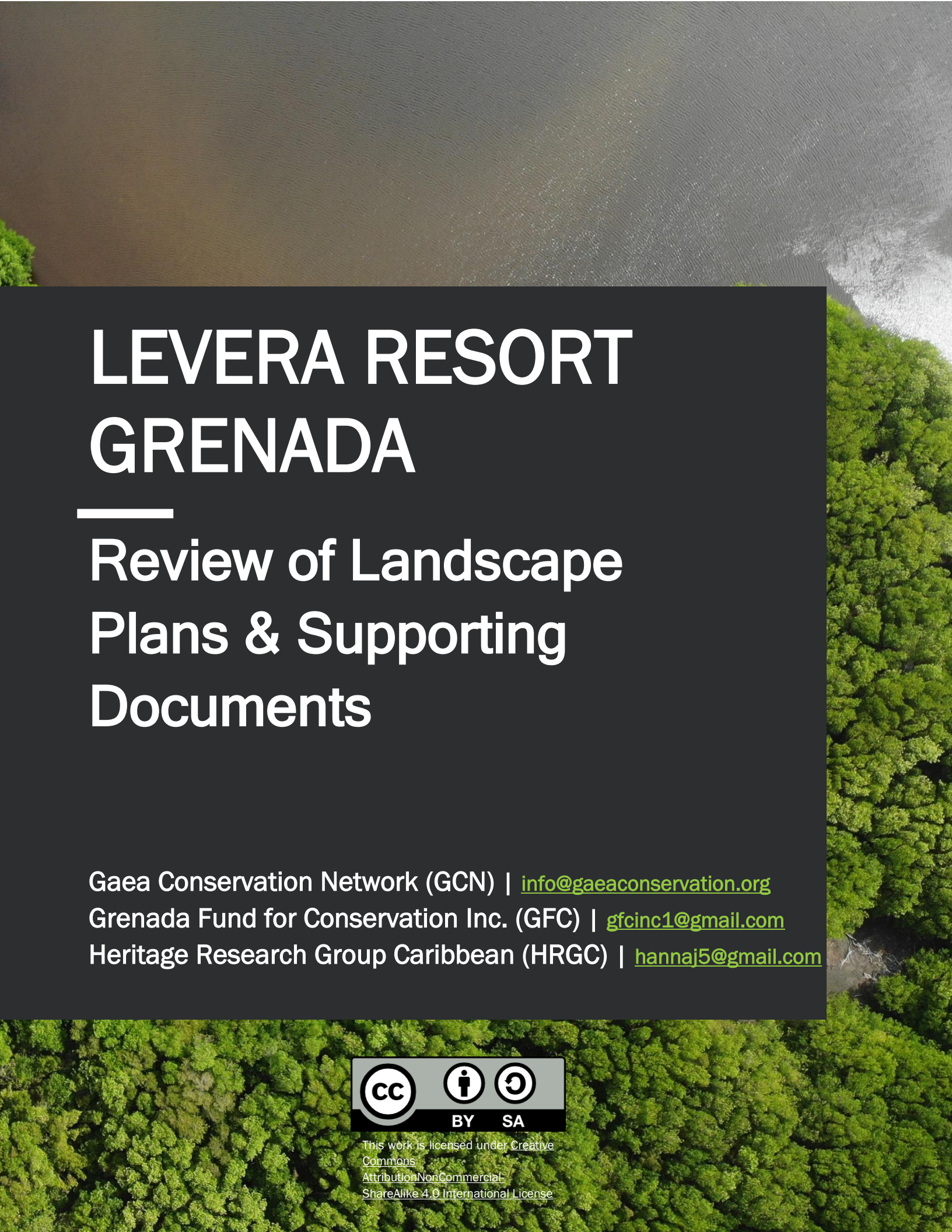

LEVERA RESORT GRENADA

Review of Landscape Plans & Supporting Documents

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Background

Gaea Conservation Network (GCN) has reviewed the development plans for the Levera Resort. Included in this review are comments from the Grenada Fund for Conservation Inc. (GFC), who has led mangrove restoration efforts in Grenada over the past 10 years, and the Heritage Research Group Caribbean (HRGC), a Grenada-based heritage consultancy that specializes in the archaeological, historical, and legal aspects of cultural resources management. Under an Environment and Climate Change Canada-funded project, GCN has surveyed the Ramsar-designated wetland over the past year. The Levera wetland was selected as a baseline site for the following reasons: 1) it is a wetland of local and international importance; 2) it supports a large number of wetland-dependent birds; 3) visual surveys suggested that the stands of mangrove forests were, on average, more mature than the other wetlands surveyed on island during our pilot surveys; 4) it is one of the largest wetlands available. Our plan is to use these baseline data to help inform a new draft of Grenada's mangrove restoration protocol, in collaboration with the Grenada Fund for Conservation.

Biological Data

Our concerns and recommendations are informed by our baseline data, which commenced November 2019. In brief, we collected data on: 1) birds, 2) wetland vegetation, 3) stable isotopes - what are the water sources used by each species; 4) water chemistry, 5) sediment conditions, and 6) predator occurrences (Figure 1).

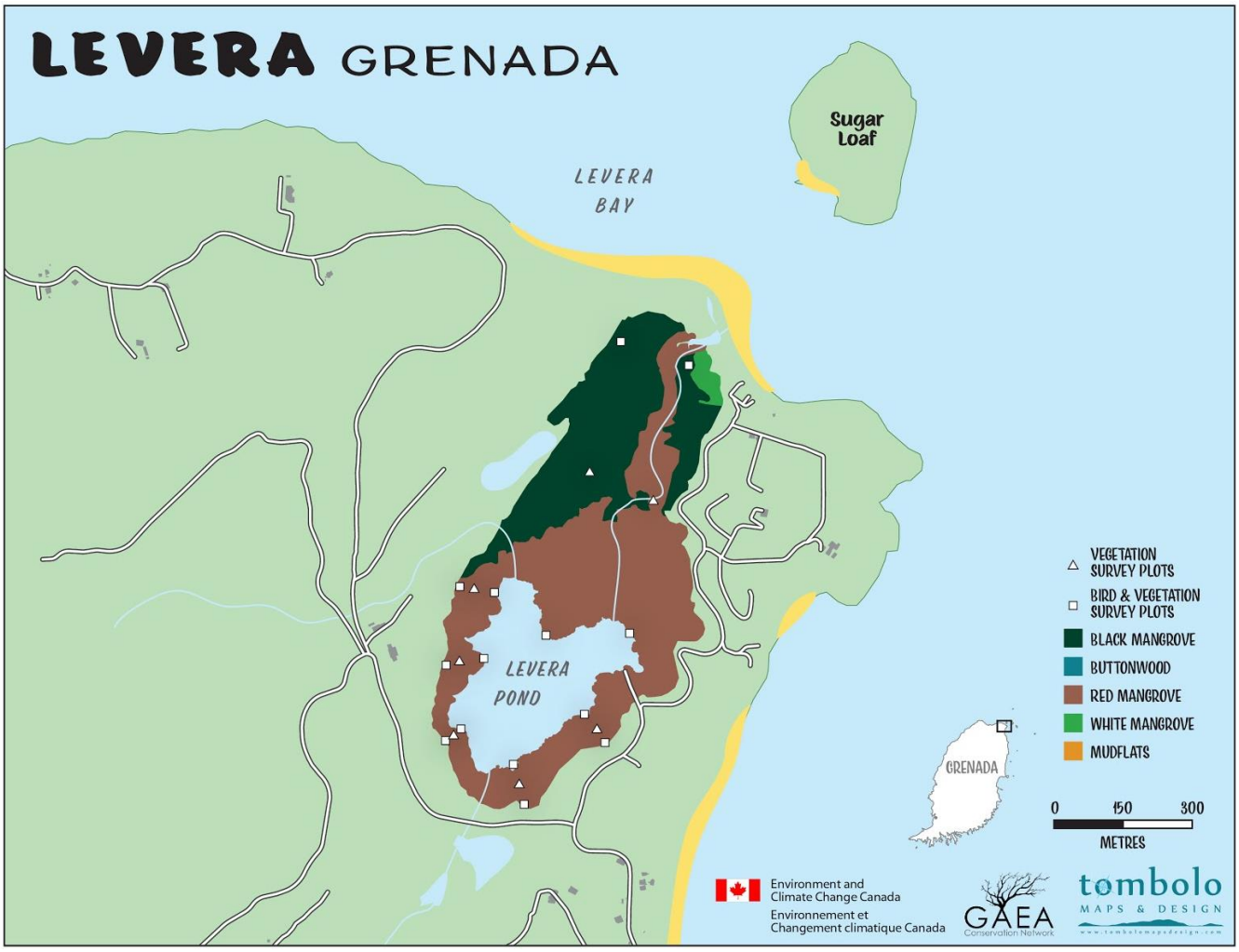

Figure 1 - Extent of mangrove assemblages based on GCN surveys in 2020, and the location of bird and vegetation survey plots.

Our data suggests that the Levera wetland supports an older-growth mangrove forest, when compared to the other wetlands we surveyed (i.e., Mt Hartman, Westerhall, Conference). On average, the mangrove vegetation was taller, had wider canopy widths, and trees had a larger diameter at breast height. For birds, we observed a large proportion of waterfowl (e.g., Pied-billed Grebes) and high diversity of wetland associate species (e.g., Spotted Sandpipers) and terrestrial birds (e.g., Grenada Flycatchers). We recommend the consultants take a close review of eBird, for a comprehensive view of the bird community in Levera over the past 15 years. For predators, we observed higher occurrences of mongoose and rats, when compared to our other baseline sites. Though our stable isotopes

analysis is still pending, the low salinity of water inputs at the pond (~19 parts per million based on our surveys) suggests that it likely is fed by groundwater, surface run-off, and precipitation.

Coastal Processes

A recent island-wide coastal vulnerability assessment using the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) model indicates that offshore wave exposure and surge potential values are high in the Levera Bay area. Considering the geomorphology and relief of the surrounding areas, the results indicate that the area is vulnerable to storm surge, coastal inundation, and future sea level rise scenarios. The model generates a habitat exposure ranking, which calculates the buffering effect of coastal ecosystems to these hazards, including coastal forest, mangroves, seagrass beds, coral reefs, and sand dunes. Habitat maps show the extent of these ecosystems in the Levera Bay, including extensive seagrass, forest and coral coverage.

The model simulates the resulting exposure levels if these protective ecosystems are removed. The results of this simulation show that the entire Levera beach moves from a medium exposure level to a high exposure level if these habitats are not present. This could indicate higher levels of erosion and increased overtopping and flooding of the nearshore coastal areas (Joseph-Witzig, 2019; Figure 2). For more information on this model, please review Joseph-Witzig (2019).

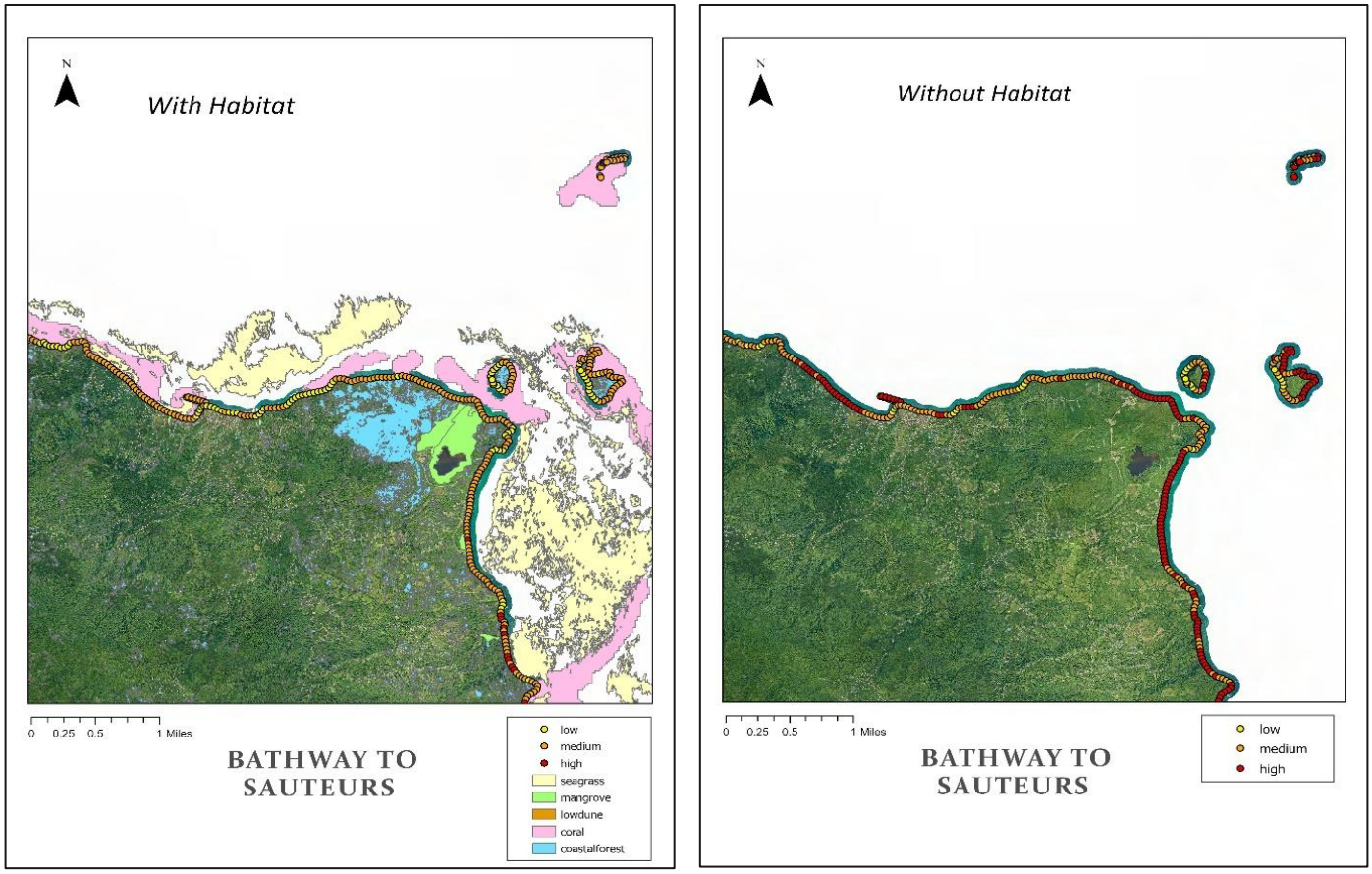

Figure 2 – Change in exposure in the greater Levera area with and without marine and costal ecosystems. As shown, the area is more vulnerable to erosion, if habitat is removed (Joseph-Witzig, 2019).

Archaeological Data

Surveys from the HRGC suggest that there are archaeological sites of interest in Levera (Figure 3). They report that much of the artifacts were removed under past Levera development when lands were graded to accommodate construction of the golf course and eco-resort. Remaining, however, are artifacts within and around areas northwest of the Ramsar wetland. Below, is a summary of what is known in Levera [see Hanna (2017), for more details]:

- A large pre-Columbian site was noted by an archaeologist in 1981, but no work was done; a bag in the National Museum from a survey in 1993 indicates a few sherds were found in the area (exact location unknown) (Hanna, 2017). Local artist Doliver Morain collected several boxes of

Amerindian ceramics from what was most likely the main concentration – an area that was later cleared by the golf course development in 2007; its destruction was confirmed in 2020. The ceramic types from Doliver's collection suggest an occupation by at least AD 750, and historic records suggest the site remained occupied at the time of French settlement in 1649.

- Several Amerindian sherds have also been recovered further back in the mangroves just north of the pond, suggesting some component of the ancient village may remain.
- A French-era pottery works is indicated on historic maps, but its location (just north of the area currently cleared for the Phase I stage) suggests it was likely demolished during the first development of the area in 2007.
- It is unknown what remains of the Great House just northwest of the pond (occupied from the early 18th century through the 1960s), but a still functional well in the area may have been associated with the residence (although more recently used for watering cattle).

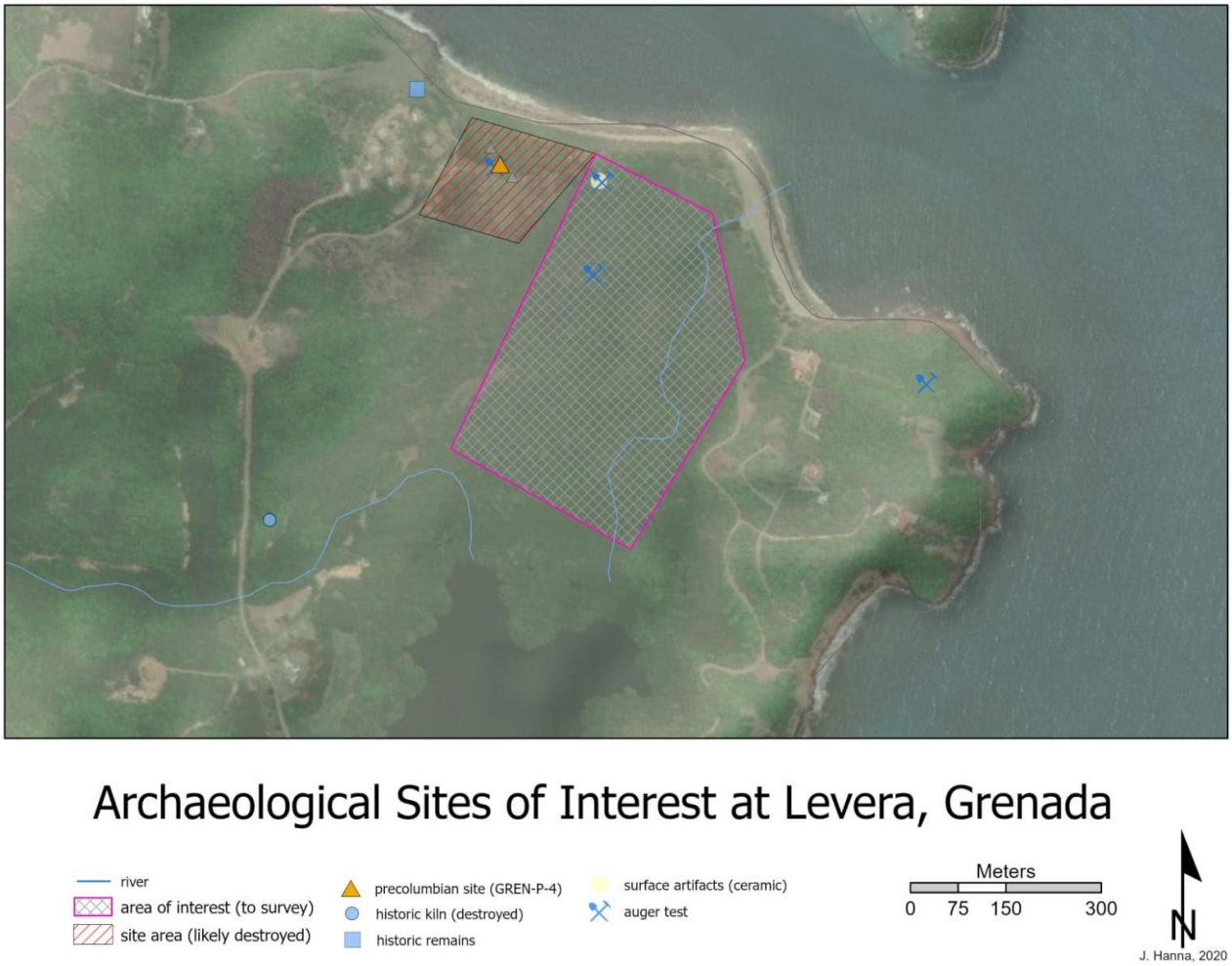

Figure 3 - HRGC survey of Levera in August 2020, which revealed areas of archaeological interest. The areas of interest are recommended for further interrogation and should not be cleared.

Concerns

Below, we highlight the issues arising from our review of the development plans. Again, these are guided by our knowledge of the system and best practices in protecting these important ecosystems.

- There is no buffer (i.e., large expanse of natural vegetation) between the wetland and the development. A major implication for the absence of the buffer is that much of the surface run-off directed towards the wetland is not filtered. Consequently, as highlighted by work in other regions, this wetland will likely see increases in sedimentation and nutrient loading (McElfish, Kihslinger, & Nichols, 2008; Welsch, 1991), and lowered bird and fish diversity (Bavins, Couchman, & Beumer, 2000; Smith & Chow-Fraser, 2010). Early Ramsar reports mention the deleterious effect on the wetland from the erosion, runoff and use of fertilizers related to the construction of the golf course in the early 2000's (Paterson, 2012).
- The planned modifications to the wetland hydrology (presence of currently absent streams and a lagoon to the north west of the pond) can affect wetland biota.
- The increases in human activity within the wetland (i.e., waterpark, boats) can negatively affect breeding birds. Noises from these activities could impair birds' ability to pair (during breeding season) as they overlap with their calls/songs (Francis, Ortega, & Cruz, 2009). Noise, generally, impairs birds' ability to communicate, whether it is to alert others of predators or defend nestlings. Another risk with the increases in these human activities is that they will likely lead to increases in the abundance of mammalian predators (Phillips et al., 2003). These predators are the leading cause of bird mortality during their breeding seasons - a point at which their populations are most sensitive to decline (Klug, Wolfenbarger, & McCarty, 2009; Thompson, 2007).
    - The plans suggest that there will be extensive activity within the Ramsar protected wetland – this includes river cruises, extensive trails, bridges, pavilions, viewing platforms, and what appears to be buildings, amongst others. These activities can conflict with local use of the pond, which residents use for fishing and for recreation.

- The development is within proximity of Levera beach, which is one of most important Leatherback sea turtle nesting beaches in the region. The data suggests that light pollution from buildings and paths may disorient and endanger nesting turtles and emerging hatchlings. Additionally, increased noise levels at night may deter nesting.
- The placement of two docks near the middle of Levera beach can have impacts on turtles and public access. First, we expect that this infrastructure will disrupt free movement of sea turtles emerging to nest. Second, the docks can result in changes to water flow dynamics along the coast, which can significantly affect the rates of beach erosion. Third, we also anticipate that the docks (during construction and use) would result in damage to the fringing coral reefs by anchoring of watercraft, especially to the large and rare patch of Acropora corals.
- The plans suggest that there will be a harbor on the Bay. Such a structure would require extensive modification of the beach and nearshore environment.
- There are no known plans to conduct a thorough archaeological survey of the site. As such, it is likely, as with the past projects, that any artifacts at the site will be damaged/discarded by the development, without putting proper protocols in place.
- The footprint of this project appears to encompass the nearby 'Levera moutain'. Such an extensive footprint to the mountainous areas will not just impact the upland vegetation, but also the hydrology and water chemistry of the entire Levera watershed. The removal of this vegetation could result in flooding of project areas and increased runoff into the pond (impacting water quality).
- The plans appear to indicate that new roads will be cut through the forested areas. Roads are associated with increases in habitat fragmentation and edge effects, both of which have negative impacts on wildlife (Owens & Myres, 1973; Summers, Cunnington, & Fahrig, 2011; Tsai, Venne, Smith, McMurry, & Haukos, 2012).

Recommendations

Based on our concerns above, we believe that there **should be a substantial reduction in the hotel footprint and size**. The proposed hotel footprint will result in a substantial increase in surface water run-off, which would have large impacts on water chemistry within the wetland and neighboring near-shore ecosystems. Yet another impact of the hotel's footprint are edge effects – where wildlife is more likely to experience declines in their productivity because the sizeable habitat they require for forging and reproduction are lost and the visual stimuli of the infrastructure will cause them to avoid these areas (Daniel & Koper, 2019). Notably, the development plans suggest that there are various phases to this project (e.g., installation of workers barracks under Phase 1). We recommend that any all phases should be informed by this EIA.

Wetland

- We recommend that no infrastructure should be placed within the bounds of the Ramsar site, and certainly none within 300 feet of the wetland boundary [Figure 3; McElfish, Kihslinger, & Nichols, (2008)]. We, therefore, recommend a vegetative

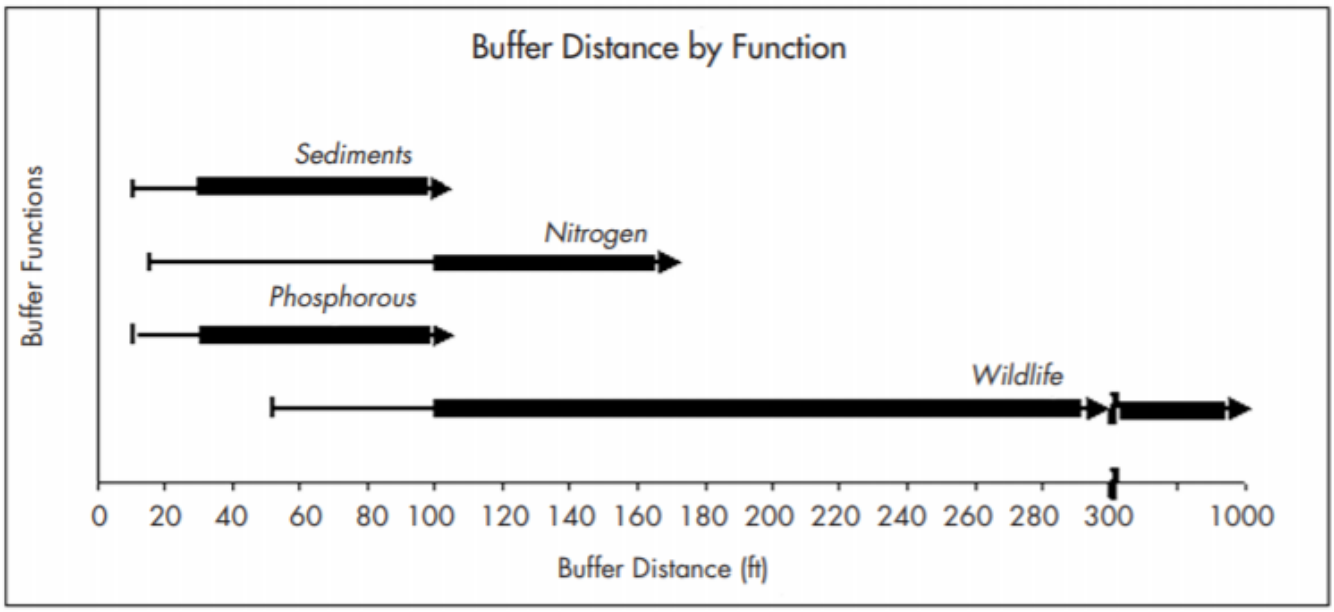

Figure 4 - Recommended vegetated buffer around wetlands and streams, depending on the ecosystem function one is attempting to preserve

buffer around the wetland, which would entail vast natural forest vegetation and little to no human activity (Parkyn, 2004).

- This vegetative buffer will ensure that activities within the landscape are less likely to impact wetland water quality.
- The buffer can also benefit wildlife. We would expect this to lower the occurrences of mammalian predators, which increases the likelihood of nesting success for breeding birds. We would also expect better-quality habitat for native mammalian predators (e.g., common opossum).
- Silt screens or other forms of sediment control should be used to prevent siltation and runoff of material into the lake from development activities. These strategies should be employed throughout the entirety of the construction phase. There is evidence that the previous development at Levera used such strategies to lessen impacts on the lake.

Forest

- Since there is evidence of artifacts to the northwest of the pond, we recommend that the developers should fund a thorough archaeological survey of this area.
- We recommend that mature trees should be left on the landscape, wherever possible. The Integrated Coastal Zone Act of 2019 also makes the removal of any coastal vegetation bordering the beach an offense. Such vegetation prevents beach erosion and provides cover for nesting sea turtles. Lights near the pond should be limited to minimize disturbance to nesting and roosting birds at night.
- Any road installation should be informed by this Environmental Impact Assessment. Any existing roads leading to the beach from La Fortune and from Bathway should be maintained for public access.

Beach

- We recommend the removal of docks and the harbor from the development plans.
  - The placement of any such structures should be informed by a recent study of coastal processes in the area, conducted by a coastal engineer. Based on

local knowledge the currents in the narrow channel between the beach and the island can be quite strong.

  - Without the correct studies, improper placement of such structures could rapidly alter the beach, affecting turtle nesting and recreation by the public. A recent study which sheds some light on coastal processes in the area is the 2019 Sediment Transport and Shoreline Change (STS) Study. This was conducted under the Integrated Climate Change Adaptation Strategies Project (ICCAS) project. This work was conducted by the Center for the Environment, Fisheries and Aquaculture Science in the UK (CEFAS) and coordinated by the Environment Division. Analysis of the Levera area in this study shows that the beach is very dynamic. Using a combination of historical data and aerial images, the STS Study shows that the beach undergoes regular morphological changes on the North and East faces. The two sides of the beach appear to have a pattern of erosion and deposition, which is reversed at certain points through the year. This results in the North face being narrow at certain times, with the East face having a large beach width. This process then seems to reverse, having the opposite effect on the beach widths (CEFAS, 2019).

- Lights should also be regulated during the nesting and hatching season (February to August), with all non-red/yellow lights visible from the sea turned off after dark. Emergency lights can be provided along pathways using red bulbs, which are less disorienting for turtles.
- We recommend that hedges/trees should be incorporated to the beachside of the development to provide an additional barrier to light sourced from the Resort. This would lower the change that turtles avoid nesting because of the disorienting nature of lights.
- We discourage anchoring along the beach altogether. The coral ecosystem located between Levera beach and Sugarloaf is fragile, with relatively rare species; furthermore, any damage to the reef will have serious and lasting negative effects on the beach as the reef buffers and protects the shore from erosion. Instead, a handful of moorings can be placed carefully in coral-free areas to secure watercraft without the use of anchors.

- Recent studies and mapping were also done by the Ridge to Reef Project to inform the creation of a marine protected area in Levera. These studies may prove useful in guiding this development in minimizing its effects on important marine and terrestrial biodiversity.

Community Consultation/Input

Finally, the level of detail in the provided plans limited our ability to provide more technical inputs. We can presume that this would impact the community's ability to provide constructive feedback on the plans as well. Consequently, we recommend that more detailed plans should be shared with community members and local experts to provide additional feedback.

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