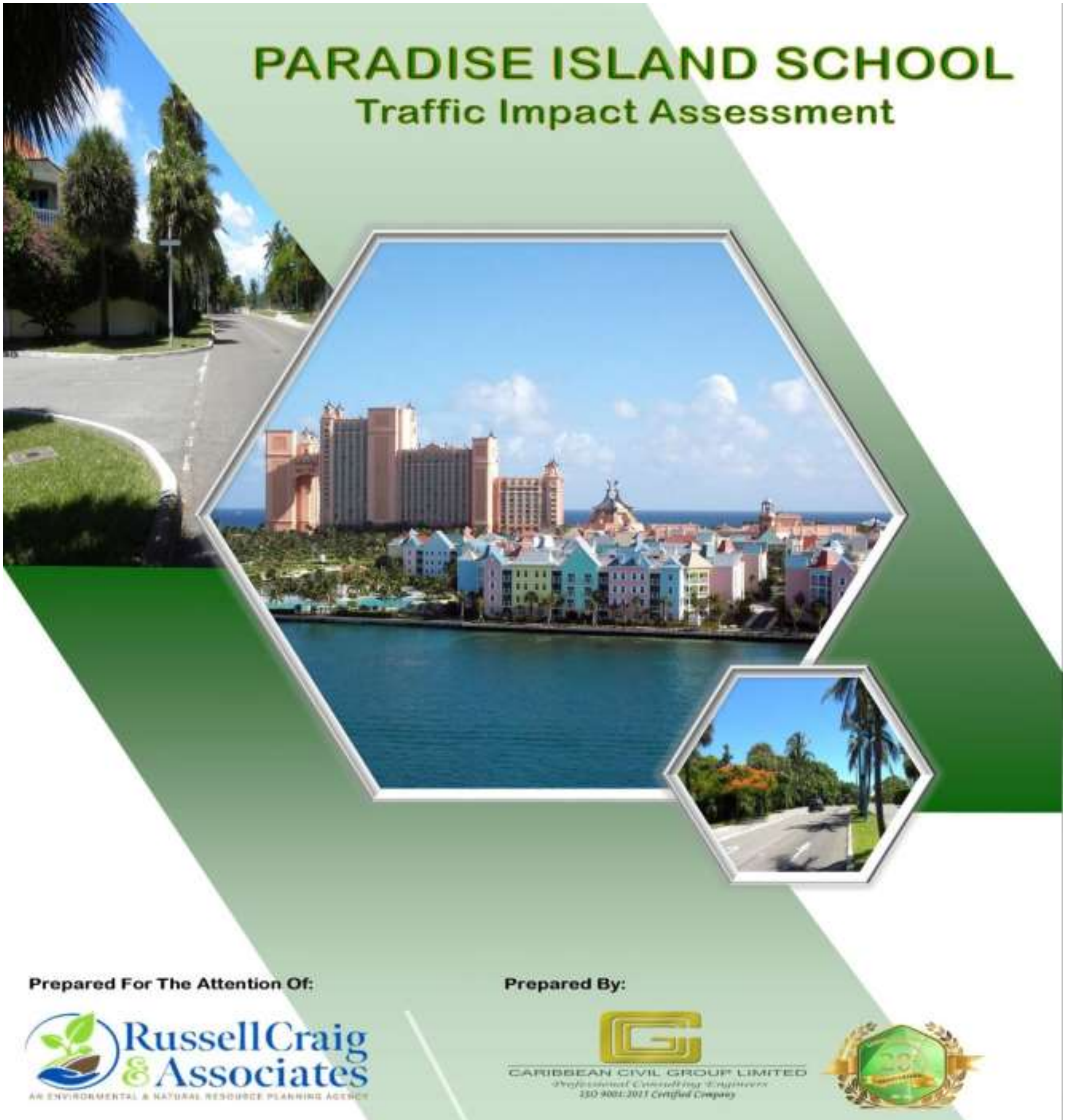
Collaboration

Name and Title	Collaborator's Company Name	Signature	Date (dd/mm/yy)
Dkwon Q. Sullivan, AASC, GACP, SRDP Senior Civil Engineering Technician	Caribbean Civil Group Ltd.		11 October 2022
Robin V. Strachan, Sr. BA, MDiv., CMS Reviewer	Caribbean Civil Group Ltd.		11 October 2022
Ledione Daniel, GACP, FAAPM, CIPM, SRDP			

Senior Civil Engineering Technician	Caribbean Civil Group Ltd.		11 October 2022

Tanya L. Chambers-Eldemire, CMS Reviewer	Caribbean Civil Group Ltd.		11 October 2022

Final Report



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Final Report

LIST OF ACRONYMS/ABBREVIATIONS

ADT	Average Daily Traffic
CMF	Crash Modification Factor
DPP	Department of Physical Planning
EB	Eastbound
HCM	Highway Capacity Manual
HWY	Highway
ITE	Institute of Transportation Engineers
ICD	Inscribed Circle Diameter
ISD	Intersection Sight Distance
LOS	Level of Service
LT	Left-turn
LF	Linear Feet
MOE	Measures of Effectiveness
MOWU	Ministry of Works & Utilities
MPH	Miles Per Hour
N/A	Not Any
NB	Northbound
PSD	Passing Sight Distance
PDA	Persons with Disabilities (Equal Opportunity) Act, 2014
RAB	Roundabout
ROW	Right-of-Way
RT	Right-turn
SB	Southbound

SF	Square Feet
Sec	Seconds
SSD	Stopping Sight Distance
TIA	Traffic Impact Assessment
TPC	Town Planning Committee
TMC	Turning Movement Counts
Veh	Vehicles
V/C	Volume to Capacity Ratio
WB	Westbound

Executive Summary

Introduction

The Developer proposes to construct a school fronting Paradise Island Drive adjacent to Bayview Lane. The School9s student recruiting focus will be from Paradise Island proper. This Traffic Impact Assessment (TIA) was commissioned to determine the impacts if any, and the mitigation thereof according to the requirements of the Ministry of Works & Utilities (MOWU) and the Town Planning Committee (TPC).

The property is located on Paradise Island in the southcentral region, accessible solely by Paradise Island Drive via an existing ingress and egress (**Figure 1**).

This study will incorporate the projected primary trips during the peak hour period based on research and historical data collected at other similar elite private schools within the Island of New Providence.

Impacts

This TIA addresses the potential impacts based on the trips generated, as outlined in **Section 6.0**. Based on the traffic capacity analysis and engineering judgment, it was determined that there would be no significant impact to the study area by the proposed school fronting the Paradise Island Drive corridor. Notwithstanding, the impacts that would require intervention will be the potential U-Turning movements at the end of the center median before the Ocean Club Road intersection and traffic calming the speeds observed between the Ocean Club Road intersection and Lakeview Drive.

Mitigation

The potential mitigation for the impacts are identified and listed in Section 6.0 of this TIA as follows: upgrade the Ocean Club Road intersection and provide traffic calming measures within the school zone.

Recommendations

The recommendation is to upgrade the Ocean Club Road intersection to a roundabout with an Inscribed Circle Diameter (ICD) of 90 feet minimum to 110 feet maximum and to install speed tables in proximity to the proposed ingress. Upgrading to a roundabout will realize a crash modification factor (CMF) of 0.65 (CMF ID: 209), which will enhance the LOS and reduce delays. The installation of traffic calming measures such as speed tables to control speeds will realize a CMF of 0.6 (CMF ID: 132) within the school zone

Section 1

1.0 Background Information

The Developer proposes to construct a school fronting Paradise Island Drive adjacent to Bayview Lane. The School9s student recruiting focus will be from Paradise Island proper. This Traffic Impact Assessment (TIA) was commissioned to determine the impacts if any, and the mitigation thereof according to the requirements of the Ministry of Works & Utilities (MOWU) and the Town Planning Committee (TPC).

The property is located on Paradise Island in the southcentral region, accessible solely by Paradise Island Drive via an existing ingress and egress (**Figure 1**).

This study will incorporate the projected primary trips during the peak hour period based on research and historical data collected at other similar elite private schools within the Island of New Providence.

This study aims to analyze the existing baseline peak hour traffic within the study area, as indicated in **Figure 2**, along with the 20-year horizon period, respectively. This TIA report will show any resultant potential traffic and vulnerable road users (VRU) impacts within the study area and make recommendations to mitigate those impacts.

1.1 Methodology

The methodology used for this private school TIA is as follows:

(a) Average Daily Traffic Counts (ADT):

ADT data collection utilized a combination of JAMAR Radar and Tube counters over a 24-hour duration for seven (7) consecutive days on the following roadways:

1. Paradise Island Drive (Adjacent to Site)

(b) Intersection Turning Movement Counts (TMC):

Turning Movement Count (TMC) utilizing the JAMAR TDC Ultra handheld counters at the Following intersections over an 8-hour duration (6:00AM – 9:00AM, 11:00AM – 1:00PM and 3:00PM – 6:00PM) are as follows:

1. Paradise Island Drive & Flamingo Road
2. Paradise Island Drive & Harbour Ridge Road
3. Paradise Island Drive & Lakeview Drive
4. Paradise Island Drive & Bayview Lane West
5. Paradise Island Drive & Ocean Club Road
6. Paradise Island Drive & Cloister Drive West
7. Paradise Island Drive & Cloister Drive East

(c) Travel Time Data

Travel time data was collected along the corridors outlined below during the peak hour of travel in the study area for modell calibration.

1. Paradise Island Drive (North Shore Terrace Booth to Comfort Suites)

(d) Classification Data

Vehicle classification data was collected during the morning, afternoon, and evening peak periods adjacent to the following corridors:

1. Paradise Island Drive Adjacent to Site **(e)**

Trip Generation Analysis:

The existing trip generation data was based on research data from similar private schools as follows: Akhepran International Academy; Windsor School Old Fort Bay Campus; Lyford Cay International School Upper Campus; Lyford Cay International School Lower Campus and Kings College School to determine the overall trip generation for the proposed site.

(f) Traffic Forecast:

The baseline and 20-Year horizon forecasts of traffic volumes took into consideration increased traffic volumes due to a determined growth rate of 1.5% based on the population change from 2000 to 2015 of +29.6%[1]. The growth factor was determined using the equation $(1 + r)^n$.

(g) Roadway Safety Analysis:

Safety in the study area corridors was evaluated to determine the expected safety performance and to identify modifications that will maintain or improve existing safety conditions in the study area for VRU and motorists alike[2].

(h) Roadway Capacity Analysis:

The software PTV Vistro/PTV Vissim 2022 was utilized to determine the existing baseline and 20-year horizon roadway capacity measures of effectiveness (MOE) and to modell the study area. The modell was calibrated and validated as indicated in the TIA **Table 14**.

1 https://www.city-facts.com/paradise-island-new-providence.

2 CH2MHILL, Best Practices for Traffic Impact Studies (Final Report SPR 614 For ODOT and FHWA 2006) 31.

(i) Traffic Impact Assessment:

This report examined the traffic impact for the peak hour period conditions and included recommendations for mitigation measures in the study area, including road safety mitigation measures over the 20-year horizon. The objective of this TIA is to seek practical measures for consideration to enhance safety for vulnerable road users and maintain or improve traffic flow and operations within the study area based on the following categories:

- Key Intersection improvements throughout the study area where practicable
- Site-specific access improvements, which include the proposed Paradise Island Drive access

1.2 Project Description

The proposed school site summary is as follows:

- Total Site Acreage – 3.6 acres
- Proposed School Square Footage – 61,000 SF
- Total Projected Students ≤ 150
- Proposed Parking Stalls – TBD
- Operation Hours:
    a. Monday to Friday – 8:00am – 4:00pm

1.3 Study Area Location

The school site is located at Latitude 25^0 49 53.71= N and Longitude 77^0 189 40.07= as indicated in **Figure 1.**

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Figure 1: Paradise Island School Site Layout Using Existing Access

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Figure 2: Proposed School Study Area

Section 2

2.0 Existing Conditions

The proposed site will be situated fronting Paradise Island Drive in proximity to the Ocean Club Road, the Four Seasons Resort access. The study area intersections are indicated in **Figure 3** to **Figure 10.**

Figure 3: Site Location on Paradise Island Drive

Figure 4: Paradise Island Drive & Flamingo

Figure 5: Paradise Island Drive & Harbour Ridge

Figure 6: Paradise Island Drive & Lakeview

Figure 7: Paradise Island Drive & Bayview

Figure 8: Paradise Island Drive & Ocean Club

Figure 9: Paradise Island Drive & Cloister West

Figure 10: Paradise Island Drive & Cloister East

2.1 Study Area

The study area is indicated in **Figure 2,** and is situated on Paradise Island in the southcentral region of that Island, comprising of the proposed School fronting Paradise Island Drive.

2.2 Roadway Cross Section Dimension Fronting Site

The existing roadway cross-section dimension (pavement width) for the pavement fronting the proposed site is outlined in **Table 1**. Paradise Island Drive is a four-lane roadway segment reducing to two-lanes at the Ocean Club intersection.

Table 1: Existing Roadway Cross Section Fronting Site

Roadway Name	Roadway Cross Section Width
Paradise Island Drive	47 Feet (Four-lanes with center median)
Paradise Island Drive	24 Feet (two-lane segment)

2.3 Study Area Land Use

The proposed site location in the immediate study area is predominately a low/medium density residential and commercial zoning.

2.4 Safety

The overall road safety within the study area will be a very important consideration for this traffic impact assessment. An evaluation of safety in the study area is outlined in **Section 3.0** of this TIA.

2.5 Existing Traffic Flow

The study area existing traffic flow pattern on Paradise Island Drive consists of two-way traffic flow, as outlined in **Table 2.**

Table 2: Existing Directional Flow

Roadway Name	Direction of Traffic Flow
Paradise Island Drive	Two-way

2.6 Site Accessibility

The ingress and egress to the proposed site will be via Paradise Island Drive.

2.7 Sidewalks

There are sidewalks on the north side of Paradise Island Drive within the study area.

2.8 Existing Parking

The site is undeveloped with no existing parking delineated.

2.9 Omni (Jitney) Bus Transit System

There are no public bus routes along Paradise Island Drive in the study area.

2.10 Traffic Volumes - Average Daily Traffic (ADT)

The existing ADT on Paradise Island Drive adjacent to the site in the study area is outlined in **Figure 11** as follows:

Table 3: Average Daily Traffic In Study Area

Roadway Name	AD	Directional Split	
Paradise Island Drive	4,31	55% E	45% WB

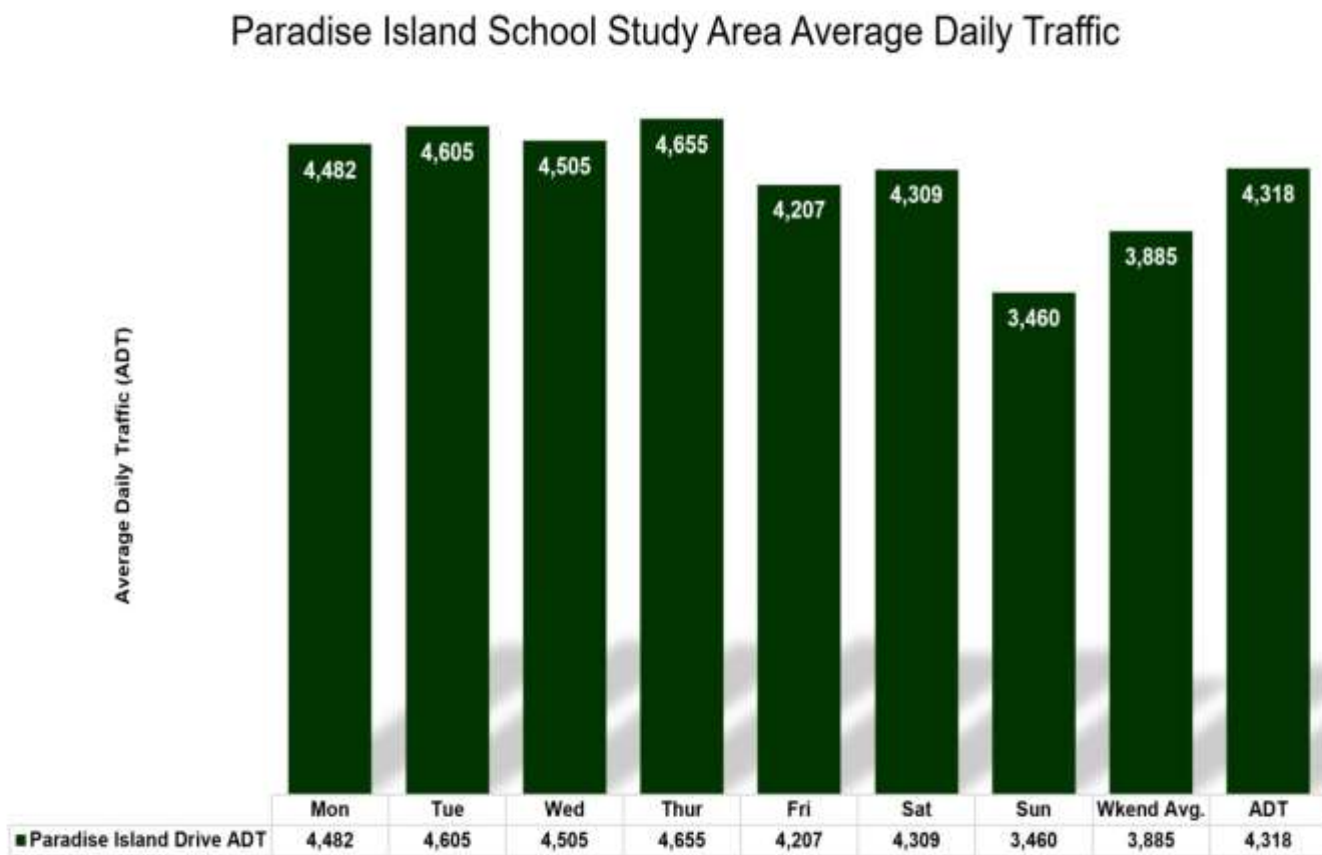

Figure 11: Paradise Island Drive Existing ADT Adjacent to Site

2.11 Vehicle Classification

Vehicle classification counts that were taken on Paradise Island Drive adjacent to the site during the peak periods of travel are outlined in **Figure 12**.

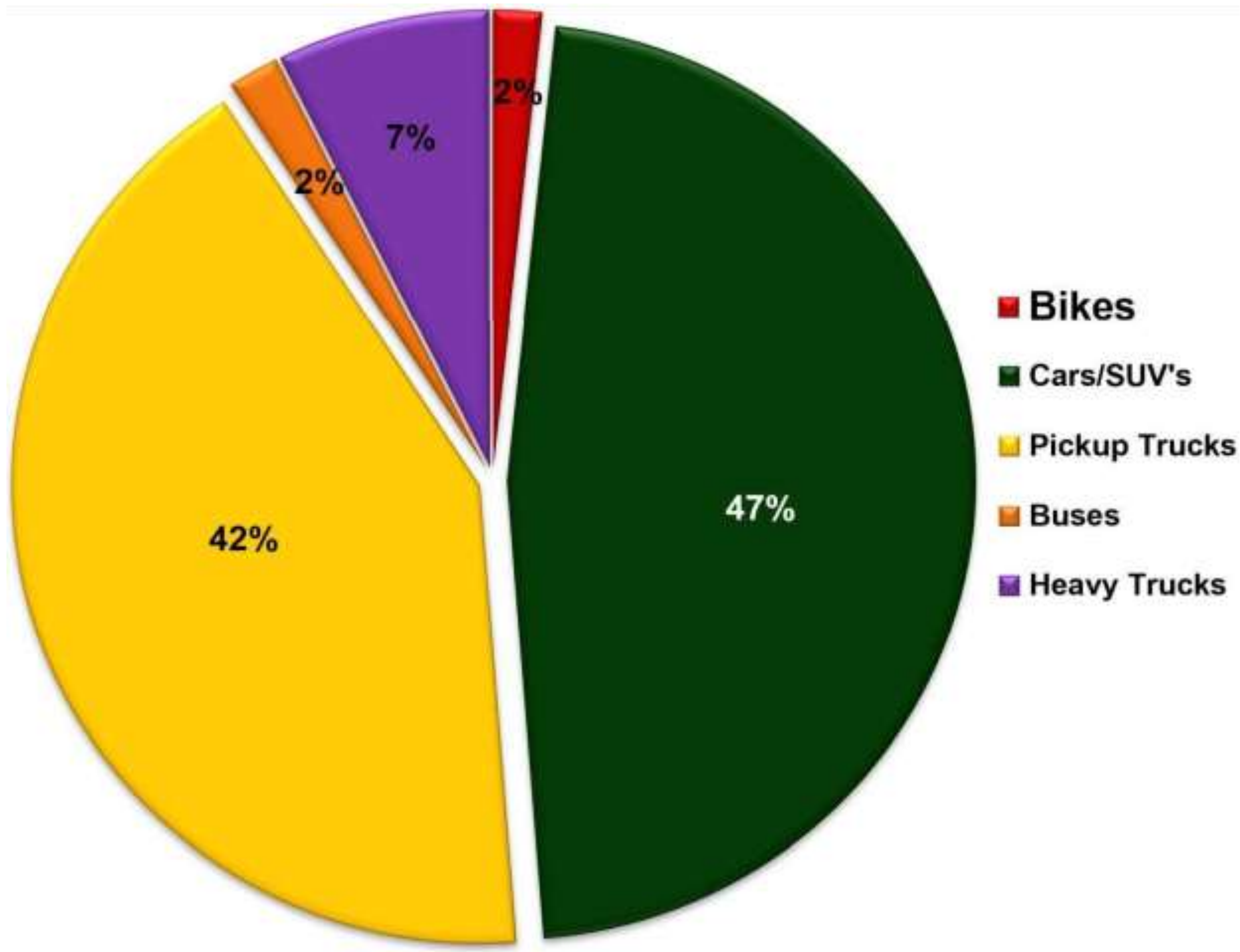

Figure 12: Paradise Island Drive Vehicle Classification Adjacent to Site

2.12 Traffic Volumes - Turning Movement Counts (TMC)

In **Figure 13** the baseline peak TMC counts were collected at the intersections indicated below during the following peak periods: 6:00AM – 9:00AM, 11:00AM – 1:00PM and 3:00PM – 6:00PM:

1. Paradise Island Drive & Flamingo Road
2. Paradise Island Drive & Harbour Ridge Road
3. Paradise Island Drive & Lakeview Drive

4. Paradise Island Drive & Bayview Lane West
5. Paradise Island Drive & Ocean Club Road
6. Paradise Island Drive & Cloister Drive West
7. Paradise Island Drive & Cloister Drive East

Figure 13: Baseline Peak Hour Traffic in Study Area

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2.13 Existing Condition Intersection Capacity Analysis

The capacity analysis was performed using PTV Vistro and PTV Vissim 2022 software for modelling purposes. Level of Service (LOS) is a quality measure describing conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience.

The HCM Version 6.0 LOS criteria for unsignalized intersections designations are A - F[3] (A being best and F worst), as outlined in **Table 4**. The LOS determined for the study is the HCM. The baseline study area intersections analyzed LOS are shown in **Figure 14**. The TIA analysis LOS criteria are indicated below.

Table 4: (Unsignalized Intersection LOS Criteria (HCM))

Unsignalized Intersection Level of Service Criteria (HCM)		
Control Delay (sec/veh)	LOS by Volume-to-Capacity Ratio[4] v/c ≤ 1.0	v/c >1.0
0-10	A	F
>10-15	B	F
>15-25	C	F
>25-35	D	F
>35-50	E	F
>50	F	F

Note: The LOS criteria apply to each lane on a given approach for minor street. LOS is not calculated for major-street approaches or for the intersection as a whole.

2.13.1 Existing Baseline[5] Study Area Level of Service (LOS)

The existing study area intersections peak hour measures of effectiveness (MOE) LOS, v/c and delay break down by approach are outlined below in **Table 5** and in the Existing Baseline Analysis Report in Appendix A. The existing baseline LOS is indicated in **Figure 14**.

---

3 Highway Capacity Manual HCM Version 6.0 Volume 3 Exhibit 19-8 Page 19-16.

4 Highway Capacity Manual HCM Version 6.0 Volume 3 Exhibit 20-2 Page 20-6. 5 Peak Hour Analysis.

Table 5: Existing Baseline Study Area Intersection Analysis Summary

7	Paradise Island Drive & Cloister Drive East	Unsignalized	SB Right	0.047	11.3	B

Figure 14: Existing Baseline LOS in Study Area

Section 3

3.0 Proposed Conditions

The proposed conditions for the School are outlined in this section of the report.

3.1 Development Land Use

No material rezoning of land use is anticipated in the study area. The land use in the study area of the proposed site is predominately a low/medium density residential and commercial zoning.

3.2 Future Development

The land fronting Paradise Island Drive on the south side of the corridor are relatively built-out areas. To the north of the corridor is somewhat built-out with some virgin land, which includes the Flamingo Lake predominately. This lake area is proposed to be developed into a nature trail in 2023. Otherwise, there are no future substantive development anticipated in the immediate study area that will have a proximate or direct impact on the proposed school access in the immediate future.

3.3 Site Accessibility

The proposed separated ingress and egress to the site will be via Paradise Island Drive from an existing ingress and egress access locations. These access points were utilized by an abandoned and vacated building adjacent to the school site.

3.4 Sidewalks

There are adequate sidewalks along the north side of Paradise Island Drive in the study area.

3.5 Omni (Jitney) Bus Transit System

There are no public bus routes along Paradise Island Drive in the study area. Notwithstanding, for the purpose of this study, it is envisaged that the trips will be predominately generated by vehicular traffic. Therefore, the impacts will be based on servicing of the trips generated by the predominant mode of transportation; as such, this study focused primarily on the vehicular trips generated.

3.6 Parking Supply

The proposed parking supply for this School is as follows:

Table 6: Parking Supply Evaluation

Proposed Parking Supply					
Item#	**Building Description**	**Required Parking**	**Parking Proposed**	**Minimum Criteria Met?**	**Minimum Handicap Stalls Required**[6]
1	Schools Parking	203	203	Yes[7]	7
2	**Total Parking Required**	**203**	**203**	**Yes**	**7**

The calculated minimum parking demand indicated is based on the DPP minimum standards which are referenced by footnote No. 6. The minimum designated handicap stalls should be seven (7), which are to be signed and marked in accordance with the Persons with Disabilities (Equal Opportunity) Act, 2014[8].

3.7 Safety

A safety evaluation of the study area is outlined in this section as follows:

3.7.1 Number of Access Points Serving the Site

The proposed separated ingress/egress servicing the site will be via an existing access on Paradise Island Drive.

3.7.2 Proposed Access Point(s) Adequately Setback from Intersections

The nearest major intersection will be Paradise Island & Paradise Beach Drives (~2,500 feet). For an urban roadway, the optimal functional upstream intersection distance for a speed of 30 MPH is 725 feet taking into account a driver9s perception-reaction time[9]. Due to the fact that this is an urban area, the location of the proposed access is well outside of this optimal upstream functional distance and therefore optimal.

3.7.3 Right-Turns Restriction into The Site

There may not be a need to restrict right-turning movements into the site with a prohibition if a separated right-turn lane is possible and given the fact that the Paradise Island Drive corridor is a relatively low volume roadway, which should provide the necessary gaps for right-turning traffic. This will be verified during the capacity analysis output.

6 The Parking Handbook for Small Communities Table 4.7 Page 72.
7 Department of Physical Planning Minimum Standard (1 Stall per 300/SF Building).
8 Persons with Disabilities (Equal Opportunity) Act, 2014, Subsections 20 and 21
9 Mason, Elizer, Hooper, Urban Street Geometric Design Handbook (ITE 2008) Table 3-3, 145.

3.7.4 Sensitivity to Vulnerable Road Users Needs

There is a continuous sidewalk system along the north side of Paradise Island Drive in the study area. This corridor is also traffic calmed given the volume of pedestrian traffic on Paradise Island.

3.7.5 Parking Adequacy

The proposed site parking supply was based on the DPP criterion is outlined in **Table 6**.

3.7.6 Speed

Paradise Island Drive has been traffic calmed utilizing speed humps throughout the corridor, which manages speed on segments of this roadway. However, between Lakeview Drive and the proposed school site, which is approximately 1,000 feet the average speed is 28MPH with an 85th percentile speed of 33MPH with the fastest speed being 57MPH. This segment of roadway will require a traffic calming measure.

3.7.7 Study Area Vehicle Conflict Analysis

There are no existing major vehicle conflict areas along the Paradise Island Drive corridor. This corridor was well designed and the various access points were managed adequately.

3.7.8 Study Area Intersection Sight Distances (ISD)

The intersection sight distance in the study area is referenced to the desired requirements 1.47Vt (V= vehicle speed and t = time for a minor road vehicle to enter a major roadway)[10] and is controlled by approach and departure sight distances. For the stop-controlled proposed site egress, the departure sight distance will govern. The ideal ISD will be 335 feet; for motorists egressing the site onto Paradise Island Drive, the available sight distance will be adequate.

3.7.9 Study Area Vehicle-Pedestrian Conflicts

Given the touristic land use of Paradise Island, there will be potential vehicle-to- pedestrian movement conflicts. However, this is mitigated by the use of sidewalks in the study area along with adequate pedestrian crossings. Additionally, and optimally, Paradise Island Drive is traffic calmed so that speeds are managed throughout most of that corridor.

3.7.10 Site Access Throat Storage Depth

Providing adequate site access throat depth will be very important for safe and efficient

10 AASHTO, A Policy on Geometric Design of Highways and Streets (7th Edition 2018) Table 9-7.

traffic operations for this site. It is necessary that the site egress throat depth enable motorists to ingress and egress without impacting Paradise Island Drive. A minimum throat depth of 60 feet[1] is desired, which would allow storage of approximately three (3) vehicles. The design of the site access and parking arrangements should incorporate this minimum standard.

3.7.11 Study Area Safe Stopping/Passing Sight Distance (SSD)

Stopping sight distance is the sum of the distance the vehicle travels from the driver9s first possible sighting of the hazard to the instant the brakes are touched, plus the distance required to stop after initial brake activation[12]. The SSD required for Paradise Island Drive adjacent to the access, which is a level roadway with an average speed of 28 MPH, is approximately 200 feet[13]. The passing sight distance for a vehicle traveling along Paradise Island Drive at that speed will be circa 500[14] feet. Therefore, this corridor has adequate SSD and PSD.

3.7.12 Use of Auxiliary Lanes

Fronting the School, there is provision for a separated auxiliary WB right-turn lane to be marked as such[15]. This will be analyzed for its measures of effectiveness (MOE9s).

3.7.13 Study Area Queuing and Storage

The study area is a private urban area with acceptable queuing and storage areas on most legs of the major Paradise Island Drive and minor side street intersections. These roadways are low volume corridors.

3.7.14 Study Area Street Lighting

The study area corridor is adequately illuminated with existing street lighting in proximity to the proposed site. The site will likewise have its own illumination.

3.8 Trip Generation

The trip generation outlined in this section was based on local historical trip generation data researched at other similar socio-economic private school facilities (Exhibit 2 Appendix B), namely the following:

---

[1] Mason, Elizer, Hooper, Urban Street Geometric Design Handbook (ITE 2008) Figure 3-28, 164.

- Windsor School, Old Fort Bay Campus
- Lyford Cay International School Upper Campus
- Lyford Cay International School Lower Campus
- Akhepran International Academy
- Kings College School

12 ITE, Traffic Engineering Handbook (5^{th} Edition 1999) 13.
13 AASHTO, A Policy on Geometric Design of Highways and Streets (7^{th} Edition 2018) Table 3-1, 3-4.
14 AASHTO, A Policy on Geometric Design of Highways and Streets (7^{th} Edition 2018) Table 3-4, 3-11.
15 AASHTO, A Policy on Geometric Design of Highways and Streets (7^{th} Edition 2018) Figure 9-5, 9-15.

3.8.1 Percentage Distribution Assignment

The estimated percentage distributional assignment (splits) for the trips generated are shown in **Table 7**.

Table 7: Trips Distributional Splits

Proposed Trips Distributional Splits

Item #	Directional Description	
1	From North	26%
2	From South	15%
3	From East	30%
4	From West	29%
5	**Total**	**100%**

3.8.2 Trips Generated by Site

The estimated trips generated by the proposed site are shown in **Table 8**. The average trip data from the School is generated by the equation $Y = 4.681X^{0.7341}$. Therefore, the average trips generated during the peak hour is 185 with 55% Ingress and 45% Egress, with an estimated 0% of the trips generated being pass-by trips[16].

The total vehicle miles traveled by the trips generated is 102.05 VMT. The estimated peak trips generated by the proposed site distributed over the study area are indicated in

Table 9 and **Figure 15**.

Table 8: Peak Hour Trips Generated by Site

Peak Hour Trips Generated by the Proposed Site[17]
(Exhibit 2 Appendix B)

Item #	Description	Ingress	Egress	Total Trips
1	Proposed Site	102	83	185

16 Trip Generation Handbook 2nd Edition, An ITE Recommended Practice, June 2004, ITE, Table 5.10, 52.
17 Ingress 62% Egress 38%

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Figure 15: Trips Generated By Site Distribution Splits in Study Area **Figure 16:** Trips Generated Plus Baseline Peak Hour Traffic in Study Area

PARADISE ISLAND DR.
PARADISE ISLAND DR.
PARADISE ISLAND DR.
LAKEVIEW DR.
THE OCEAN CLUB ROAD
BEACH CLUB DR.
SITE
FLAMINGO RD.
HARBOUR RIDGE RD.
BAYVIEW LANE
BAYVIEW LANE
CLOISTER DR. W
CLOISTER DR. E
T-1
T-2
T-3
T-4
T-5
T-6
T-7
LEGEND:
Turning Movement Counts (TMC)
Traffic Flow Direction
PARADISE ISLAND SCHOOL
TRAFFIC IMPACT ASSESSMENT
Trips Generated + Baseline Peak Traffic
CARIBBEAN CIVIL GROUP LIMITED

Table 10: Peak Trips Generated Plus Baseline Peak Hour Traffic

Peak Hour Trips Generated Plus Baseline Peak Hour Traffic Throughout Study Area													
No.	**Corridor**	**Northbound**			**Southbound**			**Eastbound**					
		LT	T	RT	LT	T	RT	LT	T	RT	LT	T	RT
1	Paradise Island Drive & Flamingo Road	19	246	12	2	4	22	22	246	14	21	367	1
2	Paradise Island Drive & Harbour Ridge Road	7	--	49	--	--	--	--	342	9	61	707	--
3	Paradise Island Drive & Lakeview Drive	--	--	--	37	--	182	138	187	--	--	317	29
4	Paradise Island Drive & Bayview Lane West & School Ingress	4	--	7	--	--	--	71	189	10	6	258	31
5	Paradise Island Drive & Ocean Club Road	1	--	--	15	--	15	1	227	1	--	282	--
6	Paradise Island Drive & Cloister Drive West	18	--	2	--	--	--	--	278	19	1	291	--
7	Paradise Island Drive & Cloister Drive East	4	--	3	13	--	3	12	119	7	3	150	1
8	Paradise Island School Egress	--	--	--	83	--	--	--	--	--	--	89	--

3.0 Proposed Site Condition Capacity Analysis

Capacity analysis is a means of determining the ability of a roadway to accommodate the traffic accessing that roadway. Level of Service (LOS) is a measure of the quality of service on transportation infrastructure generally linked to travel time and delays and denoted by a grade from A to F (A being best and F worst) for unsignalized intersections as indicated in **Table 4**.

3.0.1 Proposed Site Trips Generated Plus Baseline Peak LOS

The proposed site trips generated plus the baseline peak traffic MOE9s broken down by approach and intersection, including the proposed access, are outlined in **Table 11** and Appendix C.

Table 11: Proposed Site Trips Plus Baseline Peak Hour MOE9s

Proposed Site Trips Generated Plus Baseline Peak Hour Traffic Upgrade HCM LOS (Exhibit 3 Appendix C)						
No.	**Location**	**Control**	**Worst Leg**	**V/C**	**Delay (s/veh)**	**LOS**
1	Paradise Island Drive & Flamingo Road	Unsignalized	SB Thru	0.039	18.1	C
2	Paradise Island Drive & Harbour Ridge Road	Unsignalized	NB Right	0.450	44.6	E
3	Paradise Island Drive & Lakeview Drive	Unsignalized	SB Right	0.585	27.5	D
4	Paradise Island Drive & Bayview Lane West		NB Right	0.027	13.4	B
5	Paradise Island Drive & Ocean Club Road	Roundabout	WB Thru	--	5.2	A
6	Paradise Island Drive & Cloister Drive West	Unsignalized	NB Right	0.011	15.5	C
7	Paradise Island Drive & Cloister Drive East	Unsignalized	SB Right	0.052	12.1	B
8	Paradise Island Drive & School Egress	Unsignalized	SB Left	0.076	8.6	A

Section 4

4.0 20-Year Horizon Analysis

The 20-year horizon was calculated using a growth rate of 1.5% for a growth factor of 1.35. The analysis over the 20-year period is included in this section.

4.1 Study Area 20-Year Horizon MOE9s

The 20-Year horizon peak hour traffic for the trips generated is shown in **Table 12** and in **Figure 17**. The 20-year intersection MOE9s are indicated in **Table 13** and Appendix D.

Table 12: Proposed 20-Year Horizon Peak Hour Traffic

RT
1
--
31
31
--
--
1
--

Proposed Trips 20-Year Horizon Peak Hour Traffic In Study Area

No.	Corridor	Northbound			Southbound			Eastbound			Westbour		
		LT	T	RT	LT	T	RT	LT	T	RT	LT	T	
1	Paradise Island Drive & Flamingo Road	26	246	13	3	5	30	30	322	19	26	487	
2	Paradise Island Drive & Harbour Ridge Road	9	--	63	--	--	--	--	448	12	80	944	

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3	Paradise Island Drive & Lakeview Drive	--	--	--	41	--	246	186	236	--	--	415
4	Paradise Island Drive & Bayview Lane West & School Ingress	5	--	9	--	--	--	71	255	14	8	328
5	Paradise Island Drive & Ocean Club Road	1	--	--	20	--	20	1	298	1	--	370
6	Paradise Island Drive & Cloister Drive West	24	--	3	--	--	--	--	367	26	1	382
7	Paradise Island Drive & Cloister Drive East	5	--	4	18	--	4	16	152	9	4	192
8	Paradise Island School Egress	--	--	--	83	--	--	--	--	--	--	89


PARADISE ISLAND DR.
FLAMINGO RD.
HARBOUR RIDGE RD.
LAKEVIEW DR.
BAYVIEW LANE
THE OCEAN CLUB ROAD
CLOISTER DR. W
BEACH CLUB DR.
CLOISTER DR. E
SITE
T-1
T-2
T-3
T-4
T-5
T-6
T-7
T-8
LEGEND:
Turning Movement Counts (TMC)
Traffic Flow Direction
PARADISE ISLAND SCHOOL
TRAFFIC IMPACT ASSESSMENT
20-Year Horizon Peak Traffic In Study Area
CARIBBEAN CIVIL GROUP LIMITED

Figure 17: 20-Year Horizon Peak Hour Traffic in Study Area

Table 13: Study Area 20-Year Horizon MOE9s

Proposed Study Area 20-Year Horizon Peak Hour Traffic HCM LOS (Exhibit 4 Appendix D)						
No.	**Location**	**Control**	**Worst Leg**	**V/C**	**Delay (s/veh)**	**LOS**
1	Paradise Island Drive & Flamingo Road	Unsignalized	SB Thru	0.069	25.6	D
2	Paradise Island Drive & Harbour Ridge Road	Unsignalized	NB Right	1.107	224.5	F
3	Paradise Island Drive & Lakeview Drive	Unsignalized	SB Right	1.009	108.7	F
4	Paradise Island Drive & Bayview Lane West		NB Right	0.043	15.7	C
5	Paradise Island Drive & Ocean Club Road	Roundabout	WB Thru	--	6.2	A
6	Paradise Island Drive & Cloister Drive West	Unsignalized	NB Right	0.024	20.4	C
7	Paradise Island Drive & Cloister Drive East	Unsignalized	SB Right	0.087	13.8	B
8	Paradise Island Drive & School Egress	Unsignalized	SB Left	0.076	8.6	A

Section 5

5.0 Traffic Capacity Analysis Comparison

A comparison between the delays is outlined below for the following conditions:

- Existing baseline traffic
- Trips generated plus the existing baseline (proposed)
- Proposed roundabout at the Ocean Club Road intersection
- 20-Year Horizon

The key study area intersections delay MOE9s are indicated in **Figure 18**.

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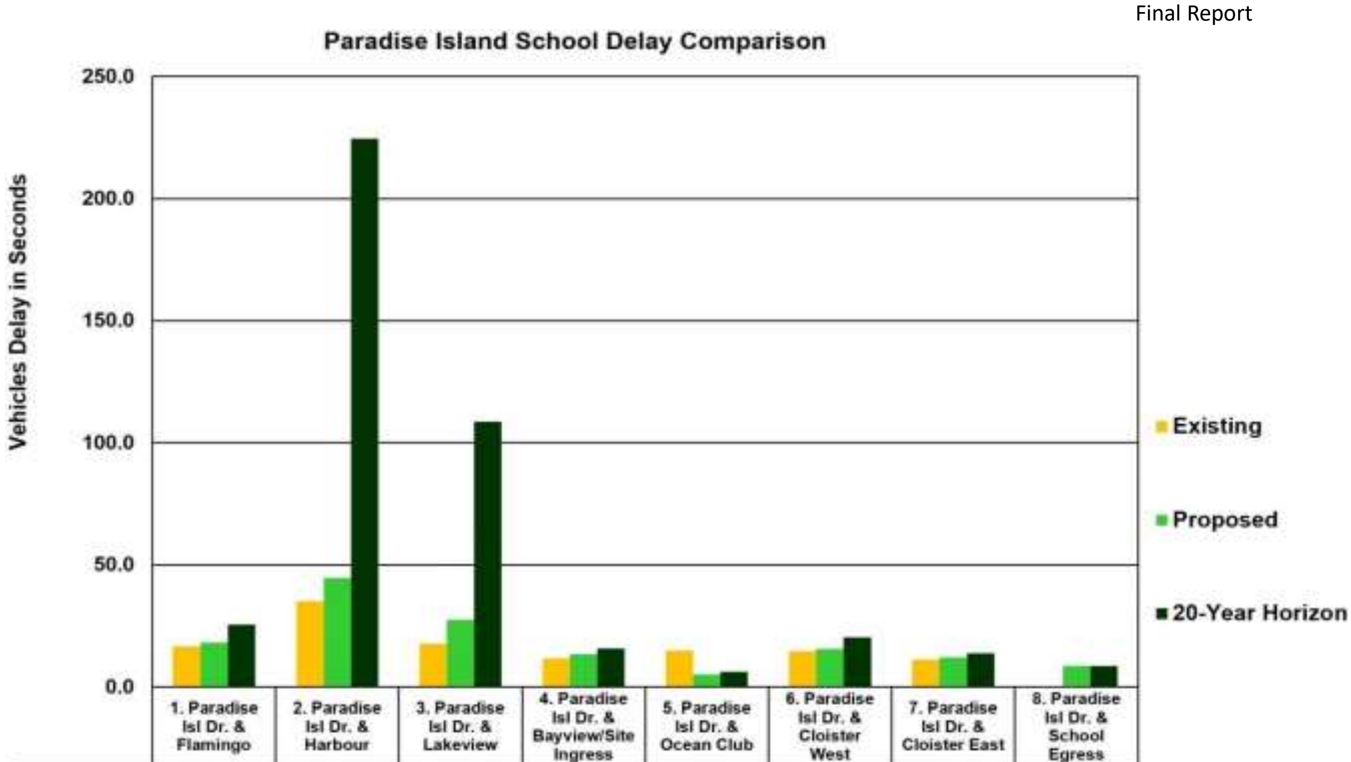

	1. Paradise Isl Dr. & Flamingo	2. Paradise Isl Dr. & Harbour	3. Paradise Isl Dr. & Lakeview	4. Paradise Isl Dr. & Bayview/Site Ingress	5. Paradise Isl Dr. & Ocean Club	6. Paradise Isl Dr. & Cloister West	7. Paradise Isl Dr. & Cloister East	8. Paradise Isl Dr. & School Egress
Existing	16.7	35.2	17.7	11.6	14.9	14.6	11.3	0.0
Proposed	18.1	44.6	27.5	13.4	5.2	15.5	12.1	8.6
20-Year Horizon	25.6	224.5	108.7	15.7	6.2	20.4	13.8	8.6

Figure 18: Study Area Delay Comparison

5.1 Traffic Modell Calibration and Validation

The modell was calibrated using turning movement count data input and average travel time speeds documented in the field. Travel times were generated by the modell for Paradise Island Drive. Therefore, the modell was validated by travel time data collection in the field on those exact routes. The calibration threshold and acceptance targets are listed below.

Table 14: Calibration and Validation of Traffic Modell

Calibration and Validation of Modell[18]

No.	Location	Field Travel Time (mm:ss)	Modell Travel Time (mm:ss)	Absolute Divergence (Time) (mm:ss)	Absolute Divergence (%)	Validation
1	**Paradise Island Drive EB** (Comfort Suites – Northshore Booth)	1:41	1:39	1.65s	2%	OK
2	**Paradise Island Drive WB** (Northshore Booth - Comfort Suites)	1:52	1:52	1.73s	8%	OK

Section 6

6.0 Impact Assessment and Recommendations

Based on the anticipated trips generated by the site, the proposed site study area interventions based on the analysis and engineering judgment are included herein this section and are outlined in **Table 15** and **Figure 19** for consideration.

Table 15: Paradise Island School Site Impact Assessment

Paradise Island School Study Area Impact Assessment						
No.	**Impact Description**	**Extent**	**Probability**	**Significance**	**Solutions to be Considered**	**Recommendations to Mitigate**
Intersection Improvements Throughout Study Area						

						this intersection to a	It is highly recommended that this intersection be converted to a roundabout with a minimum 90 feet - 110 ICD in lieu of a median cut to accommodate rightturning movements egressing the School. Consistent with **Table 5** and **Table 11** a roundabout would reduce delay by 65%. A roundabout control will reduce the vehicle conflicts from 32 to 8 (75%) and pedestrian conflicts from 24 to 8 (67%). The conversion to a roundabout at this location will realize a clear improvement in safety, as mentioned above. Using the empirical bayes methodology, a CMF of 0.65 (CMF ID: 209) should be realized by this conversion. This would also allow for an aesthetic gateway treatment at the Ocean Club Resort access. Furthermore, and equally important motorists egressing the proposed School with a westbound destination will make a U-Turn just west of this existing intersection where the center median ends impacting traffic flow and safety on Paradise Island Drive & the Ocean Club

1.0	Paradise Island Drive & the Ocean Club Road & Bayview Lane East eastbound U-turn movements	Local	Will Definitely Occur	Medium	Convert roundabout	

						Road intersection.
2.0	Paradise Island Drive Speeds	Local	Will Definitely Occur	High	Install traffic calming measures in proximity to school campus.	In addition to the existing speed table located approximately 90 feet east of the proposed egress, an additional speed table is recommended to be installed about 100 feet west of the school ingress to manage speeds along Paradise Island Drive fronting the school campus. The speed tables will realize a CMF of 0.6 (CMF ID: 132) as a result of the managed speeds within this zone.

6.1 Study Area Recommendations

The recommendation for this study area is indicated in **Figure 19**.


PARADISE ISLAND DRIVE
THE OCEAN CLUB ROAD
ICD 110'
PARADISE ISLAND DRIVE

Figure 19: Study Area Recommendation

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Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Paradise Island Drive & Flamingo	Two-way stop	HCM 7th Edition	SB Thru	0.035	16.7	C
6	Paradise Island Drive & Harbour Ridge Road	Two-way stop	HCM 7th Edition	NB Right	0.338	35.2	E
11	Paradise Island Drive & Lakeview Drive	Two-way stop	HCM 7th Edition	SB Right	0.451	17.7	C
16	Paradise Island Drive & Bayview Lane West	Two-way stop	HCM 7th Edition	NB Right	0.022	11.6	B
21	Paradise Island Drive & Ocean Club	Two-way stop	HCM 7th Edition	SB Right	0.075	14.9	B
26	Paradise Island Drive & Cloister Drive West	Two-way stop	HCM 7th Edition	NB Right	0.010	14.6	B
31	Paradise Island Drive & Cloister Drive East	Two-way stop	HCM 7th Edition	SB Right	0.047	11.3	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection

Intersection Level Of Service Report Intersection
1: Paradise Island Drive & Flamingo

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Control Type:	Two-way stop	Delay (sec / veh):	16.7
Analysis Method:	HCM 7th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.035

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Intersection Setup

Name	Flamingo			Co Su			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

d_M, Delay for Movement [s/veh]	10.15	16.15	15.42	10.19	16.68	14.49	0.00	0.00	8.36	0.00	0.00	7.86
Movement LOS	B	C	C	B	C	B	A	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.26	0.26	0.26	0.43	0.43	0.43	0.00	0.01	0.03	0.00	0.00	0.01
95th-Percentile Queue Length [ft/ln]	6.45	6.45	6.45	10.81	10.81	10.81	0.00	0.34	0.67	0.00	0.08	0.17
d_A, Approach Delay [s/veh]	12.06			14.35			0.48			0.07		
Approach LOS	B			B			A			A		
d_I, Intersection Delay [s/veh]	1.81											
Intersection LOS	C											

Name	Flaming ›			Co Su			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	19	0	4	2	4	22	22	216	14	15	343	1
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	1.00	1.00	1.00	0.00	0.00	0.00	7.00	7.00	7.00	7.00	7.00	7.00
Growth Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	19	0	4	2	4	22	22	216	14	15	343	1
Peak Hour Factor	0.679	1.000	0.250	0.250	0.333	0.611	0.786	0.915	0.875	0.625	0.817	0.250
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	7	0	4	2	3	9	7	59	4	6	105	1
Total Analysis Volume [veh/h]	28	0	16	8	12	36	28	236	16	24	420	4
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	No		
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

Intersection Level Of Service Report
Intersection 6: Paradise Island Drive & Harbour Ridge Road

V/C, Movement V/C Ratio	0.04	0.00	0.04	0.01	0.03	0.08	0.00	0.00	0.01	0.00	0.00	0.00

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Intersection Setup

Control Type:	Two-way stop	Delay (sec / veh):	35.2
Analysis Method:	HCM 7th Edition	Level Of Service:	E
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.338

Name	Harbour Ridge		Paradise Island Drive		Paradise Island Drive	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		Yes		No	

Volumes

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Intersection Setup

Name	Harbour Ridge		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	7	41	304	9	55	677
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.00	1.00	7.00	7.00	7.00	7.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	7	41	304	9	55	677
Peak Hour Factor	0.8750	0.6830	0.8940	0.5630	0.7240	0.7140
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	2	15	85	4	19	237
Total Analysis Volume [veh/h]	8	60	340	16	76	948
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.02	0.34	0.00	0.02	0.00	0.01

d_M, Delay for Movement [s/veh]	21.99	35.21	0.00	10.60	0.00	0.00
Movement LOS	C	E	A	B	A	A
95th-Percentile Queue Length [veh/ln]	1.50	1.50	0.01	0.03	0.00	0.00
95th-Percentile Queue Length [ft/ln]	37.46	37.46	0.34	0.67	0.00	0.00
d_A, Approach Delay [s/veh]	33.66		0.48		0.00	
Approach LOS	D		A		A	
d_I, Intersection Delay [s/veh]	1.70					
Intersection LOS	E					

Intersection Level Of Service Report
Intersection 11: Paradise Island Drive & Lakeview Drive

Control Type:	Two-way stop	Delay (sec / veh):	17.7
Analysis Method:	HCM 7th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.451

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Intersection Setup

Name	Lakeview Drive		Paradise Island Drive		Paradise Island Drive	
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		No		No	

Volumes

d_M, Delay for Movement [s/veh]	15.05	17.68	0.00	0.00	0.00	8.06
Movement LOS	C	C	A	A	A	A
95th-Percentile Queue Length [veh/ln]	2.48	2.48	0.00	0.00	0.01	0.02
95th-Percentile Queue Length [ft/ln]	62.12	62.12	0.00	0.00	0.25	0.50
d_A, Approach Delay [s/veh]	17.52		0.00		0.24	
Approach LOS	C		A		A	
d_I, Intersection Delay [s/veh]	4.57					
Intersection LOS	C					

Name	Lakeview Drive		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	12	182	138	141	281	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.00	1.00	7.00	7.00	7.00	7.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	12	182	138	141	281	7
Peak Hour Factor	0.7500	0.7710	0.7500	0.9040	0.7320	0.5830
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	4	59	46	39	96	3
Total Analysis Volume [veh/h]	16	236	184	156	384	12
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

Intersection Level Of Service Report Intersection 16: Paradise Island Drive & Bayview Lane West

Control Type:	Two-way stop	Delay (sec / veh):	11.6
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.022

V/C, Movement V/C Ratio	0.02	0.45	0.00	0.00	0.00	0.01

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Intersection Setup

Name	Bayview Lane West			Pr Va			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	1
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	230.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

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Intersection Setup

Name	Bayview Lane West			Pr Va			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	4	0	7	0	0	0	0	189	10	6	200	0
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	2.00	2.00	2.00	2.00	7.00	7.00	7.00	7.00	2.00
Growth Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	0	7	0	0	0	0	189	10	6	200	0
Peak Hour Factor	0.500	1.000	0.583	1.000	1.000	1.000	1.000	0.844	0.833	0.500	0.862	1.000
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	2	0	3	0	0	0	0	56	3	3	58	0
Total Analysis Volume [veh/h]	8	0	12	0	0	0	0	224	12	12	232	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00

d_M, Delay for Movement [s/veh]	9.11	12.68	11.63	0.00	0.00	0.00	0.00	0.00	7.82	0.00	0.00	0.00
Movement LOS	A	B	B					A	A	A	A	
95th-Percentile Queue Length [veh/ln]	0.09	0.09	0.09	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	2.34	2.34	2.34	0.00	0.00	0.00	0.00	0.25	0.50	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.62			0.00			0.40			0.00		
Approach LOS	B			A			A			A		
d_I, Intersection Delay [s/veh]	0.61											
Intersection LOS	B											

Intersection Level Of Service Report
Intersection 21: Paradise Island Drive & Ocean Club

Control Type:	Two-way stop	Delay (sec / veh):	14.9
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.075

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Intersection Setup

Name	Bayview Lane East			Ocean Club			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	10.00	12.00	12.00	10.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

d_M, Delay for Movement [s/veh]	10.23	0.00	14.54	10.45	0.00	14.92	0.00	0.00	8.07	0.00	0.00	7.80
Movement LOS	B		B	B		B	A	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.02	0.00	0.02	0.38	0.00	0.38	0.00	0.01	0.01	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.44	0.00	0.44	9.55	0.00	9.55	0.00	0.17	0.17	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.23			12.69			0.12			0.00		
Approach LOS	B			B			A			A		
d_I, Intersection Delay [s/veh]	1.23											
Intersection LOS	B											

Name	Bayview Lane East			Ocean Club			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	1	0	0	15	0	15	1	202	1	0	251	0
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	2.00	0.00	2.00	2.00	2.00	7.00	7.00	7.00	7.00	7.00	7.00
Growth Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	0	0	15	0	15	1	202	1	0	251	0
Peak Hour Factor	0.250	1.000	1.000	0.500	1.000	0.500	0.250	0.802	0.250	1.000	0.705	1.000
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	1	0	0	8	0	8	1	63	1	0	89	0
Total Analysis Volume [veh/h]	4	0	0	30	0	30	4	252	4	0	356	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	No		
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

Intersection Level Of Service Report Intersection 26:
Paradise Island Drive & Cloister Drive West

Control Type:	Two-way stop	Delay (sec / veh):	14.6
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.010

V/C, Movement V/C Ratio	0.01	0.00	0.00	0.04	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00

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Intersection Setup

Name	Cloister Drive West		Paradise Island Drive		Paradise Island Drive	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name	Cloister Drive West		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	18	2	253	19	1	260
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	7.00	7.00	7.00	7.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	18	2	253	19	1	260
Peak Hour Factor	0.5000	0.5000	0.7810	0.4750	0.2500	0.8670
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	9	1	81	10	1	75
Total Analysis Volume [veh/h]	36	4	324	40	4	300
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.05	0.01	0.00	0.03	0.00	0.00

Intersection Setup

d_M, Delay for Movement [s/veh]	10.18	14.58	0.00	7.97	0.00	0.00
Movement LOS	B	B	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.19	0.19	0.07	0.07	0.00	0.00
95th-Percentile Queue Length [ft/ln]	4.67	4.67	1.70	1.70	0.00	0.00
d_A, Approach Delay [s/veh]	10.62		0.88		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	1.05					
Intersection LOS	B					

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Intersection Level Of Service Report
Intersection 31: Paradise Island Drive & Cloister Drive East

Control Type:	Two-way stop	Delay (sec / veh):	11.3
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.047

d_M, Delay for Movem
Movement LO
95th-Percentile Queue Le
95th-Percentile Queue L
d_A, Approach Dela
Approach LO
d_I, Intersection Dela
Intersection LC

Intersection Setup

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Name	Cloister Drive East			Beach Club Drive			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	✚			✚			✚			✚		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

Name	Cloister Drive East			Beach Club Drive			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	3	0	4	3	0	13	12	94	7	3	119	1
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	3.00	3.00	3.00	7.00	7.00	7.00	7.00	7.00	7.00
Growth Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	3	0	4	3	0	13	12	94	7	3	119	1
Peak Hour Factor	0.375	1.000	0.500	0.750	1.000	0.464	0.500	0.758	0.583	0.750	0.726	0.250
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	2	0	2	1	0	7	6	31	3	1	41	1
Total Analysis Volume [veh/h]	8	0	8	4	0	28	24	124	12	4	164	4
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	No		
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No	No		

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Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.01	0.00	0.00	0.00

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
31	Paradise Island Drive & Cloister Drive East	3	0	4	3	0	13	12	94	7	3	119	1	259

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Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Paradise Island Drive & Flamingo	19	0	4	2	4	22	22	216	14	15	343	1	662

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
6	Paradise Island Drive & Harbour Ridge Road	7	41	304	9	55	677	1093

ID	Intersection Name	Southbound		Eastbound		Westbound		Total Volume
		Left	Right	Left	Thru	Thru	Right	
11	Paradise Island Drive & Lakeview Drive	12	182	138	141	281	7	761

ID	Intersection Name	Northbound			Eastbound		Westbound		Total Volume
		Left	Thru	Right	Thru	Right	Left	Thru	
16	Paradise Island Drive & Bayview Lane West	4	0	7	189	10	6	200	416

ID	Intersection Name	Northbound		Southbound		Eastbound			Westbound			Total Volume
		Left	Right	Left	Right	Left	Thru	Right	Left	Thru	Right	
21	Paradise Island Drive & Ocean Club	1	0	15	15	1	202	1	0	251	0	486

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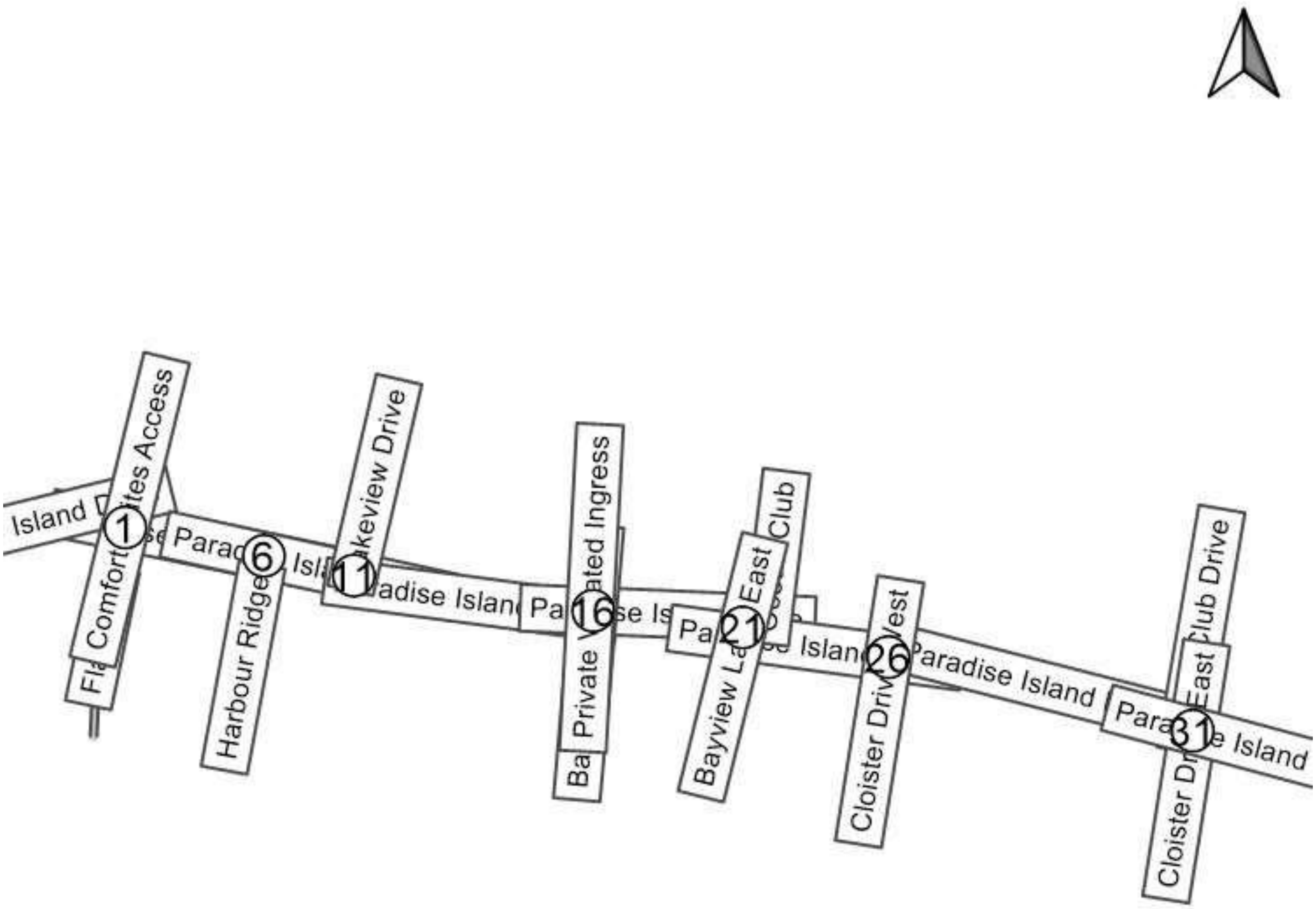
ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
26	Paradise Island Drive & Cloister Drive West	18	2	253	19	1	260	553

Report Figure 1: Study Intersections


Island D
1
6
11
16
21
26
31
Paradise Island
Harbour Ridge
Private
Bayview
Club
Club Drive
East
Cloister Dri
Paradise Island

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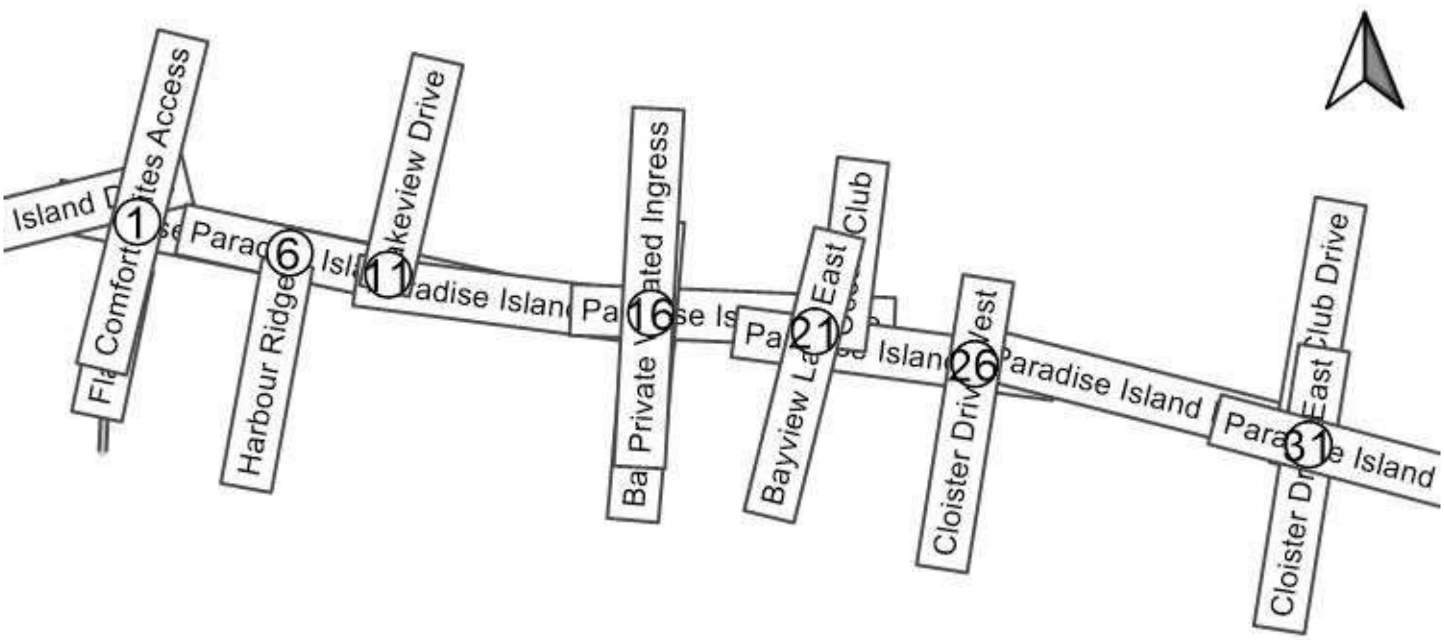
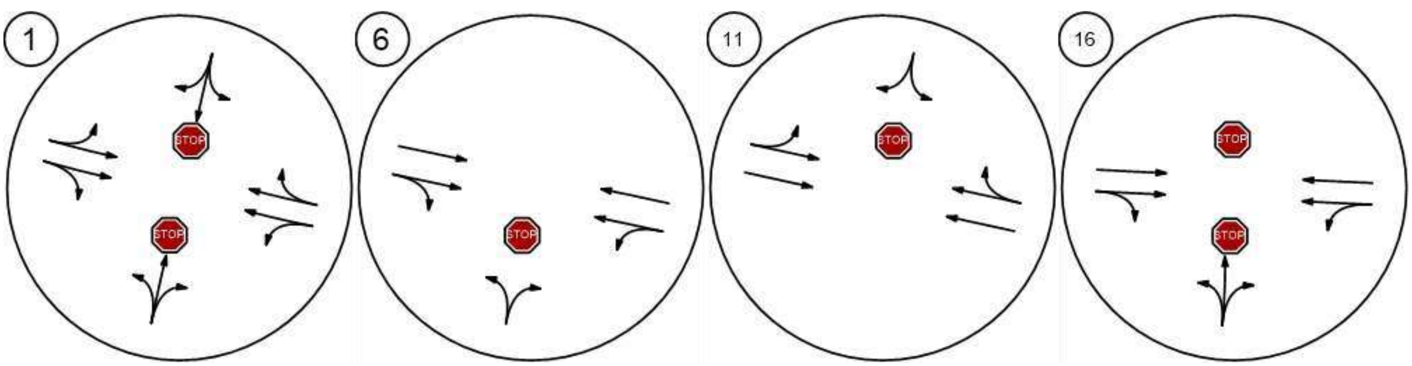
Report Figure 2: Lane Configuration and Traffic Control



Paradise Island Drive & Flami Paradise Island Drive & Harb Paradise Island Drive & Lake Paradise Island Drive & Bayvi



Paradise Island Drive & Ocea Paradise Island Drive & Clois Paradise Island Drive & Clois

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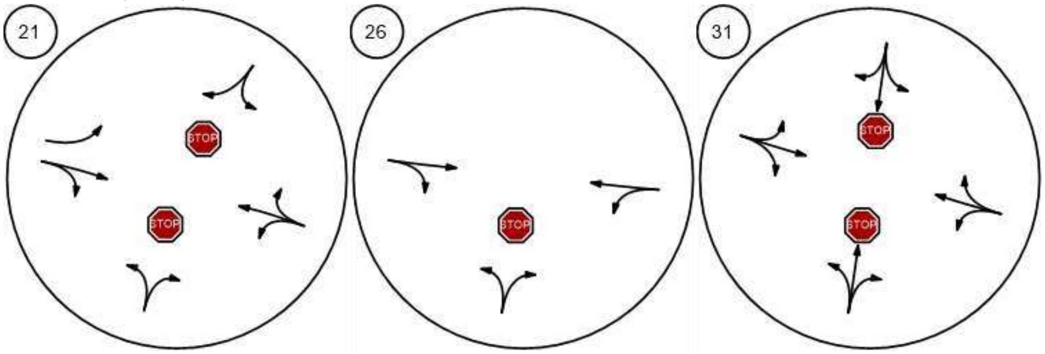
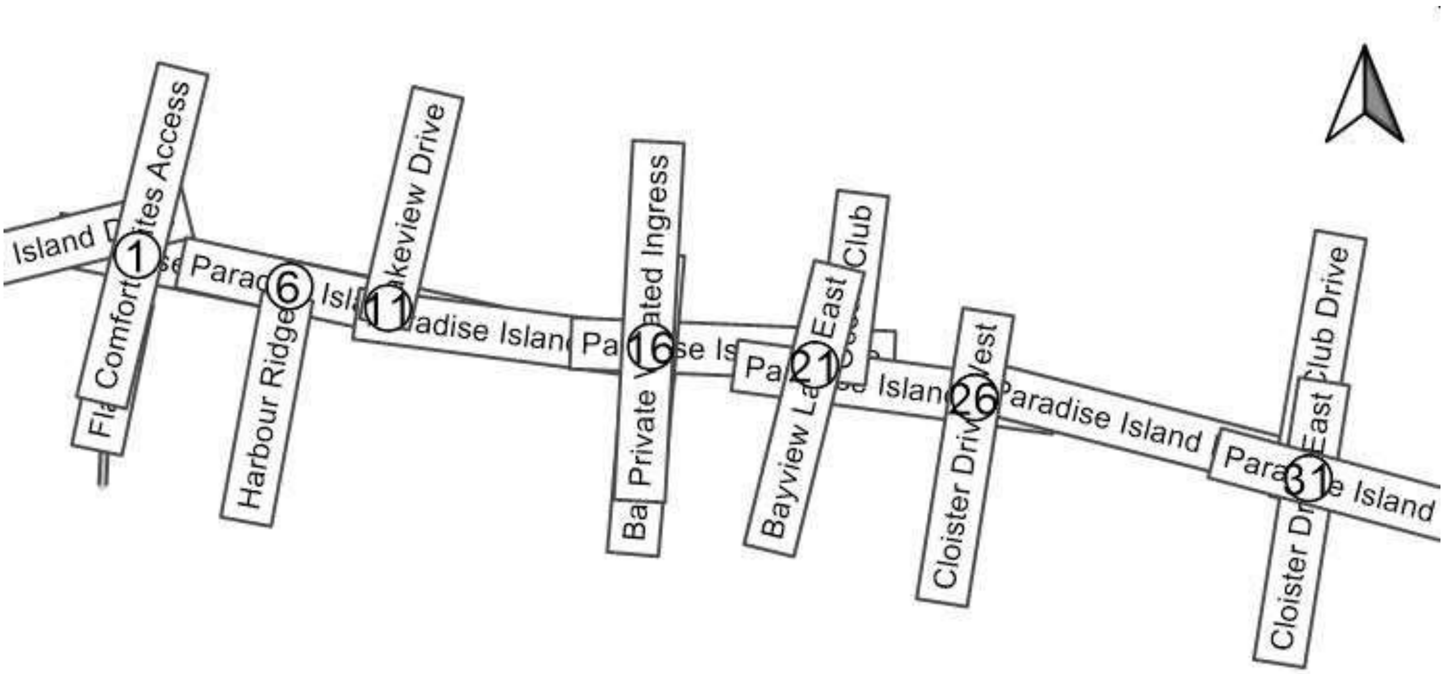


Report Figure 3a: Traffic Volume - Base Volume



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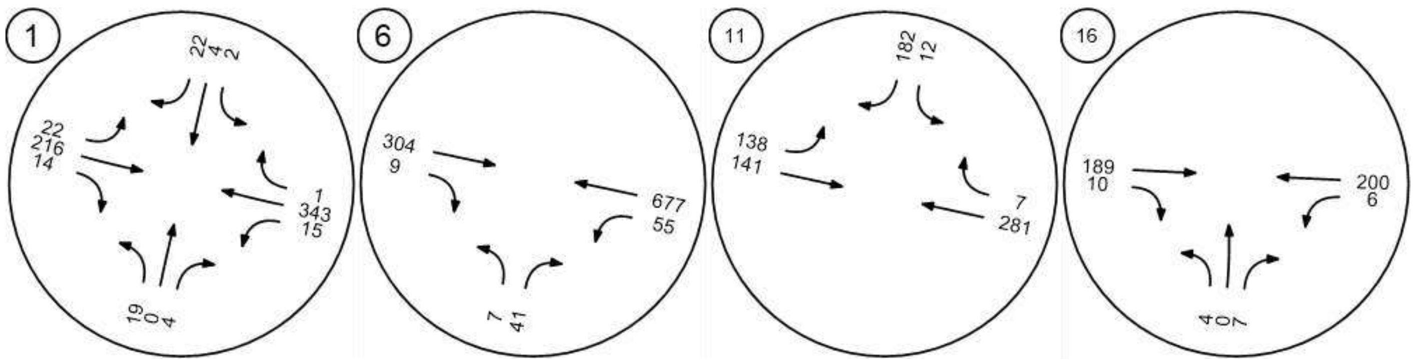
Paradise Island Drive & Flami Paradise Island Drive & Harb Paradise Island Drive & Lake Paradise Island Drive & Bayvi



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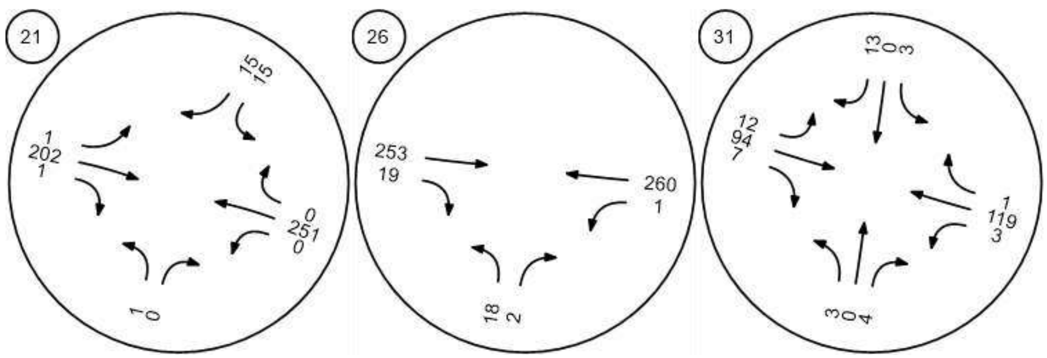

Report Figure 4: Traffic Conditions

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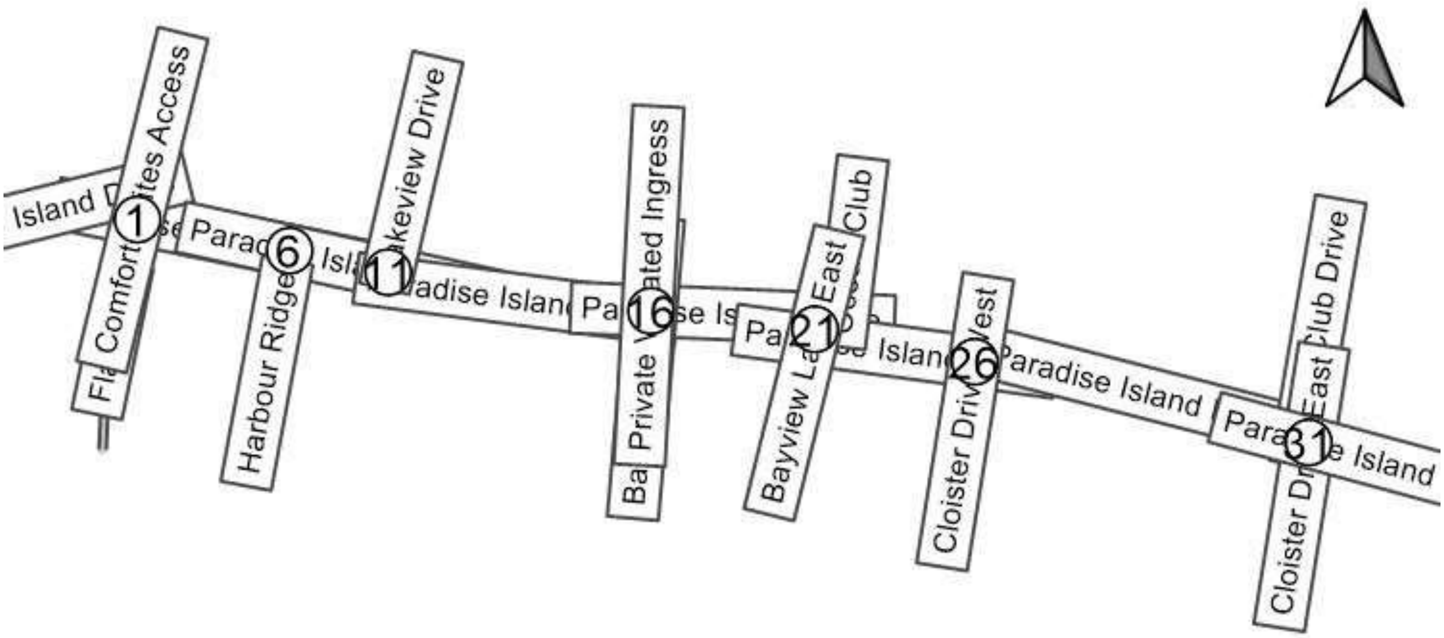
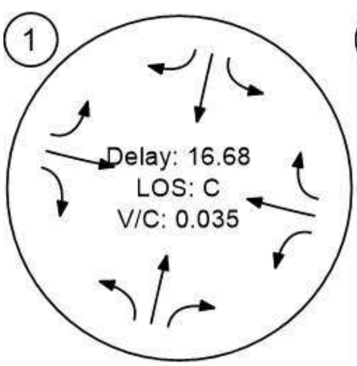
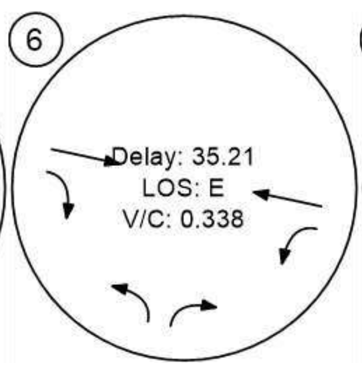
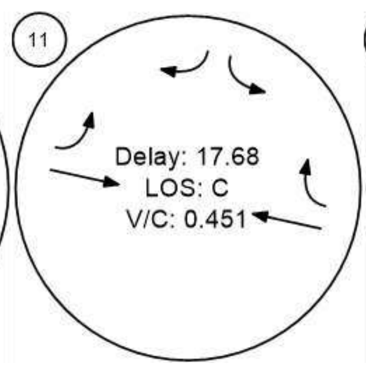
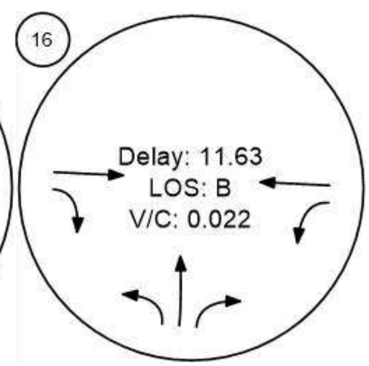


Paradise Island Drive & Flami Paradise Island Drive & Harb Paradise Island Drive & Lake Paradise Island Drive & Bayvi









Paradise Island Drive & Ocea Paradise Island Drive & Clois Paradise Island Drive & Clois

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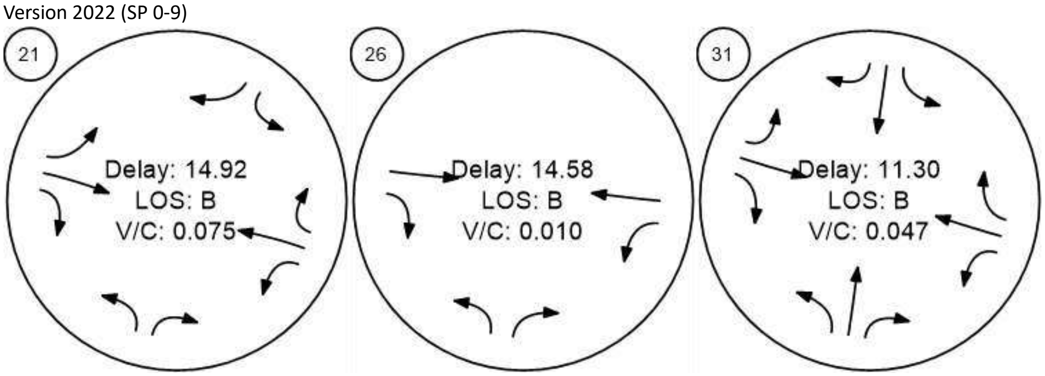
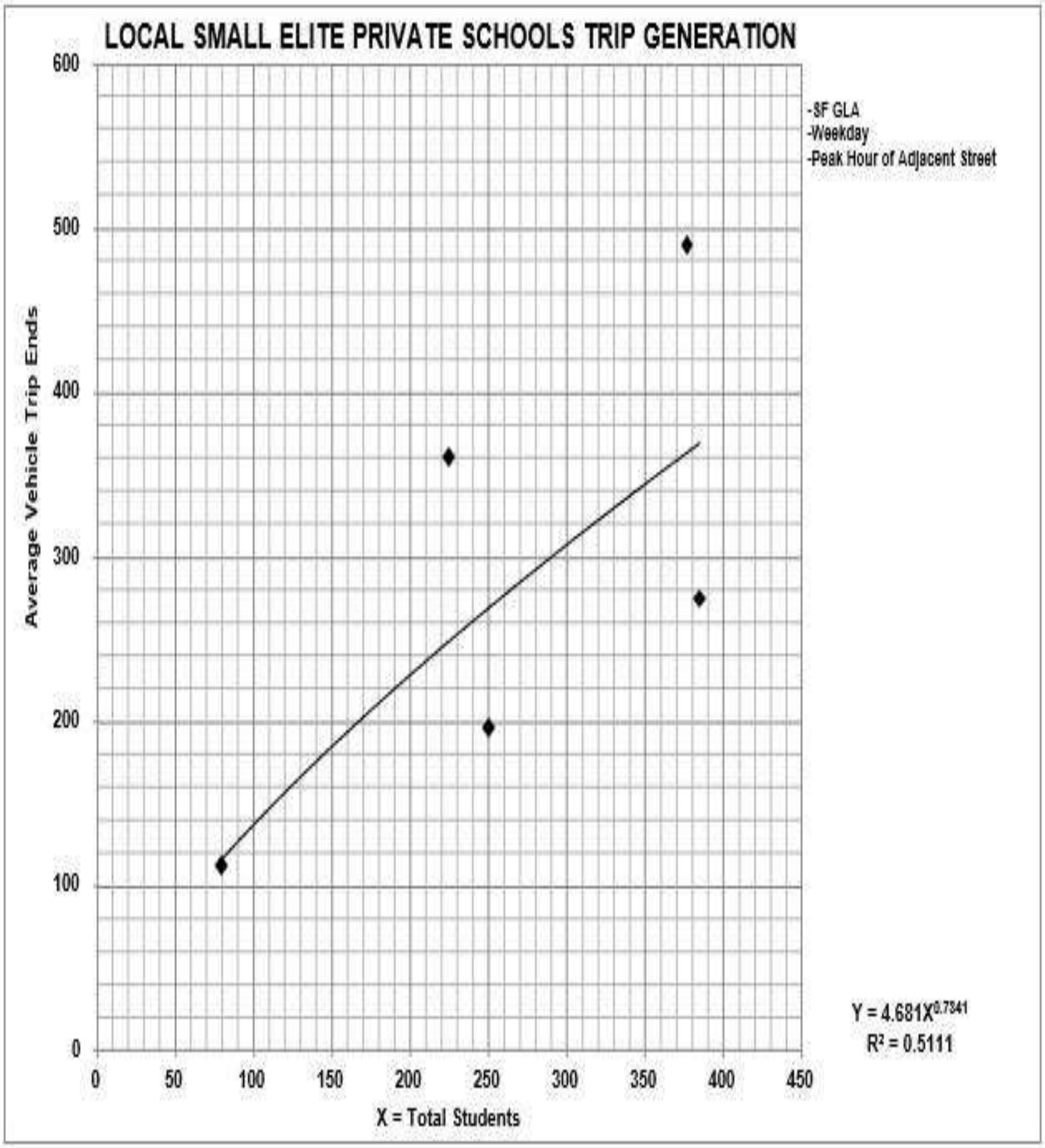


Exhibit 2


LOCAL SMALL ELITE PRIVATE SCHOOLS TRIP GENERATION
Average Vehicle Trip Ends
600
500
400
300
200
100
0
0
50
100
150
200
250
300
350
400
450
X = Total Students
-SF GLA
-Weekday
-Peak Hour of Adjacent Street
Y = 4.681X^0.7341
R² = 0.5111

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Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Paradise Island Drive & Flamingo	Two-way stop	HCM 7th Edition	SB Thru	0.039	18.1	C
6	Paradise Island Drive & Harbour Ridge Road	Two-way stop	HCM 7th Edition	NB Right	0.450	44.6	E
11	Paradise Island Drive & Lakeview Drive	Two-way stop	HCM 7th Edition	SB Right	0.585	27.5	D
16	Paradise Island Drive & Bayview Lane West & School Ingress	Two-way stop	HCM 7th Edition	NB Right	0.027	13.4	B
21	Paradise Island Drive & The Ocean Club Road	Roundabout	HCM 7th Edition	WB Thru		5.2	A
26	Paradise Island Drive & Cloister Drive West	Two-way stop	HCM 7th Edition	NB Right	0.011	15.5	C
31	Paradise Island Drive & Cloister Drive East	Two-way stop	HCM 7th Edition	SB Right	0.052	12.1	B
32	Paradise Island Drive & School Egress	Two-way stop	HCM 7th Edition	SB Left	0.076	8.6	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection

Intersection Level Of Service Report Intersection
1: Paradise Island Drive & Flamingo

Control Type:	Two-way stop	Delay (sec / veh):	18.1
Analysis Method:	HCM 7th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.039

Intersection Setup

Name	Flamingo	Co Su	Paradise Island Drive	Paradise Island Drive
Approach	Northbound	Southbound	Eastbound	Westbound
Lane Configuration				

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Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]		30.00			30.00			30.00			28.00	
Grade [%]		0.00			0.00			0.00			0.00	
Crosswalk		No			No			No			No	

Volumes

Name		Flaming ›			Co Su			Paradise Island Drive			Paradise Island Drive	
Base Volume Input [veh/h]	19	0	4	2	4	22	22	216	14	15	343	1
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	1.00	1.00	1.00	1.00	1.00	1.00	7.00	7.00	7.00	7.00	7.00	7.00
Growth Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	8	0	0	0	0	30	0	6	24	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	19	0	12	2	4	22	22	246	14	21	367	1
Peak Hour Factor	0.679	1.000	0.250	0.250	0.333	0.611	0.786	0.915	0.875	0.625	0.817	0.250
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	7	0	12	2	3	9	7	67	4	8	112	1
Total Analysis Volume [veh/h]	28	0	48	8	12	36	28	269	16	34	449	4
Pedestrian Volume [ped/h]		0			0			0			0	

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	No		
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.04	0.00	0.14	0.01	0.04	0.09	0.00	0.00	0.02	0.00	0.00	0.00

d_M, Delay for Movement [s/veh]	11.59	18.46	17.63	10.54	18.06	15.47	0.00	0.00	8.47	0.00	0.00	7.94
Movement LOS	B	C	C	B	C	C	A	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.65	0.65	0.65	0.48	0.48	0.48	0.00	0.01	0.03	0.00	0.00	0.01
95th-Percentile Queue Length [ft/ln]	16.25	16.25	16.25	11.92	11.92	11.92	0.00	0.34	0.67	0.00	0.08	0.17
d_A, Approach Delay [s/veh]	15.41			15.32			0.43			0.07		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	2.36											
Intersection LOS	C											

Intersection Level Of Service Report
Intersection 6: Paradise Island Drive & Harbour Ridge Road

Control Type:	Two-way stop	Delay (sec / veh):	44.6
Analysis Method:	HCM 7th Edition	Level Of Service:	E
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.450

Intersection Setup

Name	Harbour Ridge		Paradise Island Drive		Paradise Island Drive	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		Yes		No	

Volumes

Name	Harbour Ridge		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	7	41	304	9	55	677

Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.00	1.00	7.00	7.00	7.00	7.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0

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Site-Generated Trips [veh/h]	0	8	38	0	6	30
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	7	49	342	9	61	707
Peak Hour Factor	0.8750	0.6830	0.8940	0.5630	0.7240	0.7140
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	2	18	96	4	21	248
Total Analysis Volume [veh/h]	8	72	383	16	84	990
Pedestrian Volume [ped/h]	0		0		0	

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Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.02	0.45	0.00	0.03	0.00	0.01
d_M, Delay for Movement [s/veh]	29.43	44.59	0.00	10.86	0.00	0.00
Movement LOS	D	E	A	B	A	A
95th-Percentile Queue Length [veh/ln]	2.20	2.20	0.01	0.03	0.00	0.00
95th-Percentile Queue Length [ft/ln]	54.95	54.95	0.34	0.67	0.00	0.00
d_A, Approach Delay [s/veh]	43.08		0.44		0.00	
Approach LOS	E		A		A	
d_I, Intersection Delay [s/veh]	2.33					
Intersection LOS	E					

Intersection Level Of Service Report

Intersection 11: Paradise Island Drive & Lakeview Drive

Control Type:	Two-way stop	Delay (sec / veh):	27.5
Analysis Method:	HCM 7th Edition	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.585

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Intersection Setup

Name	Lakeview Drive		Paradise Island Drive		Paradise Island Drive	
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		No		No	

Volumes

Name	Lakeview Drive		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	12	182	138	141	281	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.00	1.00	7.00	7.00	7.00	7.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	25	0	0	46	36	22
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	37	182	138	187	317	29
Peak Hour Factor	0.7500	0.7710	0.7500	0.9040	0.7320	0.5830
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	12	59	46	52	108	12
Total Analysis Volume [veh/h]	49	236	184	207	433	50
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free

d_M, Delay for Movement [s/veh]	23.03	27.54	0.00	0.00	0.00	8.25
Movement LOS	C	D	A	A	A	A
95th-Percentile Queue Length [veh/ln]	4.44	4.44	0.00	0.00	0.04	0.09
95th-Percentile Queue Length [ft/ln]	111.01	111.01	0.00	0.00	1.07	2.14
d_A, Approach Delay [s/veh]	26.76		0.00		0.85	
Approach LOS	D		A		A	
d_I, Intersection Delay [s/veh]	6.94					
Intersection LOS	D					

Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.06	0.58	0.00	0.00	0.00	0.04

Intersection Level Of Service Report Intersection 16: Paradise Island Drive & Bayview Lane West & School Ingress

Control Type:	Two-way stop	Delay (sec / veh):	13.4
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.027

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Intersection Setup

Name	Bayview Lane West			Pr Va			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	1
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	60.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

Name	Bayview Lane West			Pr Va			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	4	0	7	0	0	0	0	189	10	6	200	0
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	2.00	2.00	2.00	2.00	7.00	7.00	7.00	7.00	2.00
Growth Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	71	0	0	0	58	31
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	0	7	0	0	0	71	189	10	6	258	31
Peak Hour Factor	0.500	1.000	0.583	1.000	1.000	1.000	1.000	0.844	0.833	0.500	0.862	1.000
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	2	0	3	0	0	0	18	56	3	3	75	8
Total Analysis Volume [veh/h]	8	0	12	0	0	0	71	224	12	12	299	31
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

d_M, Delay for Movement [s/veh]	9.39	15.26	13.43	0.00	0.00	0.00	0.00	0.00	7.99	0.00	0.00	7.92
Movement LOS	A	C	B				A	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.11	0.11	0.11	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.08
95th-Percentile Queue Length [ft/ln]	2.84	2.84	2.84	0.00	0.00	0.00	0.00	0.25	0.50	0.00	0.00	1.89
d_A, Approach Delay [s/veh]	11.82			0.00			0.31			0.72		
Approach LOS	B			A			A			A		
d_I, Intersection Delay [s/veh]	0.86											
Intersection LOS	B											

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02

Intersection Level Of Service Report

Intersection 21: Paradise Island Drive & The Ocean Club Road

Control Type:	Roundabout	Delay (sec / veh):	5.2
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes		

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Intersection Setup

Name	Bayview Lane East			The Ocean Club Road			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

Name	Bayview Lane East			The Ocean Club Road			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	1	0	0	15	0	15	1	202	1	0	251	0
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	2.00	2.00	2.00	7.00	7.00	7.00	7.00	7.00	7.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	25	0	0	31	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	0	0	15	0	15	1	227	1	0	282	0
Peak Hour Factor	0.250	1.000	1.000	0.500	1.000	0.500	0.250	0.802	0.250	1.000	0.705	1.000
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	1	0	0	8	0	8	1	71	1	0	100	0
Total Analysis Volume [veh/h]	4	0	0	30	0	30	4	283	4	0	400	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Number of Conflicting Circulating Lanes	1			1			1			1		
Circulating Flow Rate [veh/h]	459			307			0			35		
Exiting Flow Rate [veh/h]	4			4			463			333		
Demand Flow Rate [veh/h]	1	0	0	15	0	15	1	227	1	0	282	0
Adjusted Demand Flow Rate [veh/h]	4	0	0	30	0	30	4	283	4	0	400	0

Lanes

User-Defined Critical Headway [s]	4.00	4.00	4.00	4.00	4.00
Overwrite Calculated Follow-Up Time	No	No	No	No	No
User-Defined Follow-Up Time [s]	3.00	3.00	3.00	3.00	3.00
A (intercept)	1380.00	1380.00	1420.00	1420.00	1380.00
B (coefficient)	0.00102	0.00102	0.00091	0.00091	0.00102
HV Adjustment Factor	1.00	0.98	0.93	0.93	0.93
Entry Flow Rate [veh/h]	4	62	5	308	428
Capacity of Entry and Bypass Lanes [veh/h]	865	1009	1420	1420	1332
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00
Overwrite Calculated Critical Headway	No	No	No	No	No

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Intersection Setup

Capacity per Entry Lane [veh/h]	865	990	1328	1328	1245
X, volume / capacity	0.00	0.06	0.00	0.22	0.32

Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.01	0.19	0.01	0.82	1.40
95th-Percentile Queue Length [ft]	0.35	4.84	0.23	20.56	35.05
Approach Delay [s/veh]	4.21	4.18	4.52		5.86
Approach LOS	A	A	A		A
Intersection Delay [s/veh]	5.20				
Intersection LOS	A				

Intersection Level Of Service Report
Intersection 26: Paradise Island Drive & Cloister Drive West

Control Type: Two-way stop
Analysis Method: Delay (sec / veh): Level HCM 7th Edition Of Service: 15.5
Analysis Period: 15 minutes C
Volume to Capacity (v/c): 0.011

Name	Cloister Drive West		Paradise Island Drive		Paradise Island Drive	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name	Cloister Drive West		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	18	2	253	19	1	260
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	7.00	7.00	7.00	7.00

d_M, Delay for Movement [s/veh]	10.45	15.53	0.00	8.07	0.00	0.00
Movement LOS	B	C	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.20	0.20	0.07	0.07	0.00	0.00
95th-Percentile Queue Length [ft/ln]	4.95	4.95	1.70	1.70	0.00	0.00
d_A, Approach Delay [s/veh]	10.96		0.81		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.98					
Intersection LOS	C					

Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	25	0	0	31
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	18	2	278	19	1	291
Peak Hour Factor	0.5000	0.5000	0.7810	0.4750	0.2500	0.8670
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	9	1	89	10	1	84
Total Analysis Volume [veh/h]	36	4	356	40	4	336
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.05	0.01	0.00	0.03	0.00	0.00

Intersection Level Of Service Report Intersection
31: Paradise Island Drive & Cloister Drive East

Control Type:	Two-way stop	Delay (sec / veh):	12.1
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.052

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Intersection Setup

Name	Cloister Drive East			Beach Club Drive			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

Name	Cloister Drive East			Beach Club Drive			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	3	0	4	3	0	13	12	94	7	3	119	1
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	3.00	3.00	3.00	7.00	7.00	7.00	7.00	7.00	7.00
Growth Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	25	0	0	31	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	3	0	4	3	0	13	12	119	7	3	150	1
Peak Hour Factor	0.375	1.000	0.500	0.750	1.000	0.464	0.500	0.780	0.583	0.750	0.726	0.250
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	2	0	2	1	0	7	6	38	3	1	52	1
Total Analysis Volume [veh/h]	8	0	8	4	0	28	24	153	12	4	207	4
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

d_M, Delay for Movement [s/veh]	9.44	12.03	11.71	9.49	12.25	12.08	0.00	0.00	7.72	0.00	0.00	7.63
Movement LOS	A	B	B	A	B	B	A	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.07	0.07	0.07	0.18	0.18	0.18	0.02	0.02	0.02	0.01	0.01	0.01
95th-Percentile Queue Length [ft/ln]	1.86	1.86	1.86	4.49	4.49	4.49	0.52	0.52	0.52	0.17	0.17	0.17
d_A, Approach Delay [s/veh]	10.58			11.75			0.49			0.14		
Approach LOS	B			B			A			A		
d_I, Intersection Delay [s/veh]	1.48											
Intersection LOS	B											

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	No		
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.01	0.00	0.00	0.00

Intersection Level Of Service Report Intersection 32: Paradise Island Drive & School Egress

Control Type:	Two-way stop	Delay (sec / veh):	8.6
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.076

d_M, Delay for Movement [s/v

Movement LOS

95th-Percentile Queue Length [v

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Intersection Setup

Name	Proposed School Egress		Paradise Island Drive		Paradise Island Drive	
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	10.00	10.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	1
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	170.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		No		No	

Paradise Island Drive 95th Percentile Queue Length [

d_A, Ap Delay [s/veh]

Approach LOS

Intersection Delay [s/veh]

Intersection LOS

Volumes

Name	Proposed School Egress		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	0	0	0	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.00	2.00	7.00	7.00	2.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	83	0	0	0	89	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	83	0	0	0	89	0
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	21	0	0	0	22	0
Total Analysis Volume [veh/h]	83	0	0	0	89	0
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.08	0.00	0.00	0.00	0.00	0.00

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Paradise Island Drive & Flamingo	19	0	12	2	4	22	22	246	14	21	367	1	730

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
6	Paradise Island Drive & Harbour Ridge Road	7	49	342	9	61	707	1175

ID	Intersection Name	Southbound		Eastbound		Westbound		Total Volume
		Left	Right	Left	Thru	Thru	Right	
11	Paradise Island Drive & Lakeview Drive	37	182	138	187	317	29	890

ID	Intersection Name	Northbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
16	Paradise Island Drive & Bayview Lane West & School Ingress	4	0	7	71	189	10	6	258	31	576

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
21	Paradise Island Drive & The Ocean Club Road	1	0	0	15	0	15	1	227	1	0	282	0	542

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ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
26	Paradise Island Drive & Cloister Drive West	18	2	278	19	1	291	609

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
31	Paradise Island Drive & Cloister Drive East	3	0	4	3	0	13	12	119	7	3	150	1	315

ID	Intersection Name	Southbound	Eastbound	Westbound	Total Volume
		Left	Thru	Thru	
32	Paradise Island Drive & School Egress	83	0	89	172

Report Figure 1: Study Intersections

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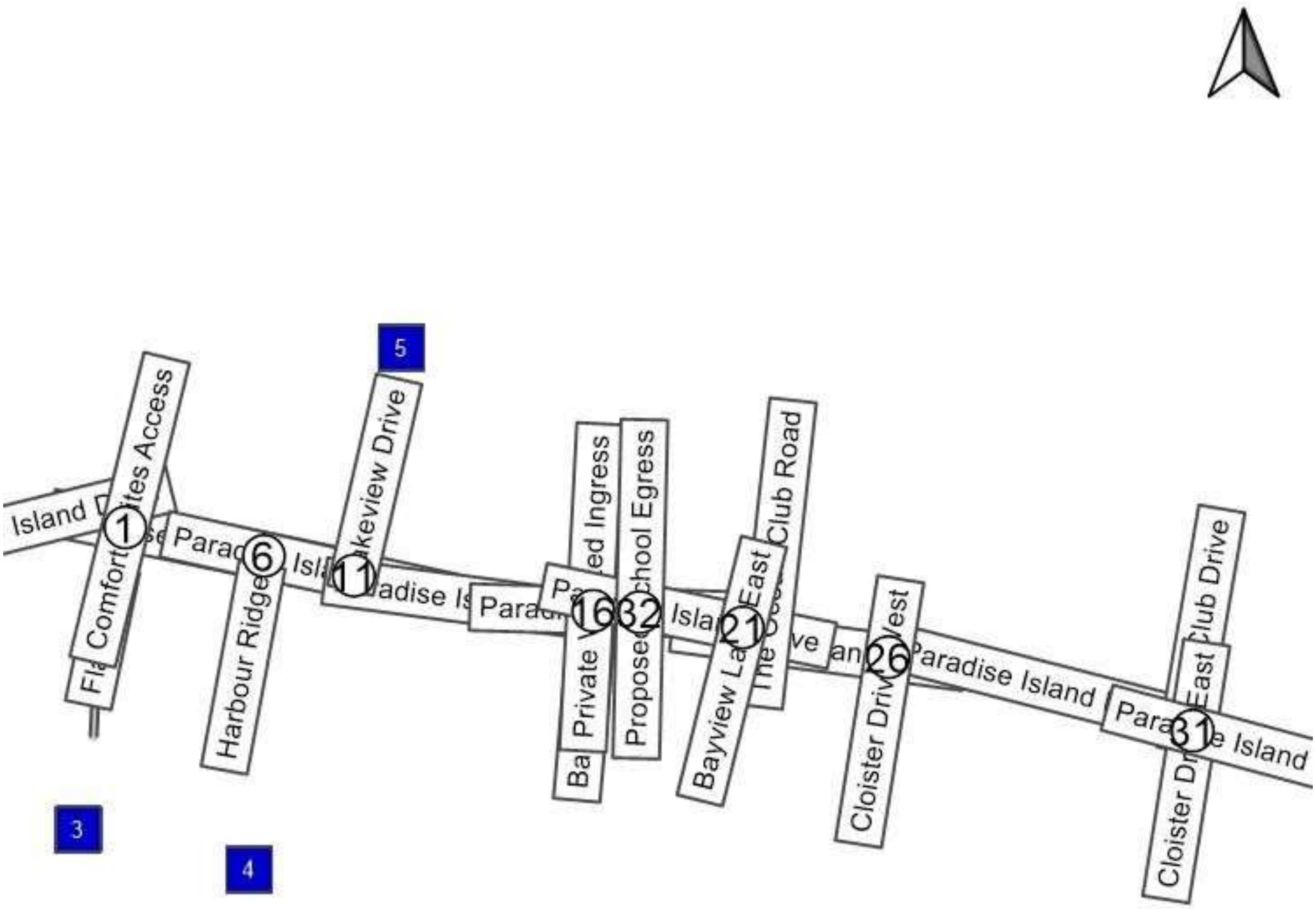

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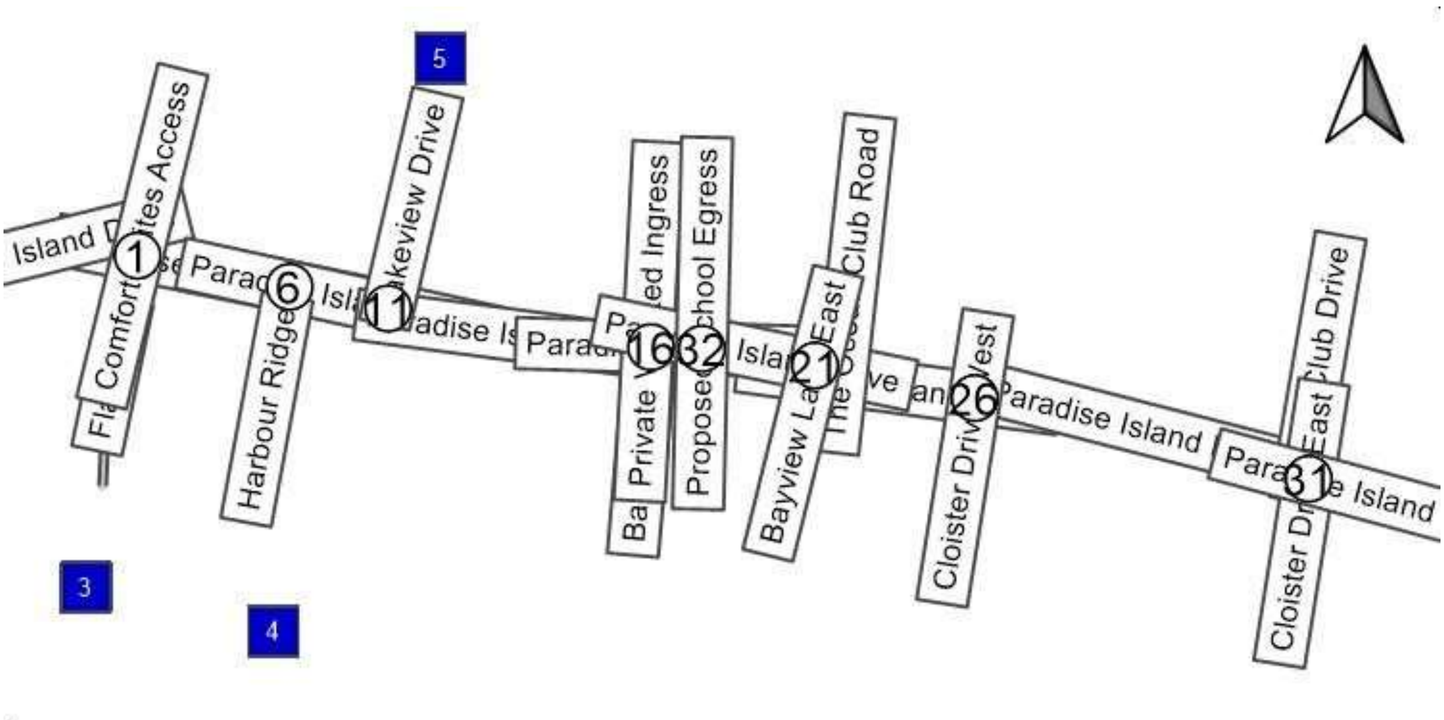
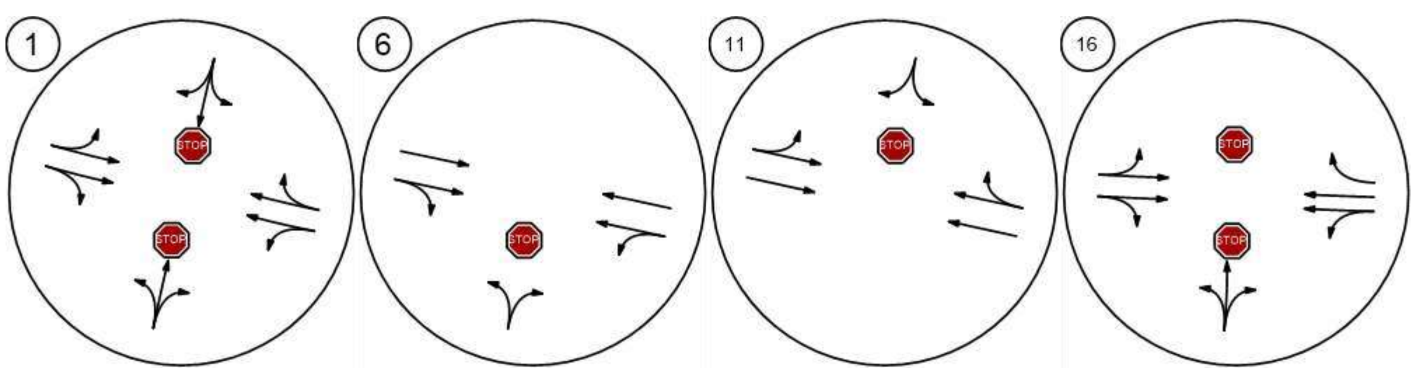
Report Figure 2: Lane Configuration and Traffic Control



Paradise Island Drive & Flami Paradise Island Drive & Harb Paradise Island Drive & Lake Paradise Island Drive & Bayvi



Paradise Island Drive & The Paradise Island Drive & Clois Paradise Island Drive & Clois Paradise Island Drive & Scho

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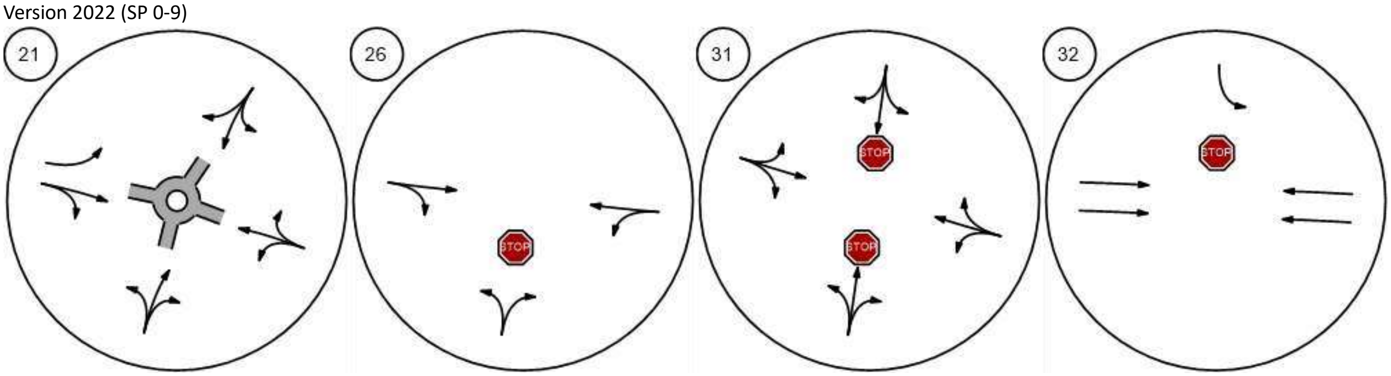
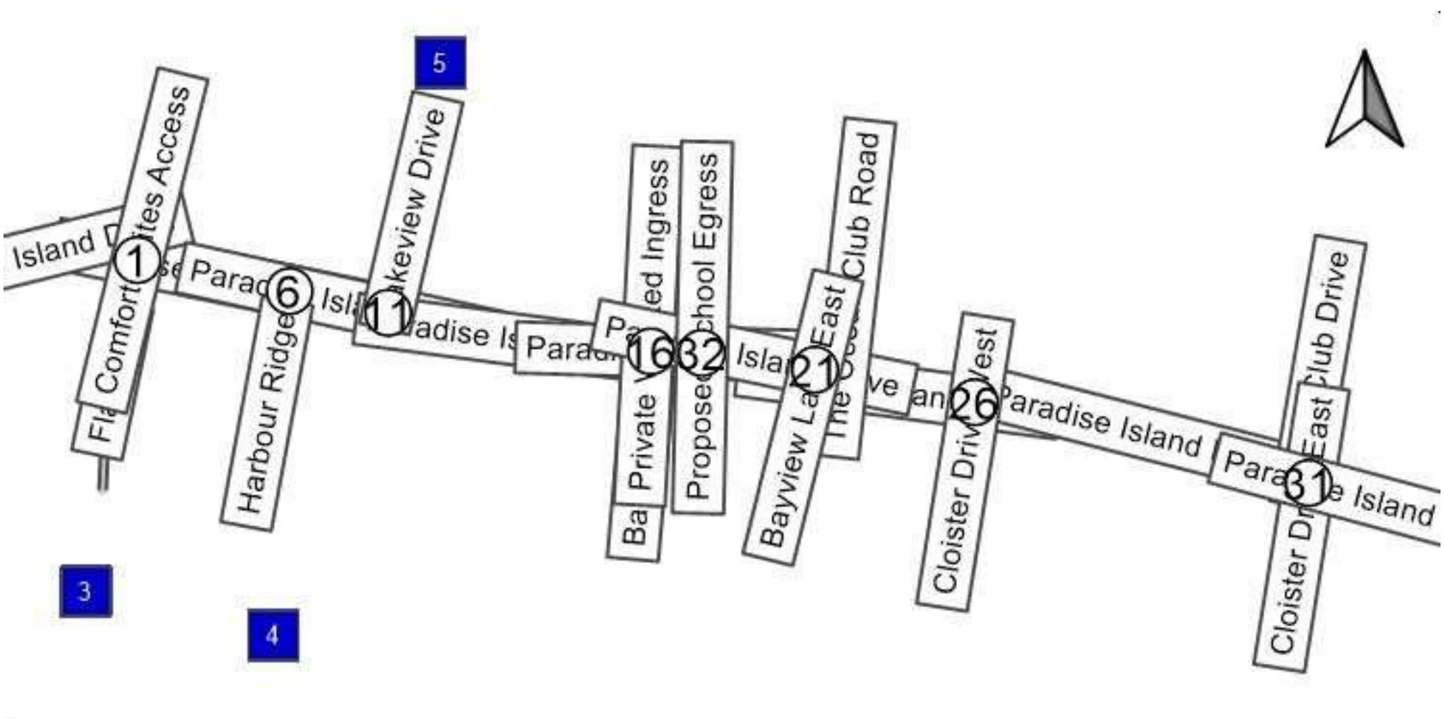


Report Figure 3a: Traffic Volume - Base Volume



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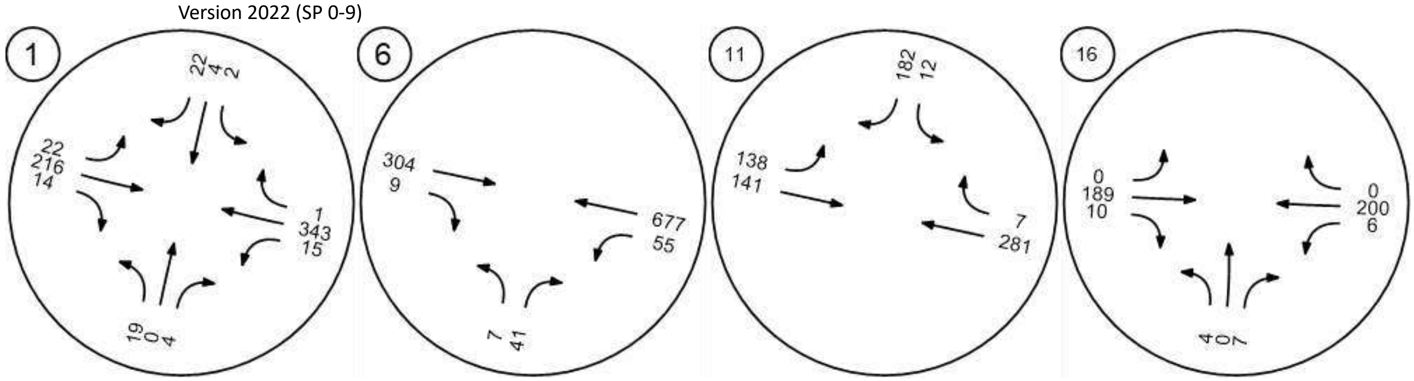
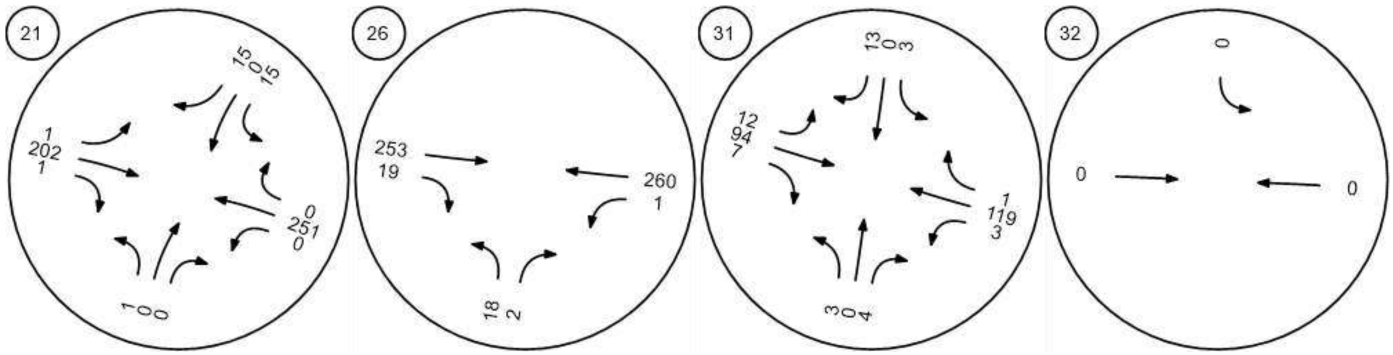
Version 2022 (SP 0-9)



Paradise Island Drive & The Paradise Island Drive & Clois Paradise Island Drive & Clois Paradise Island Drive & Scho



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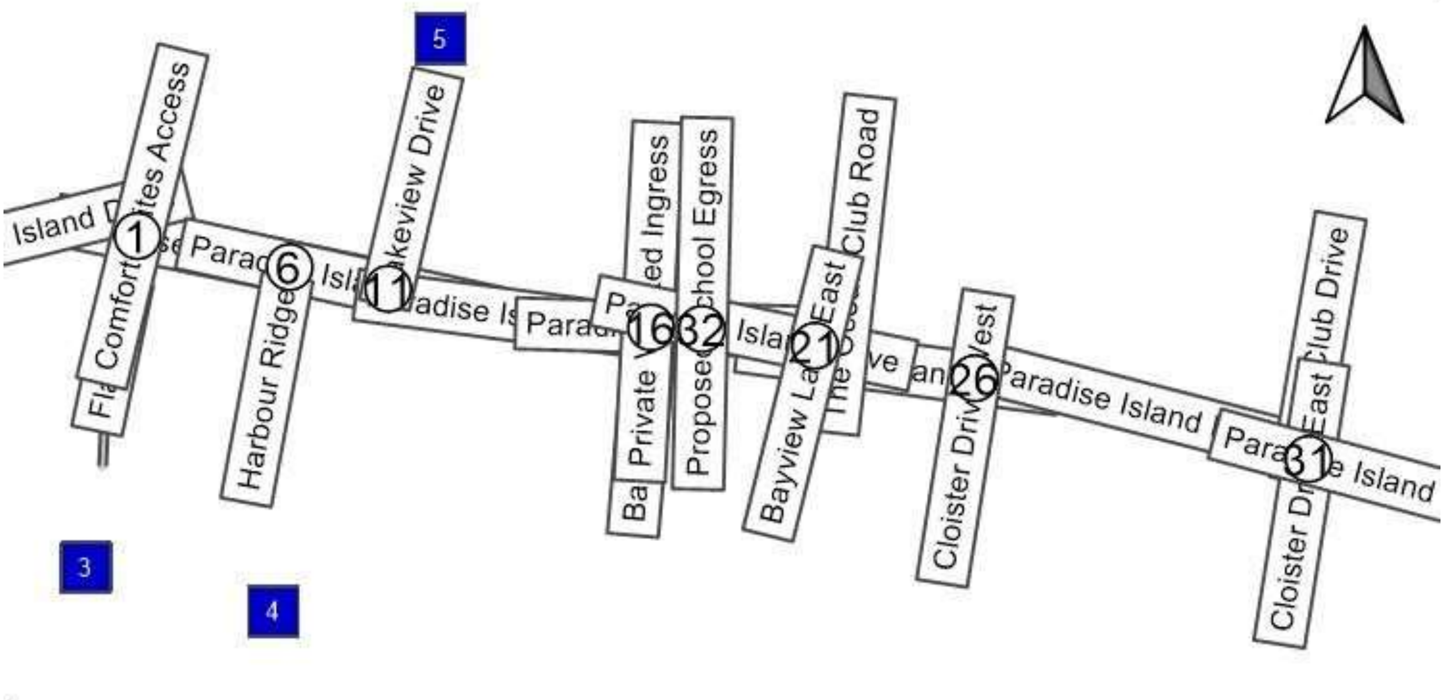
Report Figure 3d: Traffic Volume - Net New Site Trips



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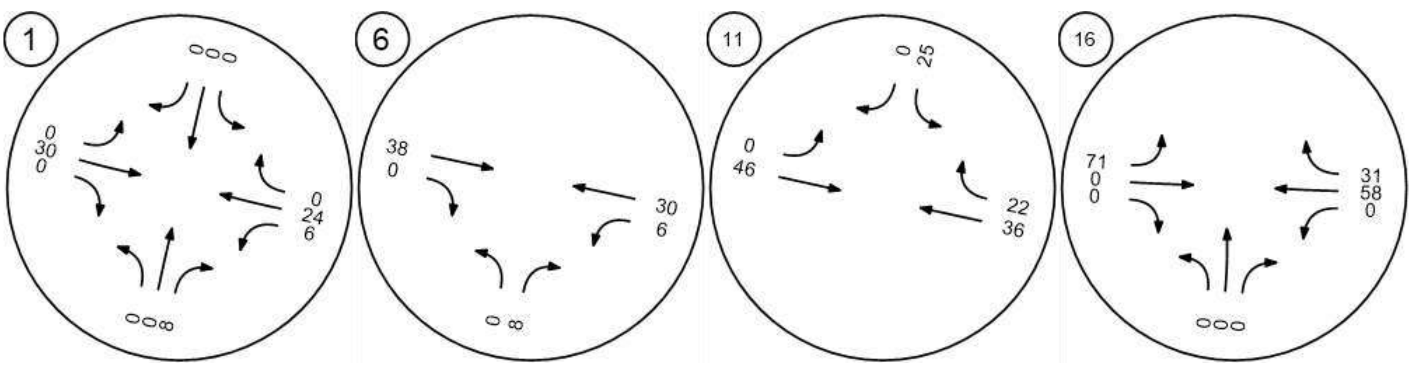

Paradise Island Drive & The Paradise Island Drive & Clois Paradise Island Drive & Clois Paradise Island Drive & Scho

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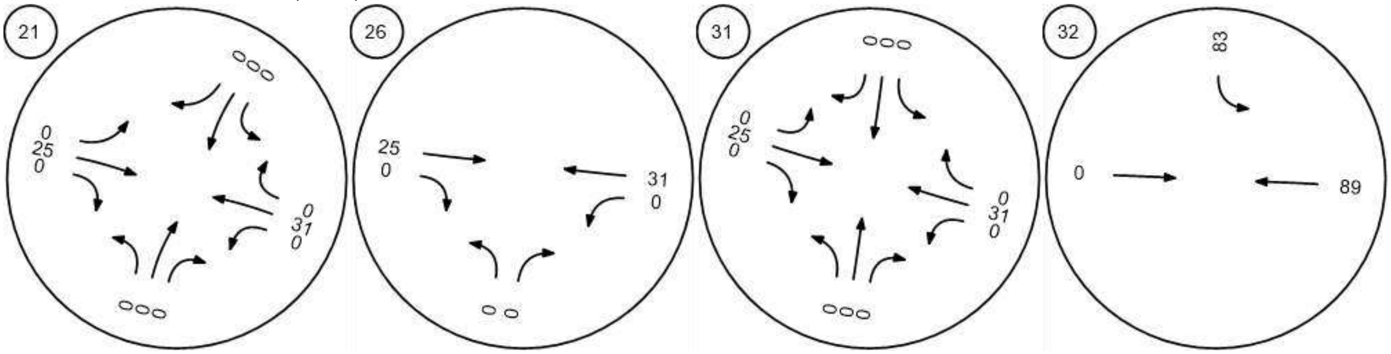

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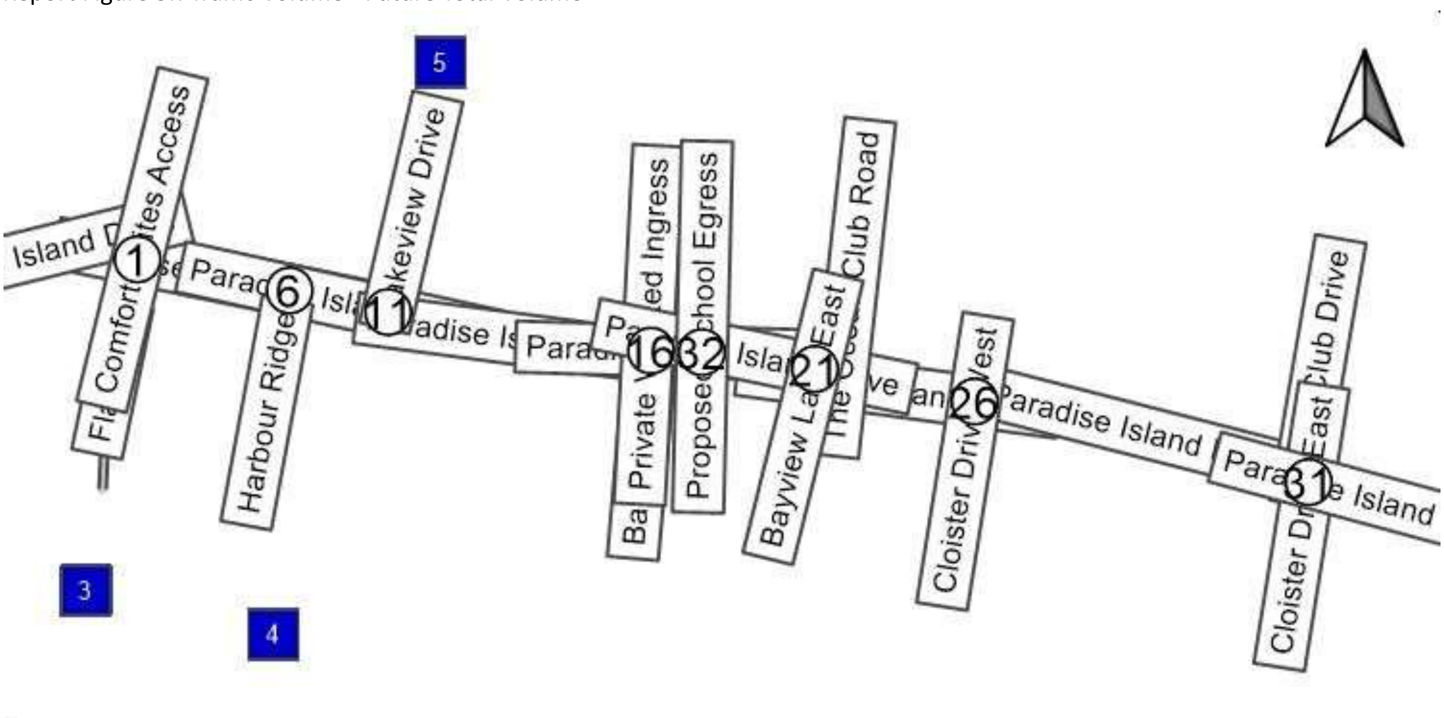
Report Figure 3f: Traffic Volume - Future Total Volume



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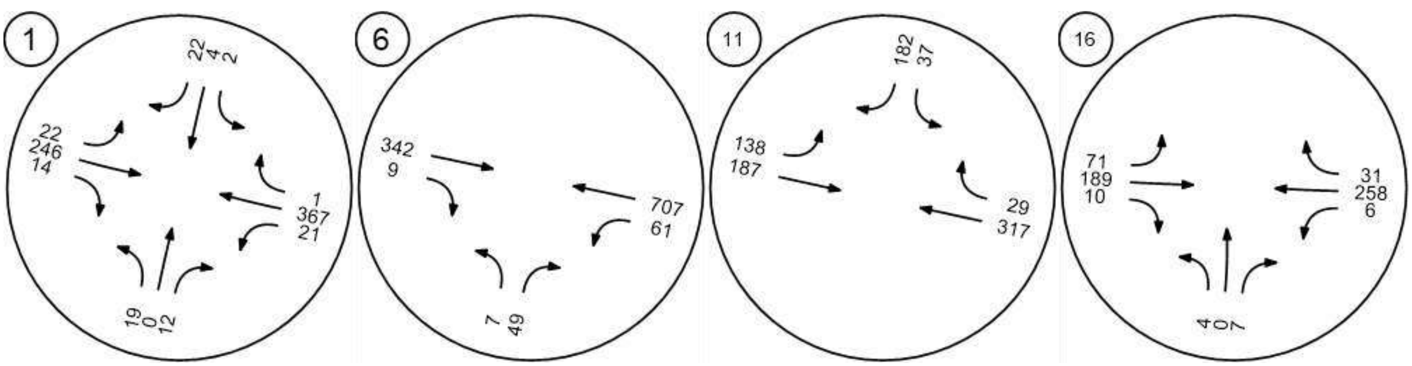
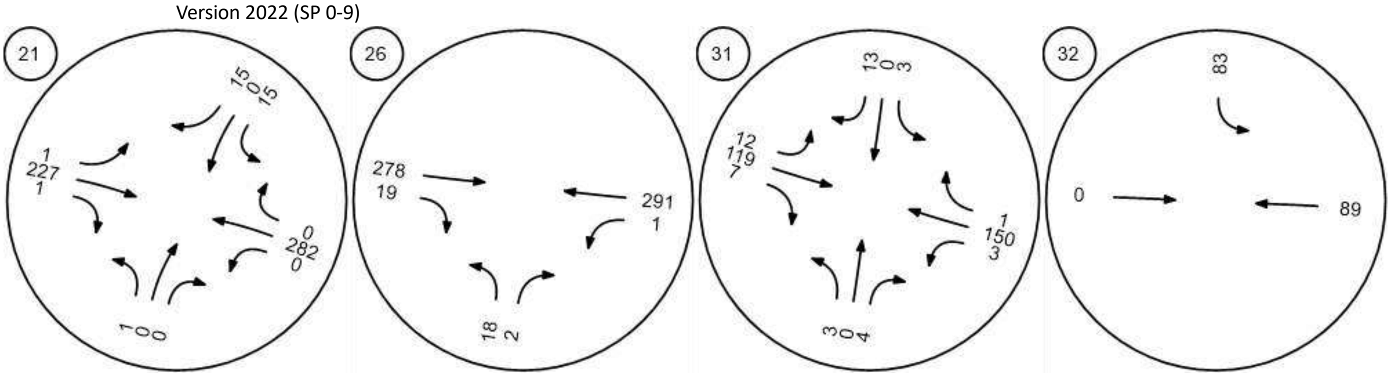


Paradise Island Drive & The Paradise Island Drive & Clois Paradise Island Drive & Clois Paradise Island Drive & Scho

Version 2022 (SP 0-9)



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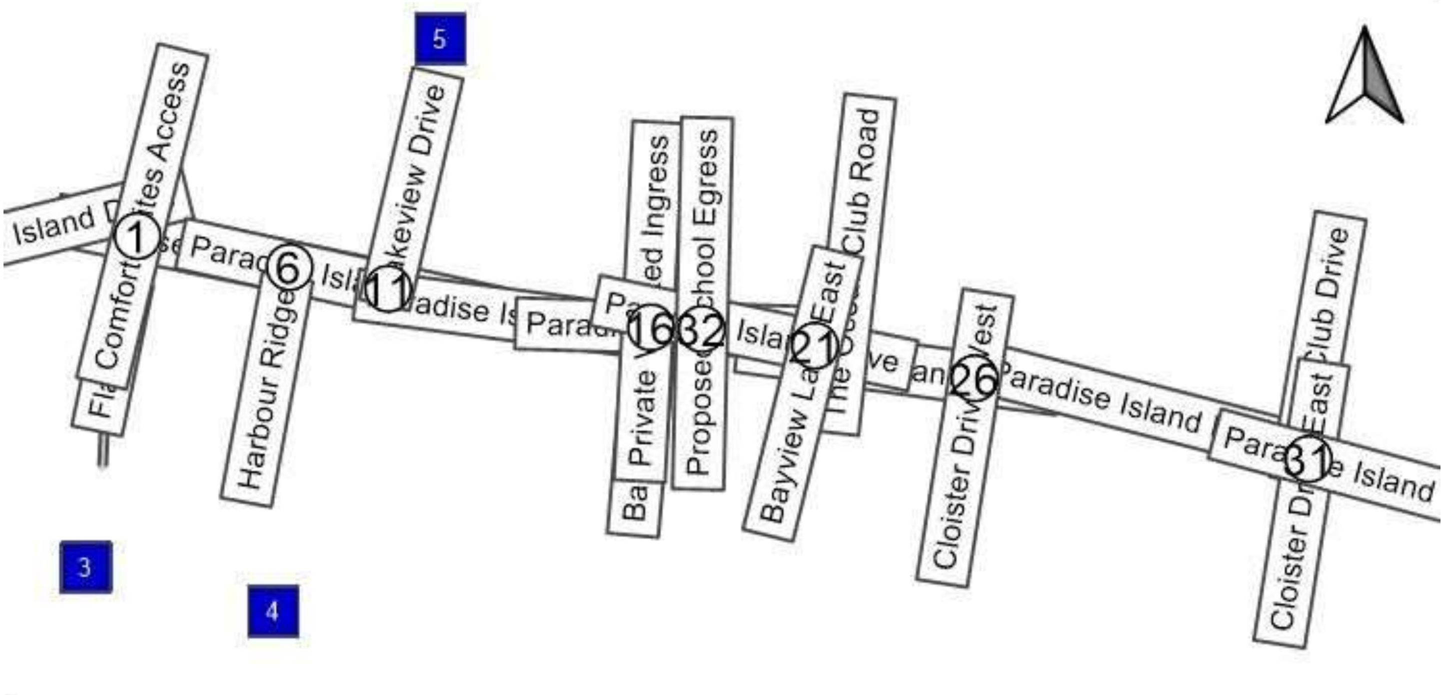
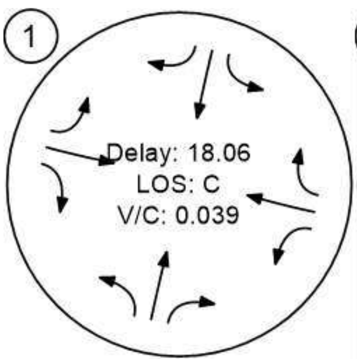
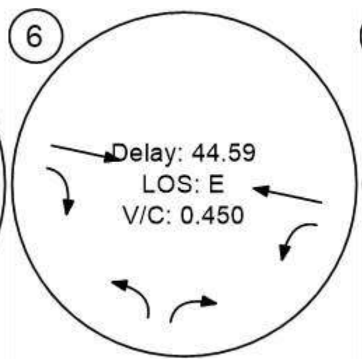
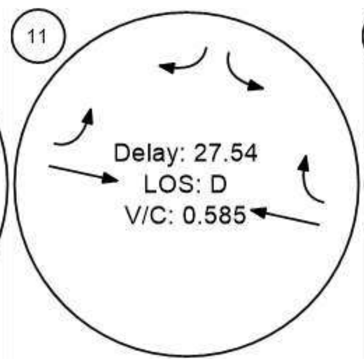
Report Figure 4: Traffic Conditions

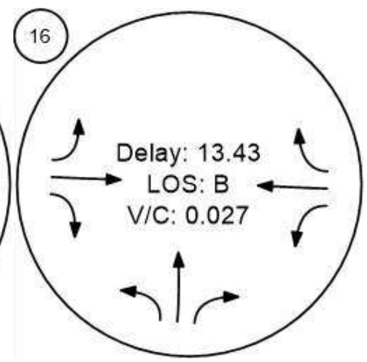


Paradise Island Drive & Flami Paradise Island Drive & Harb Paradise Island Drive & Lake Paradise Island Drive & Bayvi









Paradise Island Drive & The Paradise Island Drive & Clois Paradise Island Drive & Clois Paradise Island Drive & Scho

Scenario 1: 1 Proposed Scenario

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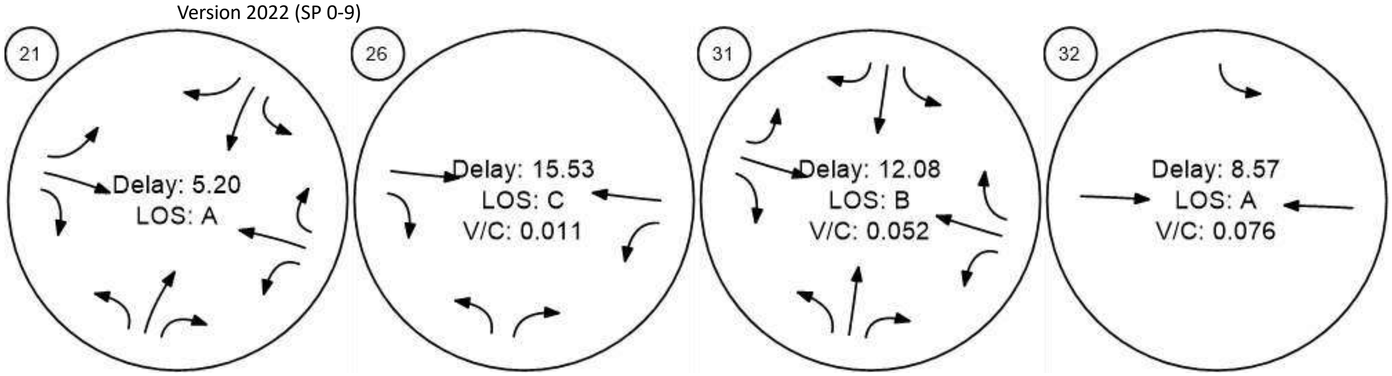

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Table of Contents

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Paradise Island Drive & Flamingo	Two-way stop	HCM 7th Edition	SB Thru	0.069	25.6	D
6	Paradise Island Drive & Harbour Ridge Road	Two-way stop	HCM 7th Edition	NB Right	1.107	224.5	F
11	Paradise Island Drive & Lakeview Drive	Two-way stop	HCM 7th Edition	SB Right	1.009	108.7	F
16	Paradise Island Drive & Bayview Lane West & School Ingress	Two-way stop	HCM 7th Edition	NB Right	0.043	15.7	C
21	Paradise Island Drive & The Ocean Club Road	Roundabout	HCM 7th Edition	WB Thru		6.2	A
26	Paradise Island Drive & Cloister Drive West	Two-way stop	HCM 7th Edition	NB Right	0.024	20.4	C
31	Paradise Island Drive & Cloister Drive East	Two-way stop	HCM 7th Edition	SB Right	0.087	13.8	B
32	Paradise Island Drive & School Egress	Two-way stop	HCM 7th Edition	SB Left	0.076	8.6	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report Intersection
1: Paradise Island Drive & Flamingo

Control Type:	Two-way stop	Delay (sec / veh):	25.6
Analysis Method:	HCM 7th Edition	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.069

Name	Flamingo			Co Su			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Flaming ›			Co Su			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	19	0	4	2	4	22	22	216	14	15	343	1
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	1.00	1.00	1.00	1.00	1.00	1.00	7.00	7.00	7.00	7.00	7.00	7.00
Growth Factor	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	8	0	0	0	0	30	0	6	24	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	26	0	13	3	5	30	30	322	19	26	487	1
Peak Hour Factor	0.679	1.000	0.250	0.250	0.333	0.611	0.786	0.915	0.875	0.625	0.817	0.250
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	10	0	13	3	4	12	10	88	5	10	149	1
Total Analysis Volume [veh/h]	38	0	52	12	15	49	38	352	22	42	596	4
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	No		
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

d_M, Delay for Movement [s/veh]	14.80	26.06	25.40	13.42	25.62	21.45	0.00	0.00	8.99	0.00	0.00	8.19
Movement LOS	B	D	D	B	D	C	A	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	1.15	1.15	1.15	0.98	0.98	0.98	0.00	0.02	0.04	0.00	0.00	0.01
95th-Percentile Queue Length [ft/ln]	28.79	28.79	28.79	24.56	24.56	24.56	0.00	0.46	0.93	0.00	0.08	0.17
d_A, Approach Delay [s/veh]	20.92			21.01			0.48			0.05		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	3.04											
Intersection LOS	D											

Intersection Setup

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.06	0.00	0.23	0.01	0.07	0.17	0.00	0.00	0.02	0.00	0.01	0.00

Intersection Level Of Service Report Intersection 6: Paradise Island Drive & Harbour Ridge Road

Control Type:	Two-way stop	Delay (sec / veh):	224.5
Analysis Method:	HCM 7th Edition	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.107

Name	Harbour Ridge		Paradise Island Drive		Paradise Island Drive	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		Yes		No	

Volumes

Name	Harbour Ridge		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	7	41	304	9	55	677
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.00	1.00	7.00	7.00	7.00	7.00
Growth Factor	1.3500	1.3500	1.3500	1.3500	1.3500	1.3500
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	8	38	0	6	30
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	9	63	448	12	80	944
Peak Hour Factor	0.8750	0.6830	0.8940	0.5630	0.7240	0.7140
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	3	23	125	5	28	331
Total Analysis Volume [veh/h]	10	92	501	21	110	1322
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

Intersection Setup

d_M, Delay for Movement [s/veh]	190.81	224.53	0.00	13.10	0.00	0.00
Movement LOS	F	F	A	B	A	A
95th-Percentile Queue Length [veh/ln]	6.98	6.98	0.02	0.04	0.00	0.00
95th-Percentile Queue Length [ft/ln]	174.59	174.59	0.44	0.89	0.00	0.00
d_A, Approach Delay [s/veh]	221.23		0.53		0.00	
Approach LOS	F		A		A	
d_I, Intersection Delay [s/veh]	11.11					
Intersection LOS	F					
V/C, Movement V/C Ratio	0.03	1.11	0.01	0.05	0.00	0.01

Intersection Level Of Service Report
Intersection 11: Paradise Island Drive & Lakeview Drive

Control Type:	Two-way stop	Delay (sec / veh):	108.7
Analysis Method:	HCM 7th Edition	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.009

Name	Lakeview Drive		Paradise Island Drive		Paradise Island Drive	
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		No		No	

Volumes

Name	Lakeview Drive		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	12	182	138	141	281	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.00	1.00	7.00	7.00	7.00	7.00
Growth Factor	1.3500	1.3500	1.3500	1.3500	1.3500	1.3500
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	25	0	0	46	36	22
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	41	246	186	236	415	31
Peak Hour Factor	0.7500	0.7710	0.7500	0.9040	0.7320	0.5830
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	14	80	62	65	142	13
Total Analysis Volume [veh/h]	55	319	248	261	567	53
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

Intersection Setup

d_M, Delay for Movement [s/veh]	102.11	108.68	0.00	0.00	0.00	8.60
Movement LOS	F	F	A	A	A	A
95th-Percentile Queue Length [veh/ln]	13.76	13.76	0.00	0.00	0.05	0.09
95th-Percentile Queue Length [ft/ln]	344.12	344.12	0.00	0.00	1.14	2.27
d_A, Approach Delay [s/veh]	107.72		0.00		0.73	
Approach LOS	F		A		A	
d_I, Intersection Delay [s/veh]	27.11					
Intersection LOS	F					
V/C, Movement V/C Ratio	0.07	1.01	0.00	0.00	0.01	0.05

Intersection Level Of Service Report Intersection 16: Paradise Island Drive & Bayview Lane West & School Ingress

Control Type:	Two-way stop	Delay (sec / veh):	15.7
Analysis Method:	HCM 7th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.043

Name	Bayview Lane West			Pr Va			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	1
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	60.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

Name	Bayview Lane West			Pr Va			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	4	0	7	0	0	0	0	189	10	6	200	0
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	2.00	2.00	2.00	2.00	7.00	7.00	7.00	7.00	2.00
Growth Factor	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	71	0	0	0	58	31
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	5	0	9	0	0	0	71	255	14	8	328	31
Peak Hour Factor	0.500	1.000	0.583	1.000	1.000	1.000	1.000	0.844	0.833	0.500	0.862	1.000
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	3	0	4	0	0	0	18	76	4	4	95	8
Total Analysis Volume [veh/h]	10	0	15	0	0	0	71	302	17	16	381	31
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No			
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No			
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	9.87	18.15	15.72	0.00	0.00	0.00	0.00	0.00	8.22	0.00	0.00	8.13
Movement LOS	A	C	C				A	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.17	0.17	0.17	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.08
95th-Percentile Queue Length [ft/ln]	4.35	4.35	4.35	0.00	0.00	0.00	0.00	0.36	0.71	0.00	0.00	2.02
Intersection Setup d_A, Approach Delay [s/veh]	13.38			0.00			0.36			0.59		
Approach LOS	B			A			A			A		
d_I, Intersection Delay [s/veh]	0.86											
Intersection LOS	C											
V/C, Movement V/C Ratio	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03

Intersection Level Of Service Report

Intersection 21: Paradise Island Drive & The Ocean Club Road

Control Type:	Roundabout	Delay (sec / veh):	6.2
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes		

Name	Bayview Lane East			The Ocean Club Road			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

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Intersection Setup

Name	Bayview Lane East			The Ocean Club Road			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	1	0	0	15	0	15	1	202	1	0	251	0
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	2.00	2.00	2.00	7.00	7.00	7.00	7.00	7.00	7.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	25	0	0	31	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	0	0	20	0	20	1	298	1	0	370	0
Peak Hour Factor	0.250	1.000	1.000	0.500	1.000	0.500	0.250	0.802	0.250	1.000	0.705	1.000
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	1	0	0	10	0	10	1	93	1	0	131	0
Total Analysis Volume [veh/h]	4	0	0	40	0	40	4	372	4	0	525	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Number of Conflicting Circulating Lanes	1			1			1			1		
Circulating Flow Rate [veh/h]	603			402			0			45		
Exiting Flow Rate [veh/h]	4			4			607			439		
Demand Flow Rate [veh/h]	1	0	0	20	0	20	1	298	1	0	370	0
Adjusted Demand Flow Rate [veh/h]	4	0	0	40	0	40	4	372	4	0	525	0

Lanes

User-Defined Critical Headway [s]	4.00	4.00	4.00	4.00	4.00
Overwrite Calculated Follow-Up Time	No	No	No	No	No
Overwrite Calculated Critical Headway	No	No	No	No	No

User-Defined Follow-Up Time [s]	3.00	3.00	3.00	3.00	3.00
A (intercept)	1380.00	1380.00	1420.00	1420.00	1380.00
B (coefficient)	0.00102	0.00102	0.00091	0.00091	0.00102
HV Adjustment Factor	1.00	0.98	0.93	0.93	0.93
Entry Flow Rate [veh/h]	4	82	5	403	562
Capacity of Entry and Bypass Lanes [veh/h]	747	916	1420	1420	1318
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	747	898	1328	1328	1232
X, volume / capacity	0.01	0.09	0.00	0.28	0.43

Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.02	0.29	0.01	1.17	2.17
95th-Percentile Queue Length [ft]	0.40	7.32	0.23	29.36	54.37
Approach Delay [s/veh]	4.88	4.85	5.17		7.21
Approach LOS	A	A	A		A
Intersection Delay [s/veh]	6.22				
Intersection LOS	A				

Intersection Level Of Service Report
Intersection 26: Paradise Island Drive & Cloister Drive West

Control Type:	Two-way stop	Delay (sec / veh):	20.4
Analysis Method:	HCM 7th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.024

Name	Cloister Drive West		Paradise Island Drive		Paradise Island Drive	
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name	Cloister Drive West		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	18	2	253	19	1	260

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Intersection Setup

Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	7.00	7.00	7.00	7.00
Growth Factor	1.3500	1.3500	1.3500	1.3500	1.3500	1.3500
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	25	0	0	31
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	24	3	367	26	1	382
Peak Hour Factor	0.5000	0.5000	0.7810	0.4750	0.2500	0.8670
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	12	2	117	14	1	110
Total Analysis Volume [veh/h]	48	6	470	55	4	441
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.08	0.02	0.00	0.05	0.00	0.00

d_M, Delay for Movement [s/veh]	11.59	20.44	0.00	8.37	0.00	0.00
Movement LOS	B	C	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.34	0.34	0.09	0.09	0.00	0.00
95th-Percentile Queue Length [ft/ln]	8.47	8.47	2.36	2.36	0.00	0.00
d_A, Approach Delay [s/veh]	12.57		0.88		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	1.11					
Intersection LOS	C					

Intersection Level Of Service Report Intersection
31: Paradise Island Drive & Cloister Drive East

Control Type:	Two-way stop	Delay (sec / veh):	13.8
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.087

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Intersection Setup

Name	Cloister Drive East			Beach Club Drive			Paradise Island Drive			Paradise Island Drive		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+			+			+			+		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			28.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			Yes			No			No		

Volumes

Name	Cloister Drive East			Beach Club Drive			Paradise Island Drive			Paradise Island Drive		
Base Volume Input [veh/h]	3	0	4	3	0	13	12	94	7	3	119	1
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	3.00	3.00	3.00	7.00	7.00	7.00	7.00	7.00	7.00
Growth Factor	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350	1.350
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	25	0	0	31	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	0	5	4	0	18	16	152	9	4	192	1
Peak Hour Factor	0.375	1.000	0.500	0.750	1.000	0.464	0.500	0.780	0.583	0.750	0.726	0.250
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	3	0	3	1	0	10	8	49	4	1	66	1
Total Analysis Volume [veh/h]	11	0	10	5	0	39	32	195	15	5	264	4

d_M, Delay for Movement [s/veh]	9.86	13.25	13.05	10.13	13.73	13.77	0.00	0.00	7.86	0.00	0.00	7.75
Movement LOS	A	B	B	B	B	B	A	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.11	0.11	0.11	0.30	0.30	0.30	0.03	0.03	0.03	0.01	0.01	0.01
95th-Percentile Queue Length [ft/ln]	2.79	2.79	2.79	7.62	7.62	7.62	0.65	0.65	0.65	0.17	0.17	0.17
d_A, Approach Delay [s/veh]	11.38			13.36			0.49			0.11		
Approach LOS	B			B			A			A		
d_I, Intersection Delay [s/veh]	1.68											
Intersection LOS	B											
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Stop	Stop	Free	Free
Flared Lane	No	No		
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.00	0.02	0.01	0.00	0.09	0.00	0.00	0.01	0.00	0.00	0.00

Intersection Level Of Service Report Intersection
32: Paradise Island Drive & School Egress

Control Type:	Two-way stop	Delay (sec / veh):	8.6
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.076

d_M, Delay for Movement [s/ve

Movement LOS

95th-Percentile Queue Length [ve

Intersection Setup

Name	Proposed School Egress		Paradise Island Drive		Paradise Island Drive 95th-Percentile Queue Length [f	
Approach	Southbound		Eastbound		Westbound d_A, Approach Delay [s/veh]	
Lane Configuration					Approach LOS d_I, Intersection Delay [s/veh]	
Turning Movement	Left	Right	Left	Thru	Thru	Intersection LOS Right
Lane Width [ft]	12.00	12.00	12.00	10.00	10.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	1
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	170.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		28.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		No		No	

Volumes

Name	Proposed School Egress		Paradise Island Drive		Paradise Island Drive	
Base Volume Input [veh/h]	0	0	0	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.00	2.00	7.00	7.00	2.00
Growth Factor	1.3500	1.3500	1.3500	1.3500	1.3500	1.3500
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	83	0	0	0	89	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	83	0	0	0	89	0
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	21	0	0	0	22	0
Total Analysis Volume [veh/h]	83	0	0	0	89	0
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.08	0.00	0.00	0.00	0.00	0.00

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Scenario 2 2 20-Year Scenario

Paradise Island School 20-Year Analysis

Vistro File: Y:\...\01-Paradise Island School 20-Year Analysis 28Sep22.vistro

30/09/2022

Report File: Y:\...\01-Paradise Island School 20-Year Analysis 30Sep22.pdf

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Paradise Island Drive & Flamingo	26	0	13	3	5	30	30	322	19	26	487	1	962

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
6	Paradise Island Drive & Harbour Ridge Road	9	63	448	12	80	944	1556

ID	Intersection Name	Southbound		Eastbound		Westbound		Total Volume
		Left	Right	Left	Thru	Thru	Right	
11	Paradise Island Drive & Lakeview Drive	41	246	186	236	415	31	1155

ID	Intersection Name	Northbound	Eastbound	Westbound	Total

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		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Volume
16	Paradise Island Drive & Bayview Lane West & School Ingress	5	0	9	71	255	14	8	328	31	721

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
21	Paradise Island Drive & The Ocean Club Road	1	0	0	20	0	20	1	298	1	0	370	0	711

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
26	Paradise Island Drive & Cloister Drive West	24	3	367	26	1	382	803

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ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
31	Paradise Island Drive & Cloister Drive East	4	0	5	4	0	18	16	152	9	4	192	1	405

ID	Intersection Name	Southbound	Eastbound	Westbound	Total Volume
		Left	Thru	Thru	
32	Paradise Island Drive & School Egress	83	0	89	172

Report Figure 1: Study Intersections

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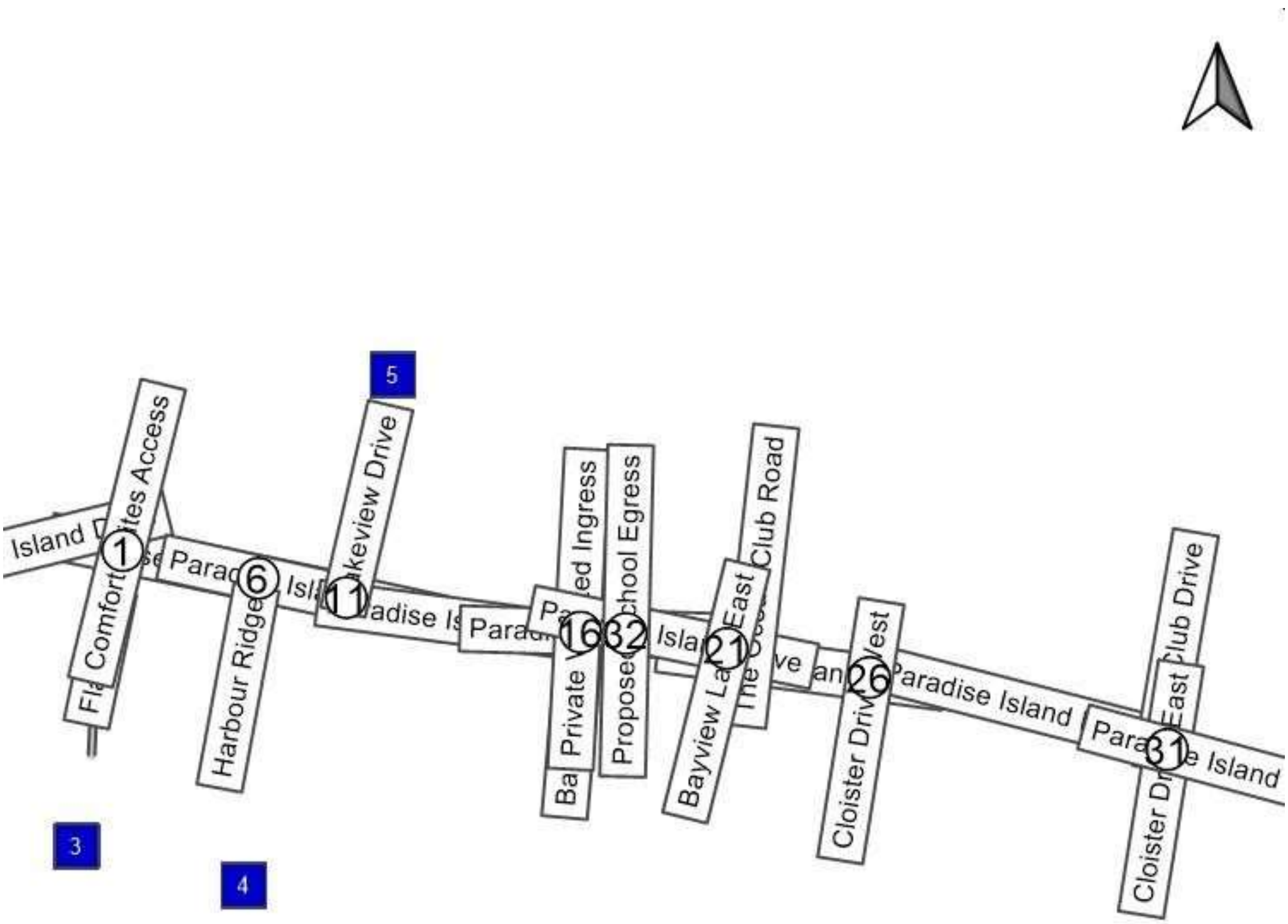

Report Figure 2: Lane Configuration and Traffic Control

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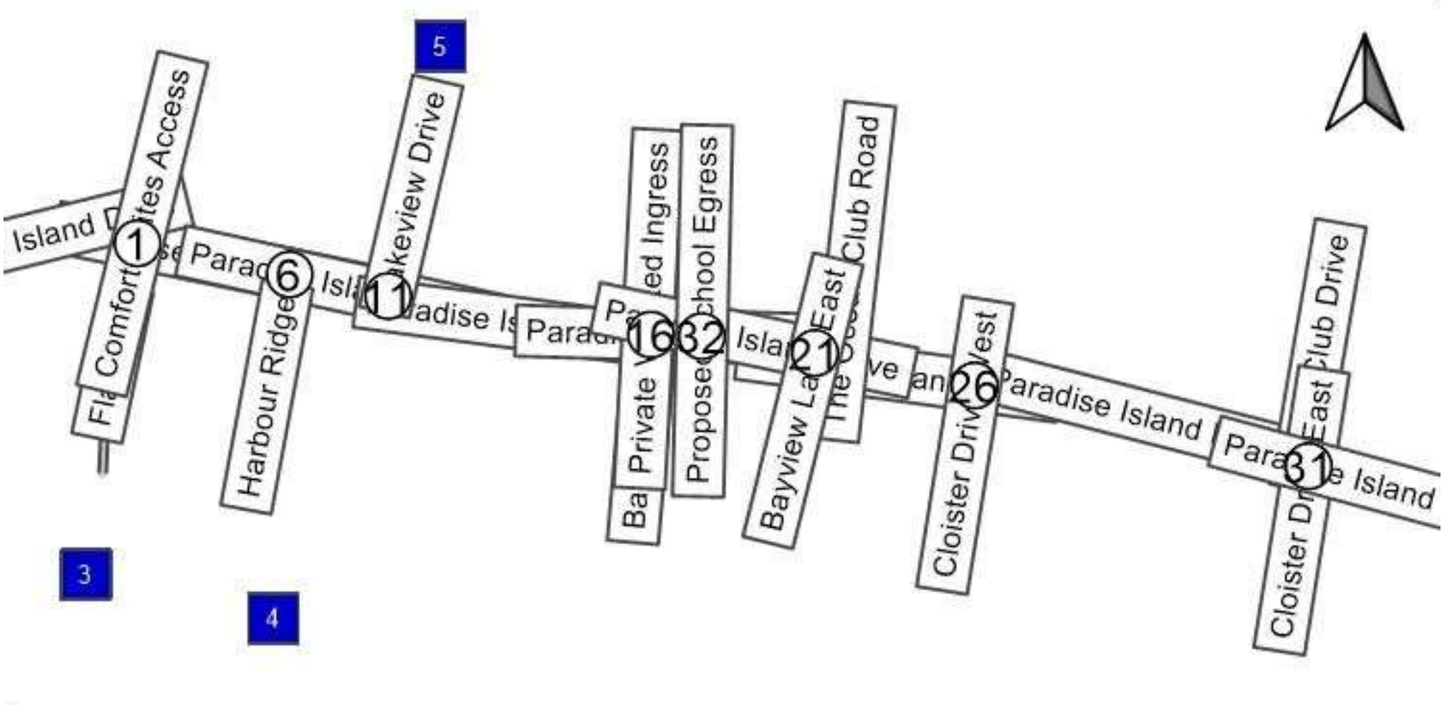

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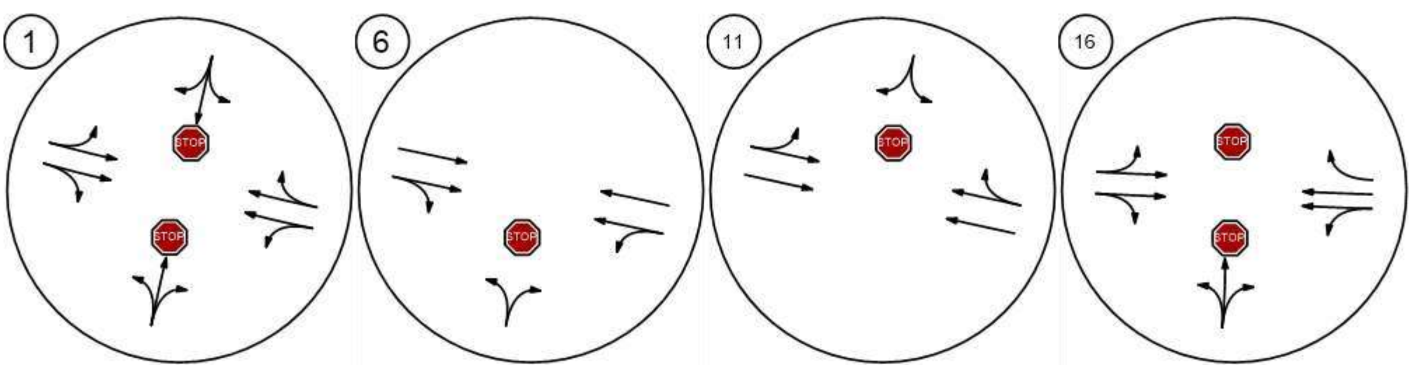

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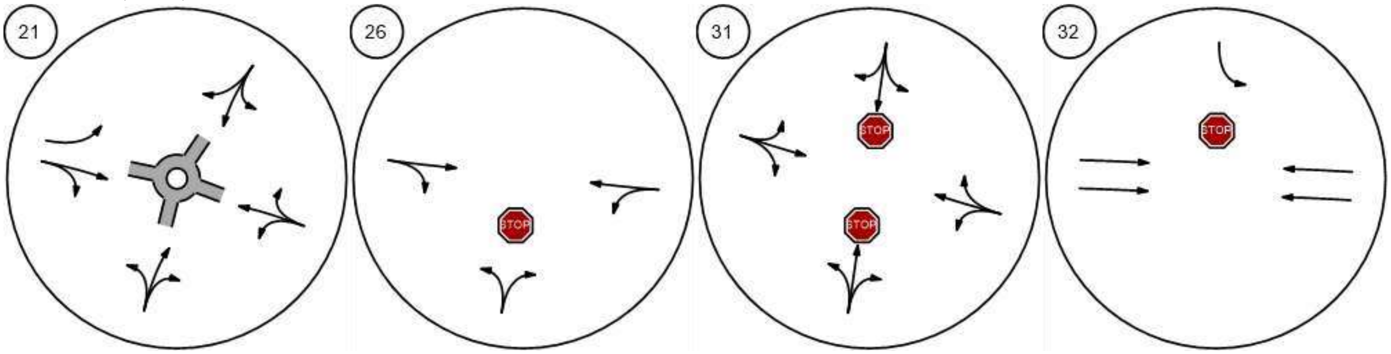
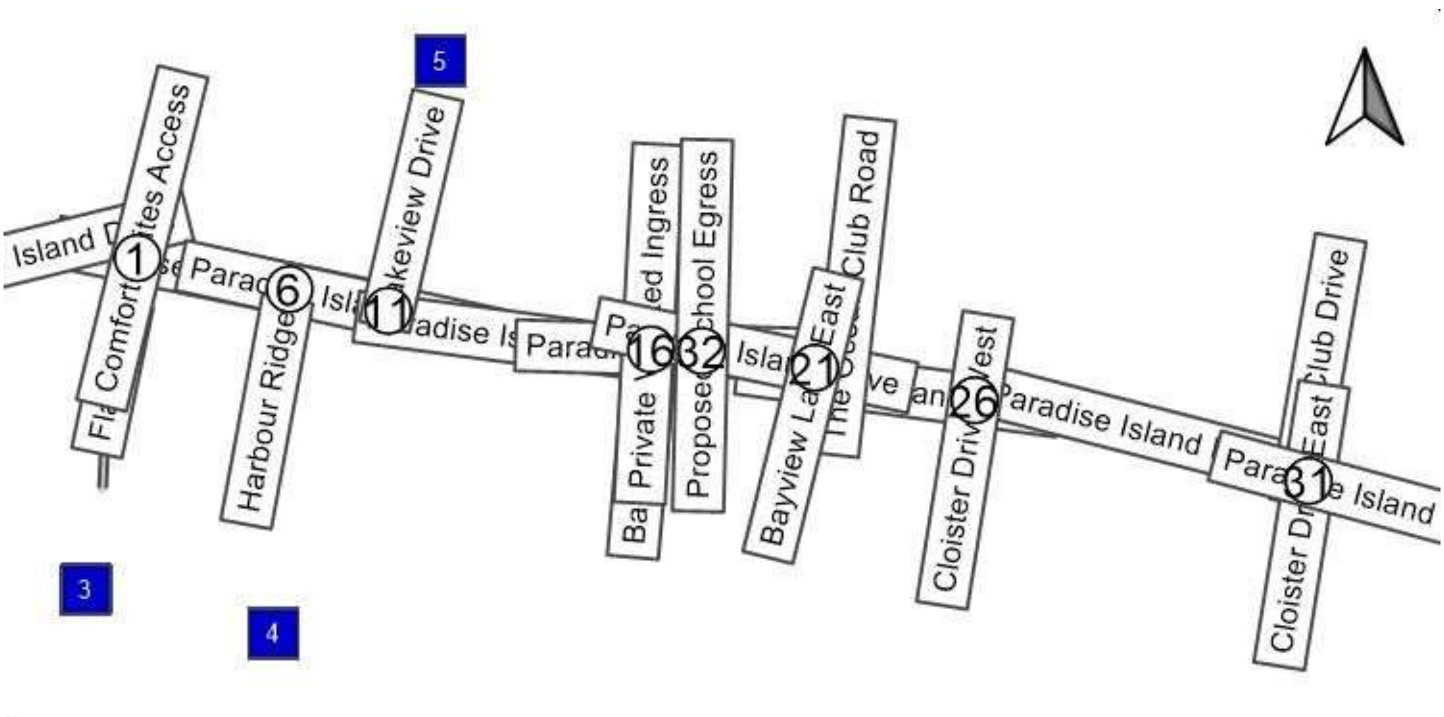


Report Figure 3a: Traffic Volume - Base Volume



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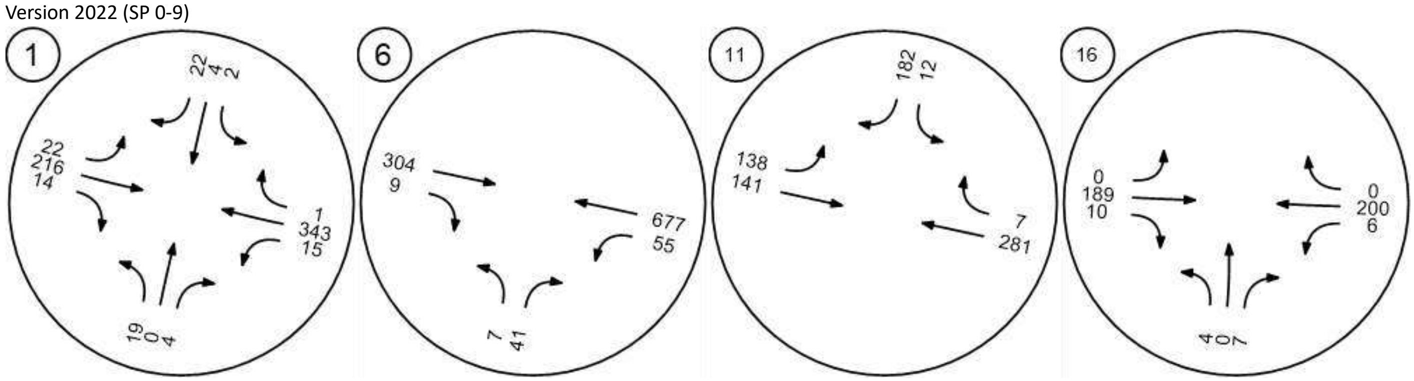

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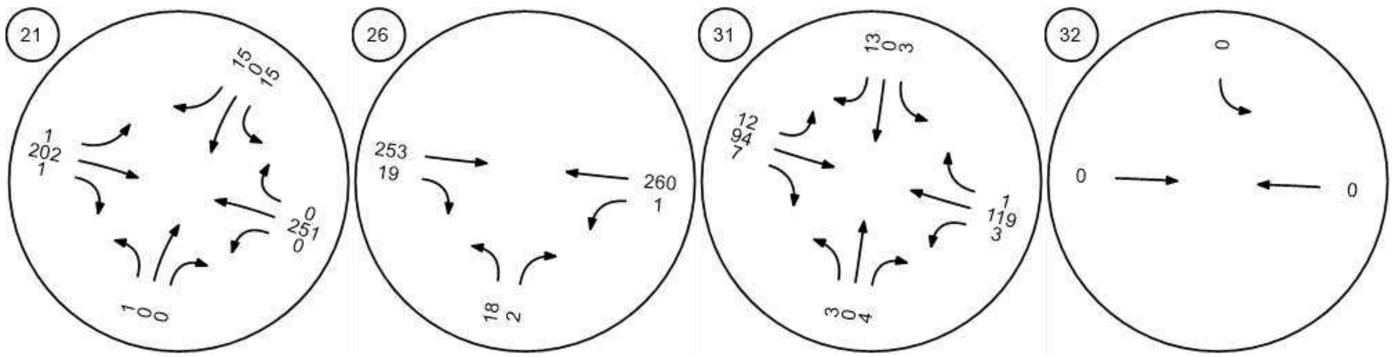

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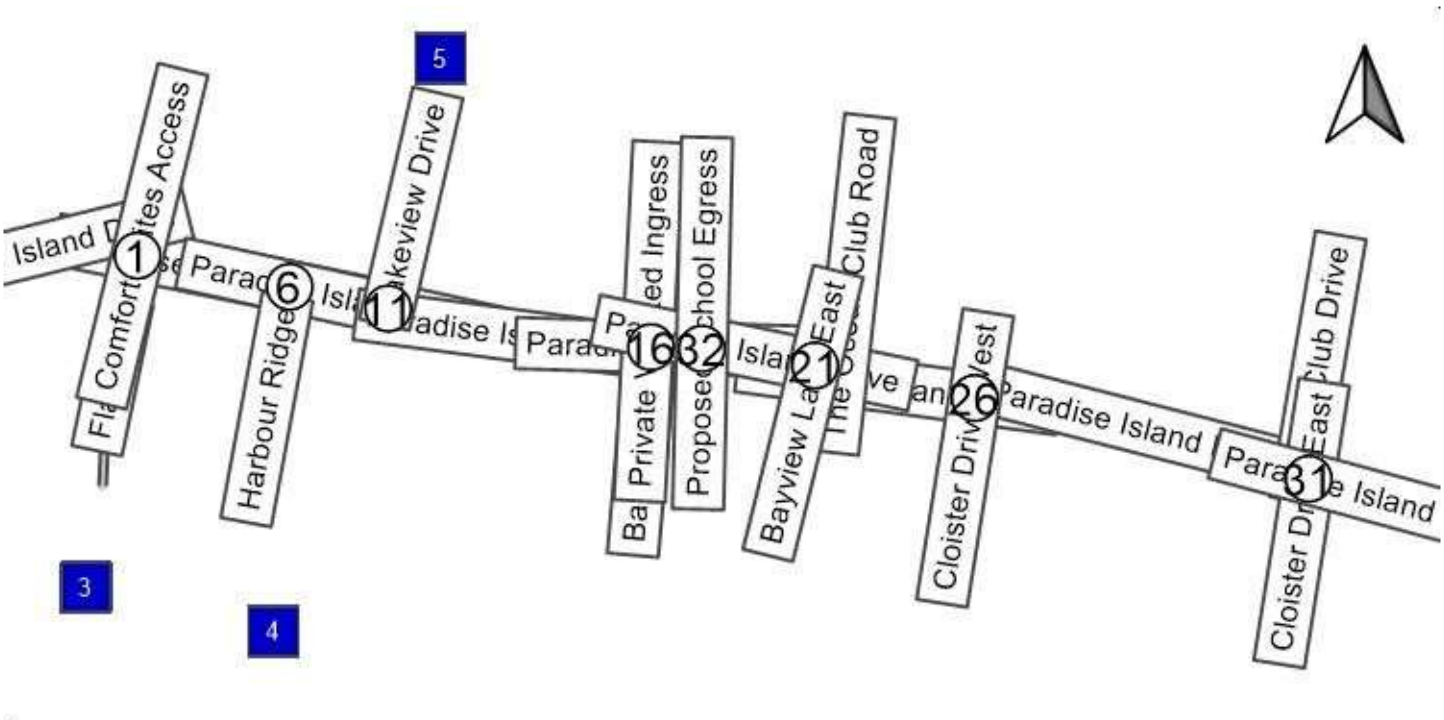
Report Figure 3f: Traffic Volume - Future Total Volume



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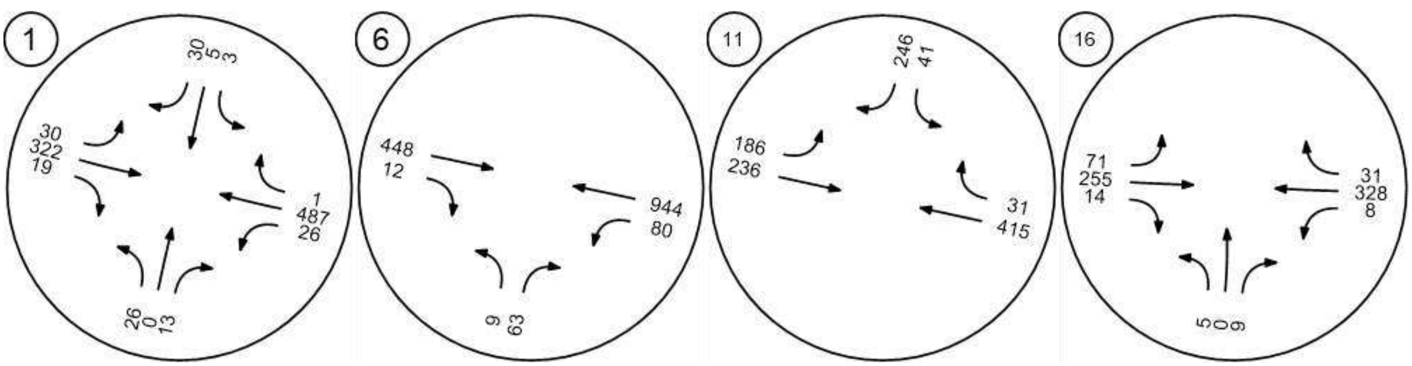

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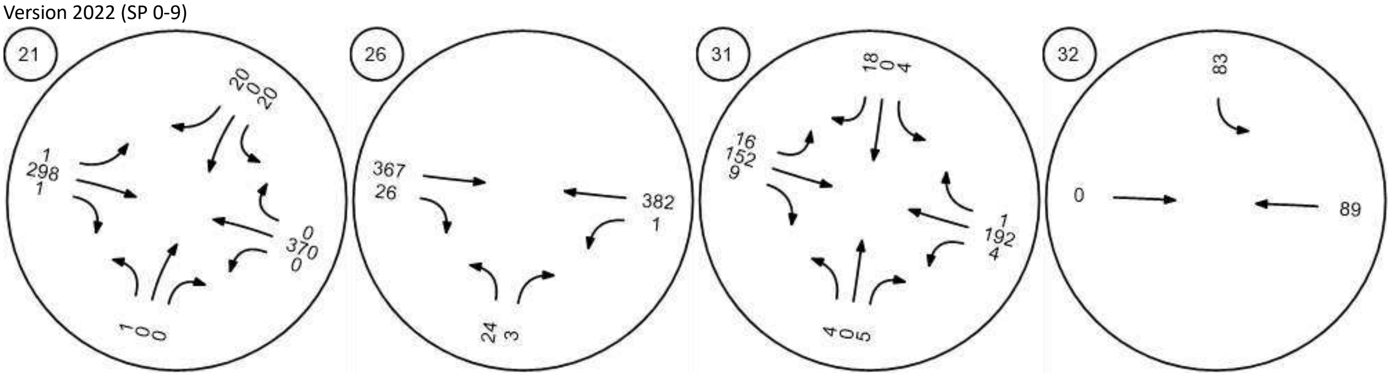

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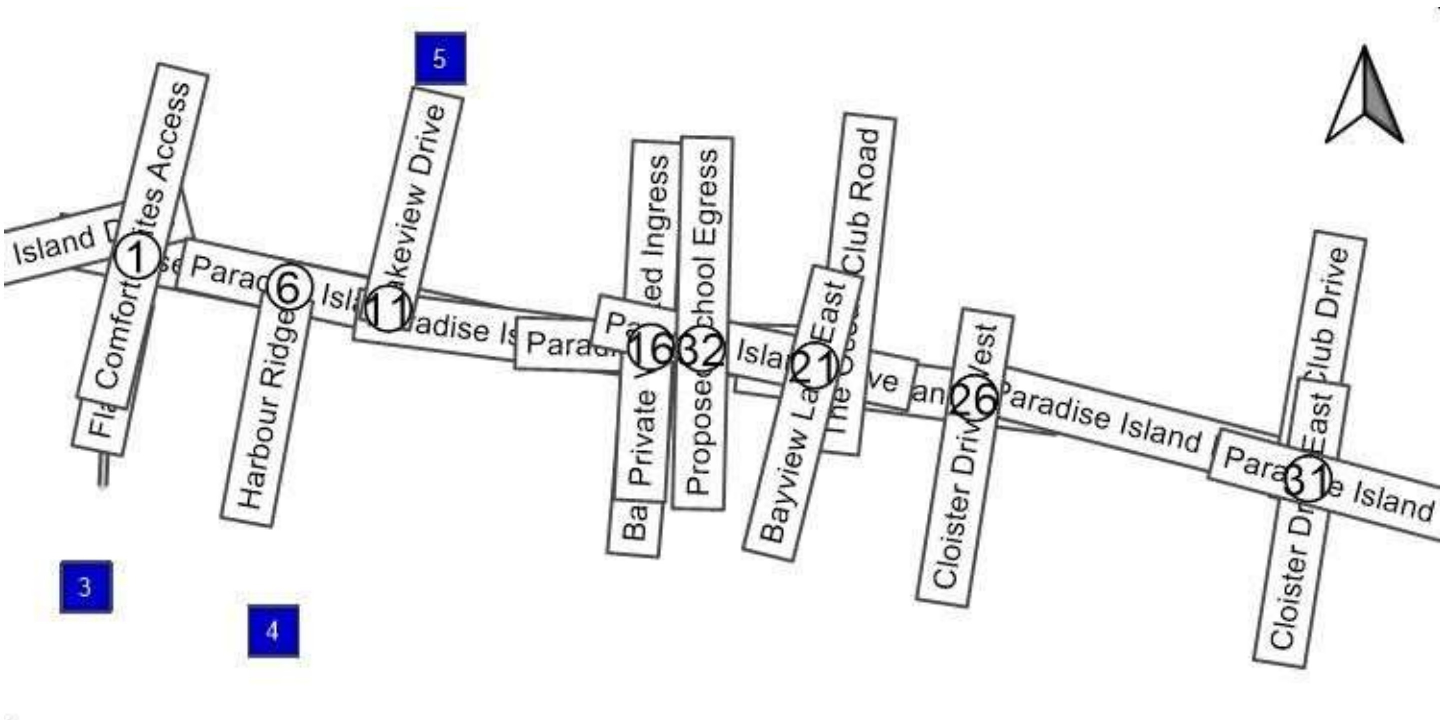
Report Figure 4: Traffic Conditions



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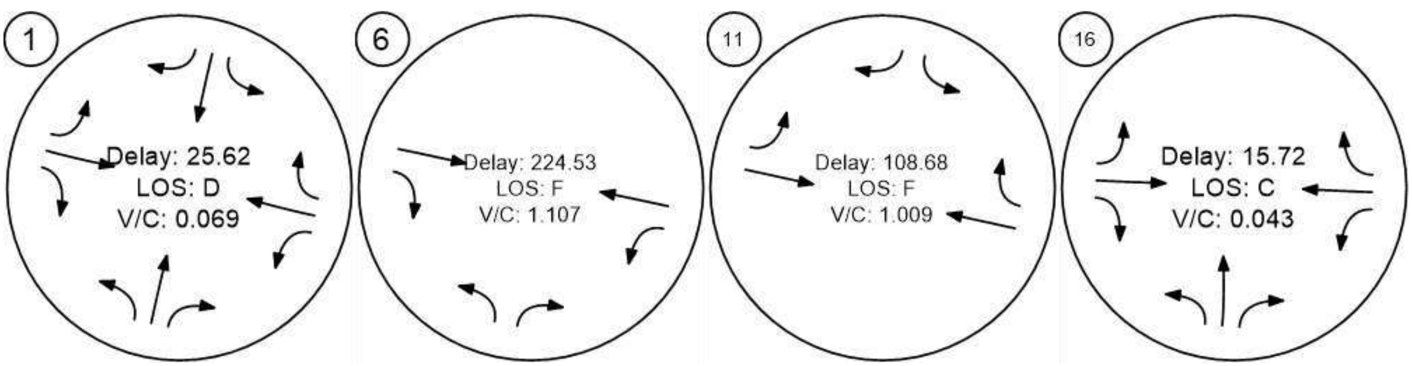

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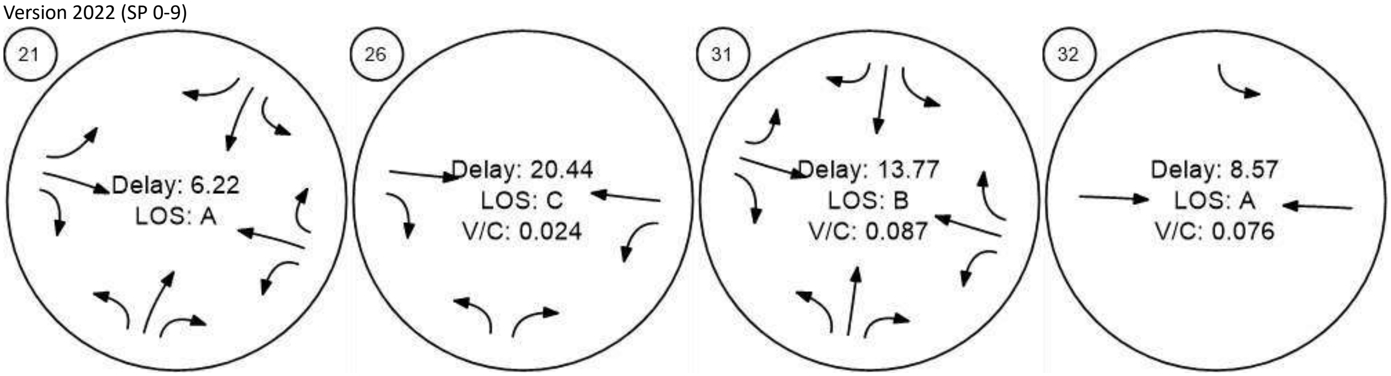
Version 2022 (SP 0-9)



OUR SERVICES

Project Coordination

Transportation Engineering

Traffic Engineering

Civil Engineering

Drainage Engineering

Environmental Engineering

Topographical & Site Surveying

Construction Supervision & Contract Administration

CARIBBEAN CIVIL GROUP LIMITED

Professional Consulting Engineers

ISO 9001: 2015 Certified Company

Appendix D: Hydrology Report

January 14, 2025

OVERVIEW

A site visit with report was conducted during August-2022. The proposed 4.0 Acre Atlantis School Site is on Paradise Island, located North of the Eastern District of New Providence, on a moderately elevated land parcel with significant vegetative cover. The site is proposed to be expanded / co-joined with the Atlantis Wilderness Site. During the months of December-2024 | January-2025, AEES visited the site for hydrological review & specified water sample collection and analysis.

The groundwater resources of the Commonwealth of the Bahamas comprise the fresh, brackish, saline and hyper saline waters found in the subsurface and in the lakes and ponds that intercept the land surface. There is a direct connection of the landform to the marine/coastal environment, separated by a mangrove vegetation buffer / wetlands (8Flamingo Lake9) to the North of the proposed 8Atlantis School Site9.

Salinity levels of water are expressed in parts per million (ppm) or milligrams per litre (mg/l) of the chloride content in the water, which is a constituent of the total dissolved solids. For the purposes of this particular site and the proposed water use, the ranges of salinity follow:

Water Description	**Dissolved Solids**
Fresh	Less than 1,500-mg/l
Brackish	1,500 3 3,000-mg/l
Salt	More than 3,000-mg/l
Saline	More than 30,000-mg/l

ATLANTIS PROPOSED SCHOOL | WILDERNESS SITE @ PARADISE ISLAND, NP - BAHAMAS

Figure I. – Proposed Atlantis Wilderness Site @ Paradise Island (Not to Scale – NTS)

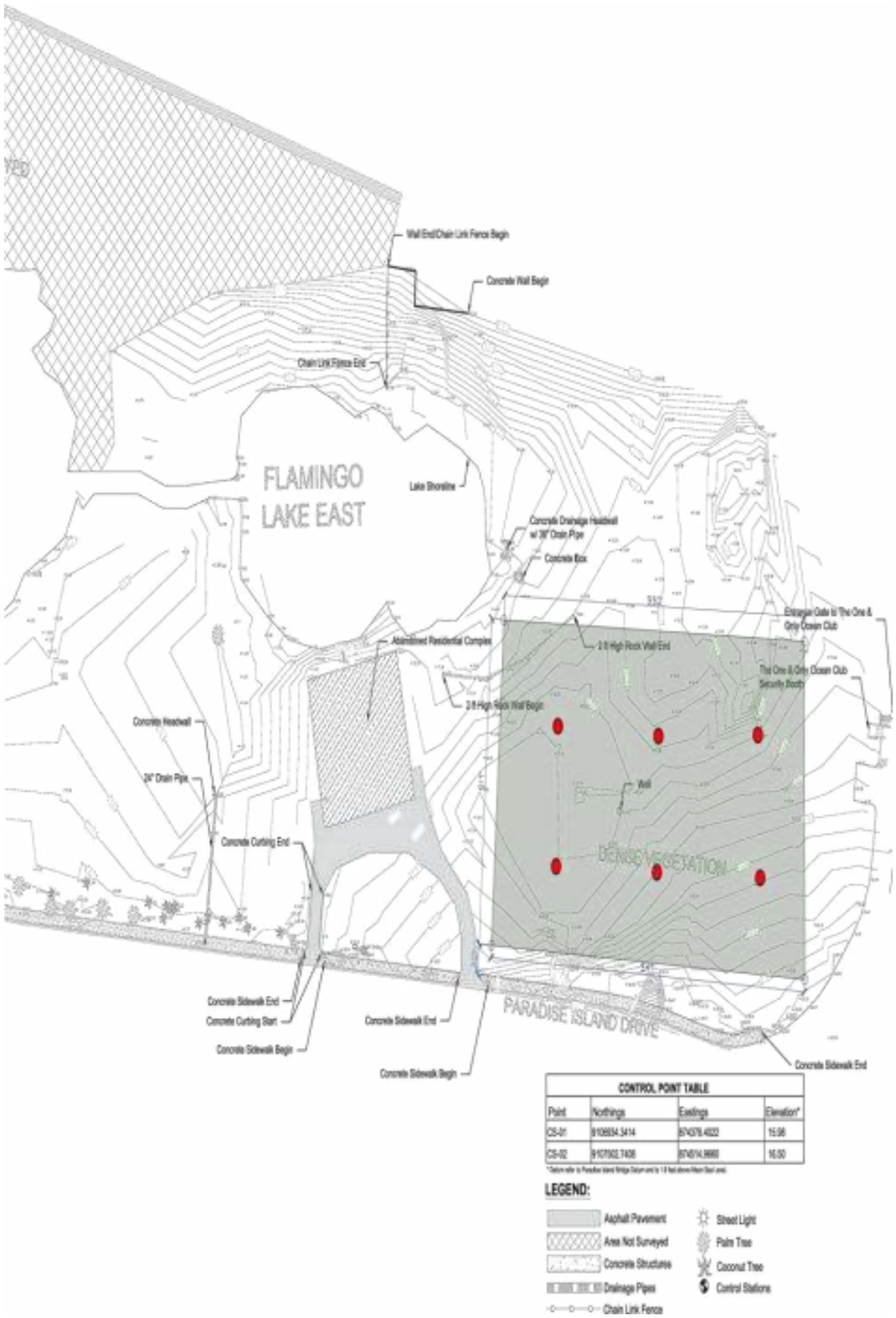
Per John A. Bowleg, PE - Water Consultant for AEES

4 Initial Water Quality (WQ) Sample Sites

Other Hydrogeological Areas that may warrent WQ Sampling

Source: Wilderness Graphics Concept Plan, Wildlife Viewing & Natural Trail Flamingo Lake, PI (Apr-2015 | Revised Aug-2022)

Figure II. – Topographic Plan w/ Proposed Atlantis School Site @ Paradise Island (NTS)



Source: Atlantis School Site Concept - Topographic Plan, for Paradise Island (Aug-2022) – Abandoned Residential Complex to West | Flamingo Lake (Wetlands) to North

Site Location and Land Description

The proposed school site runs 347-Feet (105.7-m) from East to West along the South boundary, 217-Feet (66.1-

m) North along the West, 332-Feet (1,011.9-m) West to East along the North, and bounded by 8One & Only Ocean Club / Four Seasons9 to the East. Due West of the subject property (proposed 8Atlantis School9) is an abandoned residential property. Both properties slope slightly North from the southeast, toward the South shoreline of the 8Flamingo Lake - East9 wetland area. The properties immediately North of 8Flamingo Lake 3 East9 (the Ocean Club Resort Car Park + Private Residences along 8Casino Drive9) are more elevated (@ +22Ft | 6.71-meter).

North of the subject property are hydrologic infrastructure to manage flows from the East toward 8Flamingo Lake - East9. The extreme East Lake is subsequently connected by an East-West open water channel to larger portion of 8Flamingo Lake - East9 and subsequently to 8Flamingo Lake - West9 (separated by 8Lake View Drive9).

The 8Atlantis School9 property is between 15.98-Feet (4.87-m) to 16.50-Feet (5.02-m) Elevation. The shoreline of 8Flamingo Lake 3 East9 is between 5Ft to 7ft (1.52 to 2.13-m) Elevation. Lake water levels are approximately1.9-Feet (0.57-m) above Mean Sea Level [reference is to the East Paradise Island Bridge Datum].

See **Figure III.** below of the 8Flamingo Lake - East9 wetlands; North of the subject property, have to date been compromised by suspected laundry flows indicative by the 8blue sheen9 color (Aug-2022). The contamination within this area continues to date (Dec-2024 | Jan-2025) and shall have to be addressed.

A 8Concrete Drainage Headwall w/ a 36-Inch (914.4-mm) Drain Pipe9 and 8Concrete Box9 Structure with an enclosed drainage well, serve to introduce flows to the eastern extreme of the 8Flamingo Lake East9 (See **Figures IV. & V.**). Other drainage structures exist toward Flamingo Lake, but no abstraction sources from the water body were witnessed.

Alternative potable water supplies are readily available at the project site, as 8Paradise Island Drive9 (running EastWest) bounds the subject property at a distance of 20-Feet (6.09-m) from the Southern Boundary of the proposed 8Atlantis School Site9.

Figure III. – Site Photo of 8Flamingo Lake - East9 near the 8Concrete Drainage Headwall9 (Aug-2022)

Figure IV. and V. – Site Photos of 8Concrete Box w/ Drainage Well9 @ Flamingo Lake – East (Aug-2022)

Inner Drainage Overflow Structure

Outer Drainage Overflow Structure

Figure(s) VI. – 8Flamingo Lake – East Area9 near the East 8Concrete Drainage Headwall9 (Dec-2024)

Site Location

Water Quality, near Culvert (Dec-11-2024)


Site Conditions, near the Drainage Headwall (Dec-11-2024)

At present, the water quality analysis focuses on the ecological impact to the area (Biological Oxygen Demand), and not any specific required site remediation activities [potential Detergents | Oil & Grease | Hydrocarbon (Fuel)].

This area shall require additional reviews / specific water quality analysis, toward environmental remediation activities. In December-2024, it was apparent that in addition to laundry/wash flows, suspected oil & grease is also being introduced to the wetland area via this Eastern culvert. Prior disclosed that these drainage structures may terminate at the 8Eastern Laundry Facility9 for the Paradise Island Hotels (to be confirmed, via site plans).

Figure(s) VII. – Areas of Concern: Possible Drainage (Unknown Source) to the Wetland Area (Jan-2025)

Drainage from the West, looking toward RIU Parking | Atlantis Convention Center (Jan-2025)

Drainage from the East (Jan-2025)

Previous Oil Containment Devices @ East (Jan-2025)

Additional culverts are directed to the wetland area, from surrounding developed areas. Presumed that the wetland area was prior utilized as part of the surrounding development(s) stormwater management control. Several additional drainage culverts terminate at the Flamingo Lake Wetland Area. The wetlands are bounded by an active car park area to the NE (for One & Only, Ocean Club Resort), and also to the West (for the RIU Resort).

Table I. – Wetland Water Quality @ Site, Flamingo Lakes (Dec-2024 | Jan-2025)

Table 3.1. – Wetland Water Quality @ Site, Flamingo Lakes (Dec-2024 | Jan2025) (Source AEES, 2025)

Laboratory Test	#1 Wetland Water	#2 Wetland Water	#3 Wetland Water	#4 Wetland Water	#5 Wetland Water	Drinking Water Regulatory Limits #
GPS Coordinates	25° 4955= N 77°18942= W	25° 4956= N 77°18942= W	25° 4957= N 77°18951= W	25° 4957= N 77°18952= W	25° 4959= N 77°18957= W	-----
Chemical pH	6.71	7.26	7.75	7.74	7.37	6.5 to 8.5
Total Dissolved Solids – ppm [TDS]	584	371	284	195	213	1,200
Sodium Chloride – ppm [Salinity]	225	135	75	45	45	600 250(desirable)
Total Hardness – ppm	25.98	27.12	29.37	28.25	33.89	<200
Appearance	Cloudy	Green Particles	Particles	Particles	None	Clear
Odor	Fishy	Mossy	None	None	None	None
Nitrate – ppm	4.9	6.0	1.5	1.4	0.7	10 2.0(desirable)

Turbidity – FNU	125	65	7	6	0.0	5.0 0.0(desirable)
Bacterial	WW#1	WW#2	WW#3	WW#4	WW#5	Regulatory #
Coliform/100ML	TNTC	TNTC	TNTC	TNTC	178	None
Fecal Coliform/100ML	TNTC	41	TNTC	TNTC	13	None

Note: Recommended data review of any detected compounds is per SW-II for Bathing, Contact Water Sports and Commercial Fishing Regulations: SW-II Coastal Water Regulations" refers to a set of water quality standards designated for coastal waters primarily used for bathing, contact water sports, and commercial fishing. Where "SW-II" signifies the "Secondary Water Quality" class for coastal areas, specifying permissible limits for parameters like pH, dissolved oxygen, fecal coliform count, and biochemical oxygen demand to ensure the water is safe for these recreational and fishing activities [**pH:** Should be within a range of 6.5 to 8.5, **Fecal Coliform:** Limited counts per100ml], but no specific limits for **TDS** | **Salinity**]. *Source: https://mpcb.gov.in/sites/default/files/water-quality/standards-protocols/CoastalwaterStandards.pdf*

SOIL-WATER QUALITY DATA (DEC-2024 | JAN-2025)

The environmental (wetlands water) quality results collected from the project site are presented in **Tables I.** above. No soil samples were taken (or required), as an available water sample matrix was easily accessible for collection & analysis.

The water quality for the wetland samples (for TDS, Salinity, & Total Hardness) are outside the WHO standard for drinking water, but acceptable for aquatic life. Alternative municipal water supplies are available within the project limits for drinking purposes. Low levels of nitrate (0.7 to 6.0-mg/L) & iron (0.07 to 1.41-mg/L) observed for the sample results; along with low (<200-mg/L) levels of total hardness.

Iron while naturally occurring in the environment and within the World Health Organization9s (WHO) Drinking Water Limit; should desirable not exceed 1.0-mg/L. Where slight nutrient loading plus iron occurs, there is also the possibility of iron reducing bacterium {<obtains its energy by oxidation of ferrous iron, or reduced inorganic sulfur compounds=}. Iron / sulfur reducing bacteria is often associated with the production of a 8slime9 that can become a nuisance, blocking irrigation lines and filters.

Total coliform | fecal coliform bacterium was detected all the collected samples. Biological Oxygen Demand (BOD) within the Flamingo Lake – East Area of concern (WW#1) was 157-mg/L (ppm). General BOD levels for different types of water are: 1.) **Drinking water**: Has a BOD level of 1–2 ppm, 2.) **Moderately clean water**: Has a BOD level of 3–5 ppm, and 3.) **Polluted water**: Has a BOD level of 6–9 ppm. Sample WW#1 BOD is more than 25x the level of a 8typical9 polluted source.

Note: All wetland samples were collected 0.5 to 1Ft below surface. Water quality for the wetland samples (for TDS, Salinity & Total Hardness) are within the WHO standard for drinking water, but solely acceptable for aquatic life.

TNTC = Too-Numerous-To-Count, or <numerous amounts of coliform and fecal coliform bacteria=, which are <indicators of disease-causing organisms= were detected for the samples. The nitrate content or influence from septic | sewerage for the water samples ranged from 0.7 to 6.0-mg/L. All subsequent environmental quality data indicates that the Western areas 0.7 to 1.5mg/L) are not as influenced / affected by nutrient loading, as with the Eastern areas (4.9 to 6.0-mg/L). Fecal coliform(s) detected may be attributed to water fowl | wetland habitat. **For the ecological (8wetland9) water samples:** <Chemically, all of the minerals fell within standards for potable water.= All sample data is compared to the permissible limits of the WHO standards for 8potable water9. Acceptable levels of nitrate & iron (0.07 to 1.41-mg/L) were observed; along with low levels of total hardness. Turbidity levels were elevated in the vast majority (4 of 5) of the collected samples.

RECOMMENDATIONS | CONCLUSIONS

The limited hydrogeological | water quality survey involved the confirmation of groundwater, any freshwater resources, and influence to wetlands on/near the project site, and the status of these resources. Recommendations have been made on minimizing negative impacts to these resources at the Atlantis School & Wilderness Site(s).

- ✦ The groundwater lens configuration of the Atlantis School Site is best described as brackish to salt water.

- ✦ Relevant to the environmental impact to the groundwater / water resources / hydrology / water quality / wetlands: the project construction operations were determined/confirmed to be MINOR - MODERATE / SHORT TERM. The continued operation of a school site on the property was determined to be MINOR / LONG TERM. Additional areas of concern are the potential drainage sources into the Wetland Area. ✦ Storm surge effects to the project site were determined to be MINOR - MODERATE / LONG TERM.

- ✦ ADDITIONAL REQUIRED REVIEWS FOR THE POTENTIAL INFLUENCE OF THE 8EASTERN LAUNDRY FACILITY9 TO THE WATER QUALITY OF THE 8FLAMINGO LAKE - EAST9 AREA.

- ✦ Additional hydrological data reviews may be required for impact of the project development to the adjacent wetland area(s). The Environmental Impact Assessment (EIA) / Environmental Management Plan (EMP) shall detail other environmental aspects of the proposed project, along with surveyed land elevations.

Site Wetlands (Water) Quality Analysis Results (Dec-2024 | Jan-2025)

Soil-Water Quality Sample Results

Atlantis [Wetland] Water/Sample #1 (WW#1)

NAME: AEES Consultants LLC **DATE:** January 14th, 2025

LOCATION: WW#5 **EMAIL:** jbowleg@aeesconsultants.com

LAB TEST	UNIT	RESULT	DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Bacteria				
COLIFORM	cfu/100ml	*178	NONE	NONE
FECAL COLIFORM	cfu/100ml	*13	NONE	NONE
NON-COLIFORM	cfu/100ml	0		
*TNTC-TOO NUMEROUS TO COUNT				
Chemical				
pH	n/a	7.37	6.5 – 8.5	6.5 – 8.5
TOTAL DISSOLVED SOLIDS (TDS)	mg/L	213	500	1,200
SODIUM CHLORIDE	mg/L	45	250	250(desirable)
TOTAL HARDNESS	mg/L	33.89	100	<200
NITRATE	mg/L	0.7	10.00	10.00
IRON	mg/L	0.06	0.3	0.5
APPEARANCE		None	CLEAR	CLEAR
ODOR		None	NONE	NONE
CHLORINE RESIDUAL	mg/L	Nil	4.0	5.0
TURBIDITY-FNU	FNU	0.0	5.0FNU	5.0FNU
NOTE: W.H.O. - WORLD HEALTH ORGANIZATION				
NOTE: E.P.A.-ENVIRONMENTAL PROTECTION AGENCY				

COMMENTS:
Both coliform and fecal coliform bacteria were isolated in the water sample. Coliform bacteria are indicators of disease-causing organisms and fecal coliform denotes sewer contamination.

Chemically, all of the minerals fell within standards for potable water.

Site Photo

Sample Site Location

NAME: AEES Consultants LLC **DATE:** January 14th, 2025

LOCATION: WW#1 **EMAIL:** jbowleg@aeesconsultants.com

LAB TEST	UNIT	RESULT	DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Bacteria				
COLIFORM	cfu/100ml	*TNTC	NONE	NONE
FECAL COLIFORM	cfu/100ml	*TNTC	NONE	NONE
NON-COLIFORM	cfu/100ml	0		
*TNTC-TOO NUMEROUS TO COUNT				
Chemical				
pH	n/a	6.71	6.5 – 8.5	6.5 – 8.5
TOTAL DISSOLVED SOLIDS (TDS)	mg/L	584	500	1,200
SODIUM CHLORIDE	mg/L	225	250	250(desirable)
TOTAL HARDNESS	mg/L	25.98	100	<200
NITRATE	mg/L	4.9	10.00	10.00
IRON	mg/L	*1.41	0.3	0.5
APPEARANCE		Cloudy	CLEAR	CLEAR
ODOR		Fishy	NONE	NONE
CHLORINE RESIDUAL	mg/L	NIL	4.0	5.0
TURBIDITY-FNU	FNU	*125	5.0FNU	5.0FNU
NOTE: W.H.O. - WORLD HEALTH ORGANIZATION				
NOTE: E.P.A.-ENVIRONMENTAL PROTECTION AGENCY				

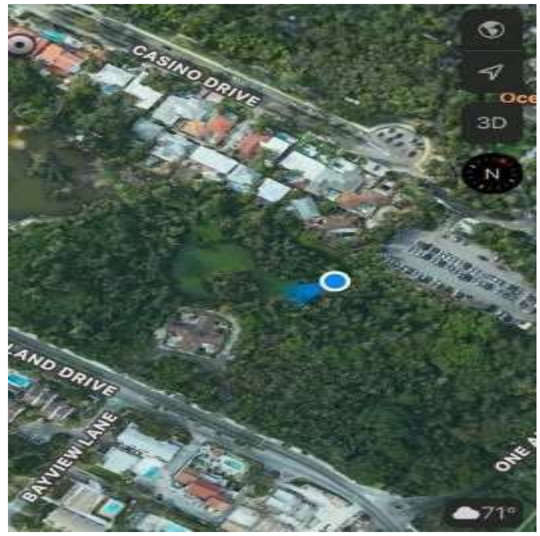
COMMENTS:
Numerous amounts of coliform and fecal coliform bacteria were isolated in the water sample. Coliform bacteria are indicators of disease-causing organisms and fecal coliform indicates sewer contamination.

Chemically, both the iron and turbidity levels far exceeded the maximum permissible limits for potable water.

Atlantis [Wetland] Water/Sample #2 (WW#2)

Soil-Water Quality Sample Results

Site Photo



Sample Site Location

Soil-Water Quality Sample Results

Atlantis [Wetland] Water/Sample #3 (WW#3)

Site Photo

Sample Site Location

Soil-Water Quality Sample Results

Atlantis [Wetland] Water/Sample #4 (WW#4)

Site Photo

Sample Site Location

Soil-Water Quality Sample Results

NAME: AEES Consultants LLC **DATE:** January 14th, 2025

LOCATION: WW#4 **EMAIL:** jbowleg@aeesconsultants.com

LAB TEST	UNIT	RESULT	DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Bacteria				
COLIFORM	cfu/100ml	***TNTC**	NONE	NONE
FECAL COLIFORM	cfu/100ml	***TNTC**	NONE	NONE
NON-COLIFORM	cfu/100ml	0		
*TNTC-TOO NUMEROUS TO COUNT				
Chemical				
pH	n/a	7.74	6.5 – 8.5	6.5 – 8.5
TOTAL DISSOLVED SOLIDS (TDS)	mg/L	195	500	1,200
SODIUM CHLORIDE	mg/L	45	250	250(desirable)
TOTAL HARDNESS	mg/L	28.25	100	<200
NITRATE	mg/L	1.4	10.00	10.00
IRON	mg/L	0.14	0.3	0.5
APPEARANCE		Particles	CLEAR	CLEAR
ODOR		None	NONE	NONE
CHLORINE RESIDUAL	mg/L	Nil	4.0	5.0
TURBIDITY-FNU	FNU	***6**	5.0FNU	5.0FNU
NOTE: W.H.O. - WORLD HEALTH ORGANIZATION				
NOTE: E.P.A.-ENVIRONMENTAL PROTECTION AGENCY				

COMMENTS:

Numerous amounts of coliform and fecal coliform bacteria were isolated in the water sample. Coliform bacteria are indicators of disease-causing organisms and fecal coliform denotes sewer contamination.

Chemically, all of the minerals fell within standards for potable water. However, the turbidity level slightly exceeded the maximum permissible limit for potable water due to a few suspended particles.

Atlantis [Wetland] Water/Sample #5 (WW#5)

Soil-Water Quality Sample Results

Site Photo

Sample Site Location

NAME: AEES Consultants LLC

DATE: January 14th, 2025

LOCATION: WW#5

EMAIL: jbowleg@aeesconsultants.com

LAB TEST	UNIT	RESULT	DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Bacteria				
COLIFORM	cfu/100ml	*178	NONE	NONE
FECAL COLIFORM	cfu/100ml	*13	NONE	NONE
NON-COLIFORM	cfu/100ml	0		
*TNTC-TOO NUMEROUS TO COUNT				
Chemical				
pH	n/a	7.37	6.5 – 8.5	6.5 – 8.5
TOTAL DISSOLVED SOLIDS (TDS)	mg/L	213	500	1,200
SODIUM CHLORIDE	mg/L	45	250	250(desirable)
TOTAL HARDNESS	mg/L	33.89	100	<200
NITRATE	mg/L	0.7	10.00	10.00
IRON	mg/L	0.06	0.3	0.5
APPEARANCE		None	CLEAR	CLEAR
ODOR		None	NONE	NONE
CHLORINE RESIDUAL	mg/L	Nil	4.0	5.0
TURBIDITY-FNU	FNU	0.0	5.0FNU	5.0FNU
NOTE: W.H.O. - WORLD HEALTH ORGANIZATION				
NOTE: E.P.A.-ENVIRONMENTAL PROTECTION AGENCY				

COMMENTS:

Both coliform and fecal coliform bacteria were isolated in the water sample. Coliform bacteria are indicators of disease-causing organisms and fecal coliform denotes sewer contamination.

Chemically, all of the minerals fell within standards for potable water.

Atlantis [Wetland] Water/Sample #1 (WW#1)
5-Day Biological Oxygen Demand (BOD), by EPA SM5210B-2016

Site Photo

Sample Site Location

Florida Spectrum Environmental Services, Inc.

Report To:
John Bowleg
Adarie Engineering
855 West Commerical Boulevard
Fort Lauderdale FL, 33309-3108

Page 16 of 17
Report Printed: 12/23/2024
Work Order # 24L0452
Project:
Xanadu, GB & Atlantis Wilderness, PI Sites

[none]

Lab ID: 24L0452-07
Client Sample ID: Atlantis Wilderness, PI Water Sample
Matrix: Water

Collection Date: 12/11/24 11:00
Received Date: 12/12/24 09:50
Collected By: John Bowleg

Laboratory Analysis Report

Parameter	Result	QC	Units	Dil	MDL	PQL	Method	Date Ext.	Date Analy.	Analyst
Microbiology										
Biochemical Oxygen Demand	157		mg/L	1	2.00	2.00	SM5210B-2016	12/13 08:55	12/18 09:10	CF

Florida-Spectrum Environmental Services, Inc.
1460 W. McNab Road, Fort Lauderdale, FL 33309

Pembroke Laboratory
528 Gooch Rd.
Fort Mead, FL 33841

Big Lake Laboratory
610 Parrot Ave. N.
Okeechobee, FL 34972

Lakeland Laboratory
111 Easton Dr.
Lakeland, FL 33803

Savannah Laboratory
108 Airport Park Dr.
Garden City, GA 31408

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Atlantis [Wetland] Water/Sample #1 (WW#1)
5-Day Biological Oxygen Demand (BOD), by EPA SM5210B-2016

Notes and Definitions

U	Indicated that the compound was analyzed for but not detected. This shall be used to indicate that the specific component was not detected. The value associated with the qualifier shall be the laboratory method detection limit.
Q	Sample held beyond accepted holding time.
J3	The matrix spike recovery outside method acceptance limits indicating matrix interference.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the detection limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
N.O.O.	No Odor Observed
REP	Field parameter measured by client
V	Indicated that the analyte was detected in both the sample and the associated method blank.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Z	Too many colonies were present for accurate counting.
SUB	Work performed by outside (subcontracted) labs denoted by SUB in analyst field.

QC=Qualifier Codes as defined by DEP 62-160
Unless indicated, soil results are reported on actual (wet) weight basis.
The Color SM2120B method is reported as (Color / pH)
Legionella analyzed under CDC acreditation program
Dilution factors >= 1000 are abreviated using k=1000 and M=1000000
Field parameters are not NELAP acredited.
Results relate only to this sample.

Angel Barreto - Customer Services Manager

Authorized Signature
Florida-Spectrum Environmental Services,Inc.
Certification# E86006 Phone#: (954) 978-6400

All NELAP certified analysis are performed in accordance with Chapter 64E-1 Florida Administrative code, which has been determined to be equivalent to NELAC standards. Analysis certified by programs other than NELAP are designated with a "~".

Florida-Spectrum Environmental Services, Inc.
1460 W. McNab Road, Fort Lauderdale, FL 33309

Pembroke Laboratory 528 Gooch Rd. Fort Mead, FL 33841	Big Lake Laboratory 610 Parrot Ave. N. Okeechobee, FL 34972	Lakeland Laboratory 111 Easton Dr. Lakeland, FL 33803	Savannah Laboratory 108 Airport Park Dr. Garden City, GA 31408

www.flenviro.com

PROFESSIONAL ENGINEERS
Engineering Council (UK)
JOHN A. BOWLEG
C.ENG, M.CIWEM

John A. Bowleg, P.E. C.Eng, C.Env, C.Sci (Hydrology)
CERTIFICATION #10129 (BAH)

Appendix E: Geotechnical Report

BRON
POSSIBILITIES UNLIMITED

ATLANTIS FLAMINGO LAKES
PARADISE ISLAND
THE BAHAMAS

Prepared By:
BRON Ltd.

BRON File No.: 2021-129

May 26, 2022

GEOTECHNICAL INVESTIGATION

TABLE OF CONTENTS

INTRODUCTION

1.1 SCOPE

BRON Ltd. (BRON) prepared this geotechnical investigation report (Report) for design of the proposed development at Flamingo Lakes (Project), located on Paradise Island. BRON was authorized to conduct the scope services outlined below:

- Subsurface Field Exploration
- Soil Classification
- Data Analysis and Conclusions
- Report Preparation

1.2

1.2.2 Existing Facilities

The Report is intend ed for the exclusive use of Island Hotel Company Ltd. and their authorized consultants for design of the proposed development . Reproduction in whole or in part is prohibited. Written consent must be obtained prior to any quotations or excerpts of its contents. Appendix A provides further limitations of the Report.

PROJECT LOCATION

The P roject is located on Paradise Island , located off the northeast co ast of New Providence . The project site is located on the northern side of Paradise Drive, just west of the entrance to the Ocean Club . The subsurface field exploration was conduct ed at the locations shown on t he borehole location plan , which can be seen i n Appendix B .

1.2.1 Site Conditions

The site was vegetated with tall trees and medium dense shrubs at the time of the investigation .

No existing facilities were observed on the site at the time of the fieldwork.

1.2.3 Climatic Conditions

The Baham as is located within a temperate climatic zone. The two main seasons are the dry season (winter) and the rainy season (May-Oct) . Due to the temperate climate, no freeze thaw effects have been considered within this report.

The drainage of the site appears to be handled predominantly via seepage into the underlying soil . The site does not appear to be graded for drainage purposes. However, the site slopes downward naturally from the road northwards.

1.2.4 Surface Drainage

2 PROPOSED CONSTRUCTION

Based on our understanding, the client intends to construct a nature path and a day school. The design of the building(s) is not known at the time of preparing this report. It is assumed that the buildings will be a maximum of 2-storeys.

3 SUBSURFACE INVESTIGATION

3.1 STANDARD PENETRATION TEST

At each boring location, a 4= solid flight auger was used to drill from the surface to a depth of 3 ft. Sampling was then conducted from 3 ft to 5 ft. Sampling then progressed at 3 ft intervals with drilling in between to a target depth of 30 ft (sample 3-5 ft, drill from 5-8 ft, sample from 8-10 ft and so forth).

Sampling entails conducting a Standard Penetration Test (SPT), using 2= inner diameter split spoon. Blow counts were obtained in accordance with ASTM Standard D1586. The spoon was driven by dropping a 140 lb hammer freely over 30= onto the driving rods. The number of blows to progress the tip every 6= was counted and recorded, over an 18= sampling distance (a total of 3 blow count values per sample distance). The full 24= was not sampled to avoid compression of the soil within the split spoon in the event of over-driving. Soil samples were recovered where possible, and the recovery measured, photographed and documented accordingly.

If 50 blow counts failed to advance the tip 6=, the penetration blow count was recorded as 50, with the progression in inches recorded. The hole is then drilled to the next sampling depth, and sampling is continued.

The boring logs are included in Appendix C. These values represent the 8raw9 blow count values, before any correction factors are applied.

3.2 SUBSURFACE PROFILE

The subsurface was consistently dense to very dense. The average soil consistency observed was very dense.
B6 exhibited a less dense layer at approximately 20ft below ground surface. This layer is still medium dense, with an SPT of 34. Therefore, it is not considered to be a hazard.

3.3 GROUNDWATER

The depth of the water surface beneath ground elevation was measured at the time of testing. The salinity of the water was not tested. Only boreholes 2, 5 and 6 progressed deep enough to allow for measurement of the water table. The results can be seen on the boring logs in Appendix C.

Tides in the region occur semidiurnally, meaning 2 high tides and 2 low tides occur over a 24hour period. The tidal range is on the order of 3 ft on average. Other factors which may affect

water surface elevations are the effects of hurricanes or other severe weather events, including heavy rainfall and storm surge.

Angle of Internal Friction	***Unit Weight***	***Coefficient of Active Earth Pressure***	***Coefficient of Passive Earth Pressure***
(φ,°)	(lb/ft^3)	(k_a)	(k_p)
40	125	0.22	4.5

Table 1. Recommended Design Parameters

4 FOUNDATIONS

Evaluation of the subsurface conditions encountered during our subsurface investigation indicates that proposed single and multistorey structures could be supported on a shallow foundation system (i.e., strip footings or mat foundation) bearing on the predominantly Very Dense soil layer (<5ft below grade).

Shallow foundations could be designed with soil contact pressures on the order of 8,000 psf. Settlements on the order of 3/4 inch to 1 inch are estimated. Soil modifications are recommended in the areas where loose soils or organics are encountered within the first 5 feet. Soil modifications require removal of poor material and replacement with engineered fill as per Section 5.1.

If cavities are encountered during excavation, the conditions should be inspected by a qualified geotechnical or structural engineer. The remediation measures may include filling the cavity, or designing the structure to span the width of the cavity.

4.1 STRIP/SPREAD FOOTINGS

The following sections provide recommendations regarding footing geometry, bearing elevations and bearing capacities.

4.1.1 Scour depth

Due to elevation of the site, scour is not considered to be critical. The slight does slope to the north and in heavy rains the soil may be susceptible to erosion due to run-off. As such, the

3.4 RECOMMENDED DESIGN SOIL PARAMETERS

assumed scour depth is 19-6= below the existing grade. It is therefore recommended that the bottom of any footings be placed a minimum of 19-6= below grade.

4.1.2 Lateral Earth Pressures

Proposed finish floor elevations will dictate the lateral earth pressures acting on stem walls, and thus strip footings. The width of the footings will be largely dependent on the finish floor elevations, and transition to existing grade. Footings will need to be sized accordingly to resist overturning and sliding, using the soil parameters provided in Table 1.

4.1.3 Bearing Capacity

The bearing capacity for strip footings was calculated using the SPT values for the first sample at each borehole. Shallow foundations could be designed with soil contact pressures on the order of 8,000 psf. Settlements on the order of 3/4 inch to 1 inch are estimated.

4.1.4 Footing Geometry

The upper soil layers are Very Dense. Minimum footing depths should be 18= for continuous footings and isolated pad footings. Minimum footing widths for strip should be 24=. Minimum footing widths for isolated pad footings should be 24=.

5 EARTHWORK

5.1 FILL PLACEMENT AND COMPACTION

Based on the existing ground elevations and consistency, fill material will likely be required to backfill the foundation within the footprint of the proposed buildings.

Fill material should consist of inorganic granular soils free from deleterious materials and should be approved by our firm. Backfill should have a maximum particle size of 3 inches. Limestone fill material should be placed in lifts not thicker than 12 inches. Lifts should be moisture conditioned as required. Each lift should be compacted to field dry densities of not less than 95 percent of the material9s maximum dry density as determined by the Modified Proctor Compaction Test (ASTM D-1557).

The fill and backfill material must be placed under qualified engineering inspection and each lift must be tested to ensure conformance with the project specifications. In restricted areas where a small compactor must be used, the lift thickness should be reduced to 6 inches.

5.2 TRENCHES

Utility trenches should be located such that the bottom of the trench does not intersect a 1:1 slope projected downward from nearby footing bearing surfaces. Trench backfill should be compacted as described in Section 5.1.

5.3 STRIP/SPREAD FOOTINGS

Where strip/spread footings are to be constructed, the footing excavation should be evaluated by a qualified engineering inspection to confirm that recently placed fill materials have been compacted according to the project specifications and to evaluate variations in the natural subgrade materials.

This report is respectfully submitted by:

BRON Limited

Ken neth Scott,
Civi l Enginee r
kscott@bebron.com

6 APPENDIX A – STATEMENT OF LIMITATIONS

The attached Report (the <Report=) has been prepared by BRON Ltd. (<Consultant=) for the benefit of the client (<Client=) in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the <Agreement=). The information, data, recommendations and conclusions contained in the Report:

- are subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the <Limitations=)
- represent Consultant9s professional judgement in light of the Limitations and industry standards for the preparation of similar reports
- may be based on information provided to Consultant which has not been independently verified
- have not been updated since the date of issuance of the Report and their accuracy is limited to the time period and circumstances in which they were collected, processed, made or issued
- must be read as a whole and sections thereof should not be read out of such context
- were prepared for the specific purposes described in the Report and the Agreement
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time

Unless expressly stated to the contrary in the Report or the Agreement, Consultant:

- shall not be responsible for any events or circumstances that may have occurred since the date on which the Report was prepared or for any inaccuracies contained in information that was provided to Consultant
- agrees that the Report represents its professional judgement as described above for the specific purpose described in the Report and the Agreement, but Consultant makes no other representations with respect to the Report or any part thereof
- in the case of subsurface, environmental or geotechnical conditions, is not responsible for variability in such conditions geographically or over time

The Report is to be treated as confidential and may not be used or relied upon by third parties, except:

- as agreed, in writing, by Consultant and Client
- as required by law
- for use by governmental reviewing agencies

Any use of this Report is subject to this Statement of Qualifications and Limitations. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

This Statement of Limitations is attached to and forms part of the Report.

7 APPENDIX B – FIGURES

VICINITY MAP

SCALE: N.T.S.

BORING LOCATION PLAN

SCALE: N.T.S.

BRON
POSSIBILITIES UNLIMITED

#57 Raphia Close East
Airport Industrial Park
NASSAU, BAHAMAS
p 242-327-5348 f 242-327-4981

email. info@bebron.com
website.www.bebron.com

PROJECT NAME:
ATLANTIS FLAMINGO LAKES
PARADISE ISLAND
THE BAHAMAS

DRAWING NAME:
BORING LOCATION PLAN

DATE: 25-04-2021

FIGURE: 01

Project: **Atlantis Flamingo Lakes** Project Location: **Paradise Island, The Bahamas** Project Number: **2021.129**	Log of Boring B01 **Sheet 1 of 1**	**BRON Ltd** 57 Raphnia Close Airport Industrial Park Nassau, New Providence

Date(s) Drilled **Apr. 4th - Apr. 6th 2022**	Logged By **D. Major**	Checked By **B. Palacious**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4"**	Total Depth of Borehole **30 feet bgs**
Drill Rig Type **TMG Mini Rig**	Drilling Contractor **BRON**	Approximate Surface Elevation **15.5 ft**
Groundwater Level and Date Measured **N/A**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **Yes**	Location	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	N-Value	REMARKS AND OTHER TESTS	Material Type	Graphic Log	MATERIAL DESCRIPTION
15.5	0								
			B1_01	50/4	100				
10.5	5								
			B1_02	50/5	100				
5.5	10								
			B1_03	50/5	100	Borehole Terminated			
0.5	15								
-4.5	20								
-9.5	25								
-14.5	30								

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Project: **Atlantis Flamingo Lakes** Project Location: **Paradise Island, The Bahamas** Project Number: **2021.129**	Log of Boring B02 **Sheet 1 of 1**	**BRON Ltd** 57 Raphnia Close Airport Industrial Park Nassau, New Providence

Date(s) Drilled **May 13th 2022**	Logged By **D. Major**	Checked By **B. Palacious**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4"**	Total Depth of Borehole **30 feet bgs**
Drill Rig Type **TMG Mini Rig**	Drilling Contractor **BRON**	Approximate Surface Elevation **15.5 ft**
Groundwater Level and Date Measured **5ft**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **Yes**	Location	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	N-Value	REMARKS AND OTHER TESTS	Material Type	Graphic Log	MATERIAL DESCRIPTION
15.5	0								
10.5	5		B1_01	33 45 50	95		SW		Well graded sand with soil ∇
5.5	10		B1_02	20 45 50	95		SW-SM		Well graded sand with gravel
					100	Auger Refusal - Borehole Terminated			
0.5	15								
-4.5	20								
-9.5	25								
-14.5	30								

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Project: **Atlantis Flamingo Lakes** Project Location: **Paradise Island, The Bahamas** Project Number: **2021.129**	Log of Boring B03 **Sheet 1 of 1**	**BRON Ltd** 57 Raphnia Close Airport Industrial Park Nassau, New Providence

Date(s) Drilled **Apr. 4th - Apr. 6th 2022**	Logged By **D. Major**	Checked By **B. Palacious**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4"**	Total Depth of Borehole **30 feet bgs**
Drill Rig Type **TMG Mini Rig**	Drilling Contractor **BRON**	Approximate Surface Elevation **16 ft**
Groundwater Level and Date Measured **N/A**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **Yes**	Location	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	N-Value	REMARKS AND OTHER TESTS	Material Type	Graphic Log	MATERIAL DESCRIPTION
16	0								
11	5		B1_01	5 10 50/4	100				
6	10		B1_02	50/5	100	Auger refusal at 13ft - Borehole terminated			
1	15								
-4	20								
-9	25								
-14	30								

BRON Template.tpl

Project: **Atlantis Flamingo Lakes** Project Location: **Paradise Island, The Bahamas** Project Number: **2021.129**	Log of Boring B04 **Sheet 1 of 1**	**BRON Ltd** 57 Raphnia Close Airport Industrial Park Nassau, New Providence
Date(s) Drilled **Apr. 4th - Apr. 6th 2022**	Logged By **D. Major**	Checked By **B. Palacious**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4"**	Total Depth of Borehole **30 feet bgs**
Drill Rig Type **TMG Mini Rig**	Drilling Contractor **BRON**	Approximate Surface Elevation **17 ft**
Groundwater Level and Date Measured **N/A**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **Yes**	Location	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	N-Value	REMARKS AND OTHER TESTS	Material Type	Graphic Log	MATERIAL DESCRIPTION
17	0								
12	5		B1_01	21 50/1	100	Auger Refusal @ 7ft. Borehole terminated			
7	10								
2	15								
-3	20								
-8	25								
-13	30								

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Project: **Atlantis Flamingo Lakes** Project Location: **Paradise Island, The Bahamas** Project Number: **2021.129**	Log of Boring B05 **Sheet 1 of 1**	**BRON Ltd** 57 Raphnia Close Airport Industrial Park Nassau, New Providence

Date(s) Drilled **Apr. 4th - Apr. 6th 2022**	Logged By **D. Major**	Checked By **B. Palacious**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4"**	Total Depth of Borehole **30 feet bgs**
Drill Rig Type **TMG Mini Rig**	Drilling Contractor **BRON**	Approximate Surface Elevation **20 ft**
Groundwater Level and Date Measured **25 ft**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **Yes**	Location	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	N-Value	REMARKS AND OTHER TESTS	Material Type	Graphic Log	MATERIAL DESCRIPTION
20	0								
15	5		B5_01	24 28 50/3	78		SW-SM		Well graded sand and gravel, brown and beige, dry
10	10		B5_02	21 43 50	93		SW-SM		Well graded sand with gravel, beige and brown, dry
5	15		B6_03	50/4	100		SP-SM		Poorly graded sand with gravel, beige and brown, dry
0	20		B6_04	50/4	100		SW-SM		Poorly graded sand and gravel, beige, wet
-5	25		B6_05	50/3	100		SW-SM		Poorly graded sand and gravel, beige, wet
-10	30		B6_06	46 47 50/3	97	Borehole Completed	SW-SM		Poorly graded sand and gravel, beige, wet

Project: **Atlantis Flamingo Lakes** Project Location: **Paradise Island, The Bahamas** Project Number: **2021.129**	Log of Boring B06 **Sheet 1 of 1**	**BRON Ltd** 57 Raphnia Close Airport Industrial Park Nassau, New Providence
Date(s) Drilled **Apr. 4th - Apr. 6th 2022**	Logged By **D. Major**	Checked By **B. Palacious**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **4"**	Total Depth of Borehole **30 feet bgs**
Drill Rig Type **TMG Mini Rig**	Drilling Contractor **BRON**	Approximate Surface Elevation **23 ft**
Groundwater Level and Date Measured **20 ft**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **Yes**	Location	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	N-Value	REMARKS AND OTHER TESTS	Material Type	Graphic Log	MATERIAL DESCRIPTION
23	0								
18	5		B6_01	47 42 32	74		SW-SM		Well graded sand and gravel, brown and beige, dry
13	10		B6_02	20 50/4	100		SP-SM		Poorly graded sand with gravel, beige and brown, dry
8	15		B6_03	21 50/5	100		SP-SM		Poorly graded sand with gravel, beige and brown, dry
3	20		B6_04	13 17 17	34		SW-SM		Poorly graded sand and gravel, beige, wet
-2	25		B6_05	17 24 39	63		SW-SM		Poorly graded sand and gravel, beige, wet
-7	30		B6_06	15 17 42	59	Borehole Completed	SW-SM		Poorly graded sand and gravel, beige, wet

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Project: **Atlantis Flamingo Lakes** Project Location: **Paradise Island, The Bahamas** Project Number: **2021.129**	Key to Log of Boring **Sheet 1 of 1**	**BRON Ltd** 57 Raphnia Close Airport Industrial Park Nassau, New Providence

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	N-Value	REMARKS AND OTHER TESTS	Material Type	Graphic Log	MATERIAL DESCRIPTION
1	2	3	4	5	6	7	8	9	10

COLUMN DESCRIPTIONS

1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sample Number: Sample identification number.
5 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6 N-Value: Blow counts to progress 12"
7 REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.
8 Material Type: Type of material encountered.
9 Graphic Log: Graphic depiction of the subsurface material encountered.
10 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Poorly graded SAND with Silt (SP-SM)

Well graded SAND (SW)

Well graded SAND with Silt (SW-SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Bulk Sample

3-inch-OD California w/ brass rings

CME Sampler

Grab Sample

2-inch-OD unlined split spoon (SPT)

Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)

Water level (after waiting, AW)

Minor change in material properties within a stratum

Inferred/gradational contact between strata

Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

RON Template.tpl

Appendix – F: Spill Prevention and Response Plan

FLAMINGO LAKES, PARADISE ISLAND, NEW PROVIDENCE SPILL PREVENTION AND RESPONSE PLAN (SPRP)

Prepared for:

Date of Issue: July 2025

Prepared by: James Hunnicutt

1. Executive Summary

This Spill Prevention and Response Plan (SPRP) outlines the framework for minimizing the risk of pollutant discharges to Flamingo Lakes, a sensitive, closed-basin waterbody situated on Paradise Island.

The lake is surrounded by high-intensity land uses, including hospitality venues, utility infrastructure, and roadways that funnel stormwater directly into the lake. This SPRP addresses both preventive measures and emergency response protocols to manage accidental releases of hazardous substances that may adversely affect water quality, aquatic life, and the public image of Paradise Island as a premier international destination.

2. Environmental Context and Risk Profile

Flamingo Lakes is a shallow, semi-enclosed freshwater system located near the center of Paradise Island. It receives stormwater inflows from a 0.7 km† developed catchment area. The lake lacks natural outflows, making it especially vulnerable to nutrient accumulation, hydrocarbon pollution, and bacterial contamination. Surrounding facilities include resorts, a laundry plant, a gas station, wastewater treatment facilities, and desalination infrastructure, each presenting distinct spill risks, including hydrocarbons, cleaning chemicals, wastewater byproducts, and stormwater contaminants.

3. Regulatory Framework

This plan complies with The Bahamas9 Environmental Health Services Act, the Planning and Subdivision Act, BEST Commission Guidelines, MARPOL Annex V, and international best practices under the EPA SPCC rule and OPRC 1990 protocols.

4. Spill Prevention Strategy

Prevention measures include installation of hydrodynamic separators, grease interceptors, permeable pavement systems, bunded storage, and spill alarms. Operationally, chemical inventories, SOPs, and scheduled inspections reduce the likelihood of incidents. All sites must segregate incompatible materials and maintain clear access to emergency equipment.

5. Emergency Spill Response Protocol

Spills are addressed in five phases:

(1) Alert and Contain

(2) Stop the Source

(3) Assess Impact

(4) Remediate and Restore

(5) Report

The Flamingo Lakes Emergency Response Committee (FLERC), a combination of members of Paradise Island Utilities, PITDA Roads and Easements, and Atlantis Engineering, leads coordinated response, mobilizing facility teams and licensed contractors. Incident reports must be submitted to authorities within 2–24 hours, depending on severity.

6. Spill Response Equipment Requirements

All spill-prone sites must maintain absorbent booms and pads, drain covers, PPE, neutralizers, disposal drums, laminated SOPs, and a 24/7 emergency contact sheet. Equipment must be checked monthly and restocked after any use.

7. Training, Drills, and Competency Assessment

All personnel must receive bi-annual spill response training. Facilities must conduct annual full-scale joint simulations with FLERC. Post-spill reviews serve to identify improvements. Training logs are retained for 3 years.

8. Environmental Monitoring and Adaptive Management

Quarterly lake monitoring includes testing for nutrients, hydrocarbons, bacteria, and turbidity. Post-spill sampling is mandatory within 24 hours. This SPRP is reviewed annually and updated to reflect new infrastructure, operations, or lessons learned.

Lake Catchment & Infrastructure Map

Emergency Contact Directory

1. Daniel Bonello – daniel.bonello@atlantisparadise.com or (242) 376-7976
2. James Hunnicutt – James.hunnicutt@atlantisparadise.com or (242) 816-1044
3. Kevan Dean – kevan.dean@atlantisparadise.com or (242) 424-9728
4. Henry Thurston – henry.thurston@atlantisparadise.com or (242) 376-1858
5. Abigail Davis – abigail.davis@atlantisparadise.com or (242) 829-5412

Water Quality Testing Schedule & Protocols

Purpose:

To routinely monitor the physical, chemical, and biological condition of Flamingo Lakes and detect any changes due to spill events, runoff, or chronic pollution sources. The testing schedule supports early intervention and adaptive management.

E.1. Testing Locations:

Water sampling must be conducted at five fixed monitoring stations:

- Station FL-1: Western inlet near resort stormwater outfall
- Station FL-2: Northern shoreline near gas station
- Station FL-3: Southern basin adjacent to the wastewater treatment plant
- Station FL-4: Eastern margin near the laundry facility runoff channel
- Station FL-5: Mid-lake center (reference station)

E.2. Routine Monitoring Schedule:

Parameter Group	Parameter	Frequency	Notes
Physical Parameters	Temperature, pH, Dissolved Oxygen (DO), Turbidity	Quarterly (Jan, Apr, Jul, Oct)	In-situ testing using multiparameter probe
Nutrients	Nitrate, Ammonia, Phosphate	Quarterly	Lab-based analysis from preserved water samples
Biological Indicators	Total Coliforms, E. coli	Quarterly	Use IDEXX or membrane filtration method
Chemical Pollutants	Total Petroleum Hydrocarbons (TPH), Surfactants	Quarterly	Critical near gas station and laundry outfalls
Heavy Metals (screening)	Lead, Zinc, Copper	Semi-Annually (Apr, Oct)	Based on risk tier from nearby activities

Post-Spill Testing	All above parameters	Within 24–48 hrs of spill	Continue weekly for 4 weeks postincident

E.3. Laboratory & QA/QC Requirements:

- All samples must be analyzed by a DEPP-approved laboratory or ISO/IEC 17025-accredited lab. - Duplicate samples and blanks must be submitted with each sampling round (minimum 10% of total samples).
- Chain of Custody forms must be completed for all lab submissions.
- Field logs must include GPS location, weather, flow conditions, and observer name.

E.4. Reporting and Data Management:

- Monitoring reports must be submitted to the Paradise Island Environmental Protection Oversight Committee (PIEPOC) within 21 days of sampling.
- All data should be entered into the Flamingo Lakes Water Quality Database and visually summarized with trend graphs annually.

Spill Incident Report Template

This form must be completed and submitted to the Environmental Oversight Committee and relevant regulatory bodies within 24 hours of any reportable spill incident.

Date & Time of Incident	[To be completed]
Location (GPS or Landmark)	[To be completed]
Reporting Person (Name & Contact)	[To be completed]
Type of Material Spilled	[To be completed]
Estimated Quantity (Liters, Gal, Lbs or Kg)	[To be completed]
Cause of Spill	[To be completed]
Immediate Actions Taken	[To be completed]
Personnel Notified (Authorities, Emergency Teams)	[To be completed]
Environmental Impacts Observed (Water, Wildlife, Odors)	[To be completed]
Corrective and Preventive Actions Implemented	[To be completed]

Standard Checks and Reporting for High-Risk Facilities

This section outlines minimum requirements for facilities adjacent to Flamingo Lakes that handle chemicals, fuels, or wastewater.

Gas Station

- Daily inspection of fuel dispensers for leaks or damage
- Secondary containment for all fuel storage tanks
- Spill kits with hydrocarbon-absorbing pads accessible within 10 meters
- Staff trained in emergency shutoff and spill response

Laundry Facility

- Chemical storage in labeled, bunded containers
- Regular inspection of piping and dosing pumps
- Use of biodegradable detergents and dosing control systems
- Backflow prevention devices on required lines
- Reporting of any spills or events of stormwater system intrusion

Wastewater Treatment Plant

- Emergency bypass monitoring and alarm system
- Fencing and restricted access
- Monitoring and reporting of any of SSOs reaching the outfall drainage system

Water Quality Testing Schedule & Protocols

Purpose:
To routinely monitor the physical, chemical, and biological condition of Flamingo Lakes and detect any changes due to spill events, runoff, or chronic pollution sources. The testing schedule supports early intervention and adaptive management.

E.1. Testing Locations:
Water sampling must be conducted at five fixed monitoring stations:
- Station FL-1: Western inlet near resort stormwater outfall
- Station FL-2: Northern shoreline across from hotel
- Station FL-3: Eastern basin
- Station FL-4: Eastern outfall near the laundry facility runoff channel - Station FL-5: Mid-lake center

E.2. Routine Monitoring Schedule:

Parameter Group	Parameter	Frequency	Notes
Physical Parameters	Temperature, pH, Dissolved Oxygen (DO), Turbidity	Quarterly (Jan, Apr, Jul, Oct)	In-situ testing using multiparameter probe
Nutrients	Nitrate, Ammonia, Phosphate	Quarterly	Lab-based analysis from preserved water samples
Biological Indicators	Total Coliforms, E. coli	Quarterly	Use IDEXX or membrane filtration method
Chemical Pollutants	Total Petroleum Hydrocarbons (TPH), Surfactants	Quarterly	Critical near gas station and laundry outfalls
Heavy Metals (screening)	Lead, Zinc, Copper	Semi-Annually (Apr, Oct)	Based on risk tier from nearby activities
Post-Spill Testing	All above parameters	Within 24–48 hrs of spill	Continue weekly for 4 weeks postincident

E.3. Laboratory & QA/QC Requirements:
- All samples must be analyzed by a DEPP-approved laboratory or ISO/IEC 17025-accredited lab. - Duplicate samples and blanks must be submitted with each sampling round (minimum 10% of total samples).
- Chain of Custody forms must be completed for all lab submissions.
- Field logs must include GPS location, weather, flow conditions, and observer name.

Spill Response Equipment Inventory Checklist

Each high-risk site must maintain the following spill response equipment, checked monthly and restocked after any use.

Item	Required Quantity	Checked (Y/N) / Notes
Oil-Only Absorbent Pads	40	
Universal Spill Socks (1.2m)	10	
Drain Covers (Reusable Rubber)	2	
Emergency PPE Kits (Gloves, Goggles, Apron)	3	
Neutralizing Agent (for acids/alkalis)	5 kg	
Hazard Waste Disposal Bags	10	
Portable Warning Signs	2	
Copy of SPRP Laminated	1	

Appendix G: Stormwater Management Plan

Stormwater Management Plan

Project: Paradise Island School Development
Location: Paradise Island, Bahamas
Date: July 2025 Prepared for:

INTRODUCTION

The purpose of this Storm Water Management Plan is to provide a comprehensive approach to managing surface water runoff for the proposed School located on Paradise Island, Bahamas. The goals of this plan are:

- To protect the school campus and adjacent public infrastructure from flood-related damage - To preserve and enhance the natural environment, including stormwater pathways, existing vegetation, and infiltration zones
- To minimize erosion and sedimentation from site development
- To maintain or enhance water quality in Flamingo Lakes and adjacent areas
- To ensure sustainability of freshwater resources through use of rainwater harvesting and infiltration - To strive for a sustainable environment while pursuing economic development.

EXISTING SYSTEM

The project site is currently undeveloped coastal vegetation and dry broadleaf evergreen forest with moderate slopes. The area drains naturally via sheet flow and shallow vegetated depressions toward the northern and western boundaries of the site. Runoff from these areas eventually enters the surrounding stormwater system, flamingo lakes, or percolates into the sandy substrate. The pervious nature of the land allows for high infiltration rates, which may be disrupted once impervious surfaces (roofs, roads, walkways) are introduced.

A formal stormwater conveyance system is located along the southern boundary of the project site, Located in close proximity to. Paradise Island Drive and continues east along Lake View Road. This existing system is comprised of roadside catch basins and underground piping that collects and diverts runoff toward Flamingo Lakes. These legacy stormwater structures are critical to the drainage of the broader area and will be integrated into the updated site design for hydrological continuity and capacity control.

PROPOSED SYSTEM

a. **Overview**

The proposed storm water swale system must be designed to have minimal impact on the underground fresh water resources, through the careful implementation of sustainable drainage systems (SuDS) and stormwater management systems. The transformation of the undeveloped land to hardened surfaces increases the surface runoff from the transformed areas, which reduces the infiltration of surface water into the underground resources. All stormwater-related structures, pipes, and drains must be designed by the project engineer in consultation with the project Environmental Monitor for the project.

To achieve this, school development will include a system of:
- Graded internal roads and parking lots designed to divert water into catch basins and bio-retention swales
- Rooftop gutters and downspouts connected to rainwater harvesting tanks
- Subsurface stormwater pipe network discharging into two stormwater attenuation ponds located at the eastern and southern corners of the site
- Bioswales and rain gardens for runoff filtration and infiltration

b. **Erosion Control**

The design of the storm water system must make provision for erosion protection, as the transformed area, after construction has a greater surface run-off that will contribute to higher flows. It is therefore essential that the transformed areas must be vegetated and rehabilitated as soon as possible after the completion of bulk earthworks, roadworks and foundation work. Erosion control measures could be a combination of attenuation ponds, grass sods, stone pitching, silt traps, geofabrics, gabion baskets and mattresses, energy dissipaters and grass lined drains.

Erosion protection measures incorporated with the school design will include:
- Stabilization of exposed embankments with Bahama-native grasses and vegetation
- Gabion mattresses and energy dissipaters at stormwater pipe outfalls
- Silt fences and hay bales at storm drain inlets during construction
- Grass-lined drains and riprap to slow runoff velocity
- Landscaping of open areas immediately after grading

SURFACE RUNOFF

Run-off from roofs should be collected in gutters and stored in rainwater tanks for the utilization of gardening and other domestic activities. Any overflow from the tanks or gutters will be dispersed into swales and thereafter directed and collected into attenuation ponds. Surface run-off from roads, parking areas and other hardened areas will be collected in kerb and channels along the roads and diverted into the two strategically positioned stormwater attenuation ponds. The stormwater system must be kept separate from the sewage system and any contamination of surface runoff must be avoided.

INTERNAL ROADS AND PARKING AREAS

A site development plan has been produced by the architect and environmentalist, showing the various residential sites and road reserves in relation to the land development area. The hardened surface areas from the roads, house roofs and other buildings are the main contributing factors in the increased runoff within the development. Where possible, grass blocks and rain gardens should be introduced along roads and in parking areas to promote infiltration of storm water run-off. The geometric design of the internal road network will include crossfalls that direct the run-off along kerbs into grid inlets and catchpits. Once collected, stormwater will be conveyed through underground concrete pipes, with an outlet into the respective stormwater drainage system. Methods of dissipating the kinetic energy of runoff and silt collection will be incorporated into the design of stormwater infrastructure serving the road network.

Internal roads and parking lots will include:
- 3–5% crossfall directing runoff into side drains and catchpits
- Permeable pavers and grasscrete in low-traffic areas
- Rain gardens along walkways where possible
- Underground drainage lines sized for 10-year return interval storm events
- Grid inlets with debris screens and outlet headwalls into detention ponds

STORMWATER MANAGEMENT

The proposed storm water management system has been designed to be self-regulating with no external control. It will aim to collect run-off into rainwater harvesting tank, swales, underground pipes with an attenuation pond to attenuate and manage the increase in flow between the pre and post development stages from the transformed areas.

STORMWATER MANAGEMENT OBJECTIVES

- Minimize flooding risk through strategic runoff collection
- Retain stormwater onsite as much as possible through infiltration and detention
- Maintain or reduce post-development runoff compared to pre-development
- Improve water quality before discharge
- Prevent damage to Flamingo Lakes, groundwater lens, and downstream marine ecosystems

STORMWATER RUNOFF ASSUMPTIONS

- Impervious coverage (roof + road + parking): approx. 45% of the total 2-acre site - Runoff Coefficients:
- Rooftops: 0.90
- Paved roads: 0.85
- Landscaped/open space: 0.20
- Storm event design: 10-year and 25-year 1-hour rainfall intensity based on Bahamas Met Office data
- All runoff directed toward 2 main attenuation ponds, sized for controlled outflow

STORMWATER FLOW ATTENUATION

The need for attenuation of the storm water flow is recognized in order to minimize the peak flow across the property and from each of the buildings, hardened parking areas and roads before its eventual discharge. The distribution of the increase flow is of importance to ensure that any downstream facility is not negatively affected.

- Attenuation ponds will reduce peak discharge through:
- Temporary stormwater detention
- Overflow spillways with erosion protection
- Vegetated berms and stone-lined inlets
- Designed to reduce post-development peak flow rates to levels at or below pre-development conditions
- Outlet controls (orifices and weirs) sized to prevent flooding downstream

MONITORING AND MAINTENANCE

The storm water system must be monitored during construction at regular intervals by the Environmental monitor. It is also critically important that the site is fenced off prior to construction, to ensure that the area outside the site development area remains in its natural condition during the construction process.

a. Construction Monitoring
- Weekly inspections by the Environmental Monitor during earthworks - Silt screens, temporary berms, and cut-off drains to control sediment
- Dust control with water trucks or biodegradable dust suppressants
- Immediate vegetation of embankments after grading

b. Post-Construction Maintenance
- Biannual inspection of all drainage elements (pipes, catchpits, ponds)
- Routine removal of sediment and debris from ponds, traps, and channels
- Grass cutting on embankments at least 6 times per year
- Professional inspections every 3 years for structural review of pipes and basins

RECOMMENDATIONS

The following recommendations will be followed in both construction and post construction phases.

- Maintain separation between stormwater and sewage systems
- Store hazardous materials (e.g., fuels, paint, cement) in covered and bunded zones - Implement best practices during all construction phases including:
- Use of silt traps and sediment basins
- Topsoil conservation
- Rapid revegetation of disturbed areas
- Dust suppression and traffic minimization in buffer areas
- Ensure all exposed surfaces are vegetated or stabilized post-construction
- Final inspection and approval required by DEPP before site handover

Appendix – H: Curriculum Vitae for Environmental Consultants Environmental Consultant – 1.

CV - STATEMENT OF QUALIFICATIONS

Name: **Craig Christopher Russell**
B.Sc. (Hons), MRRP, MBSE, CIPM, FAAPM, FIMMM

Date of Birth: 24th April 1964

PRESENT EMPLOYMENT

2022 to present

Title: Managing Principal and Lead Environmental Consultant – Russell Craig and Associates Ltd (RCA)

- Business development
- Staff recruitment and training
- Delivery of client services
    - Environmental policy and legislation review
    - Environmental Impact Assessment
    - Environmental Baseline Assessment
    - Environmental Management Plan
    - Environmental Monitoring
    - Benthic and Bathymetric Surveys
    - Project Management, Advisory & Facilitation
    - Natural Resource Planning and Assessment
    - Forest Management and Inventory
    - Urban and Regional Planning
    - Land Use Planning
    - Trees Assessment and Valuations/Appraisals
    - Land Survey and GIS Mapping

EDUCATION:

1994-1995	University of Otago, Dunedin, New Zealand **Professional Master's degree in Regional and Resource Planning (MRRP.)**
1989-1992	Bangor University, (formerly University of Wales at Bangor), North Wales, United Kingdom. **B.Sc. (Hons.) Forestry and Wood Science**
1986-1988	Cyprus Forestry College, Republic of Cyprus **Diploma & Certificate in Forestry**

LECTURESHIPS, MEMBERSHIP AND ASSOCIATIONS

Past Adjunct Professor in Geography (100 level), Plant Biology (200 level), Comparative Geography of Small Island States (200 level), Environmental Impact Studies (EIA) (400 level) – (School of Environment and Life Sciences), University of the Bahamas (UB).
Past Council Member - Bahamas National Trust.
Past Board Member – Bahamas Public Park and Public Beaches Authority.
Past President (2005/06) – Rotary Club of New Providence – The Commonwealth of the Bahamas.

Paul Harris Fellow – Rotary International.
Member, Bahamas Society of Engineers (MBSE)
FELLOW Member: (FIMMM) – Institute of Materials, Mining and Minerals, UK
Certified International Project Management (CIPM)
Fellow, American Association of Project Management (FAAPM).

ONGOING CONSULTANCIES

- Land Use Planning Consultancy - GEF Pine Island Project, Department of Environmental Planning and Protection (DEPP), Ministry of the Environment and Natural Resources (2023 – present).

- Local Environmental Consultant Liaison for the Environmental Defense Fund (EDF) US based NGO in the Bahamas (2023 – present)

- Environmental Consultant – Cat Island Water and Road Improvement Project, Water and Sewerage Corporation (WSC - CDB), Cat ISLAND Development Company (CIDC Contractors).

Previous Employment History:

2010 – 2022 - **Director of Forestry** – Ministry of the Environment and Natural Resources

- Director and administrative head of the Forestry Unit.
- Provide technical advice to the Minister and Permanent Secretary on Forestry and Environmental matters.

2009 – 2010 - **Deputy Permanent Secretary** – Ministry of the Environment

- Assist the Minister of State for the Environment with portfolio responsibilities (i.e., policy matters relating to the management of Bahamas Electricity Corporation and Water and Sewerage Corporation)

2003 – 2009 - **Chief Housing Officer** – Department of Housing (Ministry of Housing and National Insurance).

- Administrative Head of the Department of Housing, managing the Government's affordable housing program.

1982 – 2003 **Trainee Surveyor, Assistant Forest Officer, Forest Officer, Senior Forest Officer** - Department of Lands and Surveys, Office of the Prime Minister

PUBLICATIONS, ARTICLES AND DISSERTATIONS

- Russell, Christopher. The Conservation of Biodiversity in the Natural Pine Forest of the Bahamas. *El Pitre – Journal of the Caribbean Ornithology Society*. 1993.
- Russell, Christopher. *Country Report on Forest Policy in the Bahamas.* Consultancy Report, GCP/RLA/132/EC TF No. 64335, FAO, Rome, Italy. 1997.
- Russell, Christopher. The Future of Forestry in the Bahamas. *Bahamas Journal of Science.* Volume 5, Number 3. June 1998.
- Russell, Christopher. *Forestry Policies in the Caribbean, Volume – 1: Proceedings of the Expert Consultation.* Contributing Consultant. FAO, Rome, Italy. 1998.
- Russell, Christopher. *Forestry Policies in the Caribbean – Volume – 2: Reports of 28 selected Countries and Territories.* Contributing Consultant. FAO, Rome, Italy. 1998.
- Russell, Christopher. *Bahamas Country Report: Forestry Outlook Study for the Caribbean.* FAO, Rome, Italy. 30pp. 2000.
- Russell, Christopher. *Bahamas Country Report: The use of Forest for Ecotourism.* Caribbean Regional Workshop on Forest for Ecotourism, FAO, Castries, St. Lucia, May 2003.
- Russell, Christopher. *Position Paper on Forestry Development in the Commonwealth of the Bahamas.* Department of Lands and Surveys, Office of the Prime Minister. Nassau Bahamas. 2007
- Russell, Christopher. *The Status of Forestry Development in the Commonwealth of the Bahamas.* TNC Pine Rockland Conference: "Rockland Forest in a Changing World", Miami, Florida and Andros Island, Bahamas, February 2008.
- Russell, Christopher, et. al. 2010. *Report on the production of the First Order Existing Land Use and Zoning Maps for the Island of New Providence,* Bahamas. Ministry of the Environment, Nassau Bahamas, 2010.
- Russell, Christopher; Miller, Ingeria; Daniels, Mark. *Cost Benefit Analysis of Casuarina Species Management at Governors Harbour, Eleuthera Island, Bahamas: A Case Study.* Proceedings from MTISAIC Conference. Policies Strategies and Best Practices for Managing Invasive Alien Species (IAS) in the Insular Caribbean, Trinidad and Tobago, 2014.
- Russell, Christopher; Miller, Ingeria. *Post Hurricane Dorian impact on the pine forest resources of Abaco and Grand Bahama Islands: A Rapid Resource Assessment Report.* Forestry Unit, Ministry of the Environment and Housing, Nassau, Bahamas. 2019.

- Russell, Christopher. *The Impact of Hurricane Dorian on the pine forest ecosystem on Abaco and Grand Bahama Islands.* TNC Pine Rockland Working Group Virtual Conference, Miami, Florida, USA, 2020.

- Russell, Christopher; Curry, Andrew; Rodgers, Terrance. *Environmental Baseline Study (EBS) for the Carmichael Village Subdivision,* Carmichael Road, Nassau Bahamas. Department of Housing, Ministry of the Environment and Housing. 2021

- Russell, Christopher; *Environmental Management Plan (EMP) for the Carmichael Village Subdivision,* Carmichael Road, Nassau Bahamas. Department of Housing, Ministry of Transport and Housing. 2022

- Russell, Christopher*; Environmental Baseline Assessment (EBA) for Proposed Paradise Island School Project,* Paradise Island. Atlantis Resort. Nassau Bahamas. 2022.

- Russell, Christopher. *Environmental Impact Assessment (EIA), Ki'ama Bahamas Project,* Elizabeth Island, Gt. Exuma Island. EcoIsland Elizabeth Ltd. 2022

- Russell, Christopher. *Environmental Management Plan (EMP). Ki'ama Bahamas Project,* Elizabeth Island, Gt. Exuma Island. EcoIsland Elizabeth Ltd, 2023

- Russell, Christopher. *Environmental Impact Assessment (EIA) for Goldwynn Penthouses – II Project,* Cable Beach, Nassau Bahamas. 2024.

- Russell, Christopher. *Environmental Management Plan (EMP) for Goldwyn Penthouses – II* Project, Cable Beach, Nassau Bahamas. 2024.

- Russell, Christopher. *Environmental Management Plan (EMP) RUBIS Fuel Tank Installation,* LPIA, Nassau Bahamas. 2024.

- Russell, Christopher, *Environmental Management Plan (EMP) RUBIS Big Game Fuel Station,* Bailey Town, Bimini, Bahamas. 2024

- Russell, Christopher. *Environmental Baseline Assessment (EBA) Pine Crest II Subdivision,* Department of Housing, Ministry of Housing and Urban Renewal. Nassau Bahamas. 2024

- Russell, Christopher. *Environmental Management Plan (EMP). RUBIS Fuel Station,* Mackey & Madeira Streets, Nassau Bahamas, 2024

ENVIRONMENTAL CONSULTANT – 2.

JOHN A. BOWLEG, PE C.Eng, C.Env, C.Sci (Hydrology)

Chartered Water and Environmental Manager

M.ASCE, M.BSE, M.CIWEM

#7 Wild Tamarind Drive, 8BlueCloud9 Camperdown, 855 W. Commercial Blvd, #103

PO Box EE-17345, Nassau, The Bahamas|Fort Lauderdale, Florida 33309 Mobile

#9s: (242) 557-2775 Email: JBowleg@AEESconsultants.com

EXPERIENCE:

6/05 – Present **CONSULTING PROFESSIONAL CIVIL-ENVIRONMENTAL ENGINEER | HYDROLOGIST | ANALYST**

ADARIE Engineering & Environmental Services [AEES] | AEES Consulting Group, LLC {Since Sept-2021}

Fort Lauderdale, Florida USA | Atlanta, Georgia USA.

Project management for civil engineering works, environmental monitoring, hydrological design, reverse osmosis, renewable energy, waste, and wetland projects. Construction site inspections, prepare final reports, and expert witness in defense of environmental matters. Independent environmental laboratory data review for clients. International project works for land development, water & natural resources management, climate change | disaster risk reduction & mitigation mechanisms, and the scaling of resilient water-energy technologies. Ocean Thermal Energy Conversion (OTEC) research | development.

- ***American Institute of Hydrology [AIH] – Member***
- ***American Society of Civil Engineers [ASCE] | Environmental & Water Resources Institute [EWRI] – Member***
- ***Greenhouse Gas Management Institute [GHGMI] Inventory Courses (2022)***
- ***Ocean Thermal Energy Association [OTEA] – Member (2020 – Present)***
- ***United Nations [UN] Department of Safety and Security [BSAFE] Certification (2021 - Present)***
- ***UN Food & Agricultural Organization [FAO] Forest & Water Nexus – Intro (21Nov2021)***
- ***UN Development Programme [UNDP] | UN Environment Programme [UNEP] Consultancies (2021 -Present)***
- ***UNESCO-IHP, EcoHydrology Working Group for Latin America & Caribbean – Head (2021 - Present)***
- ***UNESCO-IHP Latin America & Caribbean (LAC) – Consultant (2020 – Present)***
- ***World Meteorological Organization [WMO] – Hydrological Advisor for the Bahamas (2004 – Present)***

7/99 – Present **WATER RESOURCES CONSULTANT | SR. HYDROLOGIST [Groundwater Management | WaSH].**

{2021/2022 Pre- **Water & Sewerage Corp. [W&SC] – Water Resources Management Unit [WRMU]. Nassau, The Bahamas.**

Retire Leave} Water & Environmental Manager with responsibility for the assessment & monitoring of the groundwater resources, thru the Engineering & Planning Department of WSC. Provide guidance on the development / management of the groundwater resources & coastal zone. Involved in matters concerning groundwater abstraction, reverse osmosis processes, wastewater effluent disposal, and Water Sanitation & Hygiene [WaSH]. In accordance with a key international environmental convention, served as Chairman of the National Wetlands Committee [Ramsar Convention] to implement the countries goals/policy regarding wetlands. Additional international duties for water | hydrology | environment are:

- ***Global Water Partnership – Caribbean [GWP-C], Bahamas Water Resources Representative (2000 – 2021)***
- ***International Water Association [IWA] Specialist Group – Caribbean Representative (2013 – Present)***
- ***Ramsar Convention on Wetlands – Caribbean Representative (2003 – 2008), Vice-Chairman of Standing Committee (2005– 2008), & Member of the Management Working Group (2009 – 2012)***
- ***UNESCO-IHP, Hydrological Representative for the Bahamas | Caribbean (Aug 2007 – Present)***
- ***Water Resources Government Representative to the Organization of American States [OAS] (2002 – Present), & Inter-American Water Resources Network [IWRN] Board Member (2009 - 2012)***

4/99 – 7/99 **CONTRACT CIVIL | ENVIRONMENTAL ENGINEER. George V. Cox & Co. Nassau, NP, The Bahamas.**

<u>Family Island Infrastructure Study - Great Exuma, Little Exuma | Exuma Cays, & Cat Island, The Bahamas</u>.

Collection of data for the physical condition of government facilities. Project site data integrated into a Global Information Systems (GIS) Project. Facilities consist of Docks, Airports, Buildings, Bridges, Roads, and Utilities. Hazardous substances and potential environmental impacts also identified.

6/98 – 3/99 **PROJECT ENGINEER | CONSTRUCTION MANAGER. Willmer Engineering, Inc. Atlanta, Georgia, USA.**

Project management of landfill closure, asphalt testing at airports, and asbestos surveys | abatement monitoring. Construction Quality Control | Assurance (CQC | CQA) services for the testing & inspection of fill density | compaction, asphalt & concrete pavements, building footings, and structures. Conduct construction site inspections, and prepare final CQA Certification Reports for landfill projects.

9/97 – 6/98 **CONTRACT CIVIL | DESIGN ENGINEER. EMCON Environmental Services. Duluth, Georgia, USA.**

Designs of solid waste landfills & transfer facilities, site development, and hydrological analysis. Environmental Phase I & II Surveys, Corrective Acton Plan (CAP) analysis, site closure, and remediation for Environmental Projects. CQA, site inspections, and CQC for landfill projects.

8/96 – 9/97 **CIVIL ENGINEER | TECHNICAL SPECIALIST. GZA GeoEnvironmental, Inc. Gwinnett, Georgia, USA.**

Solid waste landfill | transfer facility design, site development, drainage studies, & environmental site assessments. Engineering | hydrological design calculations using AutoCAD, and EaglePoint Software.

12/93 – 7/96 **ENVIRONMENTAL ANALYST. Analytical Services Inc. [ASI]. Norcross, Georgia, USA.**

Extraction methodologies | organic analysis for analytical methods following the US Environmental Protection Agency (EPA) Solid Waste Regulations (SW846). Performed the review and report of clientele results for sample extracts following EPA-8270, 625, 525 methods | regulatory guidelines, including all required QA/QC Protocols for US Army Corp Of Engineers Project Sites. [ASI - Norcross, GA Environmental | Lab is presently PACE Analytical]

PUBLICATIONS | RESEARCH:

Frontiers | Frontiers in Water Publication, Community Case Study, Intervention and solutions for water supply on small islands: The case of New Providence, The Bahamas (Welch | Bowleg, 2022), DOI: 10.3389/frwa.2022.983167

Climate Change, Water Resources, & Renewable Energy in The Bahamas, 2022, DOI: 10.13140/RG.2.2.22283.98084

Water-Energy Nexus: Case Study on Climate Change and Water Resources, in The Bahamas. {Use of the reverse geothermal conditions, towards adaptation measures - OTEC | SDC/SWAC | SWRO} – September 2017 | December 2020 | Ongoing Research Activities (Bowleg, 2017, DOI: 10.13140/RG.2.2.28981.91369)

Water Resources - Challenges for Groundwater Management & Climate Change in the Caribbean | Commonwealth of The Bahamas, North Andros and Grand Bahama Storm Surge Data (UNESCO International Science School - Havana Cuba, Bowleg, 2018, DOI: 10.13140/RG.2.2.22690.45765)

UNESCO Ecohydrology, Ecosystem Change & Management Response on Tropical Island Systems: Case Study of Great Exuma linking Land Use Change, Coastal Wetlands and Marine Fisheries (Exuma Bahamas, Sealey | Bowleg, 2015)

UNESCO Graphic Publication (CRC Press), Climate Change Effects on Groundwater – Chapter 5, Effects of storm surges on groundwater resources, North Andros Island, Bahamas (Bowleg | Allen, 2011)

UNEP 1st Expert Workshop on Vulnerability of Coastal Aquifers in the Insular Caribbean, Impact to North Andros Water Resources, due to storm surge – presentation of data, following Hurricane Frances (Havana City Cuba, Bowleg, 2004)

Mobil Oil Corporation, 8Biological Activated Carbon for Removal of Gasoline Contaminants in Groundwater9, Determination of Isotherm(s) associated with the Competitive Adsorption of Benzene, Toluene,
Ethylbenzene, & O-Xylene using Calgon Filtrasorb-400 Granular Activated Carbon (Howard University School of Engineering, Washington DC, 1993)

PROFESSIONAL REGISTRATIONS | AFFILIATIONS:

American Society of Civil Engineers [ASCE], Member (#296012)
Bahamas Professional Engineers Board [PEB] Registration for Civil & Environmental (#10129)
The Bahamas Society of Engineers [BSE], Member (#0131)
The Chartered Institution of Water and Environmental Management [CIWEM], Member (#27901)
UK Chartered Engineer (C. Eng.) Register – (Registration #542642)
UK Chartered Environmentalist (C.Env.) Register – (Registration #3505)
UK Chartered Scientist (C.Sci.) Register – (Registration #WEM/105/000293)

EDUCATION:

IHE DELFT INSTITUTE FOR WATER EDUCATION | Groundwater Hydrology Studies | Certificate – Short Course [2015]

UNV. OF COLORADO BOULDER – UCAR Comet | Hydrometeorology Analysis | Certificate – International Course [2008]

MASHAV – SHEFAYIM, ISRAEL – CINADCO | Water Resources Management | Certificate – International Course [2000]

HOWARD UNV. | Mobil Oil Removal of Gasoline Contaminants in Groundwater | SeniorGraduate Research [1993]

HOWARD UNIVERSITY | School of Civil / Environmental Engineering | Bachelor of Science (BSc) [1988 – 1993]