Ministry of Works, Government of Belize

Consultancy Service for the Updating of a Feasibility Study and the preparation of the Detailed Designs for the Upgrading of the Coastal Highway
Belize

Project Coordinator
Michelan Gilharry
Power Lane
Belmopan
Tel. 822-2136/2139

Politecnica Project Director
Alessio Gori

KE1 Team Leader / Highway Engineer
Francisco Reina Barranco

KE2 Drainage Engineer / Hydrologist
Luca Boccardi

KE3 Structural / Bridge Engineer
Richard Sansom

KE4 Geotechnical Engineer
Giuseppe Furlani

KE5 Transport Economist
Dipankar Chatterji

KE6 Environmental Specialist
Jan Cornelis Meerman

KE7 Social and Gender Impact Specialist
Valentino Shal

Ministry of Works – Belize

Government of Belize

Caribbean Development Bank

Technical assistance has been provided by

Upgrading of the Coastal Highway Stann Creek District, Belize

Environmental and Social Impact Assessment

Volume II – Appendices 1-13 (ESIA)

Appendices

1 Terms of Reference

Terms of Reference
For an Environmental Impact Assessment to be conducted for the Rehabilitation of the Coastal Road, Belize and Stann Creek Districts

Background

This Terms of Reference (TOR) has been prepared pursuant to the EIA Regulations of 1995, and its 2007 Amendment. The TOR has been prepared following scoping of the most critical issues associated with the proposed rehabilitation of the Coastal Road and its related activities.

The TOR has been divided into five (5) areas, which are as follows:

A. **Baseline information of the project area, project description of the road and infrastructural improvements**
B. **Policy and legal framework**
C. **Environmental and socio-economic settings,**
D. **Environmental and social impact assessment, potential cumulative impacts, assessment of alternatives,**
E. **Mitigation and monitoring (Environmental and social management plan-ESMP), Conclusion/recommendations**

Terms of Reference

The most critical issues that this proposed development and its related activities will focus on, should include the following:

I. Potential impact to hydrology features, flooding impacts, drainage, and surface impacts;
II. Potential impact on water quality;
III. Potential pollution impacts associated with road and bridge construction, road upgrade and storage area for construction material, heavy machinery, and fuel;
IV. Waste (liquid, solid, and hazardous) management issues and their potential impacts;
V. Impacts associated with relocation of utilities (electricity and water);
VI. Impacts associated with noise pollution, air quality and soil quality;
VII. Impacts on the biological corridor and protected areas;
VIII. Transportation and traffic related impacts;
IX. Potential impacts associated with mineral extraction for source material;
X. Socio-economic impacts.

Scoping of these issues speeds up the Environmental Impact Assessment (EIA) process, cuts down its cost, improves the quality of the development and ensures that the environmental concerns are clearly addressed.

A. THE BASELINE INFORMATION

This section of the document deals primarily with information pertaining to the background of the project and the physical road and infrastructure conditions within which it is proposed, and upon which is likely to have an impact.

1.0 PROJECT DESCRIPTION AND ROAD AND INFRASTRUCTURE CONDITIONS

Provide a detailed description of the project and provide legible maps at appropriate scales with proper labels and legends to illustrate the general settings of the project relative to the development sites, as well as the surrounding areas that are likely to be impacted by the development. These maps shall include topographic contours, the position of conservation areas, political boundaries, geological and land use profiles, existing adjacent land use (tourism, residential, agriculture, industrial, etc.), as well as any zoning scheme that may be in existence, or proposed otherwise for the area and geomorphic features of the project area (by use of aerial photographs, if available.) Additionally, the following should be provided:

1.1. Provide a scaled map depicting the exact alignment of roads and river crossings, including coordinates (UTM Coordinates) of the proposed development relative to surrounding communities within the project area and zone of influence. Illustrate all major exit/entrance to the highway, particularly in populated areas;

1.2. Provide a description of the present road and infrastructure conditions including assessment of bridges, drainage, road embankment and road safety. The assessment must be conducted using an internationally accepted methodology and approved by the Ministry of Works. A description of the methodology used to conduct this assessment should be provided.

1.3. Provide engineering designs, as well as materials to be used for the construction of the road surface, structures/bridges, embankment stabilization. Identify the potential impacts associated with the preferred choice of surfacing and their mitigation measures, and with the preferred location of road materials to be extracted for this purpose.

1.4. Describe the construction of bridges and box culverts, flood relief channels (if any), roads, relocation of overhead power lines and potential removal/ relocation of buildings. Include schematics, where available.

1.5 Provide justification(s) for the proposed project including possible alternatives in the comparative form, exploring each alternative, including the no- action alternative;

1.6 Describe the timeline for the implementation of the project.

1.7 Determine the type and volume of construction materials required for the entire development, including material for road construction, infrastructure needs, etc.

B. POLICY AND LEGAL FRAMEWORK

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This section will identify operation standards, which the project must address to be environmentally acceptable. This will include, for example earth works, land acquisition, permissible noise levels, paving of the road and occupational health and safety requirements effluent discharge limitations, air emission standards, effluent receiving water quality standards, construction codes, and occupational health and safety requirements.

2.1 Provide and discuss policy, legal or administrative issues as they relate to this proposed development. This should include the pertinent regulations, standards and policies, at the local, national and international levels. Legislation and policies that relate to the proposed project which governs environmental quality, health and safety, protection of sensitive areas, including cultural resources, protection of endangered or threatened species, infrastructure development, land use control, and tourism that may have an impact on the proposed development.

C. ENVIRONMENTAL AND SOCIO-ECONOMIC SETTINGS

3.0 PHYSICAL AND BIOLOGICAL ENVIRONMENT

Provide details of the basic physical environment of the proposed project site and zone of influence. This should include:

3.1. General Geology: Geomorphology- description of characteristic of landform, land surface including exposed rock types, types of unconsolidated materials exposed (sediments) rivers, tributaries, ridges, valleys and geological structures-faults, folds if they can be determined by field mapping;

3.2. Subsurface geology- detailed description of the stratigraphy of the rocks or unconsolidated materials within the project site, particularly at bridge abutments. This must be done by core sampling (mechanical or manual). A cross section of the rock types and unconsolidated materials should be presented.

3.3. Topography: An elevation map of the project site including the flood hazard and drainage patterns around the project site.

3.4. Include a map outlining the boundaries of zone of influence in relation to road corridor. Provide a map that shows clearly the areas in the entire Coastal Road that are likely to be flooded and are at risk from rain induced floods.

3.11 3.5. Climate, hydrology, and meteorology: Provide an over view of the climate, hydrology and meteorology of the area including average rainfall per year, and prevailing winds. Identify areas prone to flooding and outline measures being implemented to address flood effects.

3.6. Provide a description of the surrounding natural (ecological) environment that can be affected by the project, including major surface water bodies as well as riparian vegetation to be impacted.

3.7. Water Quality: provide baseline data on the current water quality of the Sibun River, Cornhouse Creek, Manatee River, Soldier Creek, Jenkins Creek, Quamina Creek, Mullins River and Big Creek. Parameters to be tested for should include the following: pH, Dissolved Oxygen, Total Nitrates, Total Phosphates, Total Suspended Solids, Total Dissolved Solids, Total Hardness,

Fecal Coliform and E. Coli; Provide description of methodologies, date and time of collection and equipment used for collections of water quality baseline data. Collect at minimum of 2 samples from each water source and collected immediately downstream from the activity.

3.8. Climate Change: Assess the vulnerability of the project area to flooding, hurricanes, storm surges, sea level rise, temperature and precipitation changes. Identify the natural hazards that are specific to the project area, frequency they occur, and with what intensity; a description of all elements at risk (road, communities etc.)

3.9. Provide baseline data (field study) on the present ecosystems, flora and fauna (terrestrial and aquatic) along the proposed road alignment. This should pay attention to sensitive habitats, biological corridors, protected areas, commercial species and endangered species. This should incorporate clear indicators of percent cover and habitat composition and health. Illustrate with legible maps at an appropriate scale. Describe the scientific methodology used for the assessment, include date and time surveys were conducted. If clearing of vegetation is required, estimate the type and acreage. Identify whether land clearing may affect the ecology of the area; for example habitat, food and nutrient supplies, breeding areas, migration routes and changes in herbivore grazing patterns. Determine whether these are short, medium or long term.

3.10. Current land use management regimes of project site and immediate surrounding lands, including existing feeder roads and building infrastructure.

4.0 SOCIAL ENVIRONMENT

4.1. Provide a description of the socio-economic environment including information to demographics, land use, education level, health, income, means of transportation, social characteristics, traffic patterns, types of businesses that may be affected, identification of lots and necessary relocation due to construction, infrastructure services that may be affected including drainage, utilities including telephones, electricity etc.

4.2. Consult and report on the views and concerns of directly affected stakeholders such as nearby communities, local NGOs and CBOs, Management Organizations and relevant government departments/agencies to identify their economic, environmental and social concerns about the proposed activities. Provide a summary of the views of those interviewed and include the name and organization of all the interviewees and the date of the interview. The methodology (including questions and answers) should be provided within the EIA.

4.3. Inventory and evaluation of public and private infrastructure and buildings in the areas of direct influence during construction and operation, together with the need for land acquisition with a view to:

i) Establish a baseline to address any future damages or related claims;
ii) Identify vulnerabilities and corresponding prevention, monitoring and mitigation measures; and
iii) Design operating procedures and monitoring requirements.

4.4. Consult with NICH-Institute of Archaeology on the project area to determine any known features of archaeological or cultural importance and provide recommendations for the protection of any features as well as provide mitigation plans. Ensure that formal response from the Institute of Archeology is annexed.

D. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

This section of the EIA presents the assessment of the potential environmental and social impacts associated with the proposed road rehabilitation project. For each relevant environmental and social parameter, the potential impacts should be discussed these include air and water quality; soil erosion and soil stability, and the hydrology and drainage of the area as well as nearby or adjacent ecosystems within the project, impact the lives of residents of communities and road users.

5.0 ENVIRONMENTAL IMPACT ASSESSMENT

5.1 Identify the impacts of the project on the drainage, hydrology of the area and the impacts of flooding on the proposed project, during construction and operational phase. Based on the findings identify and provide respective mitigation measures.

5.2 Identify potential impacts, such as road and bridge abutment erosion, and mitigation measures for these activities. These mitigation measures must also include recommendations for protection measures against siltation (if applicable), and other potential pollution to the environment during construction activities

5.3 Identify the potential impacts on natural habitats, including the biological corridor from general road construction activities and the operational phase of the highway. Identify mitigation measures to reduce the impacts on wildlife.

5.4 Identify the potential impacts associated with road and bridge construction, at the site of construction as well as the storage area for construction material and areas identified for mineral extraction, heavy machinery, and fuel. Issues should include hazardous, solid and liquid waste, and the storage of hazardous materials. Identify mitigation measures to minimize the potential impacts.

5.5 Illustrate on a suitably scaled map, the location of all water body crossings and low-lying areas. For low-lying areas, where applicable, indicate the siting of culverts.

5.6 Identify the potential impacts on the air quality. Issues to be covered include impacts from noise and dust from construction activity, dust from transport and stockpile of materials and fumes emission from the operation of heavy equipment, etc. by mobile and static sources during construction and operation phases. Based on the findings identify and provide respective mitigation measures to be adopted to reduce air quality impacts, especially in consideration to any nearby by communities and schools along the right of way.

5.7 Identify the potential impacts related to the adjustment of the vertical and horizontal alignment of the highway including the disposal of spoils (material removed from the existing road). Provide mitigation measures to minimize the impacts

5.8 Identify and evaluate at minimum three (3) options for meeting the need for fill materials such as limestone marl and gravel, reviewing their sources, volume, extraction methods and transportation and identifying:

- Direct and indirect biological impacts;
- Direct and indirect physical impacts;
- Impact on water resources;

5.9 Identify the preferred option for the extraction methods, source and transportation of materials, specifying the necessary mitigation measures, their residual impacts and significance.

5.10 Provide general information on disaster risk management (including climate change) as it relates to road constructions.

5.11 Identify emergency preparation measures for the proposed development (e.g. hurricane, floods, etc.). This should include road and bridge closure, detours and hazard management plans in conjunction with:

5.11.1.1 Human and health safety,
5.11.1.2 Spillage of fuel, oil, gas, chemicals and hazardous materials,
5.11.1.3 Natural Disasters and their implications on operations.

6.0 SOCIAL IMPACT ASSESSMENT

6.1 Identify the potential socio-economic impacts such as employment, livelihoods, income generating activities, health etc. on the communities along the project area.

6.2 Transportation and traffic related impacts and mitigation measures.

6.3 Impacts associated with relocation of utilities (electricity and water); and mitigation measures.

7.0 POTENTIAL CUMULATIVE IMPACTS.

This section of the document primarily targets the potential cumulative impacts of critical concerns based on information provided in previous sections and relates to the impact of the processing activities on various environmental variables, ecosystem functions, and economic activities. Identify all potential cumulative impacts and significant changes that may result from the implementation of this overall project, taking each individual component into consideration.

8.0 ASSESSMENT OF ALTERNATIVES

This section proposes alternatives to the execution of the project based on the information generated by section A.

8.1 Present all reasonable alternatives for the development in comparative form, exploring each alternative. This includes the no-action alternative, and the reason why certain alternatives were recommended or eliminated. These alternatives should look at the following components:

- need to resurface road sections,
- rehabilitation or replacement of existing bridges and culverts and associated low lying road sections;
- proposed road junctions

5.9 Identify the preferred option for the extraction methods, source and transportation of materials, specifying the necessary mitigation measures, their residual impacts and significance.

5.10 Provide general information on disaster risk management (including climate change) as it relates to road constructions.

5.11 Identify emergency preparation measures for the proposed development (e.g. hurricane, floods, etc.). This should include road and bridge closure, detours and hazard management plans in conjunction with:

5.11.1.1 Human and health safety,
5.11.1.2 Spillage of fuel, oil, gas, chemicals and hazardous materials,
5.11.1.3 Natural Disasters and their implications on operations.

6.0 SOCIAL IMPACT ASSESSMENT

6.1 Identify the potential socio-economic impacts such as employment, livelihoods, income generating activities, health etc. on the communities along the project area.

6.2 Transportation and traffic related impacts and mitigation measures.

6.3 Impacts associated with relocation of utilities (electricity and water); and mitigation measures.

7.0 POTENTIAL CUMULATIVE IMPACTS.

This section of the document primarily targets the potential cumulative impacts of critical concerns based on information provided in previous sections and relates to the impact of the processing activities on various environmental variables, ecosystem functions, and economic activities. Identify all potential cumulative impacts and significant changes that may result from the implementation of this overall project, taking each individual component into consideration.

8.0 ASSESSMENT OF ALTERNATIVES

This section proposes alternatives to the execution of the project based on the information generated by section A.

8.1 Present all reasonable alternatives for the development in comparative form, exploring each alternative. This includes the no-action alternative, and the reason why certain alternatives were recommended or eliminated. These alternatives should look at the following components:

- need to resurface road sections,
- rehabilitation or replacement of existing bridges and culverts and associated low lying road sections;
- proposed road junctions

- need for adjustments of the horizontal and/or vertical road alignment

E. MITIGATION AND MONITORING (ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN-ESMP), CONCLUSIONS AND RECOMMENDATIONS

9.0 MITIGATION AND MONITORING

9.1 Based on assessments from section D, develop a mitigation and monitoring plan, this should include all potential negative Environmental Impacts, including, but not limited to: construction activities and road upgrade, water quality, ambient air quality, and identified Social and environmental Impacts

9.2 Develop an Environmental and Social Management plan based on the mitigation measures discussed in 8.0 above.

9.3 Conclusions and recommendations

FINAL

2 CVs team members

CURRICULUM VITAE (CV) Jan Meerman

Position Title and No.	**EIA Coordinator**
Name of Expert:	Jan Cornelis Meerman
Date of Birth:	30 August 1955
Country of Citizenship/Residence	Netherlands / **Belize Permanent Resident** #8302/90 issued 17-VII1990 (2 years resident in Belize)

Education:

- Netherlands: Bachelor's degree (HBO) In Biology. 1979
- Agricultural University Of Wageningen, The Netherlands: Bachelors Degree (HBO) In Ecology. 1980
- University of Amsterdam, The Netherlands: Literature Propadeuse, 1986

Other Training:

- ESRI Classroom Instruction: Building Geodatabases 1, Building Geodatabases 2. September 1&3, 2004.
- FAO-UNEP Global Land Cover Network (GLCN) awareness and training workshop "Mapeo de Cobertura Terrestre", San José, Costa Rica, 5-9 December 2005.
- Technical Training: "Detección de cambios con sensores remotos" El Colegio de la Frontera Sur Y Conservation International. San Cristóbal de las Casas, 5-16 March 2007.
- Expert at Inter American Biodiversity Information Network Ecosystem Thematic Network workshop, In Panama City, March 26-29, 2007. Panama City, Panama.

Employment record relevant to the assignment:

Period	Functions	Country	Summary of activities performed relevant to the Assignment
1994 to present	Freelance Consultant acting as • Environmental Specialist • Biologist & Biodiversity Expert • Team Leader • Quality Control Consultant • Gis Expert and Specialist • Natural Resources specialist	**Caribbean and/or Central America:** • **Belize** • El Salvador • St. Kits & Nevis • Panama **Develop. Countries** • Malawi • Mozambique	With over 25 of years general experience, Mr. Meerman has developed his career mainly in Belize, where he got extremely familiar with the Country's Environment, Territory and land use. He's been living for more than 25 years in Belize and has carried out all types of consultancies in the Sectors of Environment, Climate Change, Environmental Management Plans for infrastructure Projects

SIMILAR PROJECTS IN PAST FIVE YEARS (2012-2017)

Project Name: Social and Environmental Impact Assessment for the upgrading of the Hummingbird Highway, Belize **Year:** 2015- 2016 (ongoing)**, Country:** Belize

Client: Ministry of Works with funding from the OPEC Fund for International Development OFID **Main Project Features:** Prepare a SEIA for the upgrading of the Hummingbird Highway.

Positions Held: Team Leader, GIS specialist, **Biodiversity Expert, Natural Resources specialist.**

Activities performed: Team management, Biological Inventories, Environmental Impact Assessment, Spatial Data Development and Management

---

Project Name: Social and Environmental Impact Assessment for the upgrading of the Hummingbird Highway, Belize

Year: 2014**, Country:** Belize

Client: Dr. Nabeel Abdul-Raheem Consultants (NARCO)

Main Project Features: Feasibility study for the upgrading of the Hummingbird Highway.

Positions Held: Biodiversity Expert, Social Expert, Natural Resources specialist.

Activities performed: Conducting stakeholder interviews, identify high social impact areas along the highway, Investigate potential impacts on the Biological Corridor, Present environmental and social findings in a stakeholder workshop, Prepare an environmental management plan

---

Project Name: Belize Environmental Consultancies

Year: 1994 - 2016**, Country:** Belize

Client: Various

Main Project Features: Various Environmental Projects including moderation of the Biological and Environmental Resource Data System for Belize (BERDS) which is a spatially enabled on-line data base with biological and environmental data including a **spatial data warehouse**

Positions Held: Environmental Consultant

Activities performed: Biological Inventories, Management Planning, Environmental Impact Assessment, Policy Formulation, Spatial Data Development, Spatial Data Management

---

Project Name: Development of Municipal Growth Plans for the Municipalities of Corozal, Orange Walk, Benque Viejo, San Ignacio & Santa Elena, Belmopan, Dangriga and Punta Gorda, Belize

Year: 2012 - 2013**, Country:** Belize

Client: I2UD, Social Investment Fund

Main Project Features: Prepare growth Strategies for selected Municipalities in Belize

Positions Held: Environmental Consultant, Ensuring compliance with Land Use Policy and overall environmental sustainability

Activities performed: , Socio-economic analysis of towns, Infrastructure Analysis, Development of Local Plans and Strategies, GIS mapping

---

Title of Project Environmental and Social Analysis of the Construction and Operation of a Waste Water Collection, Treatment, and Disposal System for the Placencia Peninsula. Contract #001 of Aug, 2010.

Year: 2010 - March 2012, **Location:** Belize

Client: Inter-American Development Bank /Government of Belize: Ministry of Finance.

Main Project Features First assessments of the social and environmental impacts of a proposed waste water collection and treatment system

Positions Held: Team leader and Environmental Consultant, **Activities and outcomes:** Stakeholder consultations, Biodiversity Inventory, Land Suitability Mapping, Environmental Impact Assessment, Standard Operating Procedures

Project Name: National Land Use Policy and National Integrated Planning Framework for Land Resource Development **Year:** 2010-2011**, Country:** Belize **Client:** Government of Belize – UNDP – World Bank **Main Project Features:** Prepare a land use Policy for the country of Belize **Positions Held: Team leader** **Activities performed:** Stakeholder consultations, Land Use Plan, Land Suitability Mapping System, Implementation framework
Title of Project Integrating Protected Areas Policy And Management Into Belize's Forest policy. **Year:** 2009-2010. **Location:** Belize **Client:** Association of Protected Areas Managers/FAO **Main Project Features** Policy formulation **Positions Held: Team leader**, **Activities performed:** Stakeholder consultations, Policy formulation
Project Name: Preliminary Survey of Land degradation in Belize (United Nations Convention to Combat Desertification). **Year:** 2005**, Country:** Belize, **Client:** World Bank/CCAD **Main Project Features:** Preliminary Survey of Land degradation in Belize **Positions Held: Lead Environmental Consultant** **Activities performed:** Spatial Data Analysis
Project Name: Belize National Protected Areas System Policy and Systems Plan: Protected Areas System Evaluation. NPAPSP **Year:** 2004-2005**, Country:** Belize, **Client:** National Protected Areas Policy and System Taskforce – Government of Belize **Main Project Features:** National Protected Areas Policy and Systems Plan **Positions Held: Lead Environmental Consultant** **Activities performed:** Data inventory, Spatial Data Analysis
Project Name: Central American Ecosystems Mapping update **Year:** 2002**, Country:** Guatemala (but Covering Central America) **Client:** World Bank/CCAD, **Main Project Features:** Update Central American Ecosystems Map **Positions Held: GIS/Biological Coordinator-Consultant** **Activities performed:** Spatial Data Quality Control

CURRICULUM VITAE (CV) Alessio Gori

Position Title and Qualification	**Project Director**
Name of Expert:	Alessio Gori
Date of Birth:	31/01/1983
Country of Citizenship/Residence	Italy/Italy

Education:

- University of Florence (Italy), 2008: M.Sc degree in Road and Transport Engineering
- University of Florence (Italy), 2006: B.Sc degree in Civil Engineering

Employment record relevant to the assignment:

Period	Employing organization and your title/position. Contact info for references	Country	Summary of activities performed relevant to the Assignment
2008-present	**Employer:** **Politecnica Ingegneria ed Architettura Soc. Coop. - Contact:** Via G. Galilei 220, Modena – Italy Tel +39 059356527 **Authorised Representative**: Mr. Enea Sermasi, esermasi@politecnica.it; **Positions Held:** • Partner • Road/Highway/Junctions and Transport Engineer • Project Director • Certified Envision Sustainability Professional (Envision SP) • Certified BIM Specialist for Infrastructure	Belize, Italy Malta Sierra Leone Libya Ghana Palestine Ivory Coast Turkey	Alessio Gori is a senior Civil Engineer with 12 years of Professional Experience in Civil Engineering for Road and Infrastructure Projects. In last 5 years he has started to Manage many infrastructure projects of the Company as Project Director. He is experienced with feasibility studies, design and work supervision of transport infrastructures (roads and bridges), Road/Highway/Junctions (from multi-level to roundabouts) Design, Environmental Impact Studies, Traffic and mobility studies, Road safety assessment, Safety barriers and road signs design. Recently he has been certified as BIM Specialist for Infrastructure He has managed and supervised projects through all the stages, from planning to design, budgeting, resourcing, construction and maintenance, traffic control and management. He has extensive experience both at national and international level, with reference to FIDIC-PRAG-WB procurement standard He has a sound knowledge of International Financing Institutions such as World Bank, Caribbean Development Bank and EU Commission. Presently he is the Project Director for the Coastal Highway design in Belize and he was a member of the Design Team of the Haulover Bridge.

Memberships of Professional Associations:

- Engineers Registration Board of the Florence Province, membership nr. 5969 since 2009
- Certified "**Envision Sustainability Professional (Envision SP)"** Certificate n. 22374, ICMQ – Institute for Sustainable Infrastructure

Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks

DATES AND PLACE	2017 / ongoing – Belize
CLIENT	Caribbean Development Bank – Ministry of Works of Belize
PROJECT TITLE	Consultancy Services for the updating of a Feasibility Study and the preparation of Detailed Design for the Upgrading of the Coastal Highway
POSITION	Project Director, Road Engineer

DATES AND PLACE	2016 / 2018 – Belize
CLIENT	Caribbean Development Bank – Ministry of Works of Belize
PROJECT TITLE	Replacement of the Haulover Bridge
POSITION	Road Engineer and Road Safety Specialist

DATES AND PLACE	2017 / ongoing – Turkey
CLIENT	European Union – Ministry of Science, Industry and Technology of Turkey
PROJECT TITLE	Supervision for Construction of Van Enterprise Development Centre (VAN – ISGEM)
POSITION	Project Director

DATES AND PLACE	2017 / ongoing – Turkey
CLIENT	European Union – Ministry of Science, Industry and Technology of Turkey
PROJECT TITLE	Supervision for Construction of Rize Tea Research and Application Centre
POSITION	Project Director

DATES AND PLACE	2015 / 2016 –Sierra Leone
CLIENT	World Bank – Sierra Leone Roads Authority
PROJECT TITLE	Design of an Asset Management Strategy for SLRA
POSITION	Road Engineer, Project Manager

CURRICULUM VITAE (CV)

Position Title and No.	**K-1 Team Leader / Highway Engineer**
Name of Expert:	**Francisco REINA BARRANCO**
Date of Birth:	**19th of October, 1974**
Country of Citizenship/Residence	Spain / Spain

Education:

- 2009- 2010: IE Business School. Madrid, Spain, **Executive Master in Business Administration, (Executive MBA)**
- 1999-1999: Centro de Estudios y Experimentación de Obras Públicas (CEDEX), Ministry of Public Works. Spanish Government. Madrid, Spain. **MSc in Soil Mechanics and Foundation Engineering**
- 1992-1998: University of Granada. Granada, Spain, **MSc in Civil Engineering**

Employment record relevant to the assignment:

Period	Employing organization and your title/position. Contact info for references	Country	Summary of activities performed relevant to the Assignment
2005 - present	**Employer:** RB Ingenieros Consultores, C/San Pedro, 14 - 5º-4 , Almería (Spain) **Contact:** Raúl Reina. raul.reina@rbingenieros.com **POSITION HELD:** • International Managing Director • Highway Engineer • Team Leader	**Caribbean and/or Central America:** • **Belize** • Turks & Caicos Islands • Cayman Islands • Netherland Antilles • Dominican Rep. • Haiti **Develop. Countries** • Kosovo • Iraq • Burundi • Tunisia • Morocco • Algeria • Lebanon • Djibouti • Ghana • Cameroun • Uganda • Egypt • Jordan **Other Regions:** Spain	• Senior civil engineer with more than 18 years' experience in transport infrastructure engineering (roads and bridges). Main areas of expertise: paved roads, rural roads, urban roads, bridges, tunnels and road safety. Significant experience in new construction and rehabilitation road projects. • 3 Similar Projects in past five years, two of them in the Caribbean Region (Dominican Republic and Haiti): Team Leader for Feasibility/Detailed design studies/Procurement documents for Road Projects. • More than 15 years´ experience on technical assessment & assistance, audits, inspections, **feasibility studies, preliminary and detailed design, preparation of Procurement Documents**, economic cost-benefit analysis, project management, construction control and supervision and final project evaluation. • More than 12 years' experience as an international road engineer expert in multiple road transportation projects and in community infrastructure development programmes • **Extensive experience in road safety**: institutional strengthening and policy support (strategy, policy & legislation, institutional organisation, action plans, management), capacity building, **technical training**, manuals preparation, **technical studies (road safety audits & inspections, black spot treatment & reduction)** and seminar/workshops organisation & presentation. Sound experience in road safety and traffic engineering in inter urban, urban and rural road projects. • Good knowledge of international standards and good practices for construction/ rehabilitation/ maintenance of road infrastructures (studies and work construction). • More than 6 years´ professional experience in developing countries of Africa, Caribe and East Europe working for international institutions such as EC, EIB, WB. • Good experience in roads sector projects involving project
2017- present	**Employer:** FRED Engineering. Viale Camillo Sabatini, 150 – VB1/1, 00144 Rome (Italy) **Contact:** Mr. Edoardo Mazzia, Co-founder, Tel: +39 06 520 341 2 **POSITION HELD:** • Co-Founder • Highway Engineer		

POLITECNICA
BUILDING FOR HUMANS

CURRICULUM VITAE (CV) Luca Boccardi

Position Title and No.	**Drainage Engineer / Hydrologist**
Name of Expert:	Luca Boccardi
Date of Birth:	28/11/1956
Country of Citizenship/Residence	Italy / Italy

Education:

- 1976-1982, Italian State University of La Sapienza, Rome, Italy Master Degree in Civil Engineering (Hydraulic Specialisation)
- Rotary Club of Rome, 1987, Scholarship for young professional in the irrigation area of Central California (U.S.A.)
- VII Instruction and Training Course for technical and administrative waterworks personnel, on behalf of A.C.E.A. (Rome Municipal Water and Electricity board). Financed by the Italian Foreign Ministry, Department for Cooperation and Development, Rome 1984

Employment record relevant to the assignment:

Period	Employing organization and your title/POSITION HELD / ACTIVITIES. Contact info for references	Country	Summary of activities performed relevant to the Assignment
2006-present	**Employer:** Freelance Consultant **Contact:** Luca Boccardi **POSITION HELD:** • Hydrologist-hydraulic Engineer • Drainage Engineer	**Caribbean and/or Central America:** • **Belize** • British Guyana • Dominican Republic • Guatemala, Honduras, Nicaragua, Salvador **Develop. Countries** • **Africa:** Burkina Faso, Cameroun, Cape Verde, Dem.Rep of Congo, Djibouti, Gambia, GuineaBissau, Kenya; Mauritania, Morocco, Sierra Leone, Togo • **Other Regions**: Italy, China, Iran; Romania, Albania, Bangladesh;	Over **30 years of hydraulic/drainage engineering experience,** more than **20 years spent in Caribbean and/or developing Regions.** He took part to many Projects regarding the Design of Roads, Motorways, Highways, Bridges, Viaducts, Tunnels and other transport infrastructures addressing the following topics: • **Hydrology & Hydraulic studies** and models elaborated with hydraulic software such as HEC-1 (HEC-HMS) and HEC-2 (HEC-RAS). • Hydraulic and transport projects identification, monitoring and evaluation. Build, operate and transfer (BOT) and project financing procedure for hydraulic and transport infrastructures. • Sewerage, drainage, hydraulic structures for Bridges and Roads, River training works • Field investigations • Technical assistance to Administrations in planning and identification of hydraulic infrastructures, feasibility studies, design, preparation of tender documents for the construction and the supervision of works (hydraulic structures for drainage, sewerage, water supply and sanitation)
1991-2006	**Employer:** IDRA Ingegneria Ambiente Srl (Italy), Via Lorenzo Respighi 7, Rome (Italy) **Contact:** Company was closed in 2007 **POSITION HELD:** • Partner • Hydrologist-hydraulic Engineer		
1983-1991	**Employer:** C. Lotti S.p.A. (Italy) **Contact:** Via del Fiume, 14 - 00186 Roma, Italy, **Tel: +39 06 323971** **Representative**: Ms. Patrizia Lotti, lotti@lottiassociati.com **POSITION HELD:** • Hydrologist-hydraulic Engineer		

SIMILAR PROJECTS IN PAST FIVE YEARS (2012-2017)
Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks

Year & Place: 2016 - 2017 - **Belize**

Client: Politecnica Ingegneria ed Architettura for the Ministry of Works of Belize

Main project features: Detailed Design of Haulover Bridge Replacement (funded by CDB) over the Belize River.

Existing Bridge is a steel structure built in 1947 across the Belize River, featuring a two lane carriageway 5m wide, founded on reinforced abutments and four intermediate reinforced concrete piers. The project consists in the design of a new Bridge. After identification of three alternatives (Girder Bridge, Tied-Arch Bridge, Cable-Stayed Bridge), the Tied-Arch type was chosen.

Position Held / Activities Performed: Key Expert (**Hydraulic & hydrology Expert**) in charge of the Feasibility Studies including the Hydraulic Surveys, the hydraulic Models, the Climate Vulnerability Assessment with relation to flooding, river flows, level rise, storm surge.

Year: 2015, **Countries:** Haiti / Dominican Republic, **Client:** EU / ARS Progetti (Italy)

Main project features: Design of the ring road in the Dajabon (DR) and Ouanaminthe (Haiti) frontier area for the northern corridor. The feasibility included the evaluation of 4 alternative layout of a 12 – 20 km of a first category road. Identification and preliminary design

Position Held / Activities Performed: hydraulic and hydrological expert in charge of: Analyses of the existing documents; On site survey to verify the main hydraulic works and the road condition; Hydrological evaluation of the design water flow; Hydraulic calculation of the water crossing works dimensions and of the road level in the flooding areas.

Year: 2012, **Countries:** Haiti / Dominican Republic, Client**:** EU / ALANET Alatec (Spain)

Main project features: 1) road between the town of Jimani in Dominican Republic and the Haitian frontier, affected by the growth of the lake Azuey level. Preparation of the tender documents for the construction of the hydraulic works for the floods management in observance to the PRAG rules. 2) design of the rural roads in the Dajabon (DR) and Ouanaminthe (Haiti) frontier area. The design included the rehabilitation of 55 km of existing roads and the realization of the new water management works. Preliminary and detailed design

Position Held / Activities Performed: Hydraulic Engineer / Hydrologist in charge of: Analyses of the existing technical documents related to ancient designs; On site survey to verify the hydraulic works and the road condition; Hydrological evaluation of the design water flow.

CURRICULUM VITAE (CV) Richard Samsom

Position Title and No.	K-3 Structural/Bridge Engineer
Name of Expert:	Richard Sansom
Date of Birth:	18/05/1950
Country of Citizenship/Residence	Italy

Education: University of Florence, Master of Science Degree in Civil Engineering (Hydraulics) in 1978

Post Graduate Courses: May 2003: ANIMP and OICE Project Management Course

Employment record relevant to the assignment:

period1981-present	Employer: Politecnica Ingegneria ed Architettura Contact: Via G. Galilei 220, Modena — Italy, Tel +39 059356527 Authorised Representative: Mr. Enea Sermasi, esermasi@politecnica.it POSITION HELD: • Team Leader Structural Engineer / Bridge & Hydraulic Engineer Site supervisor Partner Consultant	Caribbean and/or Developing Regions: • Belize Trinidad & Tobago • Jamaica Mauritania • Sierra Leone Albania Argentina Other Countries: Italy Malta China Country	Summary of activities performed relevant Almost 40 years of Civil Engineering experience in Transport and Water Infrastructure Projects, of which more than 10 years spent in the Caribbean and/or developing Regions. He took part in Design activities (feasibility, preliminary and detailed designs) in all Projects relevant to Roads, Motorways, Highways, Bridges, Viaducts, with specific focus on the Design of the Main Structures and the Hydraulic/Drainage Structures. In particular the following topics are part of Mr. Sansom's relevant track record: Sewerage, drainage, hydraulic structures for Bridges and Roads, flooding protection Bridges of any kind (girder bridges, tied-arch, cable stayed), overpasses and underpasses Bridges' decks, piers, abutments, supports for bridge decks, foundations, Bridge freeboard and clearance, river banks. Special foundations (piles, jet-grouting, etc.), Retaining walls, slope stability structures Hydraulic structures and river defense works related to road/railway/ bridges projects (e.g. hydraulic culverts, drainage structures, river training) Hydrology & Hydraulic studies and models He has developed a strong know-how of all categories of materials which can be adopted in the structural design of Bridges and Main Road Structures/Infrastructures, such as reinforced concrete (also pre-stressed), fiber reinforcements, steel design.

SIMILAR PROJECTS IN PAST FIVE YEARS (2012-2017) Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks	
DATES & PLACE	2016 - 2017 - Belize
CLIENT	Politecnica Ingegneria ed Architettura for the Ministry of Works of Belize
PROJECT TITLE	Detailed Design of Haulover Bridge Replacement (funded by CDB) over the Belize River. Existing Bridge is a steel structure built in 1947 across the Belize River, featuring a two lane carriageway 5m wide, founded on reinforced abutments and four intermediate reinforced concrete piers. The project consists in the design of a new Bridge. After identification of three alternatives (Girder Bridge, Tied-Arch Bridge, Cable-Stayed Bridge), the Tied-Arch type was chosen.
POSITION HELD /	Key Expert (Team Leader/Civil Engineer) in charge of the Feasibility Studies and the
ACTIVITIES HELD / ACTIVITIES:	Detailed Design of the Haulover Bridge, including the coordination of the Key Experts, the liaison with the Authorities, the control of the Quality of the Deliverables, the supervision of the Environmental, Social, Hydraulic Studies and the preparation of the Reports. As Civil Engineer/Team Leader, he supervised the Structural Design of the Bridge and of the Drainage structures, as well as the hydraulic issues related to the River Belize (freeboard and clearance issues).

DATES & PLACE	2008 - 2014 - Italy
CLIENT	Region of Lazio Road Authority, Italy
PROJECT TITLE	National Road SS7 — Feasibility Studies and Detailed Design. The Project addresses the alternative routing (variant) of SS7. The complexity of the mountainous territory and the scheduled Structural Works (tunnels, bridges and viaducts) were a challenging issue to be addressed. Construction Budget 423 Mln Euro
POSITION HELD / ACTIVITIES	Structural Engineer in charge of Preliminary Design design of the Drainage Structures of the Road and relevant hydraulic structures.

DATES & PLACE	2014, Italy
CLIENT	Province of Siena
PROJECT TITLE	Variant to road SRT429 with new Bridge over River. New road connection between the old road SRT 429 and corresponding road bypass near the towns of San Giminiano and Barberino Val d t Elsa. To overpass the Elsa River it has been necessary to design a new cable-stayed bridge with a total spam of 145 m. Moreover the project includes a new bridge to overpass railroad Empoli-Poggibonsi, and to connect the old road SRT 429 through a new roundabout.
POSITION HELD / ACTIVITIES	Structural Engineer in charge of the supervision and coordination of design for the Bridges Structural Design, the Drainage facilities of the Road and the evaluation of potential River Defense Works.

CURRICULUM VITAE (CV) Giuseppe Furlani

Position Title and No.	K-4 Geotechnical Engineer
Name of Expert:	Giuseppe Furlani
Date of Birth:	13t February 1970
Country of Citizenship/Residence	Italy / Italy

Education:

- 1996 - University of Ancona (Italy), MSc in Civil Engineering
  2000 — University of Ancona (Italy), PhD in Geotechnical Engineering

Employment record relevant to the assignment:

Period	Employing organization and your title/position. Contact info for references	Country	Summary of activities performed relevant to the Assignment
2000 present	Employer: Studio Tecnico Associato SINTESI di Guiducci Germano, Lucarelli Augusto e Furlani Giuseppe Contact: Via Flaminia 300, 47924 Rimini — (Italy) Authorized Representative: Mr. Guiducci Germano germanoguiducci@studiosintesi.net phone + 39 0541 478625 Positions Held: o Partner o Consultant: activities of Design and Consultancy in the field of Structural and Foundation Engineering, mainly for civil infrastructures o Project Manager	Caribbean and/or Developing Regions: o Belize o Colombia o Morocco Other Countries: Italy Russia Algeria Others ...	17 Years of General Experience in Geotechnical Engineering - From 2001 to 2005, a consultancy contract was signed with Snamprogetti S.p.A. for assistance in the Geotechnics Design (Preliminary and Final Design), of the High-Speed Railway Milano-Bologna. - From 2006, various contracts of consultancy and design with Metro C S.c.p.a. for the construction of the new Line C of Rome's underground. - From 2012 to 2013 contract with Invltalia Attività Produttive to specialist support for the design, technical and administrative assistance on the mitigation of hydrogeological risk in the region Puglia.

SIMILAR PROJECTS IN PAST FIVE YEARS (2012-2017) Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks	
DATES AND PLACE	2016 - 2017 - Belize
CLIENT	Politecnica Ingegneria ed Architettura for the Ministry of Works of Belize
PROJECT TITLE	Detailed Design of Haulover Bridge Replacement (funded by CDB) over the Belize River. Existing Bridge is a steel structure built in 1947 across the Belize River, featuring a two lane carriageway 5m wide, founded on reinforced abutments and four intermediate reinforced concrete piers. The project consists in the design of a new Bridge. After identification of three alternatives (Girder Bridge, Tied-Arch Bridge, Cable-Stayed Bridge), the Tied-Arch type was chosen.
POSITION HELD / ACTIVITIES:	Assistant to Key Expert (Geotechnical Engineer — Germano Guiducci) in charge of Soil and geotechnical investigations, programming and supervising geotechnical boreholes and tests, Geological and Geotechnical Modelling, Design of Foundations.
DATES & PLACE	2013-2015 - Colombia
CLIENT	CEV Consorcio Estructuraciön Vial — Bogotå Colombia
PROJECT TITLE	Rehabilitation, improvement and construction of 2200 km of roads in Colombia
POSITION HELD / ACTIVITIES:	Geotechnical Engineer in charge of Finalizing projects for concessions as "Asesor de geotecnia" responsible for the geotechnical, foundation design for more than 100 bridges and slopes stability
DATES & PLACE	2013-2014 - Colombia
CLIENT	PROGIN COLOMBIA - Bogotå Colombia
PROJECT TITLE	Replacement and/or construction of 13 bridges on routes in the departments of Boyacå, Casanare and Meta in Colombia
POSITION HELD / ACTIVITIES:	Geotechnical Engineer in charge of Final Design, "Asesor de geotecnia", responsible for the geotechnical, bridges foundation design
Other Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks	
DATES & PLACE	2014-2015 - Moscow (Russia)
CLIENT	Geodata S.p.A. (TO) - Impregilo S.p.A. (Ml)
PROJECT TITLE	Geotechnical Consultancy for the uplift of an industrial building due to a piping collapse
POSITION HELD /	Geotechnical Engineering: Responsible for the geotechnical characterization.
ACTIVITIES:	Site Supervision on geotechnical investigations: geotechnical boreholes and Penetrometer Test with piezocone

CURRICULUM VITAE (CV) Dr. Dipankar Chatterji

Position Title and No.	**K-5Transport Economist**
Name of Expert:	Dr. Dipankar Chatterji (Chattopadhyay)
Date of Birth:	05 July 1952
Citizenship:	Indian

Education:

- Calcutta University, **PhD (Transport-related Economics),**India, 1994
- Jadavpur University, **MA (Economics with econometrics and statistics**), India, 1988
- Calcutta University, B Sc, (Math, Physics) India, 1972
- Institute of UN studies, Diploma on UNO and International understanding, India, 1974 – 1975
  World Bank Institute, Transport *Diploma on Gender, Poverty, Development*, 2005

Other Training:

- **HDM-4** version 2.09 –Roads Appraisal, **RED Model** –Road Appraisal, ORN 22 Social Benefit Software, Tool of TRL Ltd., UK–Road Appraisal, COSTAB (Agriculture Projects), Monte Carlo Simulation for risk analysis,
- Gravity Model-Traffic Diversion Analysis, Forecasting Model for travel demand including generated and induced traffic and traffic forecasting with elasticity model, For Policy Analysis Projects of Transport and Water sectors; Sector Analysis, Stakeholder Analysis, Problem Tree Formulation, Root-cause analysis, System Analysis and Program Design.

Employment record relevant to the assignment:

Period	Employing organization and your title/position. Contact info for references	Country	Summary of activities performed relevant to the Assignment
Oct. 2008 to date	Self-employed **Transport Economist** Glory Jonga VP, CPCS, <gjonga@cpcs.ca SAI Consulting Engineers, India Abhik Bhattacharjee, GM abhattacharjee@saiindia.com Rebel Group International B.V, The Netherlands, Koen van Baekel, director koen.vanbaekel@rebelgroup.com Development Consultants (Pvt) Ltd Eng.S.Jegasothy,Director – jega@rdc-lk.com Millennium Challenge Corporation (USA) Kaiser Paul, Director <Kaiserpj@mcc.gov Director: Rohan Krishna rohan.krishna@ecorys.com John Thorpe, TL John.thorpe@smec.com roughton international,Inderjeet Singh Gill Regional Manager	**Central America Countries:** **Guyana** **Developing Regions:** Eritrea Oman Bhutan Sri Lanka Sudan Afghanistan Ethiopia Mozambique Nigeria Nepal Viet Nam Cambodia Ghana	Experience as **Transport Economist** in the areas of roads, mass transit, rural roads and responsible for: (1) ECONOMIC evaluation of road infrastructure projects including determination of NPV and EIRR, their sensitivity analysis **using HDM-IV Model version 2.08 or RED Model along** with determination of time value, cargo holding time value etc. The ORN 22 Social Benefit Software Tool of TRL Ltd. (2) **Calibration of HDM to local condition. Rendered Training of HDM 4** – Project, Program and Strategy to road department staff members. Expertise in Budget Estimation for road maintenance , optimization of maintenance program (3) Considerable experiences in ROAD STRATEGY ANALYSIS, PROGRAM ANALYSIS and determination of

			Maintenance Regime with budget and
	inderjeetsingh.gill@gmail.com SNC-Lavalin, Canada Mr.Rana Latif, (rana.latif@snclavalin.com), Director William Rounds wrounds@louisberger.com PADECO, Mr. B Winston, bwinston@padeco.co.jp Mr. Even Kolstad, Director, Norconsult, <even.kolstad@norconsult.com>	Laos Kenya India	without budget conditionality, POLLUTION REDUCTION with the help HDM-4 (4) Expertise in traffic forecasting including GENERATED and INDUCED traffic in post project period with statistical models taking into consideration present and future economic activities and quantitative estimation.

SIMILAR PROJECTS IN PAST FIVE YEARS (2012-2017)

Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks

Name of Project: Nodal Consultant for Feasibility Study and Detailed Project Report with Transaction Advisory services for Access Controlled Nagpur-Mumbai Super Communication Expressway (**MSRDC Funded**)

Year : May 2016 – April 2017 **, Location:** Mumbai , Client: Govt. of Maharashtra, **Main project features**: Feasibility and DPR of 750 km Access Controlled Expressway

Positions held: Transport Economist, Activities performed: The economic evaluation of the New Road using HDM4(including economic benefits, savings in road user costs, Vehicle mix, load factor, truck load for goods mix, vehicle operating costs, analysis on EIRR & NPV)

Name of Project: Consultancy Services for Environmental and Social Impact Assessment and Detailed Engineering Design for Isolo-Nginyang, 241 km Road , Kenya (AfDB Funded)

Year : 2014 –2015**, Location:** Kenya**, Client:**Govt. of Kenya &AfDB**, Main project features:** DPR of the Road for 4Laning

Positions held: Transport Economist, **Activities performed**: **The economic evaluation of the New Road using HDM4**(including economic benefits, savings in road user costs, Vehicle mix, load factor, truck load for goods mix, vehicle operating costs, analysis on EIRR & NPV)

Year: 2016 –2016**, Location: Gambia , Client:**Govt. of The Gambia and AfDB, **Main project features:** Economic analysis of Trans-Gambia Corridor Project Phase II and Bridge Tolling Management Model

Positions held:Transport Economist, **Activities performed: The economic evaluation of the New Road using HDM4**(including economic benefits, savings in road user costs, Vehicle mix, load factor, truck load for goods mix, vehicle operating costs, analysis on EIRR & NPV)

Name of project: Consultancy Services for Environmental and Social Impact Assessment and Detailed Engineering Design for LamuGarissa Road , Kenya, AfDB-funded

Year: 2014 to 2015 **, Location:** Kenya**, Client:** Govt. of Kenya &AfDB, **Main project features**: DPR of the Road for 4Laning

Positions held:Financial Analyst, Activities to be performed: Cost due diligence, Economic Analysis, Tolling strategy including toll rates; Factors for limiting revenue from toll; Affordability and sustainability of toll rates; cash flow model for financial internal rate of return, return on investment, payback period etc.

CURRICULUM VITAE (CV) Valentino Shal

Position Title and No.	K-7 Social and Gender Impact Specialist
Name of Expert:	Valentino SHAL
Date of Birth:	3 of February, 1978
Country of Citizenship/Residence	Belize / Belize

Education:

- 2004- 2005: London School Of Economics & Political Science, United Kingdom - MSc. Environment and Development
- 1999-2001: University Of Belize, Belize City, Belize - BSc. Business Administration
- 1997-1999: University College Of Belize, Punta Gorda Town, Belize - Associate's Degree — Business Administration

Employment record relevant to the assignment:

period	Employing organization and your title/position. Contact info for references	Country	Summary of activities performed relevant to the Assignment
2013 present	Employer: PRAX15 Advisory Group LLC POSITION HELD: Technical Consultant	Caribbean and/or Central America: Belize	Conduct of social impact assessments and development of mitigating and restorative measures for various projects. Carrying out stakeholder analysis and socio-economic assessments and consultations for the development protected areas and other social development programs and projects.

-

SIMILAR PROJECTS IN PAST FIVE YEARS (2012-2017) Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks
Name of assignment: Development of Project Operations Manual; Development of a Community Participation Plan and Gender Equality Guidance Note Year: 2015 Location: Belize Client: Youth and Community Transformation Project Main project features: Design of project operational procedures, gender assessment of participating organizations, gender analysis of project target areas. Position held: Social Development and Gender Specialist Activities performed: Design of project cycle, administration, financial management and procurement procedures, assessment of organizations, and community participation workshop.

Name of assignment: Finalization of REDD+ Readiness Preparation Proposal (R-PP)
Year: 2014
Location: Belize
Client: Belize Forest Department/GIZ
Main project features: Finalizing of REDD+ Readiness Preparation Proposal (R-PP) focusing on:

- Organizational Arrangements
- Consultation and Participation
- Social Management Frameworks for Social Impacts
- Social Safeguards Measures and Monitoring

Position held: Social Development and Gender Specialist
Activities performed: Document review, redesign of project management framework, and assist with submission to World Bank/Forest Carbon Partnership Facility in Lima, Peru.

Name of assignment: Social Impact Assessment for the Belize Climate Resilient Infrastructure
Project Year: 2014
Location: Belize
Client: Belize Social Investment Fund
Main project feature:

- Preparation of the Social Impact Assessment for the Belize Climate Resilient Infrastructure Project (BCRIP) along with Ministry of Works (US$30m).

❖ Preparation of Social Safeguards as per World Bank Environment and Social Management Policies.

Position held: Social Development and Gender Specialist
Activities performed: Prepare Social Impact Assessment for BCRIP, prepare Culturally Appropriate Participation Framework, prepare Involuntary Resettlement Policy Framework

3 Sample Bridge Assessment Report

POLITECNICA BUILDING FOR HUMANS

STRUCTURE INSPECTION CHECKLIST **ExBr01**

Project Prot.: 4834 **COASTAL HIGHWAY DESIGN – FEASIBILITY PHASE**

Date of Inspection: 17/12/2017
Chainage 3.78 (km) from La Democracia on the Coastal Road

GENERAL DATA

Structure ID: ExBr01
Bridge Name: SIBUN BRIDGE
Crossing: SIBUN RIVER
Road Name: COASTAL HYGHWAY
Structure Type: Concrete / Steel
Owner: MoW
Construction Type: 3 spans girder bridge
District: Belize district
Construction Material: Concrete + Steel
Local Authority: MoW
Construction Date: n/a
Length of the Bridge: 64 m
Width of the carriageway: 7.30 m
Width of footpath: Not present
Elevation:
Inspector: Gori, Cecchelli
Overall Condition Rating: Average

DEFECT LOCATION AND DETAILS

Component ID: Approaches – A; Bridge Surface – B; Waterway – C; Substructure – D; Superstructure – E; miscellaneous – F.

Inspection Elements	Problem (tick) Y	Problem (tick) N	Picture code	Location and Comments
A - Approaches				
1 Signs and Delineation				
• Missing, damaged, obscured (includes ID plate)	X			All missing
2 Guardrail / Railings				Not present
• Accident damage				
• Incorrect alignment		X		
• Connection to bridge		X		
• Delineators				n/a
3 Road Drainage				
• Blocked inlets/outlets	X			
• Scour of outlets/embankment	X			
4 Road Surface				
• Material defects* - concrete	X			Spalling
• Material defects* - surfacing	X			Spalling
• Settlement, depressions				n/a
• Rough joint transition	X			

POLITECNICA
BUILDING FOR HUMANS

STRUCTURE INSPECTION CHECKLIST **ExBr01**

Project Prot.: 4834 **COASTAL HIGHWAY DESIGN – FEASIBILITY PHASE**

Inspection Elements	Problem (tick) Y	Problem (tick) N	Picture code	Location and Comments
• Cross Girders	X			
• Deck	X			
• Coatings	X			
14 General				
• Debris/dirt build-up	X			
• Impact damage				
• Excessive movement/vibration				
• Dampness				
• Ventholes				
F - Miscellaneous				
15 Damage to services				
• Fasteners / Brackets				
• Pipe / Conduit				
• Openings				

Material *	Defects Description
Concrete	Cracking, spalling, corrosion of reinforcement, drummy areas
Steel	Bending, buckling, cracking, distortion, loose bolts, rivets, corrosion, coating damage
Timber	Splitting, crushing, decay, infestation, loose bolts or pins
Masonry	Cracking, opening joints, mortar loss, bulging
Bituminous Surfacing	Cracking, crazing, breaking up, lifting off, rutting, pushing
Protective Coatings	Cracked, peeling, weathered
** Steel Culverts	Probe or sound culvert walls at normal water level, check for pitting or loss of culvert material

INSPECTOR 'S COMMENTS

Component	General Comments
A	High slopes on approaches. No safety protection. Present discontinuity between approaches and bridge deck.
B	The Bridge Surface is spalling. There are problem of drainage on the deck. No footpaths are present. The barriers present corrosion.
C	
D	The piers are in concrete. The piers and pier caps present spalling area. The protective coating is deteriorating

PAGE 3/4

POLITECNICA BUILDING FOR HUMANS | **STRUCTURE INSPECTION CHECKLIST** | **ExBr01**

Project Prot.: 4834 | **COASTAL HIGHWAY DESIGN – FEASIBILITY PHASE**

Component	General Comments
	.....
E	The main truss girders present corrosion and coating damage .....
F	.....

REHABILITATION ACTIVITY FORESEEN/PROPOSED

Activity No.	Description	Unit	Quantity

NOTE:
.....

Date: .....

Drafted by: .....

PAGE 4/4

POLITECNICA BUILDING FOR HUMANS

STRUCTURE INSPECTION CHECKLIST **ExBr01**

Project Prot.: 4834 **COASTAL HIGHWAY DESIGN – FEASIBILITY PHASE**

Inspection Elements	Problem (tick) Y	Problem (tick) N	Picture code	Location and Comments
B - Bridge Surface				
5 Bridge Surface				
▪ Material defects*: surfacing				
▪ Material defects*: concrete	X			Poor concrete
▪ Material defects*: timber				n/a
▪ Scuppers				
6 Footpaths				
▪ Clean		X		not present
▪ Even		X		not present
7 Barriers				
▪ Impact Damage	X			Distorsion in some parts
▪ Loose/damaged fixings				
▪ Loose post base				
▪ Material Defects*	X			Locally corrosion
▪ Delineators				
8 Expansion Joints				
▪ Loose/damaged fixings				
▪ Damaged/missing seals				
▪ Deck/nosing/ballast wall damage				
▪ Obstructions in gap	X			
C - Waterway				
9 General				
▪ Trees or bushes under bridge	X			
▪ Debris against structure	X			
▪ Riverbank/Embankment Erosion	X			
▪ Scour holes in bed	X			
▪ Damaged bed protection				
D - Substructure (Including culvert wingwalls)				
10 Material Defects*				
▪ Piles				
▪ Footings				
▪ Walls				
▪ Piers	X			
▪ Abutments	X			
▪ Pier caps	X			
▪ Concrete supports of bearings	X			
11 General				
▪ Forward movement of abutments/wings				
▪ Blocked drains/weepholes				
▪ Debris on shelf/bearing				
▪ Scour/erosion of spillthrough				
▪ Dampness/leakage from deck				
▪ Substructure protection (over-bridges)				
12 Bearings				
▪ Gap closed/decks in contact/damaged				
▪ Bearing displaced/damaged				
▪ Poorly seated				
▪ Corroded/Seized/No lubricant				
E - Superstructure				
13 Material defects* in:				
▪ Girders (including fasteners)	X			

PAGE 2/4

Below the deflection do to pedestrian and traffic vehicle live loads. The value exceeds the limit which is equal to 11 mm for this bridge.

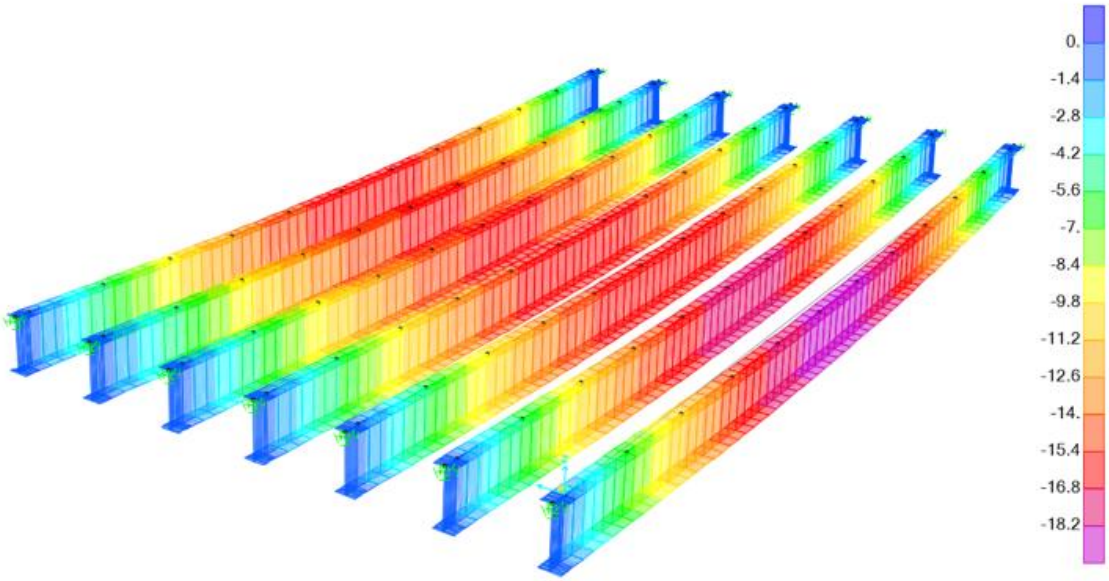


Figure 71 – Deflection do to pedestrian and traffic vehicle live loads (mm)

CONSIDERATIONS

In this bridge many elements of the steel beams exceed the demand/capacity ratio limit for Strength I combination. Maximum permitted live load deflection has been exceeded.

4 Water analysis reports

B&B WATER & WASTE LABORATORY
ENVIRONMENTAL & DRINKING WATER ANALYSIS SERVICES
1 KING STREET, PO BOX 37, BELIZE CITY, BELIZE, BELIZE

Report No: #44-2018

WATER ANALYSIS REPORT

To: Jan Meerman
From: Wilbert Estrada
Copy: Manuel Lanza

Customer: Jan Meerman
Address: NI
Report Date: 2018/04/10

Report No: #44-2018

Sample Information

Assigned Sample ID	Sample Description:	Condition of sample at arrival:
#1	*Big Creek- Surface Water*	*OK, on sampling bottles, on ice*
#2	*Mullins- Surface Water*	*OK, on sampling bottles, on ice*
#3	*Quamina-Surface Water*	*OK, on sampling bottles, on ice*
#4	*Jenkins-Surface Water*	*OK, on sampling bottles, on ice*
#5	*Soldier-Surface Water*	*OK, on sampling bottles, on ice*
#6	*Manatee-Surface Water*	*OK, on sampling bottles, on ice*
#7	*Corn House-Surface Water*	*OK, on sampling bottles, on ice*
#8	*Sibun-Surface Water*	*OK, on sampling bottles, on ice*

Report Notes:

1. The report is considered approved once it has been PDF file issued, numbered & Dated.
2. The Laboratory was not responsible for sampling unless otherwise stated. This report is confidential.
3. Further Information concerning analysis can be provided upon request.
4. Amended reports will be indicated in the comments section.
5. The results obtained relate only to the items tested and the laboratory shall not be held responsible for any matters arising from them.
6. This report cannot be copied partially or totally without the Laboratory or the customer authorization.
7. If you have any question or doubt contact the Water Manager at MLanza@bowen.bz
8. Consider that the samples will be retained for 7 days after the report is sent if additional sample volume is left after analysis are carried out.

Classified & Confidential

Page 1 of 3

B&B WATER & WASTE LABORATORY
ENVIRONMENTAL & DRINKING WATER ANALYSIS SERVICES
1 KING STREET, PO BOX 37, BELIZE CITY, BELIZE, BELIZE

Report No: #44-2018

Details:

Sample ID: ***See Sample Information*** Sampling Date: 2018/03/22
Sample point: Several Sampled by: NI
Sample Type: Surface Water Reception Date: 2018/03/22

Parameter	*LOQ*	*URL*	*Unit of Meas.*	*Result #1*	*Result #2*	*Result #3*	*Result #4*	*Method*	*Analysis Date*
PHYSICAL									
pH	0	14	unit	**6.85**	**6.89**	**7.88**	**7.90**	pH/ISE meter	2018/03/22
Total Suspended Solids	4	20,000	mg/l	**<4**	**ND**	**4**	**<4**	EPA 160.2	2018/03/22
Total Dissolved Solids	0	50,000	mg/l	**28.3**	**31.7**	**131.4**	**155.5**	Conductivity Probe	2018/03/22
NON-METALS									
Oxygen, Dissolved (DO)	0	20	mg/l	**8.00**	**8.09**	**8.14**	**8.02**	HACH Method 10360	2018/03/22
INORGANIC COMPOUNDS									
Total Phosphate (PO4)	0.02	1.10	mg/l	**0.26**	**0.15**	**0.25**	**0.30**	HACH Method 8190	2018/03/22
Nitrate (NO3)	0.1/0.3	10.0/30	mg/l	**1.1**	**0.8**	**1.0**	**1.0**	HACH Method 8171/8039	2018/03/22
Total Hardness (as CaCO3)	0.05/10	4.00/4000	mg/l	**9**	**8**	**78**	**111**	HACH Method 88030/8213	2018/03/22
MICROBIOLOGICAL ANALYSIS									
Escherichia Coli (E-Coli)	0	200	CFU/100ml	**67**	**33**	****230**	**0**	HACH Method 8367	2018/03/22
Fecal (Thermotolerant) Coliform	0	60	CFU/100ml	**22**	**40**	**55**	**240**	HACH Method 8074	2018/03/22

Optimal Colony Density

B&B WATER & WASTE LABORATORY
ENVIRONMENTAL & DRINKING WATER ANALYSIS SERVICES
1 KING STREET, PO BOX 37, BELIZE CITY, BELIZE, BELIZE

Report No: #44-2018

Parameter	*LOQ*	*URL*	*Unit of Meas.*	*Result #5*	*Result #6*	*Result #7*	*Result #8*	*Method*	*Analysis Date*
PHYSICAL									
pH	0	14	unit	**6.70**	**8.04**	**8.24**	**7.61**	pH/ISE meter	2018/03/22
Total Suspended Solids	4	20,000	mg/l	**ND**	**<4**	**ND**	**ND**	EPA 160.2	2018/03/22
Total Dissolved Solids	0	50,000	mg/l	**6.70**	**8.04**	**8.24**	**7.61**	Conductivity Probe	2018/03/22
NON-METALS									
Oxygen, Dissolved (DO)	0	20	mg/l	**8.12**	**8.22**	**7.92**	**8.09**	HACH Method 10360	2018/03/22
INORGANIC COMPOUNDS									
Total Phosphate (PO4)	0.02	1.10	mg/l	**0.32**	**0.10**	**0.10**	**0.08**	HACH Method 8190	2018/03/22
Nitrate (NO3)	0.1/0.3	10.0/30	mg/l	**0.8**	**1.1**	**0.9**	**1.1**	HACH Method 8171/8039	2018/03/22
Total Hardness (as CaCO3)	0.05/10	4.00/4000	mg/l	**12**	**111**	**209**	**92**	HACH Method 88030/8213	2018/03/22
MICROBIOLOGICAL ANALYSIS									
Escherichia Coli (E-Coli)	0	200	CFU/100ml	**0**	**0**	**40**	**0**	HACH Method 8367	2018/03/22
Fecal Coliform	0	60	CFU/100ml	**85**	**35**	**10**	**2**	HACH Method 8074	2018/03/22

Analysts:
Justin Gibbs/Remy Can

Abbreviation/Considerations:

ND= Not detected
NT= Not tested
URL= Upper Range limit
LOQ= Quantification Limit
CFU= Colony Forming Units
TNTC=Too Numerous to Count
CG= Confluent Growth
NI= Not Indicated
NA= Not Applicable
* Take with caution this result, because it was analyzed after the regulatory holding time
** = Results obtained via dilution

Comments:

Authorized By: Manuel Lanza
On: 2018/04/10

Classified & Confidential

Page 3 of 3

B&B WATER & WASTE LABORATORY
ENVIRONMENTAL & DRINKING WATER ANALYSIS SERVICES
1 KING STREET, PO BOX 37, BELIZE CITY, BELIZE, BELIZE

Report No: #9-2018

WATER ANALYSIS REPORT

To: Jan Meerman
From: Wilbert Estrada
Copy: Manuel Lanza

Customer: Jan Meerman
Address: NI
Report Date: 2018/02/08

Report No: #9-2018

Sample Information

Assigned Sample ID	Sample Description:	Condition of sample at arrival:
#1	*Big Creek- Surface Water*	*OK, on sampling bottles, on ice*
#2	*Mullins- Surface Water*	*OK, on sampling bottles, on ice*
#3	*Quamina-Surface Water*	*OK, on sampling bottles, on ice*
#4	*Jenkins-Surface Water*	*OK, on sampling bottles, on ice*
#5	*Soldier-Surface Water*	*OK, on sampling bottles, on ice*
#6	*Manatee-Surface Water*	*OK, on sampling bottles, on ice*
#7	*Corn House-Surface Water*	*OK, on sampling bottles, on ice*
#8	*Sibun-Surface Water*	*OK, on sampling bottles, on ice*

Report Notes:

1. The report is considered approved once it has been PDF file issued, numbered & Dated.
2. The Laboratory was not responsible for sampling unless otherwise stated. This report is confidential.
3. Further Information concerning analysis can be provided upon request.
4. Amended reports will be indicated in the comments section.
5. The results obtained relate only to the items tested and the laboratory shall not be held responsible for any matters arising from them.
6. This report cannot be copied partially or totally without the Laboratory or the customer authorization.
7. If you have any question or doubt contact the Water Manager at MLanza@bowen.bz
8. Consider that the samples will be retained for 7 days after the report is sent if additional sample volume is left after analysis are carried out.

Classified & Confidential

Page 1 of 3

B&B WATER & WASTE LABORATORY
ENVIRONMENTAL & DRINKING WATER ANALYSIS SERVICES
1 KING STREET, PO BOX 37, BELIZE CITY, BELIZE, BELIZE

Report No: #9-2018

Details:

Sample ID: ***See Sample Information*** Sampling Date: 2018/01/24
Sample point: Several Sampled by: NI
Sample Type: Surface Water Reception Date: 2018/01/24

Parameter	*LOQ*	*URL*	*Unit of Meas.*	*Result #1*	*Result #2*	*Result #3*	*Result #4*	*Method*	*Analysis Date*
PHYSICAL									
pH	0	14	unit	**6.75**	**7.14**	**7.68**	**7.59**	pH/ISE meter	2018/01/24
Total Suspended Solids	4	20,000	mg/l	**<4**	**<4**	**<4**	**25.2**	EPA 160.2	2018/01/24
Total Dissolved Solids	0	50,000	mg/l	**26.4**	**28.6**	**120.5**	**68.2**	Conductivity Probe	2018/01/24
NON-METALS									
Oxygen, Dissolved (DO)	0	20	mg/l	**7.10**	**7.81**	**6.49**	**7.48**	HACH Method 10360	2018/01/24
INORGANIC COMPOUNDS									
Total Phosphate (PO4)	0.02	1.10	mg/l	**0.11**	**0.10**	**0.07**	**0.07**	HACH Method 8190	2018/01/24
Nitrate (NO3)	0.1/0.3	10.0/30	mg/l	**1.4**	**0.9**	**1.3**	**0.4**	HACH Method 8171/8039	2018/01/24
Total Hardness (as CaCO3)	0.05/10	4.00/4000	mg/l	**8.5**	**11.9**	**62.7**	**48.4**	HACH Method 88030/8213	2018/01/24
MICROBIOLOGICAL ANALYSIS									
Escherichia Coli (E-Coli)	0	200	CFU/100ml	**0**	**0**	**0**	**0**	HACH Method 8367	2018/01/24
Fecal (Thermotolerant) Coliform	0	60	CFU/100ml	**0**	**20**	**25**	****375**	HACH Method 8074	2018/01/24

Optimal Colony Density

B&B WATER & WASTE LABORATORY
ENVIRONMENTAL & DRINKING WATER ANALYSIS SERVICES
1 KING STREET, PO BOX 37, BELIZE CITY, BELIZE, BELIZE

Report No: #9-2018

Parameter	LOQ	URL	Unit of Meas.	Result #5	Result #6	Result #7	Result #8	Method	Analysis Date
PHYSICAL									
pH	0	14	unit	6.62	7.75	8.21	7.87	pH/ISE meter	2018/01/24
Total Suspended Solids	4	20,000	mg/l	<4	83.6	6.4	4.2	EPA 160.2	2018/01/24
Total Dissolved Solids	0	50,000	mg/l	17.9	115.9	373	110.3	Conductivity Probe	2018/01/24
NON-METALS									
Oxygen, Dissolved (DO)	0	20	mg/l	8.01	7.81	6.95	7.56	HACH Method 10360	2018/01/24
INORGANIC COMPOUNDS									
Total Phosphate (PO4)	0.02	1.10	mg/l	0.12	0.12	0.26	0.13	HACH Method 8190	2018/01/24
Nitrate (NO3)	0.1/0.3	10.0/30	mg/l	0.8	ND	1.0	1.4	HACH Method 8171/8039	2018/01/24
Total Hardness (as CaCO3)	0.05/10	4.00/4000	mg/l	8.1	103	211	104	HACH Method 88030/8213	2018/01/24
MICROBIOLOGICAL ANALYSIS									
Escherichia Coli (E-Coli)	0	200	CFU/100ml	0	**925	**415	**130	HACH Method 8367	2018/01/24
Fecal Coliform	0	60	CFU/100ml	34	**1840	**640	**310	HACH Method 8074	2018/01/24

Analysts:
Justin Gibbs/Remy Can

Abbreviation/Considerations:

ND= Not detected
NT= Not tested
URL= Upper Range limit
LOQ= Quantification Limit
CFU= Colony Forming Units
TNTC=Too Numerous to Count
CG= Confluent Growth
NI= Not Indicated
NA= Not Applicable
* Take with caution this result, because it was analyzed after the regulatory holding time
** = Results obtained via dilution

Comments:

Authorized By: Manuel Lanza
On: 2018/02/08

Classified & Confidential

Page 3 of 3

5 Ecosystems, Flora and Fauna Assessment Methodologies

Based on 2017 Landsat satellite imagery, an attempt was made to assess the various vegetation types / ecosystems present within the protected area buffer zone.

To verify this remote sensing analysis, and in order to get information about species compositions and vegetation structure, a set of 11 vegetation transects was established. To establish the locations for these transects, using GIS methodologies, points sets 5 km apart were projected. Using a fixed distance creates a random element and prevents the researcher from selecting “convenient” locations. To further the level of randomness, the aspect of the transects was flipped each time. In other words, transect 1 was located on the east side of the road, transect 2 on the west side of the road, transect 3 on the east side and so on. The relatively large number of transects increased the chances for all major ecosystems within the road-reserve to be represented.

The methodology used for the vegetation transects has been adapted from the methodology used by the Forest Planning and Management Project in Belize (Shawe, 1997). This methodology involved the opening of a 100-meter-long (and in this study, straight) line through the vegetation under study. Care was taken not to remove any of the trees along the transects. The cut line only served to facilitate access.

The transects started at the edge of the disturbed zone along the road, i.e. in “original” vegetation. The actual transect consists of a 4 m wide band along the cut line (2 m to the left, 2 m to the right). Within this transect, all trees with a diameter at breast height (dbh at approximately 1.30 m height) of more than 10 cm were counted, dbh measured and where possible identified. Only those stems were counted that had their base within the transect (important in the case of leaning trees). All other herbs, vines, saplings, shrubs etc. were identified to the closest level possible. It should be noted that many plants cannot be identified to species when not in flower and/or fruit.

Birds.

Although the principal purpose of the transects was the ecosystem/vegetation assessment, the opportunity was taken to use the same transect for bird observations. At the start of creating the transect, 15 minutes were taken to carry out bird observations, which includes audio observations. At later stages, the same locations were again visited for bird records. All bird records, either from the transects or opportunistically along the road were later entered into the eBird database, thereby building a geo-referenced dataset of birds for the area.

Apart from this, an extensive use was made of this eBird (www.ebird.org) database. For the 5 km buffer zone along the road, as per November 2017, a staggering 25,319 bird records representing 388 species was available. This large number and great variety is no doubt caused by the variety of habitats included such as savanna, hills rivers and lagoons.

Literarature used

Balick M. J., Nee M. H. and D.E. Atha (2000). Checklist of the vascular plants of Belize with common names and uses. Memoirs of the New York Botanical Garden, Volume 85. New York Botanical Garden Press. ISBN: 0-89327-440-2

BERDS (Meerman, J. C. and J. Clabaugh (ed.) 2015). Biodiversity and Environmental Resource Data System of Belize. Internet address: http://www.biodiversity.bz

Cornec, J. H. 2003. Geology map of Belize. Private Publication.

Greenfield D. W. and J. E. Thomerson (1997). Fishes of the Continental Waters of Belize. University Press of Florida. ISBN: 0-8130-1497-2

IUCN 2015. IUCN Red List Categories and Criteria: IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. www.Redlist.org

Jones, H. L. 2003. Birds of Belize. University of Texas Press, Austin TX. 317 pp + 56 plates, 234 maps. ISBN: 0-292-74066-2

King, R.B., I.C. Baillie, T.M.B. Abell, J.R. Dunsmore, D.A. Gray, J.H. Pratt, H.R. Versey, A.C.S. Wright and S.A. Zisman, 1992. Land resource assessment of northern Belize, volume 1 and 2. Natural Resource Institute Bulletin No 43. Pp 1-513 + 8 maps.

Meerman, J. C. & W. Sabido. 2001. Ecosystems Map of Central America: Belize. 2 vols + map. Programme for Belize.

Meerman, J. C. 2002. Forest Fires in Belize. http://biological-diversity.info/fire.htm

Meerman, J. C. 2005. Ecosystems Map of Belize – 2004 edition: http://biological-diversity.info/projects.htm

Meerman, J. C. 2005. NPAPSP - Protected Area System Assessment and Analysis: Gap Analysis. Report to the Protected Areas System Plan Office.

Meerman, J. C. 2005. NPAPSP – Protected Areas System Assessment and Analysis: Critical Species. Report to the Protected Areas System Plan Office.

Meerman, J. C. 2007. Key Biodiversity Area (KBA) analysis for Belize (Draft). Report to Conservation International.

Meerman, J. C. 2015. Belize Biodiversity Website http://biological-diversity.info

Meerman, J. C., 2005. National List of Critical Species. First draft list of critical species in Belize, this document is meant to be the first step in the creation of a IUCN red data list for Belize Prepared as part of the National Protected Areas Policy and System Plan

Meerman, J. C., 2005c. National Protected Areas Policy and System Plan: GAP analysis.Worldbank, 2014. Management and Protection of Key Biodiversity Areas in Belize Project. Social Safeguards, Operational Policy 4.10. 89 pp.

Meerman, J. C., and J.R. Wilson, eds. 2005. The Belize National Protected Areas System Plan. Government of Belize. 71 pp.

Meerman, J. C., J. Epting, M. Steininger, J. Hewson, 2010. Forest Cover and Change in Belize. Circa 1990-2000-2005. Center for Applied Biodiversity Science, Arlington, VA. USA.11 pp.

Meerman, J. C., M. Vasquez, E. McRae, N. Arnold, T. Boomsma, R. Wilson. 2000. Feasibility Study of the Proposed Northern Belize Biological Corridor Project (NBBCP). Report to Programme for Belize. 2 vols. 77 pp + app.

Meerman, J. C., P. Herrera, B. Holland and A. Howe. 2004. Rapid Ecological Assessment Spanish Creek Wildlife Sanctuary. Report to the Rancho Dolores Environment and Development Group. 2 vols. 44 pp + app.

Rainwater, T.R. et al., 2010. A recent survey of the Critically Endangered Central American River Turtle (Dermatemys mawii) in Belize. Report to the Belize Fisheries Department. 76 pp. http://www.turtlesurvival.org/component/taxonomy/term/summary/115/45 Retrieved 10 September 2015

Shawe, K. 1997. Ecological Survey - Sampling Strategy and Method. Draft report to the Forest Planning and Management Project, Forest Department, Belmopan. 10 pp.

6 Ecosystems details

The following descriptions are based on Meerman & Sabido (2001), modified where appropriate. See Table # for the relation between the Unesco Code ecosystems and the "broad" ecosystems.

IA1f(2)-Tropical evergreen broad-leaved occasionally flooded alluvial forest

- Soils deep, calcium poor, brown-brown to gray in the topsoil but mottled below.
- Subject to occasional river flooding
- Frequently exposed to savanna fires but vegetation mostly resistant.
- Low scrubby forests in the depressions caused by creeks crossing short-grass savannas (type VA2).
- Frequently encountered plant species are Acacia sp., Coccoloba sp., Guazuma ulmifolia, Guettarda combsii, Hirtella racemosa, Miconia spp. Mouriri excelsa, Sabal mauritiiformis, Simarouba glauca, Vochysia hondurensis and Xylopia frutescens. In places where drainage is impeded a thick herb layer of Scleria bracteata and other sedges develops.

IA2a(1)(a)-Tropical evergreen seasonal broad-leaved lowland forest, well drained, over acidic soils &

IA2a(1)(a)-s-Tropical evergreen seasonal broad-leaved lowland forest, well drained, over acidic soils:Steep

- The two variants are distinguished by slope.
- The soils are reddish brown or gray sandy clays with stones, overlying quartzite or shale hills.
- Mostly well drained
- This ecosystem is very sensitive to fire damage and repeated burning can replace this ecosystem with areas of *Dicranopteris* with *Pinus caribaea*.
- Frequently encountered tree species in these forests are Attalea cohune, Bactris sp., Calophyllum brasiliense, Castilla elastica, Clidemia sp., Combretum farinosum, Dendropanax arboreus, Desmoncus orthacanthos, Dialium guianense, Dicranopteris sp., Euterpe precatoria, Ficus sp., Geonoma sp., Guarea spp., Heliconia vaginalis, Hirtella racemosa, Inga sp., Licania platypus, Licania hypoleuca, Miconia spp., Mimosa pigra, Mimosa watsoni, Mouriri myrtilloides, Nectandra sp., Ochroma lagopus, Passiflora ambigua, Podocarpus guatemalensis, Pourouma aspera, Protium schippii, Psychotria poeppigiana, Pterocarpus rohrii, Quararibea sp., Rheedia sp., Schefflera morototoni, Schizolobium parahybum, Scleria bracteata, Simarouba glauca, Sloanea tuerckheimii, Souroubea sp., Spondias mornbin, Stemmadenia donnell-smithii, Swietenia macrophylla, Symphonia globulifera, Terminalia amazonia, Tococca sp., Trichospermum grewiifolium., Virola koschnyi, Vismia ferruginea, Vochysia hondurensis, Xylopia frutescens and Zanthoxylum sp., with Astrocaryum mexicanum and Melastomes in the understory. In the higher areas Cyathea tree ferns occur and some ground ferns.

IA2A(1)(A)K-R-TROPICAL EVERGREEN SEASONAL BROAD-LEAVED LOWLAND FOREST, WELL DRAINED, ON ROLLING KARSTIC HILLS

- Soils over limestone rock.
- Mostly well drained
- Fires can do tremendous damage to this ecosystem. The soil at the base of these hills is often quite fertile and sought after for slash and burn agriculture. Agricultural fires associated with this practice frequently escape and creep up the hills, commonly doing relatively minor damage at the lower elevations but completely destroying the tops of the hills.
- These forests are distinguished by topography because there are distinct differences between the lowland forests in Belize and those covering the hills probably as a result of differences in drainage. These forests display characteristics intermediate between lowland tropical forests and the submontane forests of higher altitudes in the Maya Mountains. The canopy trees 15-40 m tall. There is a distinct deciduous element.
- Common woody plants are; Acacia dolychostachya, Alseis yucatenensis, Ampelocera hottlei, Annona primigenia, Aspidosperma cruenta, Attalea cohune, Bourreria oxyphylla, Brosimum alicastrum, Calophyllum brasiliense, Casearia bartlettii, Cedrela odorata, Cordia gerescanthus, Crysophila stauracantha, Cupania belizensis, Cymbopetalum mayanum, Exothea paniculata, Guarea glabra, Hirtella americana, Licaria peckii, Lysiloma acapulcense, Manilkara zapota, Sideroxylon foetidissimum, Matayba oppositifolia, Ouratea lucens, Pimenta dioica, Pouteria amygdalina, Pouteria durlandii, Protium copal, Pseudolmedia oxyphyllaria, Rehdera penninervia, Sabal mauritiiformis, Sebastiana tuerckheimiana, Simira salvadorensis, Spondias mombin, Stemmadenia donnell-smithii, Tabebuia guayacan, Trichilia havanensis, Trichilia moschata, Trophis racemosa, Vatairea lundellii, Vitex gaumeri, Wimmeria concolor, Zanthoxyulum procerum, Zuleania guidonia and Myrtaceae. Palms and Rubiaceae are abundant in the shrub layer and lianas are frequent.

IA2A(1)(B)K-TROPICAL EVERGREEN SEASONAL BROAD-LEAVED LOWLAND FOREST ON CALCAREOUS SOILS

- Soils are well drained gray or brown clays, variably stony over calcareous rock. Mostly well drained.
- Fire risk is limited to areas with slash and burn cultivation.
- The canopy attains 20-30 m.
- Common trees are Alseis yucatanensis, Ampelocera hottlei, Aspidosperma cruenta, Attalea cohune, Brosimum alicastrum, Bursera simaruba, Calophyllum brasiliense, Cedrela odorata, Clusia salvinii, Cupania belizensis, Crysophila stauracantha, Dendropanax arboreus, Drypetes laterifolia, Drypetes brownei, Ficus spp., Hirtella americana, Lonchocarpus castilloi, Manilkara zapota, Matayba oppositifolia, Metopium brownei, Passiflora mayarum, Pimenta dioica, Pouteria reticulata, Protium copal, Pseudobombax ellipticum, Pseudolmedia sp., Sabal mauritiiformis, Schizolobium parahybum, Spondias mombin, Stemmadenia donnell-smithii, Swietenia macrophylla, Talisia olivaeformis, Trichilia minutiflora, Trophis racemosa and Zuleania guidonia. The understory has species such as Adiantum pulverulatum, Malvaviscus arboreus, Piper jacquemontianum, Psychotria pubescens, Pteris longifolia and Tectaria heracleifolia. A freqently found graminoid is Ichnanthus lanceolatus.

IA2A(1)(B)S-TROPICAL EVERGREEN SEASONAL BROAD-LEAVED LOWLAND FOREST ON POOR OR SANDY SOILS

- Nutrient poor, acidic soils. Moderately well drained
- Fire is of at least occasional occurrence in this ecosystem
- Medium high forests
- Characterized by low Attalea cohune, Acosmium panamense Calophyllum brasiliense, Miconia spp., Terminalia amazonia, Virola koschnyi, Vochysia hondurensis and Xylopia frutescens. Other, frequently encountered species include: Aspidosperma sp., Bactris major, Bactris mexicana, Belotia campbellii, Bucida buceras, Byrsonima crassifolia, Chrysobalanus icaco, Chrysophyllum mexicanum, Clidemia sp., Coccoloba sp., Desmoncus orthacanthos, Guettarda combsii, Hampea trilobata, Hirtella racemosa, Licania hypoleuca, Luhea speciosa, Metopium brownei, Miconia spp., Mouriri exilis, Ouratea sp., Pachira aquatica, Pinus caribaea, Pouteria sp., Psychotria poeppigiana, Roupala montana, Scleria bracteata, Simarouba glauca, Spondias mombin, Tabernaemontana arborea, Tetracera volubilis and Trichospermum campbellii.

IA2A(2)(B)-TROPICAL EVERGREEN SEASONAL NEEDLE-LEAVED LOWLAND FOREST, MODERATELY DRAINED

- A number of soil types support this ecosystem, their common characteristic being that they are all leached and gleyed. They are also prone to droughtyness, which put a severe stress on the ecosystem during the dry season. Ill drained
- This ecosystem is the result of a frequent fire influence.
- Forests dominated by *Pinus caribaea* with a distinctive but variable content of broadleaved species.
- Distinctive species include Pinus caribaea, Acoelorraphe wrightii, Aspidosperma cruenta, Byrsonima crassifolia, Cassia emarginata, Chrysophyllum oliviforme, Pithecellobium sp., Quercus oleoides, Vitex gaumeri, Vochysia hondurensis, Xylopia frutescens, and a number of Melastomes are present. Patches with Dicranopteris sp. and Scleria bracteata are frequent.

IA2G(1)(A)-SH-TROPICAL EVERGREEN SEASONAL BROAD-LEAVED LOWLAND SWAMP FOREST, SHORT TREE VARIANT

- Generally, over calcareous rock. Some hog-wallow micro-relief exists as a result of repeated wetting and drying of the soil. Ill drained, often waterlogged for part of the year.
- Fires are limited to areas with slash and burn cultivation.
- Swampy stands of low, thin stemmed trees and shrubs without emergents. Usually associated with 1A2g(1)(a)T and closely related to IIIA1bL.There is a distinctive deciduous element.
- Frequently encountered trees include Acacia sp., Acoelorraphe wrightii (usually occurring in dense clumps), Bucida buceras, Calliandra sp., Calyptranthes sp., Cameraria latifolia, Chrysobalanus icaco, Clidemia sp., Crescentia cujete, Erythroxylum guatemalense, Haematoxylon campechianum, Hampea trilobata, Helicteres guazumifolia, Hirtella racemosa, Hymenocalis littoralis, Licania hypoleuca, Miconia spp., Mimosa hemendieta, Mouriri exilis, Rinorea sp., Xylopia frutescens and Zygia sp.

IA5A(1)(C)-CARIBBEAN MANGROVE FOREST; MIXED MANGROVE SCRUB

- Not permanently inundated.
- Mixed mangrove communities. All three mangrove species occur: Avicennia germinans, Laguncularia racemosa, and Rhizophora mangle. Other frequent species include Acoelorraphe wrightii, Acrostichum aureum, Conocarpus erectus, Eragrostis prolifera, Myrica cerifera and Rhabdadenia biflora.

IA5A(1)(E)-CARIBBEAN MANGROVE FOREST; RIVERINE MANGROVE

- The systems are nutrient-rich from river deposited alluvium. Mostly waterlogged.
- Canopy height from 10 to 30 m;
- *Rhizophora mangle* is the dominant species.

IA5A(1)(F)-CARIBBEAN MANGROVE FOREST; BASIN MANGROVE

- Mostly waterlogged.
- Found along coastal lagoons and in land-locked coastal depressions. Species composition and structure in these communities are highly variable depending on frequency and depth of inundation, nutrient exchange and water salinity levels.
- *Rhizophora mangle* dominates in areas which receive frequent tidal flooding or where flood waters are predominantly deeper than 15 cm. Where water depth is less, and tidal flushing, amplitude and kinetic energy of floodwaters decrease, other mangrove species and associates invade. Where salinity reaches levels above 50 % *Avicennia germinans* dominates. In addition to being highly saline the soils may be very reduced (anaerobic), giving the *Avicennia* an ecological advantage through its pneumatophores. Where salinity is about 30-40 %, dominant species include *Avicennia germinans*, *Laguncularia racemosa*, and *Rhizophora mangle*. When disturbed the fern *Acrostichum aureum* becomes the dominant species.

IIIA1B(A)-DECIDUOUS BROAD-LEAVED LOWLAND SHRUBLAND, POORLY DRAINED

- Soil has a "hog-wallow" micro-relief, and is gray sandy clay, fairly well mottled below. Ill drained, frequently inundated.
- Where Karst limestone hills occur in association with savannas, this ecosystem acts as a buffer, protecting the vegetation on the hills from being affected by the frequent savanna fires.
- This is a swampy stand of thin-stemmed trees and shrubs 3-4 m high with no emergents, often associated with savannas. Where Karst limestone hills occur in association with savannas, this ecosystem is often found at the base of these hills,
- Frequently encountered species include Acoelorrhaphe wrightii, Aspidosperma cruenta, Bucida buceras, Calyptranthes sp., Chrysobalanus icaco, Clidemia sp., Haematoxylon

campechianum, Miconia spp., Mimosa hemendieta, Rinorea sp., Tetragastis stevensonii, and Xylopia frutescens.

IIIB1B(A)-DECIDUOUS BROAD-LEAVED LOWLAND SHRUBLAND, WELL-DRAINED

- Land generally slopes gently, and the soils are nutrient poor sands resting on sandy clay or gravelly sandy clay. Well drained
- Frequently exposed to fire.
- Sparse, fire induced scrubland with grass in the Mountain Pine Ridge area. This ecosystem is related to VF1c(1)L (Fire-induced lowland fern thicket), but probably older and more established. In some places there is still a cap of limestone and consequently, localized islands with a lime-loving ecosystem IA2a(1)(a)K-r (Tropical evergreen seasonal broadleaf lowland forest over rolling calcareous hills) can be found.
- Woody species include Agarista sp., Clusia sp., Curatella americana, Byrsonima crassifolia, Pinus caribaea, Quercus sp. Herbs are Andropogon spp., Cyperus spp, Dichanthelium aciculare, Eragrostis maypurensis, Panicum laxum, P. pilosum, Setaria tenax, S. parviflora, Scleria ciliata, Sporobolus indicus, and Trachypogon plumosus. On hills with remnants of a limestone cap, there is usually an abundance of orchids. Another typical species for these limestone caps is Beaucarnea pliabilis.

IIIB1B(A)2-DECIDUOUS BROAD-LEAVED LOWLAND DISTURBED SHRUBLAND

- Mostly well drained
- Frequently exposed to human induced fires.
- This community varies much according to its topographic position and. Disturbance may be natural, such as the displacement by a river after flooding, or it may be anthropogenic as when land is cleared and left fallow or disturbed by fire.
- Variable. Mostly "weedy" species

IIIB1B(F)P-DECIDUOUS BROAD-LEAVED LOWLAND RIPARIAN SHRUBLAND OF THE PLAINS

- On alluvial deposits. Outcrops of calcareous rock occur, but generally the alluvial deposits are deep and there is no bedrock visible. Mostly well drained
- Frequently exposed to human induced fires.
- Found along riversides where disturbance may be natural, such as the displacement by a river after flooding, or it may be anthropogenic as when land is cleared and left fallow.
- Tall graminoids (reeds, rushes, and sedges) mix with shrubs, and many types of ruderal communities.

SA1B(5)-BRACKISH LAKE OF THE CARIBBEAN LITTORAL PLAIN

- This ecosystem grouping contains a variety of aquatic habitats. Depending on location, the water may be saline, brackish or fresh.
- Vegetation is variable, according to the water type

SA1A-RIVER

- **PRESENTED IN THE PROJECT AREA BY A VARIETY OF SMALLER RIVERS/STREAMS. MOSTLY VERY SHALLOW. THE SIBUN RIVER IS THE LARGEST RIVER IN THE AREA.**
- Submerged vegetation recorded in the streams include the alga *Chara* sp. *Cabomba palaeformis* and *Mayaca fluviatilis* and the floating leaved *Nymphaea ampla*.
- Aquatic fauna includes various fishes. See that section.

VA2A(1)(2)-SHORT-GRASS SAVANNA WITH SCATTERED TREES AND/OR SHRUBS

- The soils all have in common that they have a pale colored, course textured topsoil sharply overlying a compact, brightly red and white mottled finer textured subsoil. The soils are all acid and very deficient in nutrients (King et al. 1992).
- This and related forest types are often waterlogged during the rainy season but show drought stress during the dry season, especially in the understory.
- With increased fire regime this forest type quickly degenerates to open short-grass savanna.
- This ecosystem is transitional from Short-grass savannas VA2b(2) to Tropical evergreen seasonal needle-leaf lowland dense forest IA2a(2)(b).
- Pinus caribaea is dominating but rather sparse. Other common trees and shrubs are Acoelorrhaphe wrightii, Byrsonima crassifolia, Chrysobalanus icaco, Hirtella racemosa, Quercus oleoides and Xylopia frutescens. Generally, there is a graminoid herbaceous layer dominated by sedges but with other herbs such as Cassytha filiformis, Passiflora urbaniana, Turnera odorata and sometimes Gynerium sagittatum. Some low shrubs such as Clidemia sp. and Curatela americana complete the understory.

VA2A(1/2)-SHORT-GRASS SAVANNA WITH DENSE TREES OR SHRUBS

- The soils all have in common that they have a pale colored, course textured topsoil sharply overlying a compact, brightly red and white mottled finer textured subsoil. The soils are all acid and very deficient in nutrients (King et al. 1992).
- The very dense subsoil prevents vertical water movements causing the landscape to be partially inundated during the wet season and extremely dry in the dry season.
- The extreme drought in the dry season caused by the soil conditions makes this ecosystem extremely vulnerable for fires. Some areas burn more than once a year. The wetter conditions in most of the Toledo district do not favor extensive fires and although favorable soil conditions exist, savannas in the Toledo district are extremely limited in extend. Documentation of lowland broadleaf forest fires started by lightning is rare (Middleton et al.,

1997). Consequently, fire in tropical lowland forests has traditionally been considered as human induced (Janzen, 1986; Koonce & Gonzalez-Caban, 1990).

- Typical Belizean lowland savannas are found on gently sloping alluvial deposits in the coastal plain. The combination of poor nutrient availability, extremes in water availability and recurring fire regime has resulted in a species poor but highly specialized ecosystem. The aspect of this community is quite variable. Moss (1998) classified 12 different savanna land classes from cutting grass marsh through to pine woodland. The scrublands generally appear as islands of small, densely packed trees and shrubs in a grassland area; in some areas the islands are large and merging, in others they are quite separate.
- The graminoid vegetation is usually being dominated by sedges. Frequent woody species are Acoelorraphe wrightii, Calyptranthus sp., Cameraria latifolia, Chrysobalanus icaco, Clidemia sp., Crescentia cujete, Curatela americana, Erythroxylum guatemalense, Gliricidia sepium, Hippocratea excelsa, Metopium brownei, Miconia sp., Mimosa albicans, Pinus caribaea, Quercus oleoides and Roupala montana. There is a strong herbaceous component with typically: Bletia purpurea, Borreria sp., Casytha filliformis, Chamaecrista spp., Cipura campanulata, Coutoubea spicata, Drosera cappilaris, Eriocaulon sp., Passiflora urbaniana, Xyris sp. and Zamia polymorpha. Grasses reported from this ecosystem include: Aristida appressa, Axonopus poiophyllus, Eragrostis maypurensis, E. acutifolia, E. elliottii, Gymnopogon spicatus, Leptocoryphium lanatum, Mesosetum filifolium, Panicum rudgei, Paspalum peckii, P. pulchellum, Sporobolus cubensis and Trachypogon plumosus. Sedges include mostly Rhynchospora spp., but also Bulbostylis paradoxa and Fimbristylis vahlii. Wet places usually have Eleocharis spp. and Cyperus ligularis. The latter mostly near the coast.

VD1A(1)-ELEOCHARIS MARSH

- On alluvial deposits. Soils often peaty over clay. Mostly inundated, frequently with water of a somewhat higher salinity
- In savanna areas potentially exposed to fires.
- These almost monospecific marshes may be found in waterlogged plains, fringed with shrubs. The height of the herb layer is about 50 cm. Common in small patches in short-grass savannas but mostly too small to be mapped. A good example of this ecosystem can be found along the Hopkins road in the Stann Creek district.
- The dominant species is an Eleocharis sp. Additional plant species commonly found here include Blechnum serrulatum, Centrosema sp., Crinum erubescens, Hyptis sp., Ludwigia spp., Mimosa pigra, Sagittaria lancifolia and Thalia geniculata.

VE1A(1)-MARINE SALT MARSH

- Over calcareous rock. Partially inundated with brackish water during the rainy season. Salinity increases as water evaporates.
- This community type occurs in marshes in the coastal plains where the salinity level is high and is generally greater than 5%. This community is highly heterogeneous and containing

patches dominated by different species, which are all taken together here to indicate one main salt marsh community type. Good examples occur in the Shipstern Nature Reserve.

- Common dominants in the vegetation are Batis maritima, Distichlis spicata, Fimbristylis spadicea, Fuirena sp., Juncus spp., Salicornia perennis, Solanum donianum and Spartina cynosuroides. Flats with these principally herbaceous species may contain stunted Conocarpus erecta and dwarf Rhizophora mangle. Slightly elevated areas in this type of marsh contain forest species such as Bravaisa tubiflora, Metopium brownei, Manilkara zapota and Thrinax radiata.

7 Vegetation transects

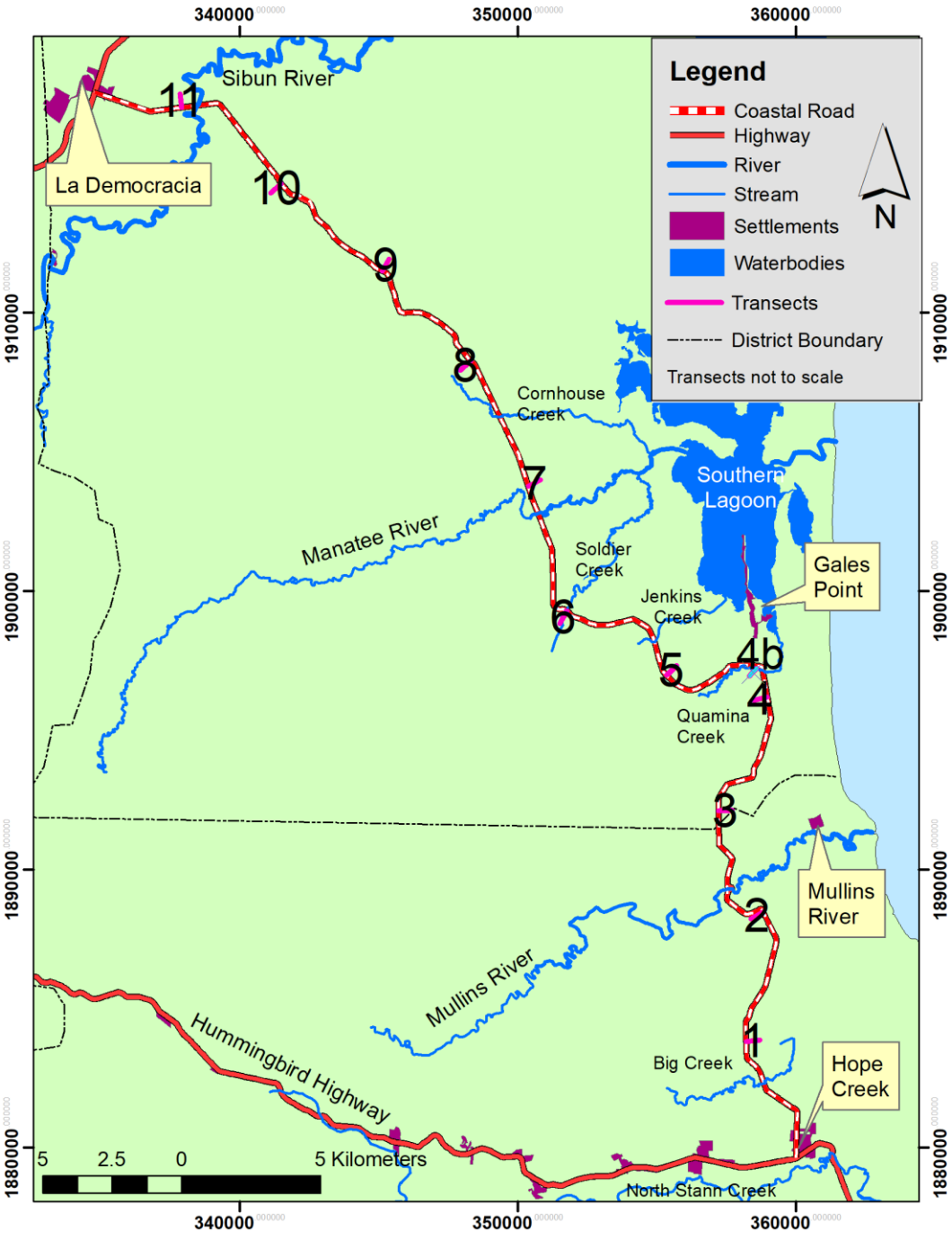


Figure 1. Location of vegetation transects. See the numbers for the description of the transects

Vegetation transects

Transect 1
Coordinates: X=358208 Y=1883805
Date 15 February 2018
Orientation: East
Length: 100 m, width: 4 m.
Habitat: Savanna
Weather: Cloudy after rain.

Description: First 50 m very scrubby. Possibly an abandoned field, towards the back into mixed pine scrub. Very few larger trees.

Health: Heavily disturbed

Tree species with DBH>10 cm:

Family	Species	DBH
Clethraceae	*Clethra occidentalis*	18 cm
Pinaceae	*Pinus caribaea*	24 cm
Combretaceae	*Terminalia amazonia*	19 cm
Malpighiaceae	*Byrsonyma crassifolia*	19 cm, 14 cm

Total list of identifiable flora species on the transect 1.

Family	*Species*
Acanthaceae	*Aphelandra scabra*

Family	*Species*
Annonaceae	*Xylopia frutescens*
Apocynaceae	*Mandevilla subsagitata*
Apocynaceae	*Thevetia ahouai*
Arecaceae	*Acoelorraphe wrightii*
Arecaceae	*Schippia concolor*
Asteraceae	*Ageratum sp.*
Asteraceae	*Calea sp1*
Asteraceae	*Calea sp2*
Asteraceae	*Lepidaploa tortuosa*
Bixaceae	*Cochlospermum vitifolium*
Burseraceae	*Bursera simaruba*
Chrysobalanaceae	*Hirtella racemosa*
Clethraceae	*Clethra occidentalis*
Combretaceae	*Terminalia amazonia*
Connaraceae.	*Connares lambertii*
Cyperaceae	*Rhynchospora cephalotus*
Cyperaceae	*Scleria bracteata*
Dilleniaceae	*Davilla kunthii*
Erythroxylaceae	*Erythroxylon guatemalense*
Euphorbiaceae	*Dalechampia schippia*
Fagaceae	*Quercus oleoides*
Gentianaceae	*Coutoubea spicata*
Lamiaceae	*Marypianthes chameadrys*
Lauraceae	*Cassytha filiformis*
Malpighiaceae	*Byrsonima crassifolia*
Malvaceae	*Hibiscus costatus*
Malvaceae	*Melochia spicata*
Malvaceae	*Sida linifolia*
Malvaceae	*Waltheria indica*
Mimosoideae	*Cojoba graciliflora*
Mimosoideae	*Mimosa albida*
Mimosoideae	*Mimosa bahamensis*
Myrtaceae	*Myrcia splendens*
Pinaceae	*Pinus caribaea*
Polygalaceae	*Bredemeyera lucida*
Polygonaceae	*Coccoloba belizensis*
Rubiaceae	*Amaioua corymbosa*
Rubiaceae	*Guettarda combsii*
Rubiaceae	*Psychotria poeppigiana*
Sapindaceae	*Dodonea viscosa*
Smilacaceae	*Smilax sp.*

Birds transect 1:

- Brown Jay
- Pale Vented Pigeon

- Northern Mockingbird
- Plain Chachalaca
- Tropical Kingbird
- Gray-headed Dove
- Hepatic Tanager
- Squirrel Cuckoo
- Baltimore Oriole

Transect 2

Coordinates: X=358825 Y=1888456
Date 15 February 2018
Orientation: West
Length: 100 m, width: 4 m.
Habitat: Savanna
Weather: Clear weather.

Description: Open pine forest. Appears under brushed for pine production

Health: Appears managed.

Trees with a DBH>10 cm:

Family	Species	DBH
Pinaceae	*Pinus caribaea*	12 cm, 14 cm, 15 cm, 15 cm, 20 cm, 22 cm, 22 cm, 24 cm,

Total list of identifiable flora species on the transect 2.

Family	*Species*
Apocynaceae	*Mandevilla subsagitata*
Aquifoliaceae	*Ilex guianensis*
Arecaceae	*Acoelorraphe wrightii*
Asteraceae	*Calea sp1*
Asteraceae	*Calea sp2*

Family	*Species*
Caesalpinoideae	*Chamaecrista diphylla*
Euphorbiaceae	*Dalechampia schippia*
Fagaceae	*Quercus oleoides*
Malpighiaceae	*Byrsonima crassifolia*
Malvaceae	*Hibiscus costatus*
Malvaceae	*Melochia spicata*
Malvaceae	*Sida linifolia*
Melastomataceae	*Clidemia capitellata*
Melastomataceae	*Clidemia strigillosa*
Melastomataceae	*Miconia sp.*
Mimosoideae	*Mimosa albida*
Myrtaceae	*Myrcia splendens*
Papilionoideae	*Pachyrhysus erosus*
Papilonoideae	*Gliricidia sepium*
Poaceae	*spp*
Poaceae	*Tripsacum latifolium*
Polygalaceae	*Polygala longicaudis*
Rubiaceae	*Dioidia apiculata*
Rubiaceae	*Spermacocce sp.*
Smilacaceae	*Smilax sp.*

Birds transect 2:

- Acorn Woodpecker
- Tropical Kingbird

Transect 3

Coordinates: X=357217 Y=1892100
Date 16 February 2018
Orientation: East
Length: 100 m, width: 4 m.
Habitat: Savanna
Weather: Cloudy after rain.

Description: Open Pine savanna. Recently burned. Herbaceous layer dominated by sedges, but most of the herbaceous layer only just re-growing.

Health: Fire damaged, but this should be considered part of the ecosystem. Some toppled pine trees appear to indicate hurricane damage.

Trees with a DBH>10 cm:

Family	Species	DBH
Pinaceae	*Pinus caribaea*	24 cm, 29 cm
Malpighiaceae	*Byrsonyma crassifolia*	16 cm, 18 cm

Total list of identifiable flora species on the transect 3.

Family	*Species*
Arecaceae	*Acoelorraphe wrightii*
Asteraceae	*Calea sp1*
Asteraceae	*Calea sp2*
Blechnaceae	*Blechnum sp.*
Clethraceae	*Clethra occidentalis*
Connaraceae.	*Connares lambertii*
Cyperaceae	*Rhynchospora cephalotus*
Cyperaceae	*spp*
Dilleniaceae	*Curatela americana*
Ericaulaceae	*Eriocaulon sp.*
Erythroxylaceae	*Erythroxylon guatemalense*
Malpighiaceae	*Byrsonima crassifolia*
Malvaceae	*Melochia spicata*
Malvaceae	*Sida linifolia*
Myrtaceae	*Myrcia splendens*
Ochnaceae	*Sauvagesia erecta*
Papilonoideae	*Gliricidia sepium*
Passifloraceae	*Passiflora urbaniana*
Pinaceae	*Pinus caribaea*
Poaceae	*spp*

Birds transect 3:

- Tropical Kingbird
- Turkey Vulture

Transect 4

Coordinates: X=358975 Y=1896199
Date 16 February 2018
Orientation: West
Length: 100 m, width: 4 m.
Habitat: Savanna
Weather: Cloudy after rain.

Description: Open Savanna. No actual trees on transect.

Health: Appears undisturbed.

Trees with DBH>10 cm:

None

Total list of identifiable flora species on the transect 4.

Family	*Species*
Arecaceae	*Acoelorraphe wrightii*
Asteraceae	*Calea sp1*
Asteraceae	*Calea sp2*
Bignoniaceae	*Cresentia cujete*
Burmanniaceae	*Burmannia capittata*
Caesalpinoideae	*Chamaecrista desvauxii*
Connaraceae.	*Connares lambertii*
Cyperaceae	*Rhynchospora sp.*
Cyperaceae	*spp*

Family	*Species*
Droseraceae	*Drosera capillaris*
Ericaulaceae	*Eriocaulon sp.*
Gentianaceae	*Coutoubea spicata*
Lamiaceae	*Hyptis sp.*
Lamiaceae	*Marypianthes chameadrys*
Lentibulariaceae	*Utricularia simulans*
Lentibulariaceae	*Utricularia spp*
Malpighiaceae	*Byrsonima crassifolia*
Malvaceae	*Melochia spicata*
Malvaceae	*Sida linifolia*
Mimosoideae	*Calliandra houstoniana*
Mimosoideae	*Mimosa albida*
Myrtaceae	*Eugenia sp.*
Myrtaceae	*Myrcia splendens*
Ochnaceae	*Sauvagesia erecta*
Polygalaceae	*Polygala adenophora*
Polygalaceae	*Polygala variabilis*
Xyridaceae	*Xyris sp.*
Zamiaceae	*Zamia prasina*

Birds transect 4:

None

Transect 4b

Coordinates: X=358724 Y=1897234
Date 25 February 2018
Orientation: SW
Length: 100 m, width: 4 m.
Habitat: Disturbed roadside vegetation
Weather: Sunny

Description: Open, grassy wasteland.

Health: Heavily disturbed and dominated by pioneering species

Trees with DBH>10 cm:

None

Total list of identifiable flora species on the transect 4b.

Family	*Species*
Asteraceae	*Ageratum sp.*
Asteraceae	*Eclipta prostrata*
Asteraceae	*Sphagneticola trilobata*
Cecropiaceae	*Cecropia peltata*
Dennstaedtiaceae	*Pteridium caudatum*
Mimosoideae	*Mimosa albida*
Mimosoideae	*Mimosa pellita*
Poaceae	*Gynerium sagittatum*
Poaceae	*spp*

Family	*Species*
Polygonaceae	*Coccoloba spp.*
Rhamnaceae	*Gouania lupuloides*

Birds transect 4b:

- None

Transect 5

Coordinates: X=355346 Y=1896981
Date 25 February 2018
Orientation: NE
Length: 100 m, width: 4 m.
Habitat: From Citrus Orchard into Broadleaf Forest on steep karstic hill
Weather: Sunny.

Description: Heavily Disturbed Broadleaf Forest (hurricane damage) on very steep hill.

Health: Heavily disturbed, many fallen trees, very dense. Recent rock falls.

Trees with DBH>10 cm:

Family	Species	DBH
Arecaceae	*Attalea cohune*	38 cm, 42 cm.
Cecropiaceae	*Cecropia peltata*	11 cm, 15 cm, 22 cm, 23 cm, 23 cm
Flacourtiaceaea	*Zuelania guidonia*	14 cm
Moraceae	*Trophis racemosa*	14 cm

Total list of identifiable flora species on the transect 5.

Family	*Species*
Acanthaceae	*Louteridium chartaceum*
Anacardiaceae	*Spondias radkofleri*
Apocynaceae	*Thevetia ahouai*
Araceae	*Philodendron radiatum*
Arecaceae	*Attalea cohune*
Arecaceae	*Sabal mauritiiformis*
Caesalpinoideae	*Bauhinia divaricata*
Cecropiaceae	*Cecropia peltata*
Convolvulaceae	*Ipomoea sepaquitensis*
Costaceae	*Costus pulverulentus*
Dilleniaceae	*Doliocarpus dentatus*
Euphorbiaceae	*Croton billbergianus*
Flacourtiaceae	*Zuelania guidonia*
Heliconiaceae	*Heliconia spissa*
Mimosoideae	*Acacia sp.*
Moraceae	*Trophis racemosa*
Ochnaceae	*Ouratea nitida*
Papilionoideae	*Pachyrhysus erosus*
Piperaceae	*Piper jacquemontianum*
Piperaceae	*Piper sp.*
Polygalaceae	*Securidaca diversifolia*
Rubiaceae	*Gonzalunga panamenis*
Sapindaceae	*Cupania belizensis*
Sterculiaceae	*Byttneria aculeata*
Vitaceae	*Vitis tiliaefolia*

Birds transect 5:

- White-tailed Hawk Geranoaetus albicaudatus
- Short-tailed Hawk Buteo brachyurus
- Pale-vented Pigeon Patagioenas cayennensis
- Ruddy Ground-Dove Columbina talpacoti
- Groove-billed Ani Crotophaga sulcirostris
- Golden-fronted Woodpecker Melanerpes aurifrons
- Golden-olive Woodpecker Colaptes rubiginosus
- Ruddy Woodcreeper Dendrocincla homochroa
- Ivory-billed Woodcreeper Xiphorhynchus flavigaster
- Pewee sp. (Contopus sp.) Contopus sp.
- Dusky-capped Flycatcher Myiarchus tuberculifer
- Great Kiskadee Pitangus sulphuratus
- Social Flycatcher Myiozetetes similis
- Tropical/Couch's Kingbird Tyrannus melancholicus/couchii
- Brown Jay Psilorhinus morio

- Wood Thrush Hylocichla mustelina
- Gray Catbird Dumetella carolinensis
- Black-and-white Warbler Mniotilta varia
- Yellow-throated Warbler Setophaga dominica
- Black-throated Green Warbler Setophaga virens
- Yellow-winged Tanager Thraupis abbas
- White-collared Seedeater Sporophila torqueola
- Summer Tanager Piranga rubra
- Montezuma Oropendola Psarocolius montezuma

Transect 6

Coordinates: X=351772 Y=1899281
Date 25 February 2018
Orientation: SW
Length: 100 m, width: 4 m.
Habitat: Broadleaf Forest near river
Weather: Sunny.

Description: Disturbed Broadleaf Forest. Abandoned orchard.

Health: Apparently once a garden with fruit trees, now regenerating to forest

Trees with DBH>10 cm:

Family	Species	DBH
Arecaceae	Attalea cohune	35 cm, 37 cm
Arecaceae	Cocos nucifera	28 cm, 29 cm
Araliaceae	Dendropanax arboreus	17 cm
Boraginaceae	Cordia alliodora	26 cm, 30 cm
Caesalpinoideae	Schizolobium parahyba	14 cm
Cecropiaceae	Cecropia peltata	11 cm, 17 cm, 22 cm, 28 cm, 31 cm, 32 cm 35 cm.
Mimosoideae	Inga sp.	24 cm
Myristicaceae	Virola *koschenyi*	96 cm
Sterculiaceae	Guazuma ulmifolia	12 cm

Total list of identifiable flora species on the transect 6.

Family	*Species*
Anacardiaceae	*Spondias radkofleri*
Apocynaceae	*Tabernaemontana*
Araceae	*Sphatiphyllum sp.*
Araliaceae	*Dendropanax arboreus*
Arecaceae	*Attalea cohune*
Arecaceae	*Cocos nucifera*
Bignoniaceae	*Vine*
Boraginaceae	*Cordia alliodora*
Boraginaceae	*Cordia sp.*
Caesalpinoideae	*Schizolobium parahyba*
Cecropiaceae	*Cecropia peltata*
Costaceae	*Costus pulverulentus*
Cucurbitaceae	*Psiguria thriphylla*
Davalliaceae	*Nephrolepis biserrata*
Euphorbiaceae	*Acalypha diversifolia*
Euphorbiaceae	*Acalypha macrostachya*
Euphorbiaceae	*Croton billbergianus*
Heliconiaceae	*Heliconia latispatha*
Lauraceae	*Nectandra sp.?*
Maranthaceae	*Calathea lutea*
Melastomataceae	*Miconia sp.*
Mimosoideae	*Acacia glomerosa*
Mimosoideae	*Acacia sp.*
Mimosoideae	*Inga sp.*
Moraceae	*Ficus sp.*
Moraceae	*Trophis racemosa*
Myristicaceae	*Virola koschenyi*
Papilionoideae	*Erythrina folkersi*
Passifloraceae	*Passiflora choconiana*
Piperaceae	*Piper jacquemontianum*
Piperaceae	*Piper sp.*
Poaceae	*Bambusa vulgaris*
Sterculiaceae	*Byttneria aculeata*
Sterculiaceae	*Guazuma ulmifolia*

Birds transect 6:

- Gray-headed Dove Leptotila plumbeiceps
- Squirrel Cuckoo Piaya cayana
- Collared Aracari Pteroglossus torquatus
- Golden-fronted Woodpecker Melanerpes aurifrons
- Barred Antshrike Thamnophilus doliatus
- Tropical Kingbird Tyrannus melancholicus
- Red-capped Manakin Ceratopipra mentalis

- Spot-breasted Wren Pheugopedius maculipectus
- Gray Catbird Dumetella carolinensis
- Black-and-white Warbler Mniotilta varia
- White-collared Seedeater Sporophila torqueola
- Black-cowled Oriole Icterus prosthemelas

Transect 7

Coordinates: X=350370 Y=1903767
Date 26 February 2018
Orientation: NE
Length: 100 m, width: 4 m.
Habitat: Broadleaf forest
Weather: Sunny.

Description: Disturbed forest on very wet soils with extensive hog-wallow relief.

Health: Heavily disturbed after past clearing. Remnants of old fence found.

Trees with DBH>10 cm:

Family	Species	DBH
Arecaceae	*Attalea cohune*	38 cm, 38 cm, 41 cm.
Melastomataceae	*Miconia argentea*	18 cm
Papilionoideae	*Lonchocarpus guatemalensis*	17 cm, 19 cm, 24 cm.
Polygonaceaea	*Coccoloba sp.*	33 cm, 38 cm.
Vochysiaceae	*Vochysia hondurensis*	17 cm

Total list of identifiable flora species on the transect 7.

Family	*Species*
Anacardiaceae	*Spondias radkofleri*
Apocynaceae	*Tabernaemontana*
Apocynaceae	*Thevetia ahouai*
Araceae	*Anthurium pentaphyllum*
Arecaceae	*Attalea cohune*
Aristolochiaceaea	*Aristolochia schippii*
Bignoniaceae	*Vine*
Boraginaceae	*Cordia sp.*
Caesalpinoideae	*Senna alata*
Clusiaceae	*Symphonia globulifera*
Costaceae	*Costus pulverulentus*
Dilleniaceae	*Doliocarpus dentatus*
Euphorbiaceae	*Acalypha diversifolia*
Euphorbiaceae	*Croton billbergianus*
Heliconiaceae	*Heliconia latispatha*
Maranthaceae	*Calathea lutea*
Melastomataceae	*Clidemia sp.*
Melastomataceae	*Miconia argentea*
Melastomataceae	*Miconia sp.*
Menispermaceae	*Cissampelos perreira*
Mimosoideae	*Cojoba sp.*
Mimosoideae	*Inga sp.*
Moraceae	*Ficus sp.*
Papilionoideae	*Lonchocarpus guatemalensis*
Piperaceae	*Piper jacquemontianum*
Piperaceae	*Piper sp.*
Polygonaceae	*Coccoloba spp.*
Rubiaceae	*Alibertia edulis*
Rubiaceae	*Gonzalunga panamenis*
Rubiaceae	*Hamelia rovirosae*
Rubiaceae	*Psychotria sp.*
Rubiaceae	*Uncaria tomentosa*
Sterculiaceae	*Byttneria aculeata*
Vochysiaceae	*Vochysia hondurensis*

Birds transect 7:

- Plain Chachalaca *Ortalis vetula*
- Roadside Hawk (Mainland) *Rupornis magnirostris [magnirostris Group]*
- Ruddy Crake *Laterallus ruber*
- Patagioenas sp. *Patagioenas sp.*
- Common Pauraque *Nyctidromus albicollis*
- Stripe-throated Hermit *Phaethornis striigularis*

- Gartered Trogon *Trogon caligatus*
- Lineated Woodpecker *Dryocopus lineatus*
- Olive-throated Parakeet (Aztec) *Eupsittula nana astec/vicinalis*
- Ivory-billed Woodcreeper *Xiphorhynchus flavigaster*
- Tropical Kingbird *Tyrannus melancholicus*
- Brown Jay *Psilorhinus morio*
- Gray Catbird *Dumetella carolinensis*
- Hooded Warbler *Setophaga citrina*
- American Redstart *Setophaga ruticilla*
- Yellow-billed Cacique *Amblycercus holosericeus*

Mammals transect 7:

- Jaguar (Tracks)
- Baird's Tapir (Tracks)

Amphibians transect 7:

- Incilius valliceps – Gulf Toad

Transect 8

Coordinates: X=348298 Y=1908278
Date 6 February 2018
Orientation: SW
Length: 100 m, width: 4 m.
Habitat: Savanna
Weather: Cloudy after rain.

Description: Open, relatively dry savanna with scattered trees.

Health: Apparently undisturbed savanna

Trees with DBH>10 cm:

Family	Species	DBH
Fagaceae	Quercus oleoides	37 cm
Pinaceae	Pinus caribaea	12 cm, 24 cm
Malpighiaceae	Byrsonyma crassifolia	17 cm

Total list of identifiable flora species on the transect 8.

Family	*Species*
Arecaceae	*Acoelorraphe wrightii*
Asteraceae	*Acmella filipes*
Asteraceae	*Ageratum radicans*
Asteraceae	*Calea longipedicellata*
Asteraceae	*Calea sp1*
Asteraceae	*Calea sp2*

Family	*Species*
Caesalpinoideae	*Chamaecrista desvauxii*
Caesalpinoideae	*Chamaecrista hipidula*
Caesalpinoideae	*Zornia reticulata*
Convolvulaceae	*Evolvulus sericeus*
Convolvulaceae	*Jacquemontia pentanthos*
Dilleniaceae	*Curatela americana*
Dilleniaceae	*Davilla kunthii*
Erythroxylaceae	*Erythroxylum guatemalense*
Euphorbiaceae	*Dalechampia schippia*
Fagaceae	*Quercus oleoides*
Gentianaceae	*Coutoubea spicata*
Gentianaceae	*Schultesia brachyptera*
Gentianaceae	*Schultesia guianensis*
Lamiaceae	*Hyptis sp.*
Lauraceae	*Cassytha filiformis*
Lygodiaceaea	*Lygodium venustum*
Malpighiaceae	*Byrsonima crassifolia*
Malvaceae	*Melochia spicata*
Melastomataceae	*Clidemia capitellata*
Melastomataceae	*Clidemia sericea*
Melastomataceae	*Clidemia strigillosa*
Melastomataceae	*Conostegia xalapensis*
Melastomataceae	*Pachyanthus lundellianus*
Mimosoideae	*Cojoba graciliflora*
Mimosoideae	*Pithecellobium lanceolatum*
Ochnaceae	*Sauvagesia erecta*
Papilonoideae	*Gliricidia sepium*
Papilonoideae	*Stylosanthes guianensis*
Papilonoideae	*Tephrosia nitens*
Passifloraceae	*Passiflora urbaniana*
Pinaceae	*Pinus caribaea*
Plantaginaceae	*Russelia sarmentosa*
Poaceae	*spp*
Rubiaceae	*Amaioua corymbosa*
Rubiaceae	*Spermacocce sp.*
Sapindaceae	*Dodonea viscosa*
Turneraceae	*Turnera sp.*
Zamiaceae	*Zamia prasina*

Birds transect 8:

- Chipping Sparrow
- Eastern Meadowlark
- Acorn Woodpecker
- Northern Mockingbird

Transect 9

Coordinates: X=345116 Y=1911504
Date 6 February 2018
Orientation: NE
Length: 100 m, width: 4 m.
Habitat: Savanna
Weather: Cloudy after rain

Description: Open, wet savanna dominated by sedges and clusters of low shrubs. No trees in the transect with a dbh>10 cm.

Total list of identifiable flora species on the transect 9:

Family	*Species*
Arecaceae	*Acoelorraphe wrightii*
Asteraceae	*Acmella filipes*
Asteraceae	*Ageratum radicans*
Caesalpinoideae	*Chamaecrista desvauxii*
Convolvulaceae	*Merremia aturensis*
Cyperaceae	*spp*
Droseraceae	*Drosera capillaris*
Ericaulaceae	*Eriocaulon sp.*
Erythroxylaceae	*Erythroxylum guatemalense*
Euphorbiaceae	*Dalechampia schippia*
Gentianaceae	*Coutoubea spicata*

Family	*Species*
Lamiaceae	*Hyptis sp.*
Lamiaceae	*Marypianthes chameadrys*
Lauraceae	*Cassytha filiformis*
Lentibulariaceae	*Utricularia spp*
Lycopodiaceae	*Lycopodiaceae*
Malpighiaceae	*Byrsonima crassifolia*
Malvaceae	*Sida linifolia*
Melastomataceae	*Clidemia capitellata*
Melastomataceae	*Clidemia sericea*
Melastomataceae	*Clidemia strigillosa*
Melastomataceae	*Conostegia xalapensis*
Melastomataceae	*Miconia sp.*
Melastomataceae	*Pachyanthus lundellianus*
Mimosoideae	*Mimosa sp.*
Ochnaceae	*Sauvagesia erecta*
Papilonoideae	*Gliricidia sepium*
Papilonoideae	*Tephrosia nitens*
Passifloraceae	*Passiflora urbaniana*
Plantaginaceae	*Buchnera pusilla*
Plantaginaceae	*Russelia sarmentosa*
Turneraceae	*Turnera sp.*
Xyridaceae	*Xyris sp.*
Zamiaceae	*Zamia prasina*

Birds transect 9:

- Green Jay
- Gray-breasted Martin
- Northern Rough-winged Swallow
- Northern Mockingbird

Transect 10

Coordinates: X=341470 Y=1914646
Date: 7 February 7, 2018
Orientation: SW
Length: 100 m, width: 4 m.
Habitat Broadleaf Forest
Weather: Cloudy after rain

Description: Low Broadleaf swamp forest, very dense with many thin stems, few larger emergent trees. Undergrowth dominated by Phillodendron and cutting grass. Soil wet with clear hog-wallow relief

Family	Species	DBH
Aquifoliaceae	*Ilex*	10 cm
Unknown	*Unknown*	14 cm
Clusiaceae	*Callophyllum brasiliense*	18 cm
Mimosoideae	*Cojoba sp?*	22 cm, 15 cm
	Byrsonima crassifolia	11 cm
Sapindaceae	*Cupania sp.*	16 cm

Total list of identifiable flora species on the transect 10.

Family	*Species*
Aquifoliaceae	*Ilex guianensis*
Arecaceae	*Schippia concolor*

Family	*Species*
Bromeliaceae	*Bromelia pinguin*
Bromeliaceae	*Tillandsia sp.*
Chrysobalanaceae	*Licania hypoleuca*
Chrysobalanaceae	*Chrysobalanos icaco*
Chrysobalanaceae	*Hirtella racemosa*
Clusiaceae	*Symphonia globulifera*
Clusiaceae	*Vismia camparaguei*
Clusiaceae	*Callophyllum brasiliensis*
Clusiaceae	*Clusia sp.*
Combretaceae	*Bucida buceras*
Connaraceae.	*Rourea glabra*
Cyperaceae	*Rhynchospora cephalotus*
Cyperaceae	*Scleria bracteata*
Eleocarpaceae	*Sloanea tuerkheimii*
Erythroxylaceae	*Erythroxylon guatemalense*
Malpighiaceae	*Byrsonima crassifolia*
Malvaceae	*Hampea trilobata*
Melastomataceae	*Clidemia capitellata*
Melastomataceae	*Clidemia sericea*
Melastomataceae	*Clidemia strigillosa*
Melastomataceae	*Miconia sp.*
Melastomataceae	*Mouriri myrtilloides*
Mimosoideae	*Cojoba sp.*
Myrsinaceae	*Parathesis sp.*
Myrtaceae	*Calyptranthes chytraculia*
Polygonaceae	*Coccoloba spp.*
Polygonaceae	*Coccoloba belizensis*
Rubiaceae	*Amaioua corymbosa*
Rubiaceae	*Guettarda combsii*
Rubiaceae	*Psychotria poeppigiana*
Vochysiaceae	*Vochysia hondurensis*
Zamiaceae	*Zamia prasina*

Birds transect 10:

- Chachalaca
- Gray-throated Chat
- Brown Jay

Transect 11

Coordinates: X=11 337887 Y=1917375
Date: 7 February 2018
Orientation: NE
Length: 100 m, width: 4 m.
Habitat: Broadleaf Forest
Weather: Cloudy after rain

Description: Strongly disturbed broadleaf forest with mostly lime-loving species. Soil wet, and subject to inundation but no hog-wallow relief

Family	Species	DBH
Anacardiaceae	*Spondias radkoffleri*	34 cm
Arecaceae	*Attalea cohune*	32 cm, 40 cm, 36 cm
Cecropiaceae	*Cecropia peltata*	18 cm, 15 cm
Melastomataceae	*Miconia argentea*	18 cm
Flacourtiaceae	*Zuelania guidonia*	24 cm
Burseraceae	*Bursera simaruba*	11 cm
	Unknown, large semi-opposite leaves	36 cm
Mimosoideae	*Inga sp.*	42 cm
Bombacaceae	*Ceiba pentandra*	84 cm (dead)
Sapindaceae	*Cupania rufescens*	18 cm
Boraginaceae	*Cordia alliodora*	22 cm
Tiliaceae	*Trichospermum grewiifolium*	23 cm
Polygonaceae	*Coccoloba sp.*	21 cm

Total list of identifiable flora species on the transect 11.

Family	*Species*
Anacardiaceae	*Spondias radkofleri*
Annonaceae	*Annona primogenia*
Apocynaceae	*Stemmadenia donnell-smithii*
Apocynaceae	*Thevetia ahouai*
Araceae	*Anthurium pentaphyllum*
Araliaceae	*Dendropanax arboreus*
Arecaceae	*Attalea cohune*
Arecaceae	*Bactris mexicanus*
Asteraceae	*Clibadium arboreum*
Asteraceae	*Sphagneticola trilobata*
Bombacaceae	*Ceiba pentandra*
Boraginaceae	*Cordia alliodora*
Bromeliaceae	*Bromelia pinguin*
Burseraceae	*Bursera simaruba*
Burseraceae	*Protium copal*
Caricaceae	*Carica papaya*
Cecropiaceae	*Cecropia peltata*
Combretaceae	*Bucida buceras*
Connaraceae.	*Rourea glabra*
Convolvulaceae	*Ipomoea tuxlensis*
Costaceae	*Costus pulverulentus*
Euphorbiaceae	*Croton billbergianus*
Flacourtiaceae	*Zuelania guidonia*
Heliconiaceae	*Heliconia latispatha*
Lacistemaceae	*Lacistema aggregatum*
Lauraceae	*Nectandra sp.?*
Malvaceae	*Hampea trilobata*
Melastomataceae	*Miconia argentea*
Meliaceae	*Guaerea glabra*
Meliaceae	*Guarea sp.*
Mimosoideae	*Acacia glomerosa*
Mimosoideae	*Inga sp.*
Moraceae	*Ficus sp.*
Moraceae	*Trophis racemosa*
Myrsinaceae	*Parathesis donnell-smithii*
Nyctaginaceae	*Neea psychotriodes*
Orchidaceae	*Oeceoclades maculata*
Papilionoideae	*Andira inermis*
Papilionoideae	*Lonchocarpus guatemalensis*
Passifloraceae	*Passiflora serratifolia*
Piperaceae	*Piper jacquemontianum*
Polygonaceae	*Coccoloba belizensis*
Polygonaceae	*Coccoloba spp.*

Family	*Species*
Rhamnaceae	*Gouania lupuloides*
Rhamnaceae	*Sageretia elegans*
Rubiaceae	*Gonzalunga panamenis*
Rubiaceae	*Guettarda combsii*
Rubiaceae	*Hamelia rovirosae*
Rubiaceae	*Simira salvadorensis*
Sapindaceae	*Cupania rufescens*
Sapindaceae	*Exothea paniculata*
Sapindaceae	*Matayba apetala*
Sterculiaceae	*Byttneria aculeata*
Sterculiaceae	*Guazuma ulmifolia*
Tiliaceae	*Trichospermum grewiifolium*
Verbenaceae	*Aegephila monstrosa*
Vitaceae	*Vitis tiliaefolia*
Zamiaceae	*Zamia prasina*
Zingiberaceae	*Renealmia aromatica*

Birds transect 11:

- Ruddy Crake
- Gray Hawk
- Great Kiskadee
- Montezuma Oropendola
- Barred Antshrike
- Osprey (flying over)
- Turkey Vulture
- Northern Rough-winged Swallow
- Black-and-White Warbler
- Stripe-throated Hermit

8 Biodiversity results

8.1 Plants

Plant family	Genus	Species	Common name
Acanthaceae	Aphelandra	scabra	0
Acanthaceae	Dicliptera	sexangularis	0
Acanthaceae	Louteridium	chartaceum	0
Acanthaceae	Odontonema	albiflorum	0
Acanthaceae	Thunbergia	grandiflora	0
Adiantaceae	Acrostichum	aureum	0
Adiantaceae	Adiantum	tenerum	0
Agavaceae	Agave	angustifolia	0
Aizoaceae	Sesuvium	portulacastrum	0
Alismataceae	Sagittaria	lancifolia	0
Amaranthaceae	Alternanthera	flavescens	0
Amaranthaceae	Chamissoa	altissima	0
Amaryllidaceae	Hymenocallis	littoralis	0
Anacardiaceae	Anacardium	occidentale	0
Anacardiaceae	Astronium	graveolens	0
Anacardiaceae	Mangifera	indica	0
Anacardiaceae	Metopium	brownei	0
Anacardiaceae	Spondias	radlkoferi	0
Annonaceae	Annona	glabra	0
Annonaceae	Cymbopetalum	mayanum	0
Annonaceae	Xylopia	frutescens	0
Apocynaceae	Allamanda	cathartica	0
Apocynaceae	Aspidosperma	megalocarpon	0
Apocynaceae	Cameraria	latifolia	0
Apocynaceae	Mandevilla	subsagittata	0
Apocynaceae	Odontadenia	macrantha	0
Apocynaceae	Pentalinon	andrieuxii	0
Apocynaceae	Plumeria	rubra	0
Apocynaceae	Prestonia	longifolia	0
Apocynaceae	Rhabdadenia	biflora	0
Apocynaceae	Stemmadenia	donnell-smithii	0
Apocynaceae	Tabernaemontana	alba	0
Apocynaceae	Tabernaemontana	arborea	0
Apocynaceae	Thevetia	ahouai	0
Aquifoliaceae	Ilex	guianensis	0
Araceae	Anthurium	bakeri	0
Araceae	Anthurium	schlechtendalii	0
Araceae	Anthurium	verapazense	0
Araceae	Philodendron	fragrantissimum	0
Araceae	Philodendron	radiatum	0
Araceae	Philodendron	smithii	0
Araliaceae	Dendropanax	arboreus	0
Arecaceae	Acoelorraphe	wrightii	0

Plant family	Genus	Species	Common name
Arecaceae	Acrocomia	aculeata	0
Arecaceae	Attalea	cohune	Cohune Palm
Arecaceae	Bactris	major Jacq.	0
Arecaceae	Bactris	mexicana	0
Arecaceae	Chamaedorea	oblongata	Jade
Arecaceae	Chamaedorea	schippi	Chapai
Arecaceae	Cocos	nucifera	0
Arecaceae	Cryosophila	stauracantha	0
Arecaceae	Desmoncus	orthacanthos	0
Arecaceae	Gaussia	maya	0
Arecaceae	Reinhardtia	gracilis (H. Wendl.) Drude ex Dammer	0
Arecaceae	Sabal	mauritiiformis	Bayleaf
Arecaceae	Schippia	concolor	Mountain Pimento
Aristolochiaceae	Aristolochia	grandiflora	Pelicanflower
Aristolochiaceae	Aristolochia	maxima	Florida Dutchman's Pipe
Aristolochiaceae	Aristolochia	schippii	0
Aristolochiaceae	Aristolochia	trilobata	Bejuco de Santiago
Asclepiadaceae	Asclepias	curassavica	0
Asclepiadaceae	Blepharodon	mucronatum	0
Asclepiadaceae	Metastelma	schlechtendalii	0
Asclepiadaceae	Metastelma	stenomeres	0
Aspleniaceae	Asplenium	delitescens	0
Aspleniaceae	Asplenium	heterochroum	0
Aspleniaceae	Lomariopsis	recurvata	0
Asteraceae	Acmella	filipes	0
Asteraceae	Acmella	lundellii	0
Asteraceae	Ageratum	littorale	0
Asteraceae	Ageratum	peckii	0
Asteraceae	Ageratum	radicans	0
Asteraceae	Bidens	pilosa	0
Asteraceae	Calea	jamaicensis	0
Asteraceae	Calea	ternifolia	0
Asteraceae	Emilia	fosbergii	0
Asteraceae	Emilia	sonchifolia	0
Asteraceae	Gnaphalium	attenuatum	0
Asteraceae	Goldmanella	sarmentosa	0
Asteraceae	Koanophyllon	albicaule	0
Asteraceae	Melanthera	nivea	0
Asteraceae	Neurolaena	lobata	0
Asteraceae	Otopappus	guatemalensis	0
Asteraceae	Pectis	prostrata	0
Asteraceae	Pluchea	carolinensis	0
Asteraceae	Pluchea	odorata	0
Asteraceae	Pluchea	yucatanensis	0

Plant family	Genus	Species	Common name
Asteraceae	Schistocarpha	eupatorioides	0
Asteraceae	Sphagneticola	trilobata	0
Asteraceae	Wedelia	acapulcensis	0
Begoniaceae	Begonia	sericoneura	0
Bignoniaceae	Amphitecna	breedlovei	0
Bignoniaceae	Anemopaegma	chrysoleucum	0
Bignoniaceae	Arrabidaea	chica	0
Bignoniaceae	Arrabidaea	florida	0
Bignoniaceae	Arrabidaea	podopogon	0
Bignoniaceae	Arrabidaea	pubescens	0
Bignoniaceae	Arrabidaea	verrucosa	0
Bignoniaceae	Crescentia	cujete	0
Bignoniaceae	Cydista	heterophylla	0
Bignoniaceae	Paragonia	pyramidata	0
Bignoniaceae	Pseudocatalpa	caudiculata	0
Bignoniaceae	Tabebuia	rosea	Mayflower
Bixaceae	Cochlospermum	vitifolium	0
Bombacaceae	Ceiba	pentandra	Kapok
Bombacaceae	Ochroma	pyramidale	0
Bombacaceae	Pachira	aquatica	Provision Tree
Bombacaceae	Pseudobombax	ellipticoideum	0
Bombacaceae	Pseudobombax	ellipticum	0
Boraginaceae	Cordia	alliodora	0
Boraginaceae	Cordia	gerascanthus	0
Brassicaceae	Cakile	lanceolata	0
Bromeliaceae	Aechmea	bracteata	0
Bromeliaceae	Aechmea	magdalenae	0
Bromeliaceae	Ananas	comosus	Pineapple
Bromeliaceae	Billbergia	viridiflora	0
Bromeliaceae	Bromelia	pinguin	0
Bromeliaceae	Catopsis	berteroniana	0
Bromeliaceae	Pitcairnia	recurvata	0
Bromeliaceae	Tillandsia	bulbosa	0
Bromeliaceae	Tillandsia	dasyliriifolia	0
Bromeliaceae	Tillandsia	limbata	0
Bromeliaceae	Tillandsia	monadelpha	0
Bromeliaceae	Tillandsia	streptophylla	0
Bromeliaceae	Tillandsia	utriculata	0
Bromeliaceae	Vriesea	heliconioides	0
Bromeliaceae	Werauhia	gladioliflora	0
Burmanniaceae	Burmannia	capitata	0
Burseraceae	Bursera	simaruba	Gumbo Limbo
Burseraceae	Protium	copal	0
Burseraceae	Protium	schippii	0
Cactaceae	Selenicereus	donkelaarii	0

Plant family	Genus	Species	Common name
Capparaceae	Forchhammeria	trifoliata	0
Caricaceae	Carica	papaya	0
Caryophyllaceae	Drymaria	cordata	0
Casuarinaceae	Casuarina	equisetifolia	0
Cecropiaceae	Cecropia	peltata	Trumpet Tree
Cecropiaceae	Coussapoa	oligocephala	0
Chrysobalanaceae	Chrysobalanus	icaco	0
Chrysobalanaceae	Couepia	polyandra	0
Chrysobalanaceae	Hirtella	americana	0
Chrysobalanaceae	Hirtella	racemosa	0
Chrysobalanaceae	Licania	hypoleuca	0
Chrysobalanaceae	Licania	platypus	0
Chrysobalanaceae	Licania	sparsipilis	0
Clethraceae	Clethra	occidentalis	0
Clusiaceae	Calophyllum	brasiliense	0
Clusiaceae	Hypericum	terrae-firmae	0
Clusiaceae	Symphonia	globulifera	0
Clusiaceae	Vismia	camparaguey	0
Combretaceae	Bucida	buceras	0
Combretaceae	Combretum	cacoucia	0
Combretaceae	Combretum	laxum	0
Combretaceae	Conocarpus	erecta	0
Combretaceae	Laguncularia	racemosa	0
Combretaceae	Terminalia	amazonia	Nargusta
Commelinaceae	Tradescantia	spathacea	0
Convolvulaceae	Evolvulus	alsinoides	0
Convolvulaceae	Ipomoea	alba	0
Convolvulaceae	Ipomoea	heterodoxa	0
Convolvulaceae	Ipomoea	squamosa	0
Convolvulaceae	Jacquemontia	havanensis	0
Convolvulaceae	Jacquemontia	tamnifolia	0
Convolvulaceae	Merremia	aturensis	0
Costaceae	Costus	guanaiensis	0
Costaceae	Costus	pictus	0
Costaceae	Costus	pulverulentus	0
Costaceae	Costus	speciosus	0
Cucurbitaceae	Cucurbita	lundelliana	0
Cucurbitaceae	Momordica	charantia	0
Cuscutaceae	Cuscuta	indecora	0
Cyperaceae	Bulbostylis	juncoides	0
Cyperaceae	Bulbostylis	paradoxa	0
Cyperaceae	Bulbostylis	tenuifolia	0
Cyperaceae	Cyperus	haspan	0
Cyperaceae	Cyperus	ligularis	0
Cyperaceae	Cyperus	luzulae	0

Plant family	Genus	Species	Common name
Cyperaceae	Eleocharis	geniculata	0
Cyperaceae	Eleocharis	interstincta	0
Cyperaceae	Fimbristylis	cymosa	0
Cyperaceae	Fimbristylis	spadicea	0
Cyperaceae	Rhynchospora	barbata	0
Cyperaceae	Rhynchospora	cephalotes	0
Cyperaceae	Rhynchospora	colorata	0
Cyperaceae	Rhynchospora	curvula	0
Cyperaceae	Rhynchospora	eximia	0
Cyperaceae	Rhynchospora	filifolia	0
Cyperaceae	Rhynchospora	filiformis	0
Cyperaceae	Rhynchospora	globosa	0
Cyperaceae	Rhynchospora	globularis	0
Cyperaceae	Rhynchospora	hassleri	0
Cyperaceae	Rhynchospora	hirsuta	0
Cyperaceae	Rhynchospora	holoschoenoides	0
Cyperaceae	Rhynchospora	nervosa	0
Cyperaceae	Rhynchospora	oligantha	0
Cyperaceae	Rhynchospora	pusilla	0
Cyperaceae	Rhynchospora	tenerrima	0
Cyperaceae	Rhynchospora	trispicata	0
Cyperaceae	Scleria	bracteata	0
Cyperaceae	Scleria	ciliata	0
Cyperaceae	Scleria	hirtella	0
Cyperaceae	Scleria	interrupta	0
Cyperaceae	Scleria	lacustris	Wright's Nut-rush
Cyrillaceae	Cyrilla	racemiflora	0
Cyrillaceae	Purdiaea	belizensis	0
Dennstaedtiaceae	Pteridium	caudatum	0
Dilleniaceae	Curatella	americana	0
Dilleniaceae	Davilla	kunthii	0
Dilleniaceae	Doliocarpus	dentatus	0
Dilleniaceae	Doliocarpus	multiflorus	0
Dilleniaceae	Tetracera	volubilis	0
Dioscoreaceae	Dioscorea	bartlettii	0
Dioscoreaceae	Dioscorea	composita	0
Dioscoreaceae	Dioscorea	densiflora	0
Dioscoreaceae	Dioscorea	floribunda	0
Dioscoreaceae	Dioscorea	hondurensis	0
Dioscoreaceae	Dioscorea	matagalpensis	0
Dracaenaceae	Dracaena	americana	0
Droseraceae	Drosera	capillaris	0
Ebenaceae	Diospyros	bumelioides	0
Elaeocarpaceae	Sloanea	tuerckheimii	0
Eriocaulaceae	Eriocaulon	decangulare	0

Plant family	Genus	Species	Common name
Eriocaulaceae	Eriocaulon	fuliginosum	0
Eriocaulaceae	Eriocaulon	schippii	0
Eriocaulaceae	Eriocaulon	williamsii	0
Erythroxylaceae	Erythroxylum	guatemalense	0
Erythroxylaceae	Erythroxylum	rotundifolium	0
Euphorbiaceae	Acalypha	arvensis	0
Euphorbiaceae	Acalypha	gentlei	0
Euphorbiaceae	Alchornea	latifolia	0
Euphorbiaceae	Chamaesyce	hypericifolia	0
Euphorbiaceae	Cnidoscolus	chayamansa	0
Euphorbiaceae	Cnidoscolus	multilobus	0
Euphorbiaceae	Croton	glandulosepalus	0
Euphorbiaceae	Croton	niveus	0
Euphorbiaceae	Dalechampia	schippii	0
Euphorbiaceae	Drypetes	lateriflora	0
Euphorbiaceae	Euphorbia	heterophylla	0
Euphorbiaceae	Pedilanthus	tithymaloides	0
Euphorbiaceae	Pera	barbellata	0
Euphorbiaceae	Phyllanthus	amarus	0
Euphorbiaceae	Plukenetia	penninervia	0
Euphorbiaceae	Sebastiania	adenophora	0
Fabaceae: Caesalpinioideae	Bauhinia	divaricata	0
Fabaceae: Caesalpinioideae	Bauhinia	herrerae	0
Fabaceae: Caesalpinioideae	Caesalpinia	gaumeri	0
Fabaceae: Caesalpinioideae	Cassia	grandis	0
Fabaceae: Caesalpinioideae	Chamaecrista	desvauxii	0
Fabaceae: Caesalpinioideae	Chamaecrista	diphylla	0
Fabaceae: Caesalpinioideae	Chamaecrista	fagonioides	0
Fabaceae: Caesalpinioideae	Chamaecrista	flexuosa	0
Fabaceae: Caesalpinioideae	Chamaecrista	hispidula	0
Fabaceae: Caesalpinioideae	Chamaecrista	kunthiana	0
Fabaceae: Caesalpinioideae	Chamaecrista	nictitans	0
Fabaceae: Caesalpinioideae	Haematoxylon	campechianum	Logwood
Fabaceae: Caesalpinioideae	Hymenaea	courbaril	0
Fabaceae: Caesalpinioideae	Schizolobium	parahyba	0
Fabaceae: Caesalpinioideae	Senna	hayesiana	0
Fabaceae: Caesalpinioideae	Senna	papillosa	0
Fabaceae: Mimosoideae	Abarema	idiopoda	0
Fabaceae: Mimosoideae	Acacia	cookii	0
Fabaceae: Mimosoideae	Balizia	leucocalyx	0
Fabaceae: Mimosoideae	Calliandra	belizensis	0
Fabaceae: Mimosoideae	Calliandra	houstoniana	0
Fabaceae: Mimosoideae	Cojoba	graciliflora	0
Fabaceae: Mimosoideae	Enterolobium	cyclocarpum	Guanacaste
Fabaceae: Mimosoideae	Havardia	albicans	0

Plant family	Genus	Species	Common name
Fabaceae: Mimosoideae	Inga	affinis	0
Fabaceae: Mimosoideae	Inga	belizensis	0
Fabaceae: Mimosoideae	Inga	pavoniana	Bribri
Fabaceae: Mimosoideae	Lysiloma	latisiliquum	0
Fabaceae: Mimosoideae	Mimosa	bahamensis	0
Fabaceae: Mimosoideae	Mimosa	hondurana	0
Fabaceae: Mimosoideae	Mimosa	pellita	0
Fabaceae: Mimosoideae	Mimosa	pudica	0
Fabaceae: Mimosoideae	Mimosa	somnians	0
Fabaceae: Mimosoideae	Mimosa	watsonii	0
Fabaceae: Mimosoideae	Pithecellobium	johansenii	0
Fabaceae: Mimosoideae	Pithecellobium	lanceolatum	0
Fabaceae: Mimosoideae	Samanea	saman	0
Fabaceae: Mimosoideae	Zygia	cognata	0
Fabaceae: Mimosoideae	Zygia	conzattii	0
Fabaceae: Papilionoideae	Aeschynomene	histrix	0
Fabaceae: Papilionoideae	Centrosema	virginianum	0
Fabaceae: Papilionoideae	Dalbergia	glabra	0
Fabaceae: Papilionoideae	Desmodium	barbatum	0
Fabaceae: Papilionoideae	Desmodium	incanum	0
Fabaceae: Papilionoideae	Diphysa	carthaginensis	0
Fabaceae: Papilionoideae	Gliricidia	maculata	0
Fabaceae: Papilionoideae	Gliricidia	sepium	0
Fabaceae: Papilionoideae	Lennea	melanocarpa	0
Fabaceae: Papilionoideae	Lonchocarpus	guatemalensis	0
Fabaceae: Papilionoideae	Lonchocarpus	luteomaculatus	0
Fabaceae: Papilionoideae	Lonchocarpus	rugosus	0
Fabaceae: Papilionoideae	Machaerium	cirrhiferum	0
Fabaceae: Papilionoideae	Machaerium	isadelphum	0
Fabaceae: Papilionoideae	Mucuna	argyrophylla	0
Fabaceae: Papilionoideae	Pachyrhizus	erosus	0
Fabaceae: Papilionoideae	Pachyrhizus	ferrugineus	0
Fabaceae: Papilionoideae	Piscidia	piscipula	0
Fabaceae: Papilionoideae	Pterocarpus	officinalis	Kaway
Fabaceae: Papilionoideae	Pterocarpus	rorhrii	0
Fabaceae: Papilionoideae	Stylosanthes	guianensis	0
Fabaceae: Papilionoideae	Stylosanthes	viscosa	0
Fabaceae: Papilionoideae	Swartzia	cubensis	0
Fabaceae: Papilionoideae	Vigna	luteola	0
Fagaceae	Quercus	elliptica	0
Fagaceae	Quercus	insignis	0
Fagaceae	Quercus	oleoides	0
Flacourtiaceae	Xylosma	flexuosa	0
Flacourtiaceae	Zuelania	guidonia	0
Gentianaceae	Coutoubea	spicata	0

Plant family	Genus	Species	Common name
Gentianaceae	Lisianthus	axillaris	0
Gentianaceae	Schultesia	guianensis	0
Gesneriaceae	Achimenes	erecta	0
Gleicheniaceae	Dicranopteris	flexuosa	0
Gleicheniaceae	Dicranopteris	pectinata	0
Grammitidaceae	Cochlidium	linearifolium	0
Heliconiaceae	Heliconia	aurantiaca	0
Heliconiaceae	Heliconia	latispatha	0
Heliconiaceae	Heliconia	librata	0
Heliconiaceae	Heliconia	rostrata	Lobster Claw
Heliconiaceae	Heliconia	spissa	0
Hippocrateaceae	Cheiloclinium	belizense	0
Hippocrateaceae	Hemiangium	excelsum	0
Hydrophyllaceae	Hydrolea	spinosa	0
Hypoxidaceae	Curculigo	scorzonerifolia	0
Iridaceae	Alophia	silvestris	0
Iridaceae	Cipura	campanulata	0
Lacistemataceae	Lacistema	aggregatum	0
Lamiaceae	Hyptis	conferta	0
Lamiaceae	Hyptis	verticillata	0
Lamiaceae	Marsypianthes	chamaedrys	0
Lauraceae	Cassytha	filiformis	0
Lauraceae	Cinnamomum	triplinerve	0
Lauraceae	Nectandra	longicaudata	0
Lauraceae	Nectandra	salicifolia	0
Lentibulariaceae	Utricularia	adpressa	0
Lentibulariaceae	Utricularia	foliosa	0
Lentibulariaceae	Utricularia	gibba	0
Lentibulariaceae	Utricularia	hispida	0
Lentibulariaceae	Utricularia	hydrocarpa	0
Lentibulariaceae	Utricularia	juncea	0
Lentibulariaceae	Utricularia	purpurea	0
Lentibulariaceae	Utricularia	resupinata	0
Lentibulariaceae	Utricularia	simulans	0
Lentibulariaceae	Utricularia	subulata	0
Loganiaceae	Spigelia	anthelmia	0
Loganiaceae	Spigelia	polystachya	0
Loganiaceae	Strychnos	peckii	0
Loranthaceae	Oryctanthus	cordifolius	0
Loranthaceae	Psittacanthus	mayanus	0
Loranthaceae	Psittacanthus	pinicola	0
Loranthaceae	Struthanthus	interruptus	0
Lycopodiaceae	Lycopodiella	cernua	0
Lythraceae	Cuphea	calophylla	0
Malpighiaceae	Byrsonima	bucidifolia	0

Plant family	Genus	Species	Common name
Malpighiaceae	Byrsonima	crassifolia	0
Malpighiaceae	Heteropterys	brachiata	0
Malpighiaceae	Malpighia	glabra	0
Malpighiaceae	Tetrapterys	arcana	0
Malvaceae	Hampea	trilobata	0
Malvaceae	Hibiscus	pernambucensis	0
Malvaceae	Lopimia	malacophylla	0
Malvaceae	Malvaviscus	arboreus	0
Malvaceae	Sida	acuta	0
Malvaceae	Sida	brachystemon	0
Malvaceae	Sida	ciliaris	0
Malvaceae	Sida	linifolia	0
Marantaceae	Calathea	lutea	Waha Leaf
Marantaceae	Maranta	arundinacea	0
Mayacaceae	Mayaca	fluviatilis	0
Melastomataceae	Acisanthera	quadrata	0
Melastomataceae	Clidemia	hirta	0
Melastomataceae	Clidemia	novemnervia	0
Melastomataceae	Clidemia	sericea	0
Melastomataceae	Clidemia	strigillosa	0
Melastomataceae	Conostegia	icosandra	0
Melastomataceae	Conostegia	xalapensis	0
Melastomataceae	Henriettea	fascicularis	0
Melastomataceae	Henriettea	succosa	0
Melastomataceae	Miconia	affinis	0
Melastomataceae	Miconia	albicans	0
Melastomataceae	Miconia	argentea	0
Melastomataceae	Miconia	bubalina	0
Melastomataceae	Miconia	chrysophylla	0
Melastomataceae	Miconia	ciliata	0
Melastomataceae	Miconia	glaberrima	0
Melastomataceae	Miconia	holosericea	0
Melastomataceae	Miconia	lundelliana	0
Melastomataceae	Miconia	prasina	0
Melastomataceae	Miconia	schippii	0
Melastomataceae	Mouriri	exilis	0
Melastomataceae	Mouriri	myrtilloides	0
Melastomataceae	Pterolepis	stenophylla	0
Meliaceae	Cedrela	odorata	0
Meliaceae	Swietenia	macrophylla	Large-leaved Mahogany
Meliaceae	Trichilia	havanensis	0
Menispermaceae	Hyperbaena	mexicana	0
Menyanthaceae	Nymphoides	indica	0
Monimiaceae	Mollinedia	guatemalensis	0
Monimiaceae	Siparuna	thecaphora	0

Plant family	Genus	Species	Common name
Moraceae	Brosimum	alicastrum	0
Moraceae	Brosimum	lactescens	0
Moraceae	Ficus	insipida	0
Moraceae	Ficus	maxima	0
Moraceae	Ficus	popenoei	0
Myricaceae	Myrica	cerifera	0
Myristicaceae	Compsoneura	sprucei	0
Myristicaceae	Virola	koschnyi	0
Myristicaceae	Virola	multiflora	0
Myrsinaceae	Parathesis	cubana	0
Myrtaceae	Calyptranthes	chytraculia	0
Myrtaceae	Chamguava	gentlei	0
Myrtaceae	Eugenia	aeruginea	0
Myrtaceae	Eugenia	farameoides	0
Myrtaceae	Myrciaria	floribunda	0
Myrtaceae	Pimenta	dioica	Allspice
Myrtaceae	Syzygium	cumini	0
Najadaceae	Najas	wrightiana	0
Nyctaginaceae	Neea	psychotrioides	0
Ochnaceae	Ouratea	lucens	0
Ochnaceae	Ouratea	nitida	0
Ochnaceae	Sauvagesia	erecta	0
Ochnaceae	Sauvagesia	tenella	0
Onagraceae	Ludwigia	erecta	0
Onagraceae	Ludwigia	octovalvis	Mexican primrose willow.
Orchidaceae	Bletia	purpurea	0
Orchidaceae	Brassavola	cucullata	0
Orchidaceae	Brassavola	nodosa	0
Orchidaceae	Campylocentrum	fasciola	0
Orchidaceae	Campylocentrum	poeppigii	0
Orchidaceae	Catasetum	integerrimum	0
Orchidaceae	Christensonella	uncata	0
Orchidaceae	Cyrtopodium	macrobulbon	0
Orchidaceae	Encyclia	alata	0
Orchidaceae	Encyclia	bractescens	0
Orchidaceae	Epidendrum	nocturnum	0
Orchidaceae	Epidendrum	rigidum	0
Orchidaceae	Erycina	pusilla	0
Orchidaceae	Galeandra	batemanii	0
Orchidaceae	Habenaria	brownelliana	0
Orchidaceae	Habenaria	mesodactyla	0
Orchidaceae	Isochilus	carnosiflorus	0
Orchidaceae	Maxillaria	ringens	0
Orchidaceae	Myrmecophila	tibicinis	0
Orchidaceae	Nidema	boothii	0

Plant family	Genus	Species	Common name
Orchidaceae	Oeceoclades	maculata	0
Orchidaceae	Oncidium	ensatum	0
Orchidaceae	Ornithocephalus	bicornis	0
Orchidaceae	Polystachya	foliosa	0
Orchidaceae	Prosthechea	cochleata	0
Orchidaceae	Scaphyglottis	leucantha	0
Orchidaceae	Specklinia	brighamii	0
Orchidaceae	Specklinia	microphylla	0
Orchidaceae	Spiranthes	torta	0
Orchidaceae	Stelis	ciliaris	0
Orchidaceae	Trigonidium	egertonianum	0
Oxalidaceae	Oxalis	frutescens	0
Passifloraceae	Passiflora	ambigua	Granadilla de Monte
Passifloraceae	Passiflora	biflora	0
Passifloraceae	Passiflora	choconiana	0
Passifloraceae	Passiflora	ciliata	0
Passifloraceae	Passiflora	cobanensis	0
Passifloraceae	Passiflora	coriaceae	0
Passifloraceae	Passiflora	foetida	Fetid Passionflower
Passifloraceae	Passiflora	lancetillensis	0
Passifloraceae	Passiflora	mayarum	0
Passifloraceae	Passiflora	oerstedii	0
Passifloraceae	Passiflora	rovirosae	0
Passifloraceae	Passiflora	serratifolia	0
Passifloraceae	Passiflora	urbaniana	0
Passifloraceae	Passiflora	xiikzodz	0
Phytolaccaceae	Petiveria	alliacea	0
Phytolaccaceae	Rivina	humilis	0
Pinaceae	Pinus	caribaea	Caribbean Pine
Piperaceae	Peperomia	pellucida	0
Piperaceae	Piper	aduncum	0
Piperaceae	Piper	auritum	0
Piperaceae	Piper	jacquemontianum	0
Piperaceae	Piper	peltatum	0
Piperaceae	Piper	tuberculatum	0
Poaceae	Andropogon	bicornis	0
Poaceae	Andropogon	glomeratus	0
Poaceae	Andropogon	leucostachyus	0
Poaceae	Andropogon	virginicus	0
Poaceae	Aristida	appressa	0
Poaceae	Aristida	purpurascens	0
Poaceae	Axonopus	aureus	0
Poaceae	Axonopus	ciliatifolius	0
Poaceae	Axonopus	compressus	0
Poaceae	Axonopus	poiophyllus	0

Plant family	Genus	Species	Common name
Poaceae	Axonopus	purpusii	0
Poaceae	Bambusa	vulgaris	0
Poaceae	Dichanthelium	aciculare	0
Poaceae	Dichanthelium	acuminatum	0
Poaceae	Digitaria	horizontalis	0
Poaceae	Distichlis	spicata	0
Poaceae	Eragrostis	elliotii	0
Poaceae	Eragrostis	maypurensis	0
Poaceae	Eragrostis	rufescens	0
Poaceae	Guadua	longifolia	0
Poaceae	Gynerium	sagittatum	Wild Cane
Poaceae	Hypogynium	virgatum	0
Poaceae	Ichnanthus	calvescens	0
Poaceae	Ichnanthus	lanceolatus	0
Poaceae	Ischaemum	latifolium	0
Poaceae	Lasiacis	sorghoidea	0
Poaceae	Leptocoryphium	lanatum	0
Poaceae	Mesosetum	blakei	0
Poaceae	Mesosetum	filifolium	0
Poaceae	Panicum	cyanescens	0
Poaceae	Panicum	hirsutum	0
Poaceae	Panicum	laxum	0
Poaceae	Panicum	parvifolium	0
Poaceae	Panicum	pilosum	0
Poaceae	Panicum	repens	0
Poaceae	Panicum	tenerum	0
Poaceae	Paspalum	conjugatum	0
Poaceae	Paspalum	fasciculatum	0
Poaceae	Paspalum	multicaule	0
Poaceae	Paspalum	peckii	0
Poaceae	Paspalum	pectinatum	0
Poaceae	Paspalum	pulchellum	0
Poaceae	Paspalum	serpentinum	0
Poaceae	Paspalum	virgatum	0
Poaceae	Paspalum	wrightii	0
Poaceae	Pennisetum	setosum	0
Poaceae	Pentarrhaphis	scabra	0
Poaceae	Schizachyrium	microstachyum	0
Poaceae	Setaria	tenacissima	0
Poaceae	Spartina	spartinae	0
Poaceae	Sporobolus	cubensis	0
Poaceae	Sporobolus	diandrus	0
Poaceae	Sporobolus	jacquemontii	0
Poaceae	Sporobolus	virginicus	0
Poaceae	Trachypogon	spicatus	0

Plant family	Genus	Species	Common name
Poaceae	Tripsacum	latifolium	0
Podocarpaceae	Podocarpus	guatemalensis	0
Polygalaceae	Polygala	adenophora	0
Polygalaceae	Polygala	longicaulis	0
Polygalaceae	Polygala	paniculata	0
Polygalaceae	Polygala	variabilis	0
Polygonaceae	Coccoloba	barbadensis	0
Polygonaceae	Coccoloba	belizensis	0
Polygonaceae	Coccoloba	hondurensis	0
Polygonaceae	Coccoloba	reflexiflora	0
Polygonaceae	Coccoloba	spp.	0
Polygonaceae	Coccoloba	swartzii	0
Polygonaceae	Coccoloba	uvifera	0
Polygonaceae	Gymnopodium	floribundum	0
Pontederiaceae	Eichhornia	heterosperma	0
Pontederiaceae	Pontederia	cordata	0
Portulacaceae	Portulaca	oleracea	0
Portulacaceae	Portulaca	pilosa	0
Proteaceae	Roupala	montana	0
Quiinaceae	Quiina	schippii	0
Rhamnaceae	Gouania	lupuloides	0
Rhamnaceae	Gouania	polygama	0
Rhizophoraceae	Cassipourea	guianensis	0
Rhizophoraceae	Rhizophora	mangle	Red Mangrove
Rubiaceae	Alibertia	edulis	0
Rubiaceae	Alseis	yucatanensis	0
Rubiaceae	Amaioua	corymbosa	0
Rubiaceae	Coccocypselum	guianense	0
Rubiaceae	Diodia	apiculata	0
Rubiaceae	Erithalis	fruticosa	0
Rubiaceae	Ernodea	littoralis	0
Rubiaceae	Guettarda	combsii	Glassywood
Rubiaceae	Guettarda	elliptica	0
Rubiaceae	Hamelia	patens	0
Rubiaceae	Hamelia	rovirosae	0
Rubiaceae	Lindenia	rivalis	0
Rubiaceae	Machaonia	lindeniana	0
Rubiaceae	Morinda	royoc	0
Rubiaceae	Palicourea	crocea	0
Rubiaceae	Psychotria	elata	0
Rubiaceae	Psychotria	glomerulata	0
Rubiaceae	Psychotria	poeppigiana	0
Rubiaceae	Randia	lundelliana	0
Rubiaceae	Simira	salvadorensis	0
Rubiaceae	Spermacoce	assurgens	0

Plant family	Genus	Species	Common name
Rubiaceae	Spermacoce	suaveolens	0
Rutaceae	Zanthoxylum	riedelianum	0
Sapindaceae	Cupania	belizensis	0
Sapindaceae	Cupania	scrobiculata	0
Sapindaceae	Cupania	spectabilis	0
Sapindaceae	Dodonaea	viscosa	0
Sapindaceae	Matayba	apetala	0
Sapindaceae	Sapindus	saponaria	0
Sapindaceae	Serjania	adiantoides	0
Sapindaceae	Serjania	grosii	0
Sapindaceae	Serjania	paucidentata	0
Sapindaceae	Talisia	oliviformis	0
Sapindaceae	Thouinia	paucidentata	0
Sapotaceae	Chrysophyllum	cainito	0
Sapotaceae	Chrysophyllum	mexicanum	0
Sapotaceae	Manilkara	chicle	0
Sapotaceae	Manilkara	zapota	0
Sapotaceae	Pouteria	amygdalina	0
Sapotaceae	Pouteria	campechiana	0
Sapotaceae	Sideroxylon	americanum	0
Sapotaceae	Sideroxylon	obtusifolium	0
Schizaeaceae	Anemia	pastinacaria	0
Schizaeaceae	Lygodium	venustum	0
Scrophulariaceae	Angelonia	ciliaris	0
Scrophulariaceae	Anisantherina	hispidula	0
Scrophulariaceae	Bacopa	lacertosa	0
Scrophulariaceae	Bacopa	sessiliflora	0
Scrophulariaceae	Buchnera	pusilla	0
Scrophulariaceae	Russelia	sarmentosa	0
Selaginellaceae	Selaginella	huehuetenangensis	0
Selaginellaceae	Selaginella	pallescens	0
Simaroubaceae	Simarouba	glauca	0
Smilacaceae	Smilax	velutina	0
Solanaceae	Schwenkia	americana	0
Solanaceae	Solanum	asperum	0
Solanaceae	Solanum	diphyllum	0
Sterculiaceae	Byttneria	aculeata	0
Sterculiaceae	Guazuma	ulmifolia	Bay Cedar
Sterculiaceae	Helicteres	guazumifolia	0
Sterculiaceae	Melochia	spicata	0
Sterculiaceae	Waltheria	indica	0
Surianaceae	Suriana	maritima	0
Symplocaceae	Symplocos	martinicensis	0
Theaceae	Ternstroemia	tepezapote	0
Theophrastaceae	Jacquinia	macrocarpa	0

Plant family	Genus	Species	Common name
Tiliaceae	Christiana	africana	0
Tiliaceae	Luehea	speciosa	0
Tiliaceae	Muntingia	calabura	0
Tiliaceae	Trichospermum	grewiifolium	0
Tiliaceae	Triumfetta	lappula	0
Turneraceae	Erblichia	odorata	0
Turneraceae	Turnera	aromatica	0
Turneraceae	Turnera	diffusa	Damiana
Turneraceae	Turnera	ulmifolia	0
Typhaceae	Typha	domingensis	0
Ulmaceae	Ampelocera	hottlei	0
Ulmaceae	Trema	micrantha	0
Verbenaceae	Aegiphila	monstrosa	0
Verbenaceae	Avicennia	germinans	0
Verbenaceae	Citharexylum	caudatum	0
Verbenaceae	Lantana	involucrata	0
Verbenaceae	Petrea	volubilis	0
Verbenaceae	Tamonea	spicata	0
Verbenaceae	Vitex	gaumeri	0
Violaceae	Hybanthus	calceolaria	0
Violaceae	Rinorea	guatemalensis	0
Viscaceae	Arceuthobium	hawksworthii	0
Viscaceae	Phoradendron	quadrangulare	0
Vitaceae	Cissus	gossypiifolia	0
Vitaceae	Cissus	verticillata	0
Vitaceae	Vitis	tiliifolia	0
Vochysiaceae	Vochysia	hondurensis	Yemeri
Xyridaceae	Xyris	ambigua	0
Xyridaceae	Xyris	jupicai	0
Xyridaceae	Xyris	navicularis	0
Zamiaceae	Zamia	meermanii	0
Zamiaceae	Zamia	prasina	Bullrush, Palmita

8.2 Invertebrates

Order	Genus	Species	Common name
Butterflies	Actinote	pellenea	
Butterflies	Adelpha	cytherea	
Butterflies	Adelpha	iphiclus	
Butterflies	Adelpha	serpa	
Butterflies	Aellopos	titan	
Butterflies	Aeria	eurimedia	
Butterflies	Agraulis	vanillae	
Butterflies	Anartia	fatima	
Butterflies	Anartia	jatrophae	
Butterflies	Anteos	clorinde	
Butterflies	Anteos	maerula	
Butterflies	Aphrissa	boisduvalii	
Butterflies	Aphrissa	statira	Jada Sulphur
Butterflies	Arsenura	armida	
Butterflies	Battus	polydamas	
Butterflies	Biblis	hyperia	
Butterflies	Calephelis	argyrodines	
Butterflies	Calephelis	sp.	
Butterflies	Caligo	memnon	
Butterflies	Catonephele	mexicana	
Butterflies	Charis	velutina	Dark Scintillant
Butterflies	Chlosyne	erodyle	
Butterflies	Chlosyne	janais	
Butterflies	Chlosyne	lacinia	
Butterflies	Colobura	dirce	
Butterflies	Danaus	gilippus	Striated Queen
Butterflies	Danaus	plexippus	Monarch
Butterflies	Dryadula	phaetusa	
Butterflies	Dryas	iulia	
Butterflies	Dynamine	artemisia	
Butterflies	Dynamine	mylitta	
Butterflies	Electrostrymon	joya	
Butterflies	Emesis	lucinda	
Butterflies	Eresia	clara	
Butterflies	Eryphanis	aesacus	
Butterflies	Eueides	aliphera	
Butterflies	Eueides	isabella	
Butterflies	Eumaeus	toxea	
Butterflies	Euptoieta	hegesia	
Butterflies	Eurema	albula	Ghost Yellow
Butterflies	Eurema	daira	Barred Yellow
Butterflies	Eurema	lisa	Little Yellow
Butterflies	Eurema	nise	Mimosa Yellow
Butterflies	Eurema	proterpia	Tailed Orange

Order	Genus	Species	Common name
Butterflies	Euselasia	aurantiaca	
Butterflies	Evenus	regalis	
Butterflies	Hamadryas	februa	
Butterflies	Hamadryas	feronia	
Butterflies	Heliconius	charithonia	
Butterflies	Heliconius	erato	
Butterflies	Heliconius	ismenius	
Butterflies	Hemiargus	hanno	Hanno Blue
Butterflies	Heraclides	anchisiades	
Butterflies	Heraclides	androgeus	
Butterflies	Heraclides	thoas	
Butterflies	Hermeuptychia	hermes	
Butterflies	Historis	acheronta	
Butterflies	Junonia	genoveva	
Butterflies	Laparus	doris	
Butterflies	Lyropteryx	lyra	
Butterflies	Marpesia	chiron	
Butterflies	Marpesia	petreus	
Butterflies	Melanis	pixe	
Butterflies	Ministrymon	una	
Butterflies	Morpho	peleides	Blue Morpho
Butterflies	Morpho	theseus	Brown Morpho
Butterflies	Nessaea	aglaura	
Butterflies	Opsiphanes	tamarindi	
Butterflies	Paches	loxus	
Butterflies	Panthiades	bitias	
Butterflies	Pareuptychia	ocirrhoe	
Butterflies	Parides	erithalion	
Butterflies	Parides	eurimedes	
Butterflies	Parides	iphidamas	
Butterflies	Parides	sesostris	
Butterflies	Phoebis	argante	Apricot Sulphur
Butterflies	Phoebis	philea	
Butterflies	Phoebis	sennae	
Butterflies	Pierella	luna	
Butterflies	Pseudolycaena	marsyas	
Butterflies	Rekoa	meton	
Butterflies	Taygetis	inconspicua	
Butterflies	Tegosa	guatemalena	
Butterflies	Thessalia	theona	
Butterflies	Urania	fulgens	
Crabs, shrimps, and lobsters	Cardisoma	guanhumi	Blue Land Crab
Dragonflies and Damselflies	Argia	frequentula	
Dragonflies and Damselflies	Argia	gaumeri	
Dragonflies and Damselflies	Argia	translata	

Order	Genus	Species	Common name
Dragonflies and Damselflies	Dythemis	multipunctata	
Dragonflies and Damselflies	Dythemis	sterilis	
Dragonflies and Damselflies	Enallagma	novaehispaniae	
Dragonflies and Damselflies	Erythemis	simplicicollis	
Dragonflies and Damselflies	Erythrodiplax	umbrata	
Dragonflies and Damselflies	Hetaerina	titia	
Dragonflies and Damselflies	Neoerythromma	cultellatum	
Dragonflies and Damselflies	Neoneura	amelia	
Dragonflies and Damselflies	Orthemis	ferruginea	
Dragonflies and Damselflies	Orthemis	levis	
Dragonflies and Damselflies	Palaemnema	desiderata	
Dragonflies and Damselflies	Protoneura	aurantiaca	
Dragonflies and Damselflies	Psaironeura	remissa	

8.3 Fish

Species	Common Name	Sibun	Cornhouse Creek	Manatee River	Soldier Creek	Jenkins Creek	Quamina Creek	Mullins River	Big Creek
Anguilla rostrata	American Eel							x	
Antherinella sp.	Belize Silverside	x							
Hexanematichthys assimilis	Mayan Sea Catfish								
Batrachoides gilberti									
Strongylura notata	Redfin needlefish						x		
Strongylura timucu	Timucu								
Lupinoblennius dispar	Mangrove blenny								
Caranx latus	Horse-eye jack	x							
Centropomus parallelus	Fat Snook			x					
Astyanax fasciatus	Banded Astyanax(Billum)	x	7-Feb	26-Feb	26-Feb	x	26-Feb	16-Feb	16-Feb
Hyphessobrycon compressus	Mayan Tetra(Billum)	x					x	x	16-Feb
Amphilophus robertsoni	False Firemouth Cichlid	x		x				x	
Archocentrus spilurus	Blue-eye Cichlid	x	15-May	26-Feb	26-Feb			16-Feb	
Cichlasoma octofasciatum	Jack Dempsey	x			x		x		
Cichlasoma salvini	Yellow Belly Cichlid	x	15-May	26-Feb	26-Feb			16-Feb	
Cichlasoma urophthalmus	Mexican MojarraMayan Cichlid								
Oreochromis niloticus	Tilapia	x							
Parachromis friedrichsthalii	Yellowjacket Cichlid (Mus mus)	x					x		
Petenia splendida	Bay Snook(Blanco)	x		x			x		
Thorichthys meeki	Firemouth Cichlid (Panya gial)	x		x			x		
Vieja intermedia	Northern Checkmark Cichlid	x							
Vieja synspila	Redhead Cichlid	x	7-Feb					x	16-Feb
Dorosoma anale	Mexican River Gizzard Shad, Longfin Gizzard Shad	x							
Floridichthys polyommus	Ocellated Killifish								
Garmanella pulchra	Yucat?n Flagfish								
Eleotris amblyopsis	Large-scaled Spinycheek Sleeper						x	x	

Species	Common Name	Sibun	Cornhouse Creek	Manatee River	Soldier Creek	Jenkins Creek	Quamina Creek	Mullins River	Big Creek
Eleotris pisonis	Spinycheek Sleeper	x						x	
Gobiomorus dormitor	Bigmouth Sleeper	x		x	x			x	
Diapterus rhombeus	Caitipa mojarra, Silver mojarra			x					
Eugerres brasilianus	Brazilian mojarra			x					
Eugerres plumieri	Striped Mojarra	x							
Awaous banana	River Goby	x						x	
Ctenogobius smaragdus	Emerald Goby								
Gobiosoma yucatanum	Yucatan Goby								
Pomadasys crocro	Burro Grunt	x		x					
Hyporhamphus roberti	Central American halfbeak				x				
Rhamdia guatemalensis	Guatemalan Chul fin	x					x	x	
Rhamdia laticauda	Filespine Chulin	x					x		
Lutjanus griseus	Grey snapper	x	15-May	x					
Megalops atlanticus	Tarpon	x					x		7-Feb
Agonostomus monticola	Mountain Mullet	x						x	
Myrophis punctatus	Speckled worm eel								
Belonesox belizanus	TopminnowPike killifish	x		x			x	x	
Gambusia luma	Sleek Mosquitofish	x		x	x		x	x	x
Gambusia sexradiata	Teardrop Mosquito	x							
Gambusia yucatana	Yucatan Mosquitofish						x		
Heterandria bimaculata	Twospot Livebearer			26-Feb	26-Feb		x	x	16-Feb
Poecilia mexicana	Shortfin Molly	x	7-Feb	x	x			x	
Poecilia orri	Mangrove Molly						x		
Xiphophorus hellerii	Green Swordtail	x		26-Feb	26-Feb		x		
Xiphophorus maculatus	Southern Platyfish	x							
Rivulus tenuis	Dogtooth Rivulus						x	x	
Archosargus probatocephalus	Sheepshead seabream, Southern sheeps head								
Ophisternon aenigmaticum	Obscure Swamp Eel	x			x			x	
Sphoeroides testudineus	Checkered puffer								

8.4 Amphibians

Family	Genus	Species
Burrowing Toads	Rhinophrynus	dorsalis
Rain Frogs	Leptodactylus	fragilis
Rain Frogs	Leptodactylus	melanonotus
Sheep Frogs	Gastrophryne	elegans
Toads	Incilius	valliceps
Toads	Rhinella	marinus
Tree Frogs	Scinax	staufferi
Tree Frogs	Smilisca	baudini
True Frogs	Lithobates	berlandieri
True Frogs	Lithobates	vaillanti

8.5 Reptiles

Family	Genus	Species
Anoles	Norops	lemurinus
Anoles	Norops	rodriguezii
Anoles	Norops	uniformis
Boas and Pythons	Boa	constrictor
Casque-headed Lizards	Basiliscus	vittatus
Casque-headed Lizards	Corytophanes	cristatus
Central American River Turtles	Dermatemys	mawii
Crocodiles	Crocodylus	acutus
Crocodiles	Crocodylus	moreletii
Geckos	Sphaerodactylus	millepunctatus
Hard-Shelled Sea Turtles	Eretmochelys	imbricata
Iguanas	Iguana	iguana
Mud and Musk Turtles	Kinosternon	acutum
Mud and Musk Turtles	Kinosternon	leucostomum
Mud and Musk Turtles	Kinosternon	scorpioides
Night Lizards	Lepidophyma	flavimaculatum
Pit Vipers and Rattlesnakes	Bothrops	asper
Skinks	Sphenomorphus	cherriei
Typical Snakes	Drymobius	margaritiferus
Typical Snakes	Leptophis	ahaetulla
Typical Snakes	Leptophis	mexicanus
Typical Snakes	Ninia	sebae
Typical Snakes	Pseustes	poecilinotus
Typical Snakes	Symphimus	mayae
Whip-Tailed Lizards	Ameiva	undulata
Wood Turtles and Sliders	Trachemys	venusta

8.6 Birds.

Although the principal purpose of the transects was the ecosystem/vegetation assessment, the opportunity was taken to use the same transect for bird observations. At the start of creating the transect, 15 minutes were taken to carry out bird observations, which includes audio observations. At later stages, the same locations were again visited for bird records. All bird records, either from the transects or opportunistically along the road were later entered into the eBird database, thereby building a geo-referenced dataset of birds for the area.

Apart from this, an extensive use was made of this eBird (www.ebird.org) database. For the 5 km buffer zone along the road, as per November 2017, a staggering 9,805 bird records representing 389 species was available. This large number and great variety is no doubt caused by the variety of habitats included such as savanna, hills rivers and lagoons as well as artificial habitats such as aquaculture ponds.

The table below, lists the species recorded together with the amount of records for each species and indicates which of the reported species were also recorded during field work for the EIA. In addition; consult the section on the vegetation transects in Appendix # for the species recorded on these specific transects.

English Name	Scientific Name	# records	EIA
Great Tinamou	Tinamus major	11	
Little Tinamou	Crypturellus soui	31	
Slaty-breasted Tinamou	Crypturellus boucardi	3	
Thicket Tinamou	Crypturellus cinnamomeus	3	
Black-bellied Whistling-Duck	Dendrocygna autumnalis	30	
Muscovy Duck	Cairina moschata	9	
Blue-winged Teal	Spatula discors	3	
Northern Shoveler	Spatula clypeata	1	
Plain Chachalaca	Ortalis vetula	104	Yes
Crested Guan	Penelope purpurascens	13	
Great Curassow	Crax rubra	7	
Black-throated Bobwhite	Colinus nigrogularis	43	
Least Grebe	Tachybaptus dominicus	1	
Pied-billed Grebe	Podilymbus podiceps	1	
Jabiru	Jabiru mycteria	14	
Wood Stork	Mycteria americana	41	Yes
Magnificent Frigatebird	Fregata magnificens	37	
Brown Booby	Sula leucogaster	1	
Neotropic Cormorant	Phalacrocorax brasilianus	8	
Double-crested Cormorant	Phalacrocorax auritus	14	
cormorant sp.	Phalacrocoracidae sp.	1	
Anhinga	Anhinga anhinga	16	
American White Pelican	Pelecanus erythrorhynchos	1	
Brown Pelican	Pelecanus occidentalis	20	
Least Bittern	Ixobrychus exilis	1	

English Name	Scientific Name	# records	EIA
Bare-throated Tiger-Heron	Tigrisoma mexicanum	16	
Great Blue Heron	Ardea herodias	60	
Great Egret	Ardea alba	73	Yes
Snowy Egret	Egretta thula	23	Yes
Little Blue Heron	Egretta caerulea	53	Yes
Tricolored Heron	Egretta tricolor	14	
Reddish Egret	Egretta rufescens	7	
Cattle Egret	Bubulcus ibis	25	Yes
white egret sp.	Ardea/Egretta/Bubulcus sp.	1	
Green Heron	Butorides virescens	33	Yes
Agami Heron	Agamia agami	1	
Black-crowned Night-Heron	Nycticorax nycticorax	5	
Yellow-crowned Night-Heron	Nyctanassa violacea	13	
Boat-billed Heron	Cochlearius cochlearius	13	
White Ibis	Eudocimus albus	12	
Glossy Ibis	Plegadis falcinellus	1	
Roseate Spoonbill	Platalea ajaja	5	
Black Vulture	Coragyps atratus	222	Yes
Turkey Vulture	Cathartes aura	166	Yes
Lesser Yellow-headed Vulture	Cathartes burrovianus	45	Yes
King Vulture	Sarcoramphus papa	16	Yes
Osprey	Pandion haliaetus	95	Yes
White-tailed Kite	Elanus leucurus	10	Yes
Hook-billed Kite	Chondrohierax uncinatus	1	
Gray-headed Kite	Leptodon cayanensis	4	
Swallow-tailed Kite	Elanoides forficatus	3	Yes
Black Hawk-Eagle	Spizaetus tyrannus	3	
Black-collared Hawk	Busarellus nigricollis	1	
Snail Kite	Rostrhamus sociabilis	9	
Double-toothed Kite	Harpagus bidentatus	1	
Plumbeous Kite	Ictinia plumbea	10	Yes
Crane Hawk	Geranospiza caerulescens	6	
Common Black Hawk	Buteogallus anthracinus	35	Yes
Great Black Hawk	Buteogallus urubitinga	10	
Roadside Hawk	Rupornis magnirostris	106	Yes
White-tailed Hawk	Geranoaetus albicaudatus	23	Yes
White Hawk	Pseudastur albicollis	2	
Gray Hawk	Buteo plagiatus	28	Yes
Broad-winged Hawk	Buteo platypterus	1	
Short-tailed Hawk	Buteo brachyurus	17	Yes
Zone-tailed Hawk	Buteo albonotatus	5	
Buteo sp.	Buteo sp.	1	
Ruddy Crake	Laterallus ruber	19	Yes
Clapper Rail	Rallus crepitans	1	
Russet-naped Wood-Rail	Aramides albiventris	19	Yes

English Name	Scientific Name	# records	EIA
Purple Gallinule	Porphyrio martinica	2	
American Coot	Fulica americana	1	
Sungrebe	Heliornis fulica	2	Yes
Limpkin	Aramus guarauna	27	Yes
Black-necked Stilt	Himantopus mexicanus	2	
Black-bellied Plover	Pluvialis squatarola	3	
Wilson's Plover	Charadrius wilsonia	2	
Semipalmated Plover	Charadrius semipalmatus	7	
Killdeer	Charadrius vociferus	6	
Northern Jacana	Jacana spinosa	6	
Whimbrel	Numenius phaeopus	1	
Ruddy Turnstone	Arenaria interpres	8	
Stilt Sandpiper	Calidris himantopus	1	
Sanderling	Calidris alba	7	
Least Sandpiper	Calidris minutilla	9	
Pectoral Sandpiper	Calidris melanotos	2	
Western Sandpiper	Calidris mauri	3	
Short-billed/Long-billed Dowitcher	Limnodromus griseus/scolopaceus	1	
Wilson's Snipe	Gallinago delicata	2	
Spotted Sandpiper	Actitis macularius	31	
Solitary Sandpiper	Tringa solitaria	9	
Greater Yellowlegs	Tringa melanoleuca	1	
Willet	Tringa semipalmata	1	
Lesser Yellowlegs	Tringa flavipes	1	
Greater/Lesser Yellowlegs	Tringa melanoleuca/flavipes	1	
Laughing Gull	Leucophaeus atricilla	12	
Franklin's Gull	Leucophaeus pipixcan	2	
Herring Gull	Larus argentatus	1	
Caspian Tern	Hydroprogne caspia	3	
Forster's Tern	Sterna forsteri	1	
Royal Tern	Thalasseus maximus	26	
Sandwich Tern	Thalasseus sandvicensis	8	
Rock Pigeon	Columba livia	4	
Pale-vented Pigeon	Patagioenas cayennensis	56	Yes
Scaled Pigeon	Patagioenas speciosa	12	
White-crowned Pigeon	Patagioenas leucocephala	2	
Red-billed Pigeon	Patagioenas flavirostris	23	Yes
Short-billed Pigeon	Patagioenas nigrirostris	39	Yes
Eurasian Collared-Dove	Streptopelia decaocto	3	
Common Ground-Dove	Columbina passerina	32	
Plain-breasted Ground-Dove	Columbina minuta	7	
Ruddy Ground-Dove	Columbina talpacoti	125	Yes
Blue Ground-Dove	Claravis pretiosa	29	
Ruddy Quail-Dove	Geotrygon montana	2	
White-tipped Dove	Leptotila verreauxi	56	

English Name	Scientific Name	# records	EIA
Caribbean Dove	Leptotila jamaicensis	5	
Gray-chested Dove	Leptotila cassinii	1	
Gray-headed Dove	Leptotila plumbeiceps	11	Yes
White-winged Dove	Zenaida asiatica	21	Yes
Mourning Dove	Zenaida macroura	1	
Smooth-billed Ani	Crotophaga ani	1	
Groove-billed Ani	Crotophaga sulcirostris	66	Yes
Striped Cuckoo	Tapera naevia	4	Yes
Squirrel Cuckoo	Piaya cayana	40	Yes
Yellow-billed Cuckoo	Coccyzus americanus	4	
Barn Owl	Tyto alba	2	Yes
Vermiculated Screech-Owl	Megascops guatemalae	1	
Ferruginous Pygmy-Owl	Glaucidium brasilianum	4	
Mottled Owl	Ciccaba virgata	8	
Stygian Owl	Asio stygius	1	
Lesser Nighthawk	Chordeiles acutipennis	1	
Common Nighthawk	Chordeiles minor	5	
Common Pauraque	Nyctidromus albicollis	25	Yes
Northern Potoo	Nyctibius jamaicensis	2	
White-collared Swift	Streptoprocne zonaris	5	
Vaux's Swift	Chaetura vauxi	25	
Lesser Swallow-tailed Swift	Panyptila cayennensis	1	
swift sp.	Apodidae sp.	2	
White-necked Jacobin	Florisuga mellivora	3	
Long-billed Hermit	Phaethornis longirostris	30	
Stripe-throated Hermit	Phaethornis striigularis	29	Yes
Green-breasted Mango	Anthracothorax prevostii	33	
Ruby-throated Hummingbird	Archilochus colubris	13	
Canivet's Emerald	Chlorostilbon canivetii	18	
Wedge-tailed Sabrewing	Campylopterus curvipennis	5	
White-bellied Emerald	Amazilia candida	35	Yes
Azure-crowned Hummingbird	Amazilia cyanocephala	20	
Rufous-tailed Hummingbird	Amazilia tzacatl	186	Yes
Buff-bellied Hummingbird	Amazilia yucatanensis	10	
Cinnamon Hummingbird	Amazilia rutila	25	
hummingbird sp.	Trochilidae sp.	5	
Slaty-tailed Trogon	Trogon massena	9	
Black-headed Trogon	Trogon melanocephalus	57	Yes
Gartered Trogon	Trogon caligatus	37	Yes
Tody Motmot	Hylomanes momotula	1	
Lesson's Motmot	Momotus lessonii	32	
Ringed Kingfisher	Megaceryle torquata	46	Yes
Belted Kingfisher	Megaceryle alcyon	18	
Amazon Kingfisher	Chloroceryle amazona	9	Yes
Green Kingfisher	Chloroceryle americana	23	Yes

English Name	Scientific Name	# records	EIA
American Pygmy Kingfisher	Chloroceryle aenea	9	
White-necked Puffbird	Notharchus hyperrhynchus	12	
Rufous-tailed Jacamar	Galbula ruficauda	15	
Collared Aracari	Pteroglossus torquatus	31	Yes
Keel-billed Toucan	Ramphastos sulfuratus	33	Yes
Acorn Woodpecker	Melanerpes formicivorus	132	Yes
Black-cheeked Woodpecker	Melanerpes pucherani	5	
Yucatan Woodpecker	Melanerpes pygmaeus	14	
Golden-fronted Woodpecker	Melanerpes aurifrons	169	Yes
Yellow-bellied Sapsucker	Sphyrapicus varius	8	
Ladder-backed Woodpecker	Picoides scalaris	6	
Smoky-brown Woodpecker	Picoides fumigatus	9	
Golden-olive Woodpecker	Colaptes rubiginosus	17	
Chestnut-colored Woodpecker	Celeus castaneus	1	
Lineated Woodpecker	Dryocopus lineatus	36	Yes
Pale-billed Woodpecker	Campephilus guatemalensis	31	
Collared Forest-Falcon	Micrastur semitorquatus	12	
Laughing Falcon	Herpetotheres cachinnans	59	Yes
American Kestrel	Falco sparverius	4	
Merlin	Falco columbarius	2	
Aplomado Falcon	Falco femoralis	14	Yes
Bat Falcon	Falco rufigularis	27	Yes
Peregrine Falcon	Falco peregrinus	5	
Brown-hooded Parrot	Pyrilia haematotis	1	
White-crowned Parrot	Pionus senilis	20	
Red-lored Parrot	Amazona autumnalis	72	Yes
Yellow-headed Parrot	Amazona oratrix	62	
White-fronted Parrot	Amazona albifrons	43	
Yellow-lored Parrot	Amazona xantholora	16	
Amazona sp.	Amazona sp.	1	
Olive-throated Parakeet	Eupsittula nana	156	Yes
Great Antshrike	Taraba major	21	
Barred Antshrike	Thamnophilus doliatus	55	Yes
Dot-winged Antwren	Microrhopias quixensis	1	
Dusky Antbird	Cercomacroides tyrannina	15	
Black-faced Antthrush	Formicarius analis	11	
Olivaceous Woodcreeper	Sittasomus griseicapillus	6	
Ruddy Woodcreeper	Dendrocincla homochroa	15	
Tawny-winged Woodcreeper	Dendrocincla anabatina	12	
Wedge-billed Woodcreeper	Glyphorynchus spirurus	7	
Northern Barred-Woodcreeper	Dendrocolaptes sanctithomae	7	
Ivory-billed Woodcreeper	Xiphorhynchus flavigaster	45	
Streak-headed Woodcreeper	Lepidocolaptes souleyetii	8	
woodcreeper sp.	Dendrocolaptinae sp.	1	
Plain Xenops	Xenops minutus	12	

English Name	Scientific Name	# records	EIA
Rufous-breasted Spinetail	Synallaxis erythrothorax	42	Yes
Yellow-bellied Tyrannulet	Ornithion semiflavum	11	
Northern Beardless-Tyrannulet	Camptostoma imberbe	31	
Greenish Elaenia	Myiopagis viridicata	30	
Caribbean Elaenia	Elaenia martinica	2	
Yellow-bellied Elaenia	Elaenia flavogaster	84	Yes
Ochre-bellied Flycatcher	Mionectes oleagineus	13	
Northern Bentbill	Oncostoma cinereigulare	32	
Slate-headed Tody-Flycatcher	Poecilotriccus sylvia	15	
Common Tody-Flycatcher	Todirostrum cinereum	108	
Eye-ringed Flatbill	Rhynchocyclus brevirostris	11	
Yellow-olive Flycatcher	Tolmomyias sulphurescens	38	Yes
Stub-tailed Spadebill	Platyrinchus cancrominus	3	
Royal Flycatcher	Onychorhynchus coronatus	5	
Sulphur-rumped Flycatcher	Myiobius sulphureipygius	1	
Olive-sided Flycatcher	Contopus cooperi	4	
Eastern Wood-Pewee	Contopus virens	23	
Tropical Pewee	Contopus cinereus	25	
pewee sp. (Contopus sp.)	Contopus sp.	3	Yes
Yellow-bellied Flycatcher	Empidonax flaviventris	17	Yes
Alder/Willow Flycatcher	Empidonax alnorum/traillii	2	
Least Flycatcher	Empidonax minimus	18	
Empidonax sp.	Empidonax sp.	4	
Black Phoebe	Sayornis nigricans	4	Yes
Vermilion Flycatcher	Pyrocephalus rubinus	65	
Bright-rumped Attila	Attila spadiceus	38	Yes
Yucatan Flycatcher	Myiarchus yucatanensis	7	
Dusky-capped Flycatcher	Myiarchus tuberculifer	70	Yes
Great Crested Flycatcher	Myiarchus crinitus	14	
Brown-crested Flycatcher	Myiarchus tyrannulus	20	
Great Kiskadee	Pitangus sulphuratus	134	Yes
Boat-billed Flycatcher	Megarynchus pitangua	22	
Social Flycatcher	Myiozetetes similis	158	Yes
Sulphur-bellied Flycatcher	Myiodynastes luteiventris	21	
Piratic Flycatcher	Legatus leucophaius	6	
Tropical Kingbird	Tyrannus melancholicus	125	Yes
Couch's Kingbird	Tyrannus couchii	58	Yes
Tropical/Couch's Kingbird	Tyrannus melancholicus/couchii	60	
Eastern Kingbird	Tyrannus tyrannus	19	
Scissor-tailed Flycatcher	Tyrannus forficatus	4	Yes
Fork-tailed Flycatcher	Tyrannus savana	77	Yes
Rufous Piha	Lipaugus unirufus	1	
White-collared Manakin	Manacus candei	24	
Red-capped Manakin	Ceratopipra mentalis	7	
Black-crowned Tityra	Tityra inquisitor	12	

English Name	Scientific Name	# records	EIA
Masked Tityra	Tityra semifasciata	34	Yes
Northern Schiffornis	Schiffornis veraepacis	10	
Rose-throated Becard	Pachyramphus aglaiae	13	
Rufous-browed Peppershrike	Cyclarhis gujanensis	61	
Tawny-crowned Greenlet	Tunchiornis ochraceiceps	14	
Lesser Greenlet	Pachysylvia decurtata	32	
White-eyed Vireo	Vireo griseus	42	
Mangrove Vireo	Vireo pallens	43	
Yellow-throated Vireo	Vireo flavifrons	13	
Philadelphia Vireo	Vireo philadelphicus	1	
Red-eyed Vireo	Vireo olivaceus	26	
Yellow-green Vireo	Vireo flavoviridis	19	
Yucatan Vireo	Vireo magister	10	
vireo sp.	Vireo sp.	1	
Brown Jay	Psilorhinus morio	200	Yes
Green Jay	Cyanocorax yncas	18	
Yucatan Jay	Cyanocorax yucatanicus	12	
Northern Rough-winged Swallow	Stelgidopteryx serripennis	38	
Purple Martin	Progne subis	11	Yes
Gray-breasted Martin	Progne chalybea	25	Yes
martin sp. (Progne sp.)	Progne sp.	2	
Tree Swallow	Tachycineta bicolor	5	
Mangrove Swallow	Tachycineta albilinea	38	Yes
Bank Swallow	Riparia riparia	1	
Barn Swallow	Hirundo rustica	17	
House Wren	Troglodytes aedon	19	
Spot-breasted Wren	Pheugopedius maculipectus	115	Yes
White-bellied Wren	Uropsila leucogastra	17	
White-breasted Wood-Wren	Henicorhina leucosticta	24	
Long-billed Gnatwren	Ramphocaenus melanurus	29	
Blue-gray Gnatcatcher	Polioptila caerulea	70	
Gray-cheeked Thrush	Catharus minimus	1	
Swainson's Thrush	Catharus ustulatus	12	
Catharus sp.	Catharus sp.	6	
Wood Thrush	Hylocichla mustelina	23	
Clay-colored Thrush	Turdus grayi	126	Yes
Black Catbird	Melanoptila glabrirostris	9	
Gray Catbird	Dumetella carolinensis	88	Yes
Tropical Mockingbird	Mimus gilvus	121	Yes
American Pipit	Anthus rubescens	1	
Cedar Waxwing	Bombycilla cedrorum	1	
Ovenbird	Seiurus aurocapilla	30	
Worm-eating Warbler	Helmitheros vermivorum	6	
Louisiana Waterthrush	Parkesia motacilla	10	Yes
Northern Waterthrush	Parkesia noveboracensis	56	

English Name	Scientific Name	# records	EIA
Louisiana/Northern Waterthrush	Parkesia motacilla/noveboracensis	9	
Golden-winged Warbler	Vermivora chrysoptera	14	
Blue-winged Warbler	Vermivora cyanoptera	12	
Lawrence's Warbler (hybrid)	Vermivora chrysoptera x cyanoptera	1	
Black-and-white Warbler	Mniotilta varia	73	Yes
Prothonotary Warbler	Protonotaria citrea	11	
Tennessee Warbler	Oreothlypis peregrina	23	
Nashville Warbler	Oreothlypis ruficapilla	1	
Gray-crowned Yellowthroat	Geothlypis poliocephala	38	
Kentucky Warbler	Geothlypis formosa	18	
Common Yellowthroat	Geothlypis trichas	54	
Hooded Warbler	Setophaga citrina	61	Yes
American Redstart	Setophaga ruticilla	123	Yes
Cape May Warbler	Setophaga tigrina	1	
Northern Parula	Setophaga americana	25	
Magnolia Warbler	Setophaga magnolia	92	Yes
Bay-breasted Warbler	Setophaga castanea	3	
Blackburnian Warbler	Setophaga fusca	3	
Yellow Warbler	Setophaga petechia	72	
Chestnut-sided Warbler	Setophaga pensylvanica	12	
Black-throated Blue Warbler	Setophaga caerulescens	1	
Palm Warbler	Setophaga palmarum	14	
Yellow-rumped Warbler	Setophaga coronata	13	Yes
Yellow-throated Warbler	Setophaga dominica	51	
Prairie Warbler	Setophaga discolor	2	
Grace's Warbler	Setophaga graciae	42	
Black-throated Green Warbler	Setophaga virens	26	
Wilson's Warbler	Cardellina pusilla	2	
Gray-headed Tanager	Eucometis penicillata	23	
Crimson-collared Tanager	Ramphocelus sanguinolentus	15	
Passerini's Tanager	Ramphocelus passerinii	34	
Blue-gray Tanager	Thraupis episcopus	83	Yes
Yellow-winged Tanager	Thraupis abbas	42	Yes
Golden-hooded Tanager	Tangara larvata	5	
Red-legged Honeycreeper	Cyanerpes cyaneus	48	
Green Honeycreeper	Chlorophanes spiza	1	
Blue-black Grassquit	Volatinia jacarina	18	
Thick-billed Seed-Finch	Sporophila funerea	45	
Variable Seedeater	Sporophila corvina	32	
White-collared Seedeater	Sporophila torqueola	143	Yes
Slate-colored Seedeater	Sporophila schistacea	1	
Bananaquit	Coereba flaveola	1	
Yellow-faced Grassquit	Tiaris olivaceus	24	
Buff-throated Saltator	Saltator maximus	17	
Black-headed Saltator	Saltator atriceps	46	Yes

English Name	Scientific Name	# records	EIA
Grayish Saltator	Saltator coerulescens	44	
Botteri's Sparrow	Peucaea botterii	1	
Grasshopper Sparrow	Ammodramus savannarum	10	
Olive Sparrow	Arremonops rufivirgatus	24	
Green-backed Sparrow	Arremonops chloronotus	53	
Chipping Sparrow	Spizella passerina	26	
Yellow-breasted Chat	Icteria virens	53	
Rose-throated Tanager	Piranga roseogularis	2	
Hepatic Tanager	Piranga flava	31	
Summer Tanager	Piranga rubra	57	Yes
Scarlet Tanager	Piranga olivacea	1	
Red-crowned Ant-Tanager	Habia rubica	4	
Red-throated Ant-Tanager	Habia fuscicauda	41	
Black-faced Grosbeak	Caryothraustes poliogaster	13	
Northern Cardinal	Cardinalis cardinalis	6	
Rose-breasted Grosbeak	Pheucticus ludovicianus	19	
Gray-throated Chat	Granatellus sallaei	3	
Blue Seedeater	Amaurospiza concolor	8	
Blue-black Grosbeak	Cyanoloxia cyanoides	21	
Blue Bunting	Cyanocompsa parellina	3	
Blue Grosbeak	Passerina caerulea	5	
Indigo Bunting	Passerina cyanea	15	
Painted Bunting	Passerina ciris	2	
Bobolink	Dolichonyx oryzivorus	1	
Eastern Meadowlark	Sturnella magna	12	
Yellow-billed Cacique	Amblycercus holosericeus	46	Yes
Montezuma Oropendola	Psarocolius montezuma	39	Yes
Black-cowled Oriole	Icterus prosthemelas	96	Yes
Orchard Oriole	Icterus spurius	49	Yes
Hooded Oriole	Icterus cucullatus	24	
Yellow-backed Oriole	Icterus chrysater	21	
Yellow-tailed Oriole	Icterus mesomelas	41	
Bullock's Oriole	Icterus bullockii	1	
Orange Oriole	Icterus auratus	5	
Altamira Oriole	Icterus gularis	14	
Baltimore Oriole	Icterus galbula	55	
new world oriole sp.	Icterus sp.	4	
Red-winged Blackbird	Agelaius phoeniceus	3	
Bronzed Cowbird	Molothrus aeneus	30	
Giant Cowbird	Molothrus oryzivorus	1	
Melodious Blackbird	Dives dives	135	Yes
Great-tailed Grackle	Quiscalus mexicanus	106	Yes
Scrub Euphonia	Euphonia affinis	12	
Yellow-throated Euphonia	Euphonia hirundinacea	39	
Olive-backed Euphonia	Euphonia gouldi	2	

8.7 Mammals

Family	Genus	Species	Commonname
Agoutis	Dasyprocta	punctata	Rabbit, Indian Rabbit, Guatusa, Liebre
Anteaters	Tamandua	mexicana	0
Armadillos	Dasypus	novemcinctus	Nine-banded Long-nosed Armadillo, Armadilly, Dilly, Ouetch
Cats	Leopardus	pardalis	Tiger-cat, Tigrillo
Cats	Leopardus	wiedii	Tiger-cat, Tigrillo, Tigrillito
Cats	Panthera	onca	Tiger, Tigre, Balum
Cats	Puma	concolor	Red Tiger, Leon
Cats	Puma	yagouaroundi	Halari, Onza, Leoncillo
Deer	Mazama	americana	South American Red Brocket, Antelope, Cabrito
Deer	Odocoileus	virginianus	Savanna Deer, Venado
Dogs	Urocyon	cinereoargenteus	gato de monte
Free-tailed Bats	Molossus	alvarezi	0
New World Monkeys	Alouatta	pigra	Guatemalan Black Howler Monkey, baboon, Araguato de Guatemala, Mono aullador negro, saraguato
New World Monkeys	Ateles	geoffroyi	Monkey, Mono
Opossums	Chironectes	minimus	Water Dog, Yapok
Opossums	Didelphis	virginiana	Possum, Zorro, Tlacuache
Opossums	Marmosa	robinsoni	0
Opossums	Philander	opossum	Common Gray Four-eyed Opossum, Four-eyes
Pacas	Agouti	paca	Gibnut, Tepesquintle
Peccaries	Pecari	tajacu	Peccary, Queqeo
Raccoons	Nasua	narica	White-nosed Coati, Coati mundi, Quash, Pisote, Tejon
Raccoons	Potos	flavus	Nightwalker, Mico de noche, Martucha
Raccoons	Procyon	lotor	Northern Raccoon, Mapache
Sac-winged Bats	Rhynchonycteris	naso	Brasilian Long-nosed Bat
Skunks	Conepatus	semistriatus	Polecat, Zorrillo
Squirrels	Sciurus	yucatanensis	Squiril, Ardilla
Tapirs	Tapirus	bairdii	Central American Tapir, Mountain Cow, Tzimil, Anteb
Weasels	Eira	barbara	Bush Dog, Perro del monte, Cabeza blanca, Grey-headed Tayra
Weasels	Galictis	vittata	Bushdog, Waterdog, Huron
Weasels	Lontra	longicaudis	Southern River Otter, Water Dog, gato de agua, lobi

9 Land acquisition for a public road procedure

Overview of the various steps of land acquisition under the Land Acquisition Act, Chapter 150.

This law allows the government to acquire lands for a public purpose and pay the owner at market rates by forcing the owner to sell. It was used extensively in the 1960s and 1970s to purchase land from large landowners for distribution to small farmers. In 1992, it was amended so that an affected person is able to apply to the courts to determine whether the acquisition was carried out for a public purpose. The amendment also allows for interest to be added at commercial bank rates.

Section 3. Whenever the Minister thinks land should be acquired for a public purpose, the Minister can declare it so and that declaration is conclusive evidence that the land is needed for a public purpose (now with the right of appeal). The declaration is to be printed in two ordinary issues of the Gazette, not consecutively but no more than six weeks between issues. Copies are to be posted on the land or exhibited in suitable places in the area where the land is located. The declaration must contain: the district where land is located; a description of the land, its approximate area and anything else needed to identify the land; if there is a plan for the area, the declaration must give a place and time for the plan to be inspected; and, the public purpose that requires the taking of the land.

Section 3 (4). Upon the second publication of the declaration in the Gazette, the land goes to the Government and any authorized officer, agents, assistants and workmen can go on the land and take possession.

Section 4. When the Minister thinks that any land is needed for any public purpose and after the first publication in the Gazette, a preliminary survey or investigation of the land can be made. This means that authorized officers, agents, assistants and/or workmen can go on that land to survey, dig, set boundaries, mark levels and lines by placing marks or digging trenches; they may cut down and clear away a standing crop, fence, tree or bush in order to survey. Anything can be done to the land to see if it is adaptable to the purpose designated. If there is a building, the authorized officer must give seven days' notice of his/her intention to enter; compensation shall be calculated and paid to persons that have an interest in the land for actual damage or injury done.

Section 5. If the requirements of Section 4 cannot be met, after the first publication of notice, the Minister can still proceed with the plans. Compensation will be paid for actual damage or injury that comes from the taking of the land.

Section 6. As soon as a declaration is published, the authorized officer shall negotiate a reasonable price, terms and conditions with the owner of the land. The negotiations or agreement must be approved, in writing, by the Minister.

Section 7. The boundaries of the land are identified and notice is given as to the acquisition of the land, any particulars about the land and anyone, or their attorney, interested must personally appear before the authorized officer to explain the nature of their interests in the land and set down the claims and amounts needed to compensate them.

The authorized officer shall notify every person believed to be entitled to compensation about the acquisition, either in person or by mail. If it is not known where any person is, notice shall be posted on the land or in suitable places in the area.

Section 8. After notice is served or mailed, the person is given a period of time, not less than 21 days, to give a written statement as to anyone who may have an interest in the land; this would include partners, tenants, someone who loaned money with the land as collateral or the like.

Section 9. If within three months of entry onto the land, the acquisition is not completed, notice can be given to the authorized officer to abandon the land; if the acquisition is not done within one month after notice, the acquisition is abandoned.

Section 10. The Minister can decide to abandon the taking of the property and no payment shall be made for loss of the bargain or breach of contract.

Section 11. A Board of Assessment shall be appointed to deal with all questions and claims for compensation. The Board will have full power to assess, award and apportion compensation.

Section 12. The Board will consist of the Chief Justice or other judge, someone appointed by the Minister and someone nominated by the owner of the land to be acquired. If the owner delays or refuses to appoint someone, the Minister, by order, in writing, can have the Board decide on the matter.

Sections 13-17. The documents needed by the Board to decide the matter are listed. The Board will hold its inquiry, giving parties no less than 14 days notice. Witnesses and rules relative to the proceedings are set forth and the Board is authorized to enter and inspect the land. The Board will, at the conclusion of its inquiry, decide on compensation.

Sections 18. When compensation does not exceed a certain amount, it can be considered small claims to be handled by a magistrate.

Sections 19-22. The rules that are to be applied in assessing and awarding compensation are listed. The Board shall assess undeveloped land separately from any developed land and any buildings on the land. Compensation can be given concerning access or crossing. The Board may also add interest at the rate of 6% per annum, starting from when the authorized officer first entered into possession of the land.

Section 23-4. The authorized officer must follow the rules set down in this section concerning costs. The decision may be appealed.

Section 25. When the owner of the land cannot be located, the compensation is paid into the Supreme Court until such time as a claim is made. If left unclaimed for a period of 12 years, the payment is transferred into the Consolidated Revenue Fund.

Sections 26-27. Those owning land next to the acquired land can seek compensation if they show they are entitled to such compensation. If someone is leasing the land for a period of time that has not expired, compensation may be available.

Section 34. If no claim for compensation is made within 12 months of entry onto the land, the former owner loses the right to claim compensation, unless the Minister considers that it is unjust to deny compensation.

Section 35. It is a crime to mess with the authorized officer or any agents, assistants or workmen and anyone doing so is liable on summary conviction to a fine of no more than $500 and/or no more than 6 months in jail.

Section 36. Anyone who wanted to convey land, not in a town, may convey the land to the Government for public use and may be paid compensation.

Section 37. The land acquired is registered.

In 1992, this Act was amended so that an affected person is able to appeal to the courts to determine whether the acquisition was carried out for a public purpose. The amendment also allows for interest to be added at commercial bank rates.

10 Archaeology report

Archaeological Sites Along the Coastal Highway

Prepared by: Yasmini Mazanero

April, 2018

Prepared by: Yasmini Mazanero

April, 2018

10.1 TABLE OF CONTENTS

ABSTRACT: *This report covers the location of interest surrounding the area of the Coastal Highway. It examines what cultural material, may be present in the area, and gives a brief history and location of the sites present along the Coastal Highway.*

10.2 Location of the Coastal Highway

Considered as a secondary road, the coastal highway is mainly used by heavy trucks transporting produce or freight. It is a 36-mile gravel road which connects the village of La Democracia near Mile 30 on the Western Highway to the Hummingbird Highway at Mile 9 and the village of Hope Creek. It is looked upon as an alternative way of saving time and fuel due to it being a "short-cut". Inadequate drainage causes occasional wash out of the low-lying bridges on months of Heavy rains. The coastal road passes through the Central Belize Jaguar Corridor and the Manatee Forest. There are two villages along the corridor, Gales Point Manatee and Mullins River, which are located approximately 1.5 km and 3 km respectively off the Highway (Best, Combie 2016).

10.3 Description of the area of interest

A map (see figure 1) provided within a 5km buffer range of the coastal Highway from La Democracia and Hope Creek provides the range of the area that will be covered for the research. The map provides adequate information, on the areas within a 5km buffer, which will help in identifying sites surrounding the area from the opposite sides of the Coastal Highway.

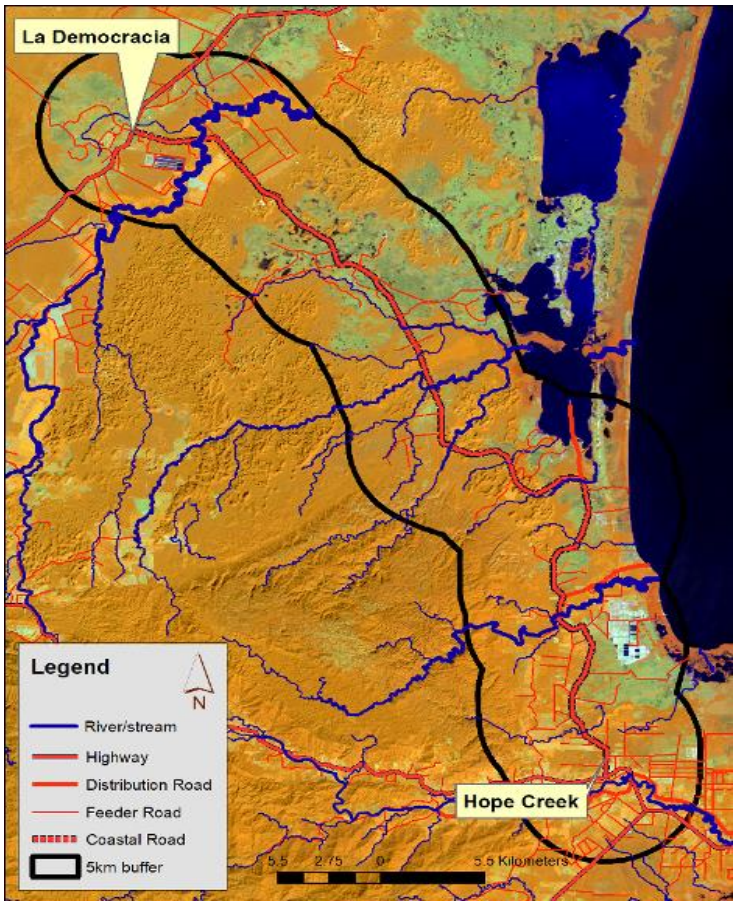


Figure 2:Showing the area of research within a 5km range

Along the Coastal Highway on opposite sides, it is covered with areas of large karst regions. Karst regions are characterized by spring, caves, sinkholes and a unique hydrogeology that results in aquifers that are highly productive but extremely vulnerable to contamination. So far, most caves found in Belize has provided with enough archaeological evidence, thus showing the importance and significant cultural aspect in which it played in the Mayan world. It is not safe to presume that there is no

archaeological structure in the area, due to surrounding sites located far within the karst region of the area. Much research is needed to be done along the coastal highway. Until further surveys, research and documentation are conducted in the area; then it would be safe to go forward with projects specified to rejuvenate within the given site. Archaeological sites such as Balam Ha, Pechtun Ha, Tiger Sandy Bay, Pedro's Mound, Actun Polbilche, Ursey Cave, Cedar Bank, Gracy Rock Bank (Arch Cave) and Batty's Cave, Runaway creek rock shelter and Mullins river provide sites with cultural material surrounding the area of the Coastal Highway. Data provided by the Institute of Archaeology from past field reports has provided information of findings in such areas but does not provide recent data for most sites located along the Coastal Highway.

Figure 3: Map of the Coastal Road from La Democracia to Hope Creek

10.4 An insight of Caves and their purposes:

All the known archaeological sites along the coastal road corridor are caves. This does not mean that there may not be Mayan sites however there are no available data on these at this time. Nonetheless, caves have always played an important part of Mayan archaeology.

Our understanding of the importance of caves within the Maya area, comes from data provide by cave exploration, surveys and dating. Dating of cave sites presents some unique problems. Stratified deposits are often not present because the underground environment is not subject to the usual above-ground processes of weathering and natural deposition that can separate cultural layers

(MacNatt, 1996). The dating of material culture found at caves sites are costly and requires extensive research. The common use of technique for dating used is relative dating, whereby you look at the changes of form, decoration, and the styles of manufacture from the different time periods for pottery. Limitations of this method include the local variation in styles from region to region, and the frequent lack of comparative material from nearby surface sites that may be linked to use of the caves (MacNatt, 1996).Carbon dating (C14) is another use of dating material culture, which provides an absolute date. Plants and animals assimilate **C14** from carbon dioxide throughout their lifetimes. When they die, they stop exchanging carbon with the biosphere and their C14 content then starts to decrease at a rate determined by the law of radioactive decay.

To the ancient Maya, caves were seen as a sacred landscape and a doorway to the underworld (Xibalba). Caves played an important role in the Maya Cosmology and were perceived as the birthplace of key elements such as clouds, maize, rain and wind (Isaza et al 1998) a natural focus for ritual, caves were also viewed as a portal to the underworld. It was through the cave passages that the deceased travelled and, therefore, rituals performed within caves could bring actors in contact with their deified ancestors, gods, and other forces of life. Thompson (1959, 1975) lists the following major uses of caves by the Maya: 1) sources of drinking water, 2) sources of "virgin water" for religious rites, 3) religious rites, 4) burials, ossuaries, and cremations, 5) art galleries, 6) ceremonial dumps, 7) places of refuge, and 8) other uses.

10.5 PLACE OF REFUGE:

There is no evidence documented in Belize of caves being used as a place of refuge for the Mayas, but Thompson mentions of the historic use of caves as temporary places of refuge, during the War of the Castes in Yucatan, and of walls in caves being used as hunting blinds.

10.6 SOURCES OF DRINKING WATER:

In several karst areas of Belize this activity would have been a necessity rather than a convenience, particularly during the dry season. Large portions of the Vaca Plateau, Chiquibul Forest, and southern Maya Mountains around Little Quartz Ridge do not have perennial streams (Veni, 1990). Water coming out of the cave would serve for agricultural, structural and for daily consumption use.

10.7 RELIGIOUS RITES:

Because caves were associated with such basic ideas as life (in the form of rain) and death (the journey through the underworld), the list of deities and associated reasons for conducting rituals in caves is very long. It includes but is not limited to rain, fertility, birth, agriculture, hunting, jaguars, deer, frogs, serpents, disease, aging, death, ancestors, calendrical period endings, and rebirth. MacLeod and Puleston (1978) The burning of copal incense likely accompanied every ritual, and human sacrifice was occasionally required. Based on the archaeological evidence, ritual offerings could include every example of Maya material culture such as items of pottery, stone, bone, shell, and wood, as well as incense, maize, and other more perishable items. Some caves appear to have been used for one primary activity, but others were used for a variety of ceremonial functions.

10.8 SOURCES OF VIRGIN WATER FOR RELIGIOUS RITES:

Traditional Maya ceremonies required new/pure/virgin offerings, including water. Spring water and dripping water found in cenotes and caves fulfilled this need and was usually collected in ollas. Sherds of these vessels represent the most common type of pottery found in most caves. In some instances,

the vessels are still complete and placed under dripping speleothems. Such example can be found in a cave in the Chiquibul area known as Kabal.

10.9 CEREMONIAL DUMPS/OFFERINGS:

Evidence of cultural deposits of debris have been found in many cave locations in Belize. The deposits usually contain large amounts of broken pottery of all kinds, plus items of flint, obsidian, bone, and shell, fragments of metates and manos, a variety of faunal remains, and sometimes even human bones. These deposits do not represent occupation middens but rather materials that were obviously thrown into the caves. Thompson interpreted these types of deposits as ceremonial "dumps." The custom of ceremonially discarding both secular and religious items was common throughout the Maya area. This activity was an important part of rituals, in particular the renewal ceremonies at the end of Maya calendrical cycle.

10.10 BURIALS

With human remains found in caves during excavations, we are able to understand that the Mayas were burying their deceased inside the caves. In Barton Creek Cave over two dozen individuals were interred, often in quite deep, inaccessible areas, and in rimstone depressions, crevasses, and alcoves. Some of these human remains represent formal burials, while others appear to have been more hastily, or haphazardly, deposited. A general absence of grave goods in the burials, especially elite-class items, reinforces the notion that these individuals were commoners in ancient Maya society (Owen 2005:331). Some archaeologists have noted that because the remains of Maya ancestors were often buried in caves, the lineages of these deceased were intimately connected to this landscape (McAnany 1995:110, 159). Through repeated use, caves became the focal point for Maya kin groups. Perhaps pilgrimages to caves in antiquity were held for commemorative rites and ritual feasting, not unlike the annual Day of the Dead ceremonies in present-day Mexico, to honour the memory of deceased family members (Zender et al. 2001).

10.11 ART

Petroglyphs (carving in rocks) are rear but in some caves in Belize they have been discovered. Some Petroglyphs may be associated with water, that being the cave as the source of water but there is not enough evidence to support this claim.

Thompson notes that "cave art is not common in the Maya area" (Thompson 1959: 128) and mentions as an example the cave of Loltun in the Puuc region, where a wall on the entrance contains a large carving of what appears to be a warrior. In the same cave there are some more, minor carvings and some handprints made visible by a precursor of air-brush techniques. When speaking of cave paintings, Naj Tunich is by far the most important and well-known site, having the largest known corpus of hieroglyphic writing and painted iconography in a cave in the Maya area (Stone 1995).

10.12 ALTARS, IDOL AND STELAE

Caves located in Belize have shown evidence of the Maya carving stalagmites as idols. Three caves in Belize contain stones placed in upright positions resembling a crude form of stela. As with so many features found in caves, the exact purpose of these stones and the ceremonies associated with them may never be known.

What do we know about the ceremonies? Jaime J. Awe, Cameron Griffith, and Sherry Gibbs (2005) describe three caves in western Belize that contain vertically standing megalithic monuments. These

modified stone slabs, which bear no carved inscriptions, resemble taller, more elaborate stelae (vertical stone monuments) found at surface sites across Mesoamerica. The cave monuments (0.8–1.2m) were made from stone (slate and limestone) brought into the caves. They were erected in the deep chambers, propped up with broken stalagmites and stalactites, and accompanied by cultural materials (such as obsidian bloodletters) likely associated with ceremonial activity. The caves (Actun Tunichil Muknal, Tarantula Cave, and Actun Chechem Ha) had abundant broken ceramics, including censers representing the God of the Underworld, scattered around the monuments, in ‘‘stela chambers’’ located hundreds of meters from the cave entrances.

10.13 ARTIFICIAL CONSTRUCTION IN CAVES

The Maya artificially modified the natural setting in so many caves in Belize. Some features in the dark interior such as narrowed passages, walls separating chambers, and sealed chambers have no practical purpose other than ceremonial. Other features such as terraces, walls, platforms and steps in the daylight zone of large entrances could have been used for habitation rather than strictly ceremonial purposes. (Brady et al.,1992; Brady, pers. comm., 1995).

10.14 CAVE FORMATIONS ALONG THE COASTAL ROAD

10.15 RUNAWAY CREEK ROCK SHELTER

In a prior archaeological assessment conducted during December 2008, in the surrounding area of Mullins River, Stann Creek district. The total area of the development site is roughly 589 acres of a mixture of palmetto and broadleaf forest. The development site runs along the east side of the Coastal Highway, just before the Mullins River junction. The property consists of approximately 589 acres from the Coastal Highway east toward the coast, stopping a few hundred meters short of the sea. Prior to the field assessment, a thorough overview assessment and map study were conducted in efforts to locate any previously identified sites within or around the property area. There are a number of cave sites to the north-west of the property in the karst hills on the opposite side of the Coastal Highway. No known sites were identified within property. It is known, however, that there is a propensity for Archaic sites to be located in pine savannah areas and this was taken into consideration during the field assessment (Robert Rosenswig).

10.15.1 Location

Runaway Creek Works is a roughly 2,500 hectares or 6,134 acres property owned by the Foundation for Wildlife Conservation. Runaway Creek Works is located in the Belize district, Belize, Central America at approximately 88°35’ W and 17°22’ N at an altitude above sea level of 20 - 120 m. Runaway Creek is bound in the north by the Sibun River, in the west by the Coastal Highway and in the south by the Manatee Forest Reserve. Runaway Creek Works is located east of La Democracia Village in the Belize District. The only other nearby community is that of Gracie Rock to the northeast. Both communities are small.

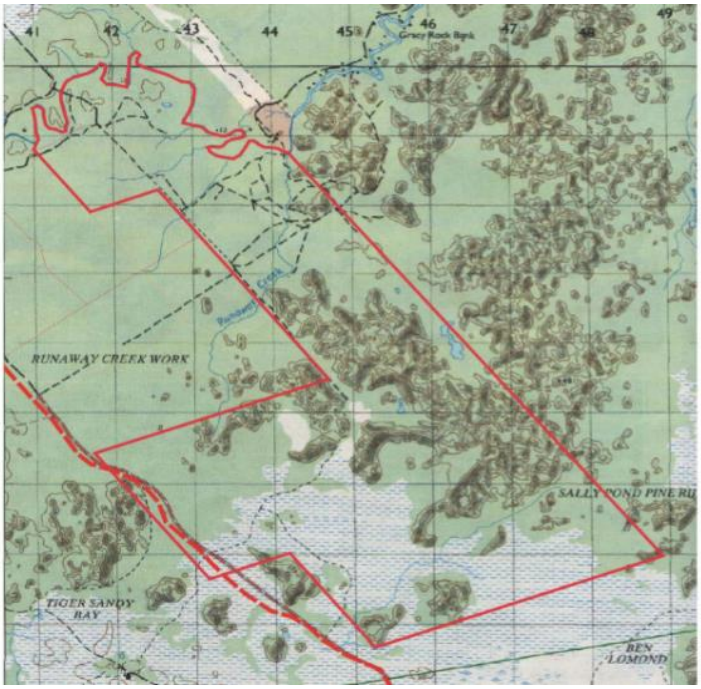


Figure 4: Topographic Map of Runaway Creek area source DOS Series E755, Sheetz 1995, based on 1988 photography

Figure 5: Aerial shot of Landscape in the south along the Coastal Highway

10.15.2 Findings at RunAway Creek Rockshelter

A complete mano made out of granite and metate with a tripod feature made out of granite or possibly Basalt were found in association with a double mouth jar and are in possession of Bird without Border. Also, a ceramic drum was found in the area, also in possession of Bird without Border

10.16 Gracy Rock / Arch Cave

Due to its lime stone ceiling being arched; Arch cave gets its name. The entrance is situated near the north most edge of the Sibun- Manatee Karst near a landmark called Gracy Rock, located in Transect 4. Although the entrance is located in this open "breezyway" at the top of the steep hill, access to the cave has been restricted by the construction, presumably in Maya times, of an artificial wall (Peterson, 2003). The entrance of the cave known to man is a narrow opening located on the easternmost side of the cave. Arch cave has provided material culture such as pottery, granite mano, sherds and rubble. Faunal remains such as a mandible of a small medium animal, large rodent incisor and other animal bones were located in the chamber on columns and Obsidian charcoal marking on columns and stalactites were also discovered during the survey of the cave.

10.16.1 Recommendation for future study:

Further research should be directed in the Gracy Rock Cave District where preliminary reconnaissance has resulted in the location of several cave interest. The karst around arch cave revealed evidence that the caves in the area has been used for ancient Maya times to the colonial period. Colonial period artefacts in caves of the Gracy rock district include Kaolin Pipes, mold-made glass, bottles, and wheel-made pottery sherds. There is great potential for continued research in the northernmost part of the Sibun Manatee Karst (Pg.96 Peterson.A.chamber.P. 2003)

10.17 Tiger sandy Bay Cave District

Tiger Sandy Bay Cave District is less than half a square kilometre, located down river, east of thumb cave District, West of Gracy Rock Cave District. Tiger Cave got its name due to the discovery of a hunter whose dog went into the cave and got devoured by a jaguar, but locally it's known as a tiger. 1973 when the cave was investigated, an alcove of 12m above the ground, contained 3 jars and fragments of other jars. Alcove two found on the western area of the cave contained fragments of polychrome vessels, 9 pine torch splints and sherds. A niche in the wall above second alcove contained to small inverted bowls, one of them with stamp designs near the base. A second niche located above the first yield two miniature tripod vessels made of mangrove wood, one whole and one fragmentary (Palacio1973:7,9-16; Rushin-Bell 1982:13-15). Within the Tiger Sandy Bay Cave District, when explored it was found that the area contained small caves, which were then given letter designation and recorded as Tiger Sandy Bay outcrops.

Obtained from the Institute of Archaeology, the data collected bellow in chart 1, comes from Forms filled and registered during excavation and survey of site of Tiger Sandy Bay Outcrops

From artefacts, such as vessels found in the area of Tiger Sandy Bay, it led archaeologist to believe that there was a correlation between the sites of Tiger Sandy Bay and Actun Polbilche, that being that residential villages were located along the Sibun river, not being too far away from each other. The shape and form correlates similarly to those found at Actun Polbilche, which were likely used for the collection of "pure water" for the use of rituals.

Cave A:	**Cave B:**	**Cave C:**	**Cave D:**
A narrow water worn fissure which goes all the way through the hill approx.70m; low point in centre of cave collects water and mud; few sherds and some animal bones from the mud; sherds located at northern entrance which is essentially a wide overhang.	entrance is ½ way up hill on south side; consist of 2-3 chambers, total length approx.50m ; one remnant of Maya wall, climbable skylight entrance at back (north end) of cave leads to top of hill overlooking north end of cave A; 5 sherds collected	*Location and access:* From Belmopan, drive east on western highway to mile 33 J.B's. Take 2nd road on right after J.B.'s follow for logging road to the left for 1.3 miles, turn ends, turn right and drive to end about 4minutes. Cave are in hill 50 meters left of road. Approx.50m east of cave A on north side of hill. Wide walking entrance with numerous formations, cave is 25m long, ceiling lowers to crawl-way at back. Numerous sherds and one large canine tooth collected.	Cave D discovered by Richard Foster 5th July 1991 with Tony Garel Vessel located Date recorded: 29th July 1991 Logan Monett. Approx. 100 meters east of cave C along same ridge; small entrance (2m wide 1m high) located about 10m above base of hill, faces NE; cave is 31m long with larger walk in entrance at the SW end on opposite side of hill. Alignment of 221 degrees from entrance to entrance.

10.18 Usrey cave

Known as the "No Man's Reach (Isaza et al.1999:56) with two entrances is located in the Tiger Sandy Bay District/ Tiger Cave. The main chamber is accessed by walking and climbing a gradual slope and other accessed through crawling a small partially walled entrance into a lower chamber.

The main entrance cave floor slopes upward to the south and then the chamber turns east a short distance, ending in a steep-sided depression, the bottom of which is accessible by the small second entrance. Vessels and Ollas have been broken, which seems to be that, for ceremonial purposes.

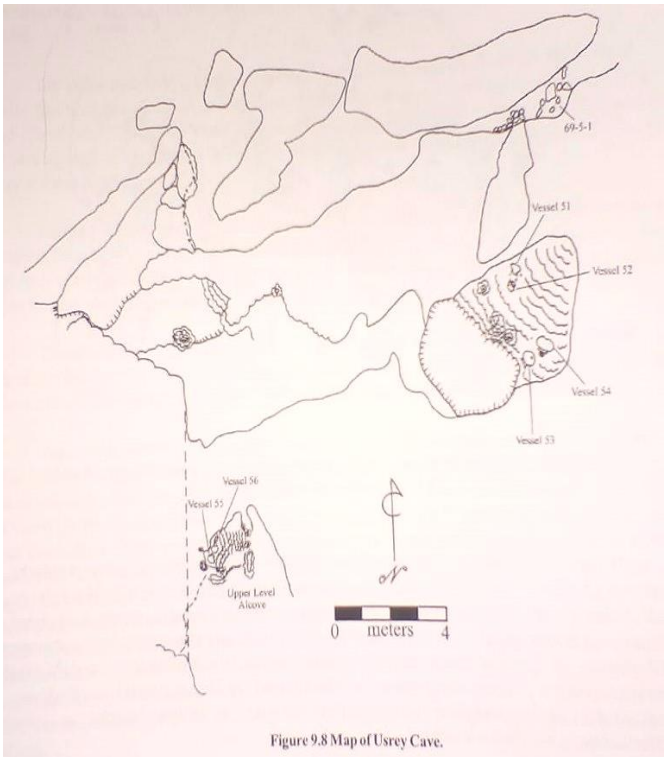


Figure 6: Map of Ursey cave

Deposits of pottery left in the caves are one of the most salient aspects of the cultural signatures within the Tiger Sandy Bay caves. Vessels encased in deposits of calcite or positioned underneath active drip water have been found in numerous caves and can be assumed to have been left for water collection. Other vessels have been identified as containing food and liquid residues and may have been left as offerings. Many of the Ollas display evidence of burning on their exterior surface suggesting that they possess a life history which included former use as cooking vessels.

The caves at Tiger sandy bay are complex limestone features with multiple entrances and chambers. Within the distinct cave chambers, diverse types of ceramic artefacts and debitage i.e. ollas, dishes and pottery sherds were discovered often under speleothem feature or in inaccessible chambers.

10.19 Pedro's Mound

Located on the east side of Churchyard Road. Named after the previous owner Pedro Reyes who had built a home on the location. Excavations of 1997 revealed a large oval mound which was suspected to have been a Maya platform structure. Material culture such as debitage, obsidian and pottery indicated early occupation of site before the occupation of the 20th century. The site did not provide sufficient cultural material due to the area being prone to flooding from the river and the later occupation of historic times might have destroyed any information that could have provided with more prehistoric data for Pedro's mound.

10.20 Pechtun Ha

Situated approximately 500m west of the confluence of Ventura Creek in the Sibun river and about 250m north of the Sibun River (Thomas.B et al,1998). The structure found in Pechtun Ha (structure100-1st A) is filled with large, loose cobble and boulders and trans- formed into a solid,

round basal platform. In the Sibun Valley, set on top of the round substructure is another circular superstructure consisting of low stub walls as high as three courses. This building type is poorly preserved

10.21 Balam Ha

Balam Ha is located in the Sibun river, east central Belize, 5 km from the cave of Tiger Sandy Bay. The site is centered at the spot along the river called Tiger Run, thus designated the site Balam Ha, A Maya translation for tiger/ Jaguar water. Located on the tiger sandy bay farms, Ltd. Balam Ha was a small Maya village of perhaps 150-400 people during its main occupation. The temporal framework for occupation ranged from perhaps the middle preclassic period (ca.400bc) to the post classic (post A.D. 1000) with preliminary occupation falling in the terminal late classic/ early post classic period (ca A.D. 800- 1100). Balam Ha was a site of 30 structures but due to the bulldozing done in the area for clearing the land for cultivation, it destroyed two mounds leaving them partially or totally levelled. Surface collection from site yield post classic and historic occupation, due to the artefacts found such as iron pot sherds, copper and rum bottles. Since settlements appear to be clustered along the levee of the Sibun, it can be said that the river served as a means of survival of the village.

10.22 Actun Polbilche:

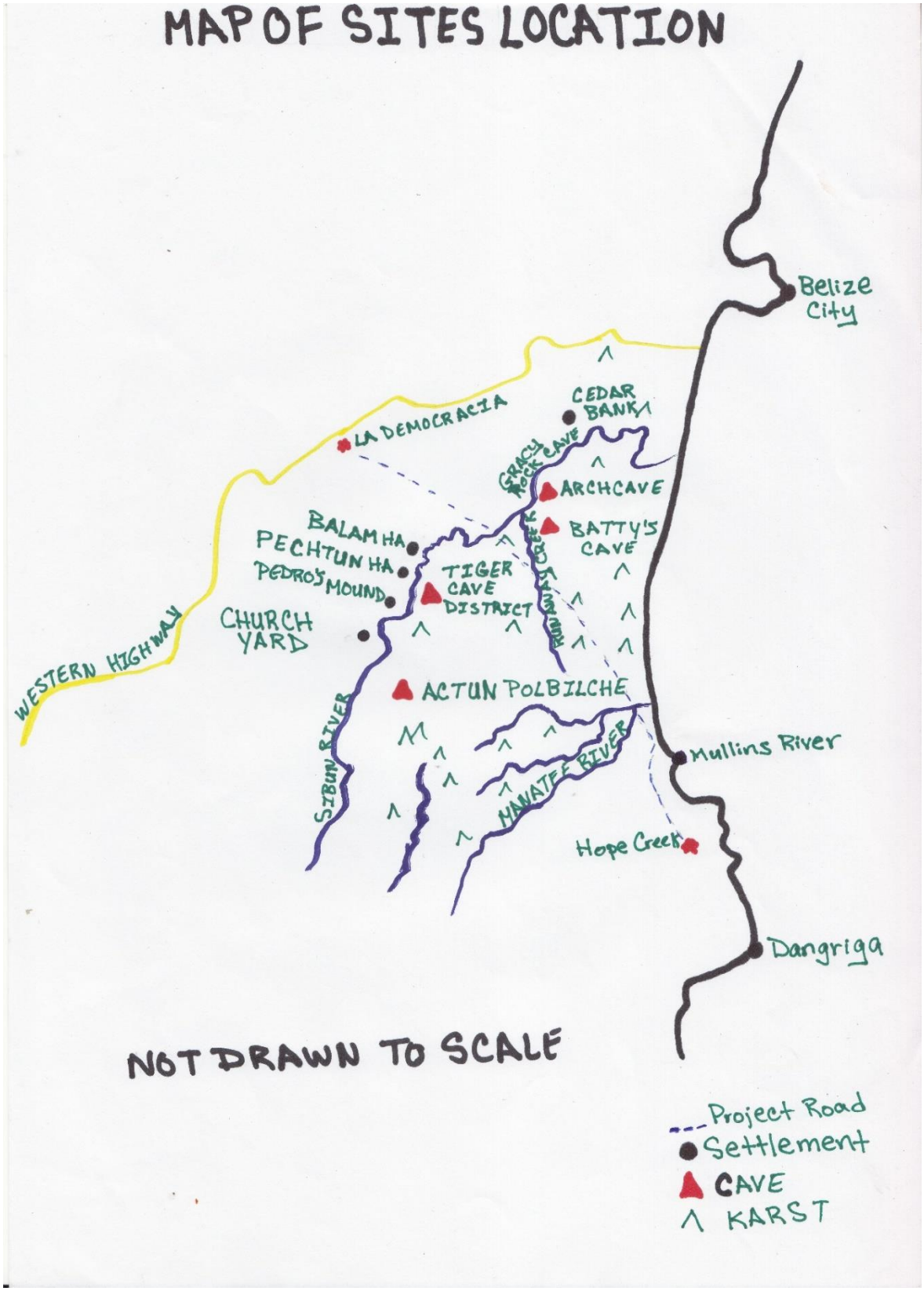
Located in the Glenwood cave district, south of the small settlement of churchyard, with coordinates, latitude 17° 17 ' 45''N, Actun Polbilche has provided archaeologist with archaeological finding of vessels dating from the late Formative to the Early Post-classic period (Pendergast 1974, p 64-47) Its greatest usage recorded dates back to the terminal classic to early post classic and earliest usage of site at late classic. The site has provided artefacts such as a wood spear, vessels, and a wooden box. Radiocarbon dates from pine splints dates back to AD 625- 735.

10.23 Cedar Bank

Largest known site in transect 4. Locate east of Gracy rock. Its plaza has four mound and artefacts excavated from site revealed that the Maya occupation was capped with colonial materials. Giving the assumption that the area was inhabited in the late 16th to 17th century. Information obtained from the Forms for registration of Ancient Monuments from the year 1969 by the Institute of Archaeology provides data location located at mile 22 leaving western Highway, pass Gracy road prison and Rockville quarry. N degrees 376. Several low mounds, apparently with few stones, near the river bank were recorded when visited on February 22nd, 1969.

10.24 Batty's Cave:

Little is known about the Batty's Cave concerning archaeological findings. The cave had been apparently known of its existence by the local population but have been heavily looted. The only known archaeological finding is that of a fragmented vessel and several bits of a carved jade pendant. Pendergast dates the vessel to the Early Late Classic.


MAP OF SITES LOCATION
Belize City
CEDAR BANK
LA DEMOCRACIA
GRACY ROCK CAVE
ARCHCAVE
BATTY'S CAVE
BALAM HA
PECHTUN HA
PEDRO'S MOUND
TIGER CAVE DISTRICT
CHURCH YARD
WESTERN HIGHWAY
ACTUN POLBILCHE
SIBUN RIVER
HANATEE RIVER
Mullins River
Hope Creek
Dangriga
NOT DRAWN TO SCALE
Project Road
Settlement
CAVE
KARST

10.25 References

Grimshaw.T, Windsor.C, Young.C, Gibbs.S, Choco.M.(2011). Limited Level Environmental Study of the Dreamscapes of Belize Development Phase Two Near Mullins River Village

Healy.F.P. (2007). The Anthropology Of Mesoamerican Caves. Reviews in Anthropology, 36: 245–278.

McAnany.A.P.(2003). Between The George And The Estuary: Investigations of the 2001 season of the Xibun Archaeological Research Project.

McNatt.L. (1996). Cave Archaeology Of Belize. Journal of Cave and Karst Studies 58(2):81-99.

Meerman.C.J.(1999). Rapid Ecological Assessment Runaway Creek.

Pendergast.M.D. (1974). Excavations at Actun Polbilche, Belize.

Wolfel.U. (2006). Architecture of Maya Cave.

Best.M.D, Combie.P.M. (2016). Coastal Highway Upgrading – Feasibility Study And Preparation Of Detailed Designs – Belize

11 Appendix: LiDAR report for Archaeology

A LiDAR survey of the project area was conducted in 2018 as part of the project. The LiDAR results principally served the hydrological assessment of the area but also proved valuable for a first Archeological Assessment.

Lidar (also called LIDAR, LiDAR, and LADAR) is a surveying method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor. Differences in laser return times and wavelengths can then be used to make digital 3-D representations of the target. The name lidar, now used as an acronym of light detection and ranging (sometimes light imaging, detection, and ranging), was originally a portmanteau of light and radar. Lidar sometimes is called 3D laser scanning, a special combination of a 3D scanning and laser scanning. It has terrestrial, airborne, and mobile applications. Lidar is commonly used to make high-resolution maps, with applications in archaeology, geography, geology, geomorphology and forestry. In Belize the technology has been extensively used in the survey of Archaeological Sites (most famously Caracol and El Pilar).

The following presents the findings of a LiDAR analysis focusing on the possible presence of Maya sites (any type of site inclusive of house mounds, refuse piles or any other elevated feature). Horizontal resolution of the LiDAR 1 m. Vertical resolution of 1 cm). Coordinates are in UTM WGS 1984 16N.

While LiDAR would clearly show larger ceremonial sites, it also reveals any house-mound or any other slight elevation for that matter. It will not reveal any subsurface artefacts.

The particular use of LiDAR in archaeology is that it allows for a rapid desk-top analysis of fairly large areas with vastly better results that the traditional transect system utilized in the past. Any suspect elevational features showing up in the LiDAR analysis can afterwards quickly be located in the field and inspected.

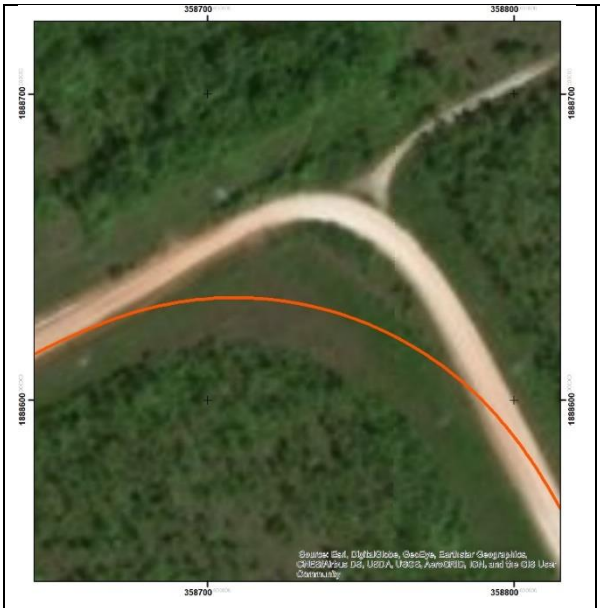
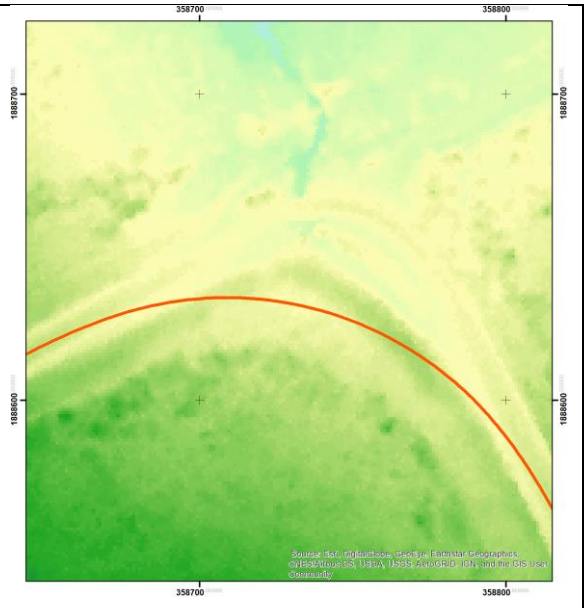
The analysis in appendix 11 shows each of the 7 locations where the new road (indicated by a red line) will deviate from the current alignment. A high-resolution satellite image will be presented next to a LiDAR image of the exact same location.

None of the 7 sites show any suspect features. Also, the analysis will present any other characteristics of the location describing the likelihood of archaeological sites being present based on geomorphological criteria.

The following presents the findings of a LiDAR analysis focusing on the possible presence of Maya sites (any type of site inclusive of house mounds, refuse piles or any other elevated feature). Horizontal resolution of the LiDAR 1 m. Vertical resolution of 1 cm). Coordinates are in UTM WGS 1984 16N.

Red line represents new alignment.

Corner near Paradise Shrimp Farm

	
High resolution Satellite Image	LiDAR DEM

UTM 358740 1888765

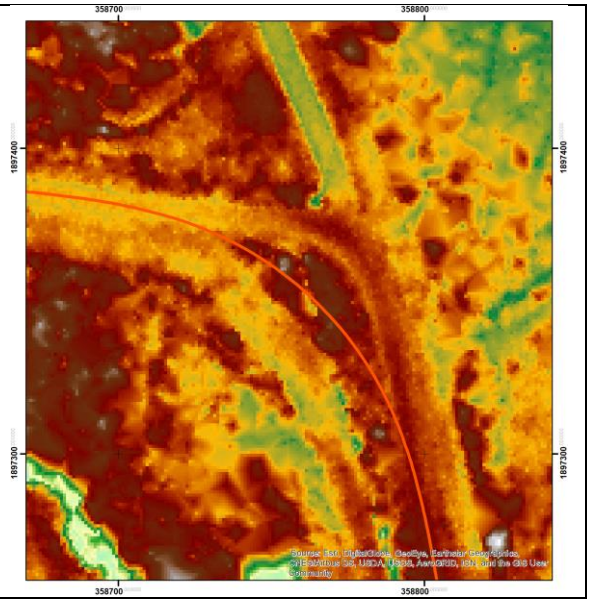
Extent of road alignment: 33 m.

Landscape: Fenced Pine forest, managed (under brushing) by private owner. Alignment correction follows land cleared for the high-tension line.

Disturbed site and habitat (pine forest) not conducive for past Maya settlement. LiDAR analysis did not reveal any potential features that warrant further inspection.

Junction at Gales Point

High resolution Satellite Image



LiDAR DEM

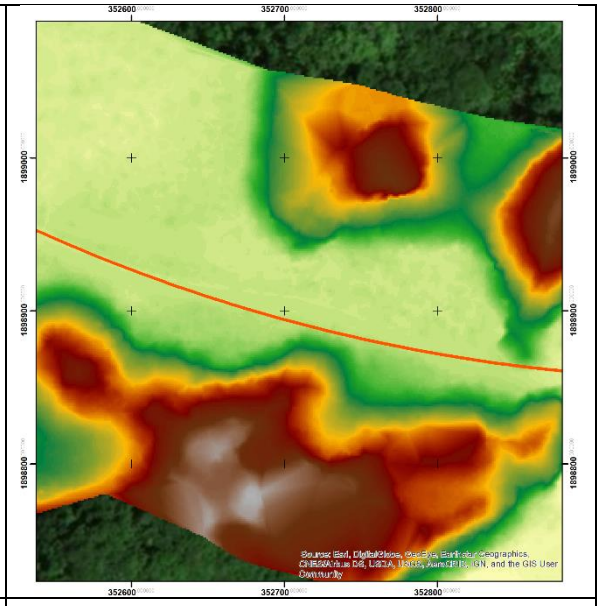
UTM 358770 1897470

Extent of road alignment: 16 m

Landscape: Low lying area subject to flooding. Alignment correction follows bulldozed area with soil deposits (from agriculture activities? High Tension line land clearing?).

Heavily disturbed site and habitat (flood plain) not conducive for past Maya settlement. LiDAR analysis did not reveal any potential features that warrant further inspection.

East of Soldier Creek

	
High resolution Satellite Image	LiDAR DEM

UTM 352555 1899045

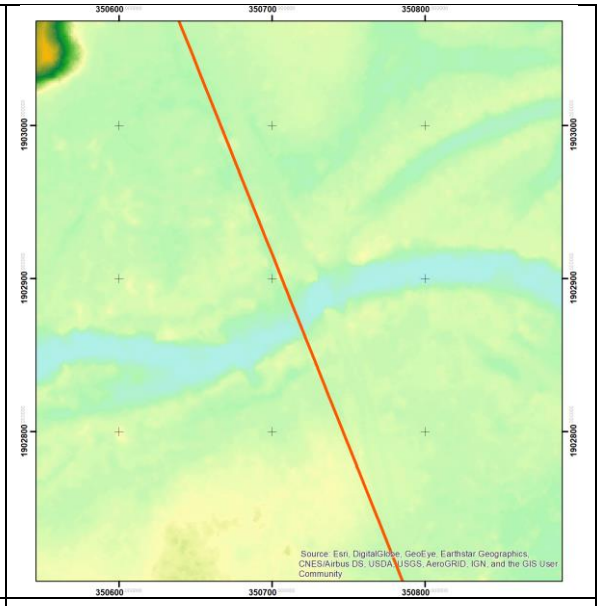
Extent of road alignment: 13 m

Landscape: Disturbed roadside in otherwise forested landscape.

Geology would be conducive for Maya settlement, but LiDAR analysis did not reveal any potential features that warrant further inspection.

Manatee River Crossing

High resolution Satellite Image



LiDAR DEM

UTM 350725 1903000

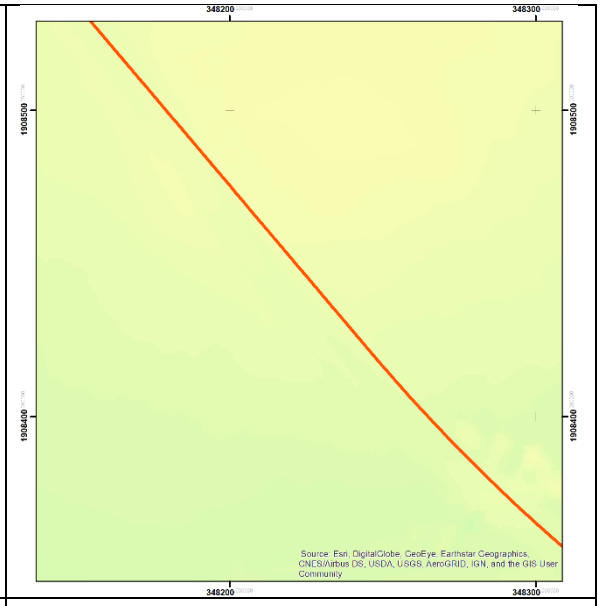
Extent of road alignment: 20 m – follows original alignment from before the construction of the current bridge.

Landscape: Disturbed roadside (because of previous road alignment) through swamp forest area with very actively meandering river.

Location (swamp forest) not conducive for Maya Settlement + part of previous road alignment. LiDAR analysis did not reveal any potential features that warrant inspection.

Savanna

High resolution Satellite Image



LiDAR DEM

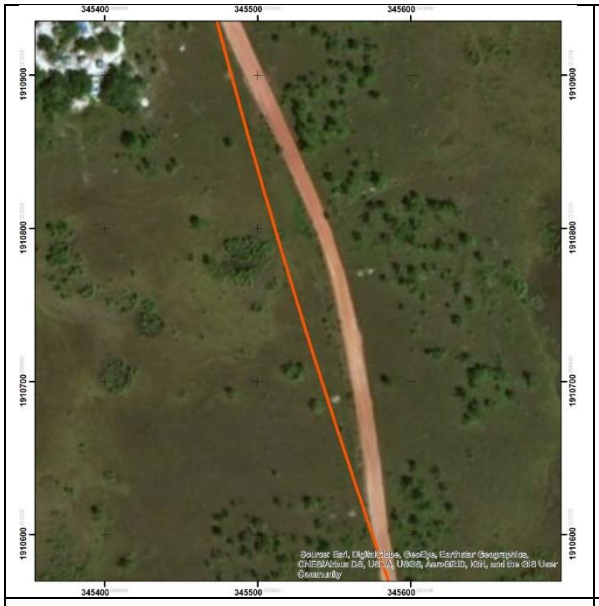
UTM 348220 1908560

Extent of road alignment: 13 m

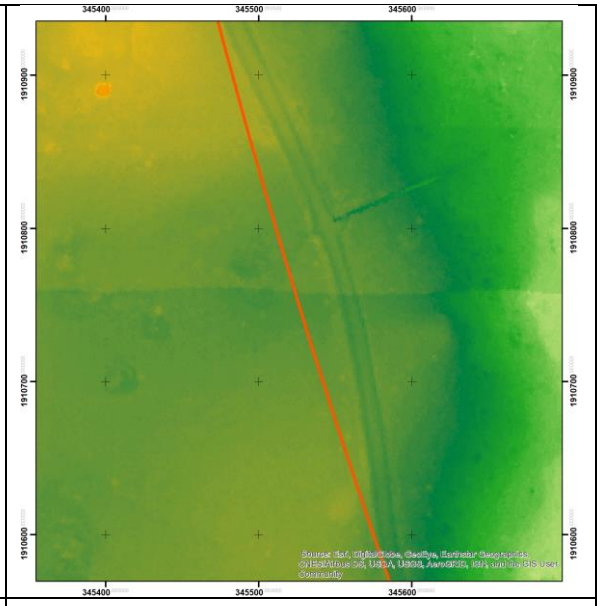
Landscape: Open Wet Savanna

Location (wet savanna) not conducive for Maya Settlement. LiDAR analysis did not reveal any potential features that warrant inspection.

BATSUB



High resolution Satellite Image



LiDAR DEM

UTM 345540 1910880

Extent of road alignment: 30 m

Landscape: Open Wet Savanna

Location (wet savanna) not conducive for Maya Settlement. LiDAR analysis did not reveal any potential features that warrant inspection.

12 Letter of response from Institute of Archaeology

INSTITUTE OF ARCHAEOLOGY

Please Quote
Ref No: IA/A/2/18 (05)
13th March 2018
Dear Mr. Jan Meerman & Mr. Valentino Shal

Thank you for your E-mail with reference of the coastal road up-grade and its consultancy stage. Please be informed by the Institute of Archaeology (NICH) of the following
1.) The Institute of Archaeology (IA) is mandated by the NATIONAL INSTITUTE OF CULTURE AND HISTORY ACT CHAPTER 331 REVISED EDITION 2003, showing the subsidiary laws as of 31st October 2003. Therefore, the IA is the legal body empowered by law to set polices and regulations for the protection of any ancient monuments and antiquities that has been in existence for one hundred years or more.

2.) It is the obligation of the consultant to ensure that an archaeologist conducts a comprehensive and proper "archaeological impact assessment - AIA" as part of the EIA component.
3.) Having stated point one it is the consultant's duty to ensure the (archaeologist of your choice) conduct field reconnaissance to verify the existence and density of any archaeological site or archaeological features within the study area and properly document it and give his or her recommendation based on the findings.
4.) Your study will confirm the existence, location and density of any archaeological site or features in the Area.
5.) The IA (NICH) as the regulatory body will then do site visit with the consultancy team to verify the existence of any archaeological site or feature and give their advice towards the project accordingly.
6.) Please be informed that you (the consultancy) is more than welcome to come and use our library facility to do your archival research. Whether prior to your filed research/reconnaissance or during or after your filed work in or to properly give a compressive report and recommendation to the project.

Mr. Josue Ramos
Archaeologist
Institute of Archaeology, NICH

NICH Administration Building
Culvert Road
Belmopan, Belize, C.A.
Phone: 501-822-2106/2227
Fax: 501-822-3345
Email: ia@nichbelize.org

NICH
national institute of culture and history

13 Archaeological Chance Finds Procedure

13.1 Introduction

The purpose of this document is to address the possibility of archaeological deposits, finds and features becoming exposed during earthmoving and ground altering activities associated with road building works and to provide procedures to follow in the event of a chance archaeological find. The objectives of these procedures are to identify and promote the preservation and recording of any archaeological material that maybe discovered and notify the Belize Institute of Archeology under the National Institute of Culture and History to resolve any archaeological issue that may arise.

13.2 Archaeological Chance Finds Procedure

The following procedure is to be executed in the event that archaeological material is discovered:

- All construction activity in the vicinity of the find/feature/site will cease immediately.
- Discovered find/ feature/ site will be delineated.
- Record the find location and all remains are to be left in place.
- Secure the area to prevent any damage or loss of removable objects.
- The field manager in charge of the area where the find has taken place must contact the Compliance and Public Relations Officer Immediately.
- The Compliance and Public Relations Officer must contact the Institute of Archeology immediately.
- An Archeologist from the Institute will assess, record and photograph the find/feature/ site.
- The Archaeologist will undertake the inspection process in accordance with all project health and safety protocols of the company.
- The Belize Institute of Archeology will determine the appropriate course of action to take.
- Finds retrieval strategy: All investigations of archaeological soils will be undertaken by hand, all finds, osteological remains and samples will be kept, handled and submitted to the Belize Institute of Archeology. In the event that any artefacts need to be conserved, this will be done following the Belize Institute of Archeology's Instructions.
- In the case of human remains, in addition to the above, Forensics Department under the Ministry of National Security will be contacted and the guidelines for the treatment of human remains will be adhered to.
- Conservation: Conservation will be done in coordination with the Belize Institute of Archeology and their instructions will be followed.
- Once authorization has been given by the Belize Institute of Archeology, works around the area can resume

14 Social impact assessment

See separate volume