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Final Report on the Environmental and Social Impact Study

Ministry of Works and Transport
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Environmental and Social Impact Assessments for the Rehabilitation of the George Price Highway From Miles 47.9 - 79.4

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on the
Environmental and Social
Impact Study

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(T-B) Roaring Creek Bridge, Z-Curve leading to Cayo, and Monitoring noise at Belmopan – Roaring Creek junction.

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Annex Ia: The Terms of Reference – DOE

Terms of Reference
For an Environmental Impact Assessment to be conducted for the Rehabilitation of the George Price Highway From Miles 47.9 - 79.4, Cayo District.

Background

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

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

A. BASELINE INFORMATION
PROJECT DESCRIPTION
ROAD AND INFRASTRUCTURE CONDITIONS
B. POLICY AND LEGAL FRAMEWORK
C. ENVIRONMENTAL AND SOCIO-ECONOMIC SETTINGS/ ASSESSMENT OF ALTERNATIVES
D. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
E. MITIGATION AND MONITORING (ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN-ESMP)

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 and water quality;
ii. Flooding impacts;
iii. Drainage and surface water impacts;
iv. Potential pollution impacts associated with road and bridge construction, and road upgrade and storage area for construction material, heavy machinery and fuel;
v. Waste (liquid, solid, and hazardous) management issues and their potential impacts;
vi. Impacts associated with relocation of utilities (electricity and water);
vii. Impacts associated with noise pollution, air quality and soil quality;
viii. Transportation and traffic related impacts;
ix. 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 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 crossing, including coordinates (GPS UTM Coordinates) of the proposed development relative to surrounding communities, infrastructure within the project area and zone of influence;

1.2 Provide a description of the present road and infrastructure conditions including assessment of bridges, drainage and road safety;

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

1.4 Describe measures, including the following, to safeguard the environment, human and health and safety:
- 1.4.1 The use of construction equipment;
- 1.4.2 Land acquisition;
- 1.4.3 Public Awareness.

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 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/ ASSESSMENT OF ALTERNATIVES

3.0 PHYSICAL 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.

3.3 Overview of the Climate, hydrology and meteorology: include average rainfall per year, and prevailing winds;

3.5 Provide baseline data on the current water quality of the Greater Belize River Basin watersheds and sub catchment (namely the Macal, Mopan and Belize River) within the project area. 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;

3.6 Provide an assessment of climate change resulting from global warming on the project.

3.7 Provide a description of the physical state and composition of the soils along the project path and determine land use with the zone of influence. In addition, provide a description of the soil profile throughout the project footprint.

3.8 Physical description of the Greater Belize River Basin watersheds and sub catchments (namely the Macal, Mopan and Belize River) through the project site, as well as riparian vegetation to be impacted.

3.9 Provide baseline data (field study) on the various terrestrial flora and fauna and aquatic fauna, including but not limited to rare or endangered species (birds, etc.), commercially valuable species within or in areas adjacent to the project site, and sensitive habitats within or adjacent to project site. This should provide a baseline from which to detect changes in the abundance and vigor of the species due to this development.

3.10 Describe the methodology used for the biological assessment, include date and time surveys were conducted.

3.11 Provide legible maps of the terrestrial and aquatic habitats drawn to scale showing ecosystem cover, natural drains, etc. This should incorporate clear indicators of percent cover and habitat composition and health.

3.12 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 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.

4.3 Inventory and evaluation of public and private infrastructure and buildings in the areas of direct influence during construction and operation, with a view to: 1) establish a base line 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-Archaeology Institute and conduct a rapid assessment study on the project area to determine any known features of archaeological or cultural importance (e.g. cemeteries) and provide recommendations for the protection of any features as well as provide mitigation plans, if applicable.

5.0 ASSESSMENT OF ALTERNATIVES

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

5.1 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;
- because of the danger it poses to motorists and the precarious nature of this embankment and the instability of the steep adjoining hill side;
- proposed roundabout constructions on indentified road junctions.

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.

6.0 Environmental Impact Assessment

6.1 Provide an impact matrix summarizing the potential environmental impacts associated with the activities of the road rehabilitation activities looking at the general road activities and the critical areas of concerns and major accompanying activities.

6.2 Provide engineering designs, as well as materials to be used for the construction of the road surface, structures/bridges. Identify the potential impacts associated with the prefer choice of surfacing and their mitigation measures.

6.3 Describe the construction of the bridge, flood relief channel, roads, relocation of overhead power lines and potential removal/ relocation of buildings. 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.

6.4 Identify the potential impacts related to geology, geological risks and evaluation and land use impacts.

6.5 Identify the impacts of the project on the drainage and hydrology of the area and the impacts of flooding on the proposed project

6.6 Base on the findings identify and provide respective mitigation measures. 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.

6.7 Impacts on the air quality should be examined. 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.

6.8 Collect data from primary and secondary source, along the construction site(s) and near residential areas (if any).

6.9 Recommend 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.

6.10 Identify the potential impacts on the ecology from general road construction activities and mitigation of impacts on wildlife.

6.11 Provide general information on disaster risk management (including climate change) as it relates to road constructions. Also take into consideration the Upper Macal River hydroelectric facilities dam break risk.

6.12 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:

6.12.1 Human and health safety,
6.12.2 Spillage of fuel, oil, gas, chemicals and hazardous materials,
6.12.3 Natural Disasters and their implications on operations.

7.0 Social Impact Assessment

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

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

8.0 Mitigation and Monitoring

8.1 Based on assessments from section D, develop an Environmental and Social Management Plan to be implemented for the entire operation. This should include mitigation and monitoring of all potential negative Environmental Impacts, including, but not limited to: construction activities and road upgrade, water quality, ambient air quality, and identified Social Impacts

8.2 Develop an Environmental and Social Management plan based on the mitigation measures discussed in 8.1 above.

8.3 Provide an indicative costing for mitigation measures

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Annex Ib: The Terms of Reference - IADB

IV. Appendices

Appendix A – **TERMS OF REFERENCE**

CONSULTANCY SERVICES FOR ENIVRONMENTAL AND SOCIAL IMPACT ASSESSMENTS FOR MILES 47.9 – 79.4, GEORGE PRICE HIGHWAY, BELIZE

1. INTRODUCTION

Belize is a small tropical country with a lightly spread population of 340,786. The country and its infrastructure, especially in the low lying coastal areas, are critically vulnerable to frequent tropical storms and hurricanes, flood damage and rising sea levels.

Belize's road network consists of 3,281 km of roads, of which 573 km are primary roads or highways, 765 km are secondary roads and 1,943 km are rural roads. Only 20% of the road network is paved. The existing network of roads and bridges is severely impacted by recurrent flooding. During the last decades tropical storms and hurricanes have affected the country recurrently. Impacts are likely to worsen due to increased rainfalls and sea level rise associated with climate variability and climate change. Insufficient maintenance coupled with under designed road alignments are contributing to both high internal freight costs and to one of the highest road fatality rate in the Latin American region.

The George Price Highway (GPH), formerly known as the Western Highway, connects: (i) Belize City, the economic center; (ii) Belmopan, the national capital; (iii) San Ignacio and Santa Elena, the second largest urban area in the country; and (iv) Benque Viejo on the Guatemalan Border. The GPH is a two-lane, 79.4 mile highway originally built in the 1930s and last rehabilitated in the mid-1980s. Since then, the roadway´s pavement has deteriorated significantly, in particular between Belmopan (mile 47.9) and the Guatemalan Border at Benque Viejo (mile 79.4) due to: (i) insufficient drainage; (ii) the steep increase in truck traffic from the expansion of, primarily, the petroleum sector and, to a lesser extent, the agriculture and tourism sectors; and (iii) limited maintenance. The pavement's poor conditions together with the absence of paved shoulders, unsafe road alignments, lack of pedestrian facilities in urban areas, and limited marking and signing lead to Belize´s high incidence of road fatalities.

Flooding greatly restricts mobility along the road and makes evident infrastructure vulnerabilities during extreme weather events. This is significant as the highway is a primary evacuation route for coastal areas including Belize City. Of particular concern is the Roaring Creek Bridge (mile 48), located near Belmopan, which has been submerged at least twice in the last ten years and frequently has water straining its superstructure, possibly undermining its structural integrity. Loss of access to the bridge cuts off a critical evacuation route during severe storm events in the short-term and severely damages trade with Guatemala and tourism to important sites in Western Belize in the long-term.

To address these problems the Government of Belize (GoBL) though funding requested from the Inter-American Development Bank is committed to address both: i) the rehabilitation of the GPH

between Belmopan and the Guatemalan Border at Benque Viejo; ii) and the Roaring Creek Bridge (both components comprise the "Project").

2. OBJECTIVE

The objective of the Consultancy is to undertake the necessary environmental and social impact studies and investigations to permit the rehabilitation of the George Price Highway between Belmopan and the Guatemalan Border at Benque Viejo with minimal effect on local communities and the surrounding environment and cultural sites.

3. GUIDELINES

The Services shall be carried out in accordance with generally accepted professional practices, following recognized engineering and management principles and practices. The consultants' scope of work is understood to cover all activities necessary to accomplish the stated objectives and outputs of the below services, while adhering to the aforementioned principles and practices. This is not an exhaustive list and the absence of any 'activities' necessary for the Consultant to satisfy the objectives and outputs, does not preclude the Consultant's obligation to perform those activities.

The Ministry of Works and Transport (MoWT) is the primary counterpart and the party responsible for directing the consultant to any necessary knowledgeable parties. All other governmental entities should be contacted through the MoWT.

The Consultant will be completing the environmental and social impact assessment in parallel with a technical feasibility assessment completed by a second consultant. The two assessments will require cooperation and unified efforts between the two consultant teams for adequate completion of either final product. It is critical that the Consultant work closely and share relevant assessment information with the Technical Feasibility Consultant for the entirety of the project timeline. The MoWT will act as both a coordinator and mediator between the two parties.

4. SCOPE OF SERVICES

The consultant is to collect and analyze all information relevant to the preliminary examination of environmental and social aspects of the project alternatives, including public consultations. This shall be carried out in adequate detail for each project option to allow for the expected cost of mitigating environmental and social issues such as property acquisitions. The consultant shall provide the necessary information to the consultant producing the feasibility and economic studies to prioritize project alternatives and provide cost estimates of any required mitigation.

The consultant is to collect and analyze all information relevant to the detailed examination of the technical, economic, environmental and social aspects of the project alternatives. The consultant will submit an ESIA report on the project alternatives, with a clear definition of the best alignment, and the optimum length of the road to be rehabilitated for which preliminary designs would be carried out.

The aforementioned reports shall be used by the client to seek funding for the project. The consultant is expected to modify and/or enhance these reports as may be requested by the Client in response to the request of potential funding agencies.

The Project is broken into two distinct components, the rehabilitation of the 31.5 miles of the GPH between miles 47.9 and 79.4 and the rehabilitation of the Roaring Creek Bridge (mile 48).

The scope of services to be provided by the Consultant will include, but not be limited to, the following tasks:

TASK 1: ENVIRONMENTAL AND SOCIAL BASELINE ASSESSMENT

1.1. Area of study

The area of study should include all areas that are likely to be impacted by the implementation of this Project. All areas where the Project intersects with human settlement, including residential, commercial, industrial, etc. should be carefully examined to determine the Project's impact. The environmental impacts must center on the area of direct environmental and social influence (ADI), defined as a band 4km east and 4km west of the center line of the current road all along the project length, provided that this band can be extended to cover a functional unit and shall include:

- The existing areas of human concentration;
- The right of way;
- The areas required for material stockpile, traffic diversions, asphalt plants, etc.;
- The transportation routes between any quarries and dumps; and
- Relevant functional units even if only partially affected (e.g., protected areas, wetlands, agricultural plots, commercial establishments, etc.);

All remaining areas where the Project will have an indirect or lower intensity impact, comprises the areas of indirect environmental and social influence (AII). The Consultant will be expected to produce maps depicting the areas of direct and indirect influence throughout the length of the roads or their functional extension at an appropriate scale showing the following:

- The population centers, protected areas (if any), and principal services.
- Other representative physical, biotic, socio-economic and cultural features should also be included.
- A cadastral survey of the land units on or adjacent to the ROW identified on a map.

Whenever the road passes close to ecologically fragile and/or protected areas, such as archaeological areas and human settlements or culturally important sites, the scope of the assessment shall be widened to permit evaluation of the impacts of the works and use of the highway in those areas.

1.2. Baseline

The Consultant will be required to carry out an Environmental and Social Baseline Assessment (ESBA) prior to Project Implementation. This assessment should aim to examine the significant short and long term effects of the proposed Project on the existing environment within the Project site. Further, the evaluation must include the processes of analyzing, monitoring and managing the intended and unintended environmental and social consequences, both positive and negative, of proposed Project and any environmental and social changes invoked by the implementation of the Project. The report to be submitted must meet the following requirements:

i. Establish the baseline environmental and social conditions within the Project's area of direct and indirect influence. In achieving this objective a complete description of the existing conditions within the Project area must be examined. Further the Consultant will be required to review all available data/study on the biological, physical, socio-economic characteristics of the Project area as well as the area of indirect influence. Special emphasis should be placed on those aspects which have the potential of being affected by the implementation of this Project.

ii. A detailed description of the physical environment should be produced and information relating to the geology, soils, land use (present and historical land use), hydrology, meteorological conditions and patterns, drainage and irrigation, water use, surface and ground water quality, air quality, environmental noise, etc. must be captured in the report.

iii. Provide a detailed description of the biological environment including information on the flora and fauna, any sensitive ecological habitats and endangered species existing within the Project area, aquatic environment including wetlands, etc. The study should also identify the existing waterways within the Project area and the environmental implications of the Project for their ecological health.

iv. A description of the socio-economic environment including information relating to demographics, land use, education levels, health, income, means of transportation (motorized, non-motorized), 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 and irrigation structures, utilities including telephones, electricity, etc.

v. Inventory and evaluation of public and private infrastructure and buildings in the areas of direct influence during construction and operation, with a view to: (i) establish a base line 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

vi. Identification of the archaeological, historical and tourist sites in proximity to the road and evaluation of the positive and negative impacts of improved access to these areas. If the road and its approach roads traverse or affect areas of archaeological interest, the

Consultant shall contact Environmental Authorities and ascertain the legal status of the areas and the specifications and requirements of the institute for appropriate treatment of the cases. Areas of communal interest (churches, cemeteries, other sites of cultural or religious significance must also be considered.

TASK 2: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

2.1. Environmental and Social Impact Assessment Activities

The Environmental and Social Impact Assessment (ESIA) should examine the potential social and environmental impacts emanating from the implementation of the proposed Project. The primary aim should be to identify the magnitude and other dimensions of the predicted social and environmental change resulting from execution of the Project, using as the point of reference, the existing situation within the Project area. Impacts should be assessed based on the social, ecological and physical information collected during the Environmental and Social Baseline Assessment (ESBA) conducted by the Consultant. The Consultant will be expected to capture the following information:

i. Provide a detailed description of the Project activities from conception through design, construction and operation in order to identify and evaluate the indirect, direct, and cumulative impacts during the execution of the works as well as during the operation phase of the roadway; including land use and community structure and activities.

ii. Identification and evaluation of direct and indirect impacts during execution of the works and when the road comes into use taking into account compliance with local regulations and the provisions of OP-703 (particularly Directives B.9, B.10 and B.11) and OP-710.

iii. A characterization of the potential impacts on the physical, biological, ecosystems and social components in the area of environmental influence traversed by the highway.

iv. The evaluation of the impacts on the physical environment should assess the potential impacts during the construction phase and must cover issues such as direct land loss, erosion, soil compaction, potential impacts due to accidental spills and noise and vibration from construction activities, etc. should be examined.

v. In addition, impacts of the Project implementation on the air quality should also be examined. Issues to be covered include impacts noise and dust from construction activity, dust from the transport and stockpile of materials and fumes emission from the operation of heavy duty machinery, etc.

vi. The evaluation of the impacts on the biological environment should assess potential impacts on the surrounding water resources. The water ways crossed by the highway should be identified and the potential environmental impacts resulting from the

Project's implementation including narrowing of their widths, erosion, blockage of streambeds, contamination etc. must also be examined.

vii. Identification of runoff and infiltration issues, including mapping of nearby underground water resources and wells.

viii. Identification and demarcation of fragile and/or protected ecosystems within the proposed Project area, where necessary and the impacts on these ecosystems including loss of habitat, etc. are to be considered.

ix. Evaluation of the principal water uses and identification of potential impacts on water quality due to accidents or transportation of hazardous materials.

x. The aesthetics of the environment can also be adversely affected during construction phase of the Project. Some issues to be examined includes change in aesthetics of the surrounding environment, improper disposal of solid waste and builder's waste generated from the Project and unsightly construction activities such as improper storage of stockpiled material.

xi. An evaluation of the impacts on the archaeological, historical, cultural and tourist sites in proximity to the highway and an evaluation of the positive and negative impacts of improved access to these areas.

xii. The evaluation should examine the extent of social disruption during each phase of the Project from mobilization through operation phase and provide appropriate mitigation measures to reduce these impacts to acceptable levels. Impacts to be considered include socio-economic, health and safety including risk of accident to workers and the surrounding communities, introduction of diseases to the community, community culture and values, and potential implications on the residence. The general implications on the changes of land-use and social-community resources should also be examined.

xiii. Where expropriation and/or relocation or restriction of use affecting households, businesses or other land users becomes necessary, the Consultant will be responsible for identifying precisely the number of persons affected, their legal rights to the property, their dependence on the land for subsistence and detailed socioeconomic characterization. If resettlement is necessary the Consultant shall prepare a resettlement and compensation plan in accordance with the IDB's guidelines for involuntary resettlements, (OP-710).

xiv. The Consultant must quantify and assign priorities to the impacts and classify them according to their importance, magnitude and extent, the permanence of the impact (temporary, permanent), the sphere of influence (local, regional, etc.), 'mitigability', reversibility, probability of occurrence and other appropriate characteristics.

xv. The Environmental Specialist will coordinate with the Technical Feasibility Consultant in the process of defining all details of Project design in order to ensure the best environmental and social solutions are provided. Joint effort is required in the preparation of, among other things:

- A map of the highway on an appropriate scale of the area of direct environmental influence (ADI), showing the locations of the existing human settlements, the areas required for encampments, water ways crossed by the highway, areas of landslides, traffic diversions, etc., and extending that area of influence to include ecologically fragile and/or protected areas, and archaeological, tourist, historical and other settled areas, on which impacts will be exerted during execution of the highway works and use of the roadway.

- Recommendation of the environmental characterization of the areas proposed for implementation of the supporting infrastructure for the works (asphalt plants, encampments, disposal areas, fuel storage, and service roads, among others).This characterization shall cover, among others, the aspects of relief, plant cover, surface and ground drainage, the direction of the prevailing winds, accessibility, and proximity to protected archaeological areas.

- On the basis of the resulting characterizations, definition of the recommended areas, performance of the preliminary studies for the plan for recovery and use of the selected areas and estimation of the corresponding costs for inclusion in the Project budget. Also, recommendation of the specific measures for the control of degradation in and environmental recovery of each of the selected areas, and framing of the rules of behavior for the workers for environmental safeguards and relations with settlements in the vicinity of the encampments.

- The Consultant shall recommend locations for dumps, stockpile of materials and other necessary areas required for Project execution so that they do not become environmental issues such as erosion into surrounding water ways, dust nuisance, and areas where traffic patterns will be significantly modified or where the change in accessibility is likely to spur significant changes in land use patterns, etc. The aspects of potentially usable sites to be considered must include the possibility of conflicts with their owners or with environmental or NDC authorities. Finally, the recommended dump and storage sites must be such as can be reconstituted and replanted for integration into the landscape upon completion of the works.

- The Environmental Specialist and the Technical Feasibility Consultant must also ensure safe crossing conditions, adequate road markings and street lighting wherever needed and incorporate these aspects into the road safety measures to be implemented.

- The Consultant must ensure that all environmental and social mitigations measures are included in the designs and resources are allocated accordingly.

xvi. Identify the relevant laws, guidelines, regulations and standards that would define the operating framework of the Project. Legal aspects related to the Project including licensing requirements and procedures, land use permits and any other relevant norms should be included. All documentation required for licensing should accompany the study.

2.2. Evaluation of Environmental Liabilities

The Environmental Liabilities usually generated by highways are the impacts on third parties from existence of the road and the impacts of third parties on it. Since in the latter case those third parties cannot always be identified and held accountable, these environmental liabilities have to be corrected only in cases of hazard to the road infrastructure and its users. Below are examples of impacts classified as environmental liabilities are:

i. Landslides and slumps, cave-ins, and slope instability

ii. Erosion, silting, streambed obstruction, flooding resulting from changes in drainage and permeability

iii. Uncontrolled off-site dumping

iv. Water pollution

v. Ecological and landscape damage in natural areas

vi. Areas degraded by quarrying and extraction of other materials for the works, the opening of service roads, encampments, etc.

vii. Accesses to and from local roads and streets with human settlements blocked by the highway

viii. Damage to water sources for human settlements and/or for irrigation canals along the highway

ix. Interference with pedestrian or non-motorized traffic that creates safety hazards

x. Hazards or nuisances affecting residential or commercial uses of the land adjacent to the ROW, including noise, dust, vibration.

xi. Occupation of the right-of-way.

xii. Damage to buildings or infrastructure as a result of construction activities or traffic (vibration, impact, dust and soot, etc.)

xiii. Safety and related injury issues.

The Environmental Liability of the road under study for construction will be confined to impacts that put at risk the route, its users, and the areas, ecosystems and communities near the right-of-ways, accesses and ancillary facilities, including transfer and detour areas during construction.

To identify the environmental liabilities (including any social aspects) the Consultant will have to carry out the following activities:

i. Devise a methodology for the evaluation of environmental liabilities.

ii. Design and submit for approval by the MoWT the characterization sheet that will be used to enter the environmental liabilities.

iii. Classify the environmental and social liabilities into categories.

iv. Compile all information needed to fill out pre-established characterization sheets.

v. Consult with stakeholders.

vi. Fill out the characterization sheets for each individual situation (environmental and social liability) detected, which shall contain, at a minimum:
   - Its location, approximate dimensions, obtained by quick reliable procedures.
   - Its identification under the pre-established general classification.
   - Its description, including its probable causes.

vii. Place in an annex photographs of the most important and unusual features of the environmental liabilities.

viii. Enter on the baseline map as an additional layer, the environmental and social liabilities detected for the road and approach roads and ancillary facilities and transfer routes, showing the distance location in kilometers. The map shall contain, at a minimum, the urban areas near the main highway and the watercourses and secondary, important natural or historical features roads that cross or connect to the roads under evaluation.

ix. Submit the characterization sheet to the MoWT for final approval.

x. Classify the environmental land social liabilities as critical and non-critical in accordance with the definitions proposed by the consultant and accepted by the MoWT.

xi. For the critical liabilities include, in addition to the information referred to above, a characterization of the works, services and/or corrective measures recommended, including schematic sketches of the solutions proposed, a determination of the quantities, costs and budget and the critical environmental liabilities to be eliminated or mitigated in the works. The solution of these liabilities must be included in the project's budget.

xii. For the non-critical liabilities include a ranking of importance and options for attenuation measures, including identifying the need for monitoring.

TASK 3: PUBLIC CONSULTATION GUIDELINES

The Consultant must also implement a Stakeholder Consultation Process that fulfills the requirements of informing and engage the general Public from the opening phase of the study, of the intention of the MOWT to implement the Project and further to listen to the expectations and concerns of the population regarding the scope of the Project before the studies are done and its implementation begins.

Any consultation process initiated must fulfill at a minimum the following objectives:

- Facilitating the incorporation in the Project of the measures required for its technical, environmental and socio-cultural viability and capturing the view of the affected persons;
- As far as practical establish agreements with stakeholders or at minimum achieving an adequate degree of acceptance on the part of the affected groups;
- Incorporate the concerns/needs of the affected persons as well as beneficiaries into the Project's priorities;
- Devise a methodology to promote local ownership of the Project and facilitate cooperation during construction and operation for instance systems and tools for continuous engagement with stakeholders including the preparation of a Communication Plan and the appointment of a Community Liaison Officer, early identification of potential conflicts and strategies to avoid or overcome them;
- Providing for transparency in the management of the Project and the impacts and opportunities it brings to the affected stakeholders; and
- Gathering local intelligence that can facilitate and improve Project design and implementation through interactive/participatory session with stakeholders.

The Public consultations process should be designed and executed with due account to the principles of sound consultation and stakeholder engagement including:

- Early consultations;
- Wide consultancy that captures the sphere of direct and indirect influences of the Project;
- Collect and maintain proper documentation of stakeholders concerns raised during consultations;
- Be knowledgeable about all the options being considered for the Project and their potential impacts;
- Allow stakeholders reasonable time for absorption of information, convening of stakeholders and provisions of feedback;

- Report on issues identified in a balanced and objective manner;
- Request feedback from stakeholders for instance with the provision of questionnaires at the end of consultation meetings, etc.; and
- Conduct consultation in mutual good faith and maintain a two way process at all times.

In achieving the above-mentioned objectives of the Public Consultations the following activities must be met by the consultant:

i. *Scoping and Stakeholder identification and analysis*

The Consultant will be expected to make recognizance site visits and based on information gathered should identify and prioritize stakeholders within the areas of direct and indirect influence, with special emphasis being placed on the vulnerable groups such as children and the elderly and any other disadvantage groups/subgroups whose needs are less likely to be taken into consideration under the usual planning scenarios.

Once the universe of stakeholders has been identified, analyze their relationship to the Project and relationships among the groups as relevant, to establish the relative priority of engaging with each group. Provide a mapping of the stakeholders that takes into account the following factors as they relate to the Project:

- Impacts, risks and opportunities generated;
- Stakeholders' characteristics, assets, capabilities and vulnerabilities; and
- Stakeholders' interests and influence.

Based on the results of the initial analysis of the various stakeholders group, the Consultant should outline how the respective consultations will be executed.

ii. *Consultation Plan*

Prepare a Consultation Plan and communicate to stakeholders which should include at minimum:

- A non-technical summary of the proposed Project for the stakeholders to make informed decisions on whether, or the degree to which, they may be affected by the implementation of the Project;
- A scheduled timeframe for consultation that allow for stakeholders to absorb Project information, ask for clarifications and provide feedback. Consideration must be given to Public holidays, work schedules and local scheduling preferences with a view of maximizing stakeholders participation;

- The manner of consultation (seminars, presentations, interviews, open-houses, workshops, structured or unstructured surveys, workshops, etc.) that is designed to elicit the interest and participation of the different types of stakeholders, should take into account:

  - Inclusiveness that allows for the participation of individuals as well as their functional and organic organizations;
  - Attention to verifying the legitimacy of any one acting in a representative capacity and to avoiding conflicts with existing representation systems;
  - Particular attention to providing for inclusion for a typically marginalized groups (such as women, youth, the elderly, the disabled and ethnic minorities depending on the situation);
  - Notifying stakeholders of consultation prior to their execution with emphasis being on reaching those expected to be affected;
  - Opportunities for stakeholders to participate in more than one event so that they can internalize information and consult with their own counterparts before providing final feedback;
  - Provision of all relevant Project information to the stakeholders;
  - The scope of the inputs expected and of the ways in which stakeholder concerns will be included in the Project; and
  - Conflict management strategies if opposing interests are identified.

The final Consultation Plan should also take in consideration the consultation requirements of local Agencies such as the Environmental Protection Agency.

iii. Implement the Consultation Plan

Carry out the consultation according to the plan employing a variety of methodologies as needed to ensure proper coverage of the various stakeholder groups. Given the nature and location of the Project, particular attention should be given to concerns that below:

- Changes in connectivity or accessibility of neighborhoods, public services and community resources;

- Traffic and pedestrian safety and access;

- Exposure to noise, dust, fumes , risk of accidents and other nuisances or hazards;

- The acquisition of the ROW, private lands and other land use changes that could cause physical displacement of homes, commercial establishments or economic or community activities and uses including as street vending, recreational uses, use as public meeting places, transportation hubs, etc.;

- Changes in economic activities and livelihoods resulting from changes in traffic patterns and accessibility;

- Potential for in or out-migration as a result of job opportunities and/or changes in access to the Project site. Further issues related to labor, job opportunities for local population and Project labor force training, housing and code of conduct should also be examined;
- Increased risk of accidents or exposure to hazards from heavy traffic and hazardous loads;
- Community needs and opportunities related to the Project;
- Affectation of infrastructure, crops or activities as a result of the construction or operation of the improved road and its ancillary works and changed patterns of use (including impacts of changes in drainage, vibration, noise, dust or light from construction or traffic, proximity of foot or vehicle traffic; and
- Any other issues, concerns, needs, demands or perceptions related to the Environmental and Social Assessment issues described in the scope of the assessment.

The methodology for carrying out the consultation needs to clearly identify the roles of the participants, the rules of engagement and the scope of the results that can be expected. Time should be allocated for brain storming to identify issues, concerns and expectations/demands and then proceed to analyze the causal relationships with respect to the Project and to identify potential solutions and alternatives for issues identified during such session.

iv. Compile and analyze the results and provide them to the Technical Team

Once all groups of stakeholders have been consulted, the Consultant shall prepare a report that classifies their inputs and analyzes their relevance to the Project in terms of at minimum:

- Environmental impacts and risks;
- Social impacts and risks;
- Community support for the Project;
- Community objections or opposition to the Project;
- Opportunities to improve the fit between the project and the stakeholders' needs and demands; and
- Key points that require feedback to the stakeholders and stakeholder issues that might pose a risk to the successful implementation of the Project.

v. *Prepare and deliver presentation(s) to the stakeholders providing feedback on their inputs*

The Project team including the Environmental Specialist and Technical Feasibility Consultant will be required to analyze the inputs and information gathered during the consultations and to determine how to provide feedback to the stakeholders. This would include:

- Explain any misconceptions about the Project to allay unjustified concerns;
- Proposing feasible Project design change or improvement options that can address specific concerns;
- Explaining any Project limitations and any issues that are beyond the scope of influence of the Project or inevitable impacts that are not feasible to avoid or fully mitigate;
- Proposing mitigation or compensation measures that would be available to address potential environmental, social and economic risks or impacts and the process by which the Project will work with the affected stakeholders to assess the impacts and implement the measures;
- Describing the process the Project will implement for continued engagement with stakeholders whose concerns require implementation of management measures;
- Describing the communication plan to keep stakeholders informed in later stages of Project development as needed and proposing mechanisms for continued interaction (such as stakeholders' committees, hot lines, etc.);
- Informing stakeholder of how they can follow up on the Project if they wish to do so and how they can obtain and provide information with respect to the performance of the Project; and
- If the analysis identified potential conflicts, describing the process the Project will implement to receive and respond to stakeholder complaints (a grievance management mechanism).

This feedback process should be provided in a brief written report and disseminated through a series of targeted presentations to key stakeholder groups.

TASK 4: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An environmental and social management plan shall be drafted (in accordance with IDB Safeguards OP-703-Directive B.5), which shall include the below.

An impact mitigation plan with descriptions of each mitigation measure proposed, the impact to which it relates, the conditions under which it will be required (in the design, before or during construction, permanently, for contingencies, etc.), and the design requirements and procedures for its execution. Each program must have a budget for its implementation.

A program for environmental and social follow-up or monitoring. Definition of the institutional responsibilities for implementation of each mitigation measure, including (i) implementation; (ii) operation, (iii) maintenance, (iv) control and supervision during construction and operation of the works, and (iv) environmental and social monitoring and reporting.

A program for resettlement and/or social compensation / expropriations (if necessary) in accordance with OP-710, including Social Baseline Information, community participation, compensation and rehabilitation package, legal institutional framework, environment, timelines, monitoring and evaluation and coordination.

An investment program, a timetable and estimated budget for all investments and recurrent costs in implementation of the environmental management plan.

A communications and grievance management program.

A timetable of the activities, which must be synchronized with the activities for construction of the main components of the project and/or its operation phase.

The expected components of the management plan include, among others:

i. soil erosion control, slope stabilization, drainage management, and restoration of natural vegetation in temporary use areas;

ii. environmental measures for the protection of surface and ground water courses and the preservation of their quality and quantity and of aquatic fauna;

iii. control of atmospheric emissions (dust and gasses) and noise which affect the workers, neighboring inhabitants, crops or the general environment;

iv. measures to manage and restore the areas impaired by the installation and operation of all ancillary facilities and transfer routes including asphalt plants, quarries, crushers, etc., to their natural condition;

v. measures for the management of domestic and industrial solid wastes and for control of sewage discharges during construction;

vi. special measures to attenuate the barrier effect of the works and to avoid disturbing the native flora and fauna;

vii. appropriate quarrying procedures to avoid excessive degradation of the areas to be worked and, afterwards, leveling, earth-filling, replanting and other needed measures to restore the quarried areas to their natural condition;

viii. appropriate procedures for using the areas slated as dumps for refuse and spoil from leveling and other wastes, with due regard for the site selection and design of the dumps, how materials are to be placed in them, and appropriate cover to ensure their stability.

ix. measures to offset impacts that cannot be mitigated, such as compensation to owners of land, structures, businesses, crops and other installations to be affected by the widening of the road;

x. measures for resettlement and compensation of any households, businesses or land users to be displaced by the road or having their access to resources, services or markets restricted directly or indirectly (if required) ;

xi. measures to protect nearby natural areas and wild life from direct impacts of construction or impacts due to increased access and land use change impacts (if required);

xii. measures to protect local population from the influx of large numbers of workers and to deal with potential problems such as alcohol and substance abuse, HIV-AIDS prevention, etc.

xiii. identification of the costs and benefits of the mitigation and the environmental management plans in order to include them in the economic-environmental evaluation;

xiv. measures to ensure compliance with local laws and the fundamental rights at work with respect to the contracting of labor for the project, and to implement assurance systems for worker health and safety;

xv. measures to manage spills of fuels and oils, and their disposal during construction;

xvi. measures to manage traffic, noise and accidents during construction.

xvii. measures to control impacts during operation including speed reduction elements, signals, barriers, safety measures, and contingency plans in case of accidents and incidents involving hazardous materials, control noise, dust and vibration, maintain pedestrian access and connectivity, etc.

TASK 5: FINAL REPORT

The report to be presented must be analytical and concise, and emphasize the significant social and environmental problems, the measures and actions recommended, and the costs and responsibilities involved. In addition to the above-mentioned, it must also include the following:

i. In addition the final ESIA/ESMP must include a monitoring plan to identify mitigation and monitoring cost for every phase of the project. The monitoring plan should cover auditing, reviewing, reporting including monitoring sheets to be used and corrective action to be taken for non-conformance to ensure compliance with the ESIA/ESMP.

ii. Emergency response plan should identify potential environmental and social issues emanating during the execution of the project. This plan must include emergency response policy, emergency response contact personnel along with their appropriate details, emergency procedures. A description of an emergency should be included in this section of the report. Where applicable response procedures to minor as well as major accidents/incidents should also is developed for fire, accident, traffic accidents and fuel spills. The consultant should also develop an incident report formatting.

iii. Closure plan where consideration should be given to principal closure and decommissioning issues that may arise. Recommendations for the predicted issues should also be identified.

ANNEXES

Financing

The cost of the consultancy will include the consultant's remuneration as well as the costs of all incidentals associated with the conduct of the consultancy. The incidentals include, but are not limited to: surveys, field tests, trips, travel allowances, international calls, local transportation, secretarial expenses, copying and office supplies. The cost of the consultancy will include the consultant's remuneration as well as the costs of all incidentals associated with the conduct of the consultancy. The incidentals include, but are not limited to: surveys, field tests, trips, travel allowances, international calls, local transportation, secretarial expenses, copying and office supplies.

Duration

The duration of the study shall be 26 weeks.

Location

The study shall be carried out in Belize.

Reporting Schedule

The Consultant will submit three copies of reports, two copies to GOB and one copy to IDB. An electronic form of the reports will also be submitted.

The outputs / deliverables of the study shall be presented as follows:

- The Inception Report shall be submitted to the MOWT on April 25th 2014. It shall include: initial findings including any comments on the TOR; Consultants' detailed work schedule and methodology; a proposed outline for the final report; and design criteria to be employed. This should include a Power Point Presentation to be presented to the Project Steering Committee on April 29th 2014.
- The Environmental and Social Baseline Assessment shall be presented on June 2nd 2014
- Draft report detailing the three preferred alternatives to be delivered no later than June 5th 2014.
- The Environmental and Social Impact Assessment shall be presented on June 30th 2014
- The Environmental and Social Management Plan to be presented on July 25th 2014
- The draft Final Report on the Environmental and Social Impact Study shall be presented to the Chief Engineer, MOWT no later than August 18th 2014. The MOWT will complete review of report within twenty (20) days after receipt and submit its comments to the consulting firm for incorporation in the final report.
- The Final Report on the Environmental and Social Impact Study shall be presented no later than October 13th 2014. An electronic copy of the Environmental and Social Impact Assessment report shall be provided in both Word and PDF formats to the Chief Engineer, MOWT.

Payments

The payments will be done according to the following schedule:

- 10% as an Advance Payment against the relevant guarantee
- 10% upon submission and approval of the Inception Report
- 40% upon submission and approval of ESIA Reports

- 40% upon submission and approval of the Final Reports

Manpower Scheduling and Costs

In estimating man-month requirements and cost of the services, the consulting firm shall ensure that the proposal takes full account of all the above requirements and the following items:

Proposed Personnel for Consulting Firm

The key experts required for the Consultant's team, and their minimum qualifications and experience are:

- **Environmental Engineer (Team Leader)**
  - Education: At least a MSc. in Environmental Engineering or 'similar' relevant field
  - Experience: 10 years of experience in carrying out ESIA's and preparing ESMP with at least 5 years of experience in developing countries. Belize, Caribbean or Latin American experience is preferred in that order.
  - Experience must include being 'Team Leader' in at least 2 projects of a similar nature in Caribbean or Latin American countries.

- **Social Specialist**
  - Education: At least a BSc. in Social Sciences or 'similar' relevant field
  - Experience: 15 years of experience for BSc. and 10 years for MSc. in carrying out Stakeholder Consultation, ESIA's and preparing ESMP with 5 years of experience in developing countries.
  - The preferred candidate would have a MSc in Social Sciences or 'similar' relevant field and 10 years of experience in carrying out Stakeholder Consultation, ESIA's and preparing ESMP with 5 years of experience in Belize (most preferred), the Caribbean or Latin American.

- **Disaster Risk Management Specialist:**
  - Education: At least a BSc in Disaster Risk Management, Civil Engineering or related field
  - Experience: 15 years of experience for BSc. and 10 years for MSc. in flood risk assessment and management
  - The preferred candidate would have a MSc in Social Sciences or 'similar' relevant field and 10 years of experience in flood risk assessment and management.

It is envisaged that inputs would be required from the following other experts:

- **Hydrologist**
- **Archaeologist**
- **Biodiversity Specialist**

The language of all reports will be English and all experts shall have a good command of English.

The Consultant must specify the qualifications and experience of each expert to be assigned to the assignment. For each key expert proposed, curriculum vitae of about 4 pages should be provided detailing the relevant experience and qualifications. Members of the consultancy team must have working experience in developing countries. Each key expert will provide a letter of commitment, confirming their availability for the study.

All team members must be present in Belize when conducting their assignments.

Coordination and Facilities

The MOWT is the executing agency for the Consultancy. The Consultant shall report to the Project Execution Unit Coordinator located within the MOWT. The IDB Project Team will have a supervisory role entailing evaluation and monitoring of the study and reviewing and approving the study in consultation with the Chief Engineer, MOWT.

The MOWT will facilitate the issuing of any permits required for the Consultant to carry out their duties and make available all relevant reports, documents, maps and data.

The MOWT shall designate personnel to be mentored in all or specific aspects of the Study.

7. COMMENTS BY THE CONSULTANTS

The consultants are requested to make comments on and suggestions for, improvements to these TORs. The financial implications, if any, of these recommendations should be indicated separately in the Financial Proposal.

Annex II: List of Contributors to the Preparation of the ESIA

Principal
Ismael Fabro M.Sc., Managing Director and Environmental Specialist – Team Leader

Ramon Frutos M.Sc., Disaster Risk Management Specialist

John Flowers M.A., Social Specialist

Environment and Law
Mark Usher B.A. LL.B., Environmental Law

Juan Rancharan M.Ag., Environmental-Agriculture and Health and Safety

Hugo Rancharan B.A., Environmental Engineering

Michael Fabro B.Sc., Environmental Assistant/Accountant

Archaeological Assessment

Jaime J. Awe Ph.D., Project Director

Rafael A. Guerra M.A., Co-Director / Surveyor

Claire Ebert, GIS Analyst

Wilfredo Bejerano, Survey Assistant

Printing Crew

Michael Fabro B.Sc., Supervisor

Marianne Pariente (Miss), Student
Jailine Donaire (Miss), Student
Andre Moguel, Student
Andrew Moguel, Student
Christian Verde, Student

Annex IIIa: Breakdown of Culverts by Road Section and Size

Breakdown of Culverts by Road Section and Size												
									Box			Total
Size (Inches)	18	24	30	36	42	48	60	108	18 x 96	None	Unknown	Section
Section I												
Replacement	1	15	0	10	0	0	0	1	0	1	1	29
No Change	0	0	0	0	0	0	0	0	0	0	1	1
											Sub-total	30
Section II												
Replacement	2	6	0	7	0	2	0	1	1	0	0	19
No Change	0	0	0	0	0	3	0	0	0	0	0	3
											Sub-Total	22
Section III												
Replacement	0	4	0	1	1	4	3	0	0	1	0	16
No Change	0	0	0	5	9	0	0	0	0	0	0	14
											Sub-total	30
Totals By Size												
Replacement	3	25	0	18	1	6	3	2	1	2	1	64
No Change	0	0	0	5	9	3	0	0	0	0	1	18
											Grand Total	82
Note: All culverts less that 36 inches will be changed												

Annex IIIb: Inventory of Culverts (Anthony Thurton and Associates)

Project Section	Ref.#	GPS Coordinates (NAD27)		Culvert Type	Culvert Diameter	No. of Barrels	Comments	Recommendations
		Eastings	Northings					
Section 3	1	271465	1887022	PVC Pipe	24-inch	1	· End structure present only on RHS. · Will require cleanout manholes	Replace with one (1) 36" Concrete Culvert with RC end walls.
	2	271951	1887703	Concrete Pipe	36-inch	1	· Flat end wall in good condition	No Change
	3	272044	1887991	Corrugated Galvanized Steel Pipe	60-inch	1	· Massive end structures in good condition · Bottom of pipe encased in concrete	Replace with two (2) 48" Concrete Pipe Culverts with RC end walls.
	4	272589	1888660	Corrugated Galvanized Steel Pipe	48-inch	1	· Maybe encased in concrete box · Bottom of pipe encased in concrete	Replace with two (1) 48" Concrete Pipe Culvert with RC end walls.
	5	272880	1888927	Corrugated Galvanized Steel Pipe	60-inch	1	· Massive end structures · Bottom of pipe encased in concrete · Some wingwall cracking	Replace with two (2) 48" Concrete Pipe Culverts with RC end walls.
	6	272787	1889109	Concrete Pipe	24-inch	1	· Wingwall failure on RHS	Replace with one (1) 36" Concrete Culvert with RC end walls.
	7	272735	1889147	Concrete Pipe	24-inch	1	Good Condition.	Replace with one (1) 36" Concrete Culvert with RC end walls.
	8	272636	1889276	Corrugated Galvanized Steel Pipe	60-inch	1	· Bottom of pipe encased in concrete · Headwall 10-inch, wingwalls 6-inch · LHS wingwall has diagonal crack.	Replace with two (2) 48" Concrete Pipe Culverts with RC end walls.
	9	272603	1889304	Concrete Pipe	24-inch	1	· RHS: End Structures in good condition	Replace with one (1) 36" Concrete Culvert with RC end walls.

						· LHS: No wing walls, headwall shows movement towards drain (overturning).	
	10	273645	1890276	Concrete Box Culvert	36-inch	1	· Concrete quality appears questionable. · Remove and replace.	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	11	273790	1890353	Concrete Pipes	42-inch	4	· End Structure: One headwalls, 2 wingwalls, 2 intermediate walls. · LHS and RHS head walls might have to be raised if road is raised, to retain soil.	No Change
	12	274367	1891364	Concrete Pipe	42-inch	1	· End Structures: RHS and LHS good condition.	No Change
	13	274559	1891755	Concrete Pipes	42-inch	2	· End Structures: RHS and LHS good condition.	No Change
	14	274675	1892035	Concrete Pipe	30-inch	1	· End Structures good.	Replace with one (1) 36" Concrete Culvert with RC end walls.
	15	274808	1892340	Concrete Pipe	24-inch	1	· End Structures good.	Replace with one (1) 36" Concrete Culvert with RC end walls.
	16	275101	1892767	Concrete Pipe	48-inch	3	· End Structure: 1 headwall, 2 wingwalls, 2 intermediate walls. · RHS: one wing wall partially collapsed. · LHS: intermediate walls deteriorated.	Rebuild Wing Walls
	17	275996	1893530	Concrete Pipe	36-inch	2	· Good Condition	No Change
	18	276405	1893976	Concrete Pipe	36-inch	1	· Good Condition	No Change
	19	276512	1894053	Concrete Pipe	30-inch	1	· Good Condition	Replace with one (1) 36" Concrete Culvert with RC end walls.
	20	276759	1894296	Concrete Pipe	42-inch	1	· Good Condition	No Change
	21	277343	1894976	Concrete Pipe	36-inch	1	· Good Condition	No Change

	22	277815	1895884	Concrete Pipe	42-inch	1	· End Structures in good condition LHS, concrete work a bit low quality with some honeycombing on RHS.	Conduct Minor Repairs to Wingwalls
	23	278396	1896436	Concrete Pipe	42-inch	1	Good Condition	No Change
	24	278922	1897200	NO CULVERT PRESENT			No culvert present. Need to investigate further the downstream effects.	Install one (1) 48" Concrete Pipe Culvert with RC end walls.
Section 2	25	282775	1900229	PVC Pipes	24-inch	2	In good condition. Recently installed to alleviate flooding in the area.	Replace with one (1) 36" Concrete Culvert with RC end walls.
	26	285017	1900633	Corrugated Galvanized Steel Pipe	48-inch	1	· No end structures · Deformed at ends. · Inadequate embedment · Consider changing.	Replace with two (1) 48" Concrete Pipe Culvert with RC end walls.
	27	285204	1900669	Corrugated Galvanized Steel Pipe	36-inch	1	No head walls. In poor condition.	Replace with (1) 48" Concrete Pipe Culvert with RC end walls.
	28	285575	1900729	Concrete Box Culvert	48-inch	2	Running W. Double culverts. One newly built 4-ft reinforced concrete box culvert facilitated through the IRF-MOWs project	No Change
	29	286668	1900926	Concrete Pipe	24-inch	1	· No end Structures · Broken off on LHS, pipe passing through. · Probably should extend ends and provide end structures.	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	30	288126	1901333	Corrugated Galvanized Steel Pipe	36-inch & 24-inch	4	Area floods. Needs larger culvert structure.	Replace with 6 ft x 6 ft RC culvert
	31	289130	1901677	Concrete Culverts	36-inch & 18-inch	3	Area floods. Needs larger culvert structure.	Replace with two (2) 48" Concrete Culverts with RC end walls
	32	289390	1901827	Concrete Box Culvert	48-inch	1	Good Condition	No Change
	33	289659	1901992	PVC Pipe	24-inch	1	· Failure in Middle	Replace with one (1) 36" Concrete

							· End Structures in good condition except LHS apron needs repair · Replace	Pipe Culverts with RC end walls.
	34	290554	1902462	PVC Pipe	48-inch	1	· Headwall retaining structure on RHS appears inadequate. · Starts out as 4’ x 4’ box on RHS, ends as 36-inch PVC pipe on LHS. · LHS end structure good	Replace with (1) 48" Concrete Pipe Culvert with RC end walls.
	35	293316	1903305	Elliptical Corrugated Metal	108-inch	1	· Poor alignment with road · Large diameter corrugated pipe, corroded on bottom – replace. · End Structures in good condition, but realignment necessary.	Replace with 10 ft x 10 ft RC culvert
	36	293664	1903677	Corrugated Galvanized Steel Pipe	36-inch	1	· End Structure: rockwall – replace · Pipe culvert looks suspect · Replace	Replace with two (2) 36" Concrete Pipe Culverts with RC end walls.
	37	294579	1904904	Corrugated Galvanized Steel Pipe	18-inch	1	· Report says (2) 24-inch but we measured (2) 18-inch corrugated onsite · Suspect condition – replace	Replace with one (1) 36" Concrete Culvert with RC end walls.
	38	295158	1905109	Box Culvert	18" x 96"	1	· Replace · End Structure in poor condition · Must address 6-inch water main passing in front of RHS. · Might have to raise road crown elevation in order to increase height of culvert from current invert	Replace with two (2) 36" Concrete Pipe Culverts with RC end walls. Road will need to be raised to accommodate larger culverts.

Section 1

						level.	
	39	295546	1905263	Corrugated Galvanized Steel Pipe	36-inch	1	· Rubble wall end structure. Suspect. · Replace.	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	40	296312	1905183	Corrugated Galvanized Steel Pipe	Unknown	1	Under thick vegetation.	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.
	41	296909	1905129	Corrugated Galvanized Steel Pipe	36-inch	1	· Partially filled · Good condition. · Need head & tail structures.	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	42	297160	1905071	Corrugated Galvanized Steel Pipe	36-inch	1	· No flooding experienced.	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.
	43	297515	1904962	Corrugated Galvanized Steel Pipe	36-inch	1	· Partially filled, less than ¼. · Wing wall – rubble stone in poor state. · Good condition. · No flooding. · Outlet completely covered with vegetation	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	44	2977876	1904936	Corrugated Galvanized Steel Pipe	36-inch	1	· Vegetation on both ends · Partially filled (1/4) · No head walls.	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	45	298093	1905079	Concrete Pipe	24-inch	1	· Filled 1/3 · Vegetation at both ends · Replace	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	46	298289	1905132	Corrugated Galvanized Steel Pipe	36-inch	1	· Partially filled 1/3 · No head on tail walls · Replace	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	47	298532	1905253	Concrete Pipe	24-inch	1	· Replace · Partially submerged.	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
	48	299005	1905364	Concrete Pipe	18-inch	1	· Partially filled 1/3 · Replace · Rubble stone	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.

						headwalls	
49	299178	1905376	Corrugated Galvanized Steel Pipe	36-inch	1	· Ok condition · Rubble stone head walls · Replace	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
50	300108	1905405	Corrugated Galvanized Steel Pipe	36-inch	1	· Partially filled – ¼ · Good condition · Replace · Rubble stone head walls · No headwall at inlet.	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
51	300636	1905196	Elliptical Corrugated Metal	~ 108-inch	1	· Replace · No flooding	Replace with 10 ft x 10 ft RC culvert
52	301401	1905376	Old-Steel Culvert	24-inch	1	· No headwall · Needs replacement	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
53	302037	1905335	Corrugated Galvanized Steel Pipe	36-inch	1	· Clean · Good condition · Rubble stone wall · Vegetation	Replace with one (1) 36" Concrete Pipe Culverts with RC end walls.
54	302401	1905270	Concrete Pipe (old)	24-inch	1	· Replace – (total)	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.
55	302592	1905267	Corrugated Galvanised Steel Pipe	Unknown	1	In good Condition. Embankment is more than 20 ft. Teakettle Culvert.	No Change
56	303139	1905386	Corrugated Galvanized Steel Pipe	36 -inch	1	Partially blocked with sediments. Outlet is also partially blocked with heavy vegetation.	Replace with two (2) 36" Concrete Pipe Culvert with RC end walls.

	57	304174	1905911	Unknown culvert details		1	· Vegetation at both ends · Needs further assessment · No headwalls	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.
	58	305559	1906784	Corrugated Galvanized Steel Pipe	36-inch	1	· Vegetation at both ends · Rubble stone headwalls · Good condition · Replace · Partially filled	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.
	69	306934	1907871	Concrete Pipe (old)	24-inch	1	· No headwalls · Clean · Flood – 4-6” over road · Replace	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.
	60	306634	1907636	Concrete Culverts	24-inch	2	Area floods. Needs larger culvert structure. Wooden Bridge has a single 24" Plastic culvert that will need replacement also.	Replace with three (3) 36" Concrete Pipe Culverts with RC end walls. Road will need to be raised to accommodate larger culverts.
	61	307356	1908236	Concrete culverts	24-inch	2	· Clean · Outlet partially blocked with pathway culvert · Replace both culverts	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.

							· Replace pathway culvert	
	62	307778	1908586	Concrete Pipe	24-inch	2	· Poor Condition	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.
	63	308586	1908884	NO CULVERT PRESENT			· Needs one · Near cemetery-Roaring Creek · 32”	Install one (1) 36" Concrete Pipe Culvert with RC end walls.
	64	309322	1908974	Concrete	24-inch	2	· No headwalls · Replace · Vegetation at both ends	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.
	65	309481	1908996	Concrete	24-inch	2	· Replace	Replace with one (1) 36" Concrete Pipe Culvert with RC end walls.

All culverts below the 36 inch diameter standard will be replaced.

ANNEXES

Annex IV: Dynamic Cone Penetration Tests (DCP's)

Twenty Dynamic Cone Penetration Tests (DCP's) were carried out along the project area by Anthony Thurton and Associates, particularly where there was strong evidence of pavement deterioration and base failure. Tests carried out in accordance with ASTM D6951, were conducted directly over existing pavements. The results provide a fair indication of the bearing capacity of the road pavement structure, including correlated California Bearing Ratio (CBR) values. The majority of the results of the DCP tests indicated high bearing capacities and CBR values of above 10,000 pounds per square foot and 100 plus respectively, within the upper layer of the road base. However, in general the bearing capacities and CBR values falls a s with depth, exposing majority of the weal\k sub-structure at the depth of 5 to 10 inches. These values coincide with the deep depressions that have farmed on the pavement surface, which serve as clear indicators of the existence of relatively weak and inadequate base and sub-base layers. Additionally, at lower depths, the bearing capacity and CBR values were even lower, indicating a weaker and less stiff soil stratum.

Inspection pits were also excavated along the project area in order to develop soil profiles adjacent to the existing carriageway as shown below.

a

DCP TEST DATA

File Name: DCP-1

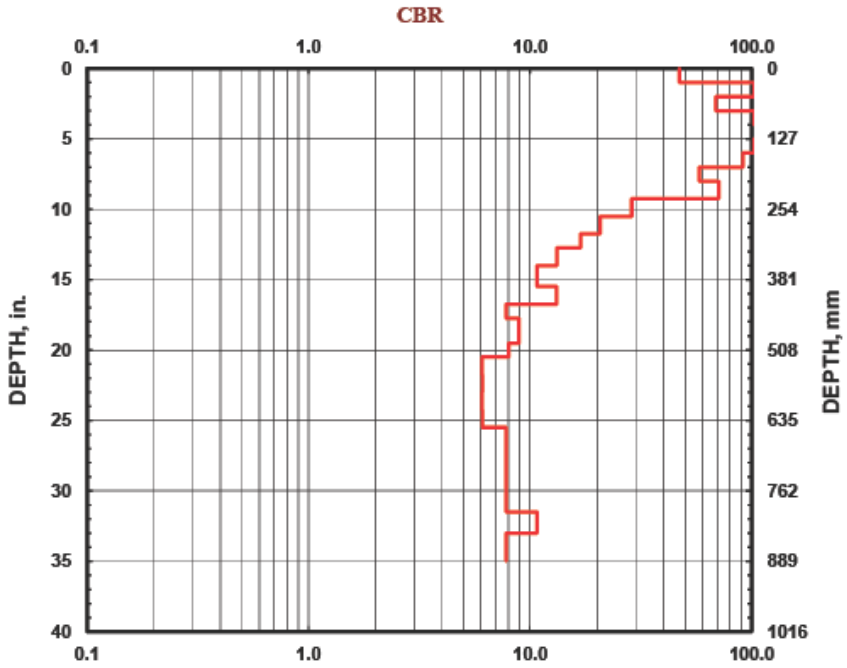
Project: *Road Safety Project* **Date:** 27-Jun-14

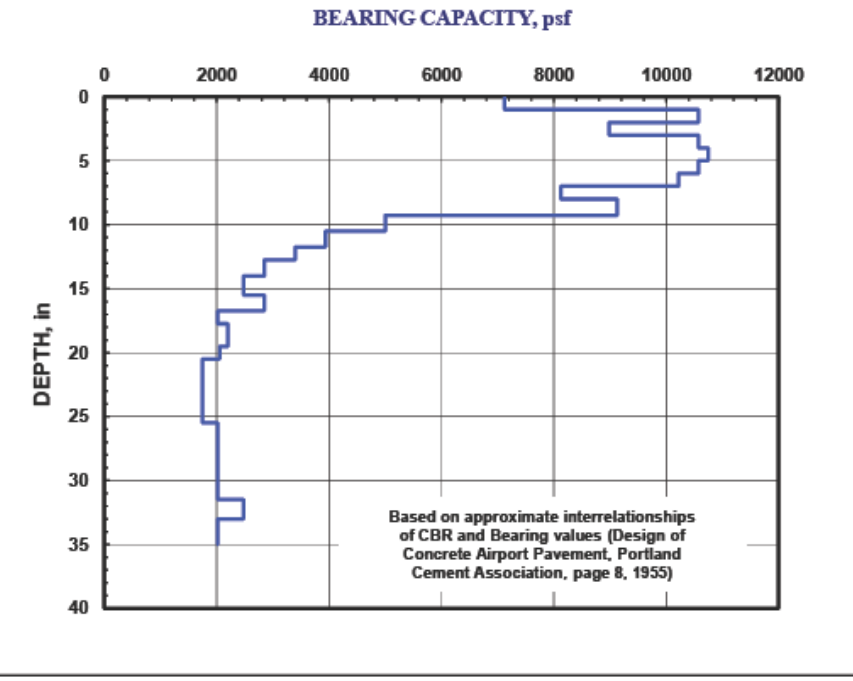
Location: Roaring Creek Bridge **Soil Type(s):** Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
5	25.4	
10	50.8	
7	76.2	
10	101.6	
11	127	
10	152.4	
9	177.8	
6	203.2	
9	235	
4	266.7	
3	298.5	
2	323.9	
2	355.6	
2	393.7	
2	425.5	
1	450.9	
2	495.9	
1	520.7	
1	552.5	
1	584.2	
1	616	
1	647.7	
1	673.1	
1	698.5	
1	723.9	
1	749.3	
1	774.7	
1	800.1	
2	838.2	
1	863.6	
1	889	





DCP TEST DATA

File Name: DCP-2

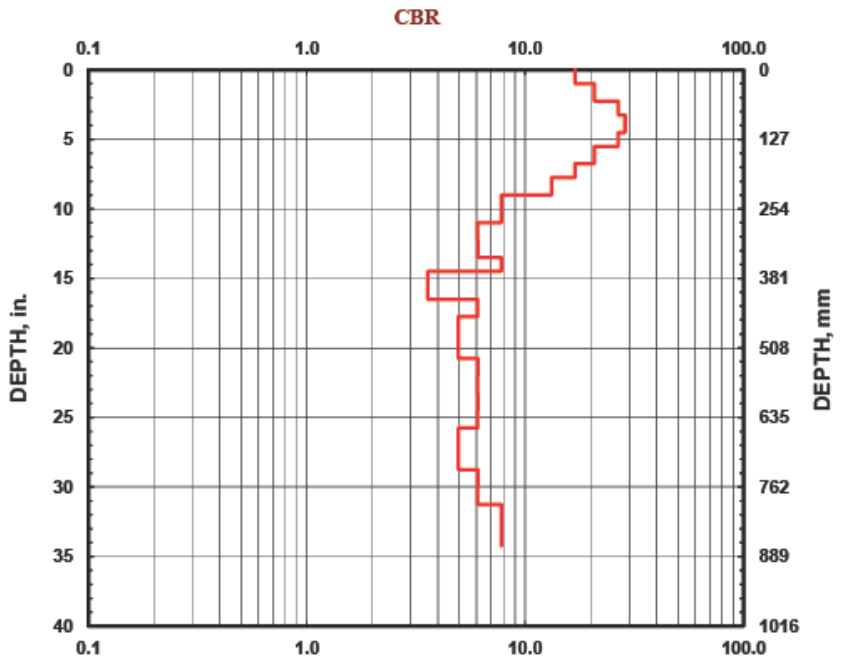
Project: *Road Safety Project* **Date:** 27-Jun-14

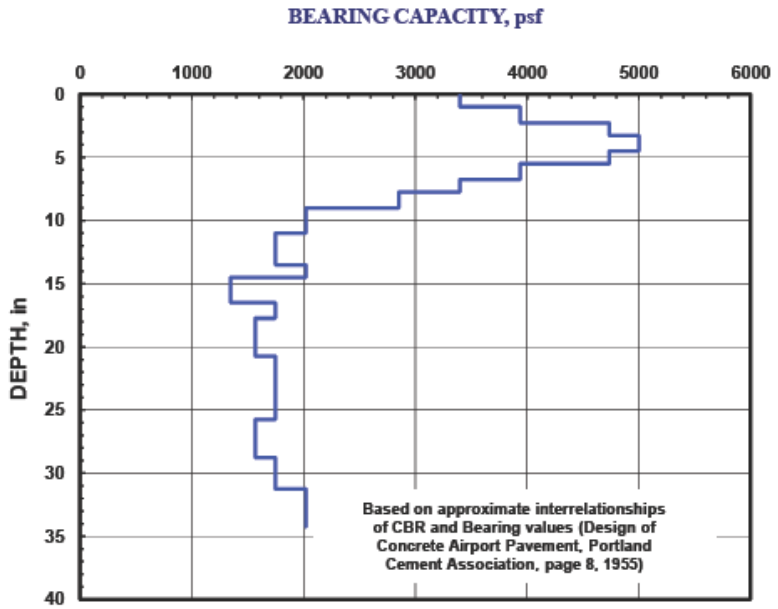
Location: Roaring Creek Bridge (B) **Soil Type(s):** Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
2	25.4	
3	57.2	
3	82.6	
4	114.3	
3	139.7	
3	171.5	
2	196.9	
2	228.6	
2	279.4	
1	311.2	
1	342.9	
1	368.3	
1	419.1	
1	450.9	
1	489	
1	527.1	
1	558.8	
1	590.6	
1	622.3	
1	654.1	
1	692.2	
1	730.3	
1	762	
1	793.8	
1	819.2	
1	844.6	
1	870	





DCP TEST DATA

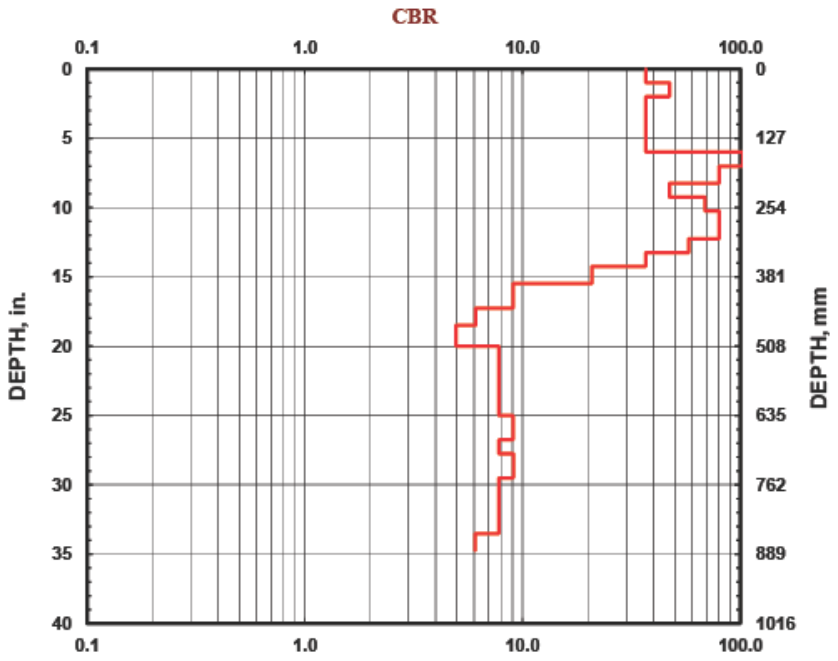
File Name: DCP-3

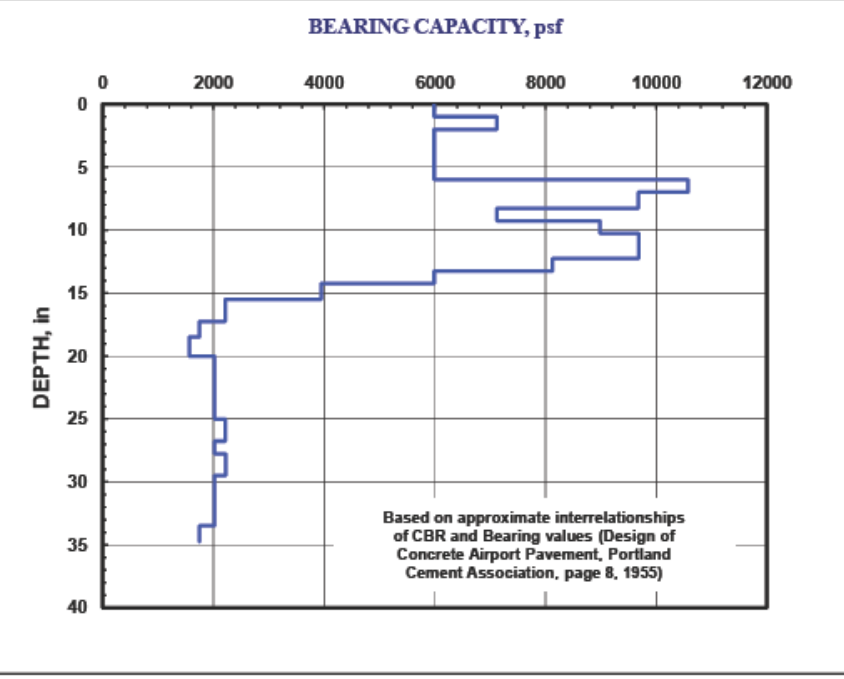
Project: *Road Safety Project*
Location: Camalote Village
Date: 27-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
4	25.4	
5	50.8	
4	76.2	
4	101.6	
4	127	
4	152.4	
10	177.8	
10	209.6	
5	235	
7	260.4	
8	285.8	
8	311.2	
6	336.6	
4	362	
3	393.7	
2	438.2	
1	469.9	
1	508	
1	533.4	
1	558.8	
1	584.2	
1	609.6	
1	635	
2	679.5	
1	704.9	
2	749.3	
1	774.7	
1	800.1	
1	825.5	
1	850.9	
1	882.7	





DCP TEST DATA

File Name: DCP-4

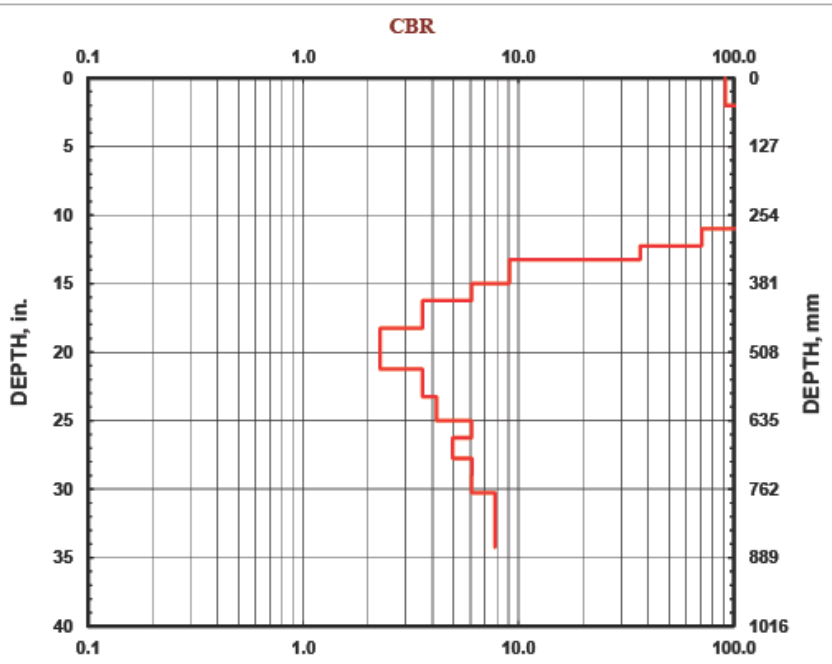
Project: *Road Safety Project* **Date:** 27-Jun-14

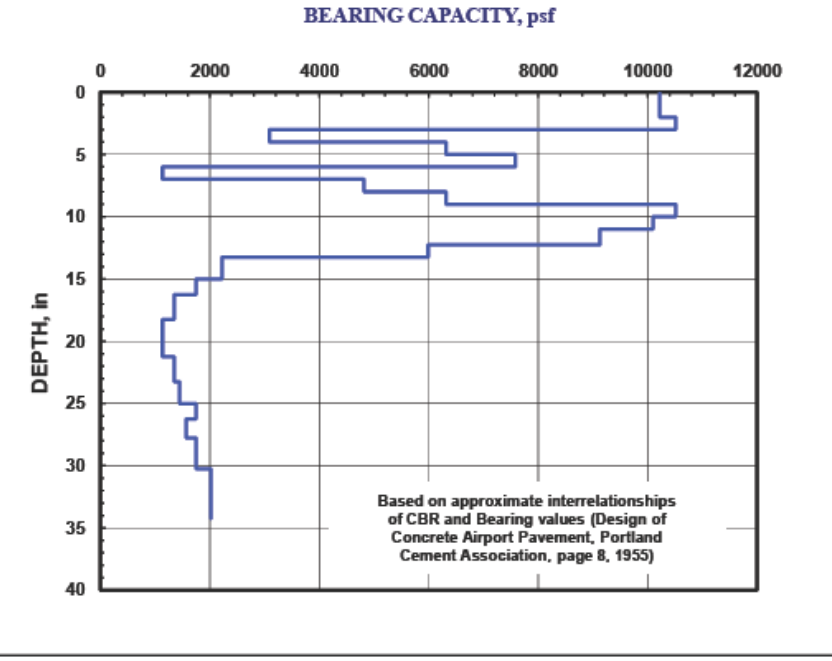
Location: Camalote Village (2) **Soil Type(s):** Type in the soil type

Hammer: ○ 10.1 lbs. ○ 17.6 lbs. ◉ Both hammers used

Soil Type: ○ CH ○ CL ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
9	25.4	
9	50.8	
13	76.2	
20	101.6	
18	127	
17	152.4	
21	177.8	
19	203.2	
18	228.6	
13	254	
14	279.4	
9	311.2	
4	336.6	
2	381	
1	412.8	
1	463.6	
1	539.8	
1	590.6	
1	635	
1	666.8	
1	704.9	
1	736.6	
1	768.4	
1	793.8	
1	819.2	
1	844.6	
1	870	





DCP TEST DATA

File Name: DCP-5

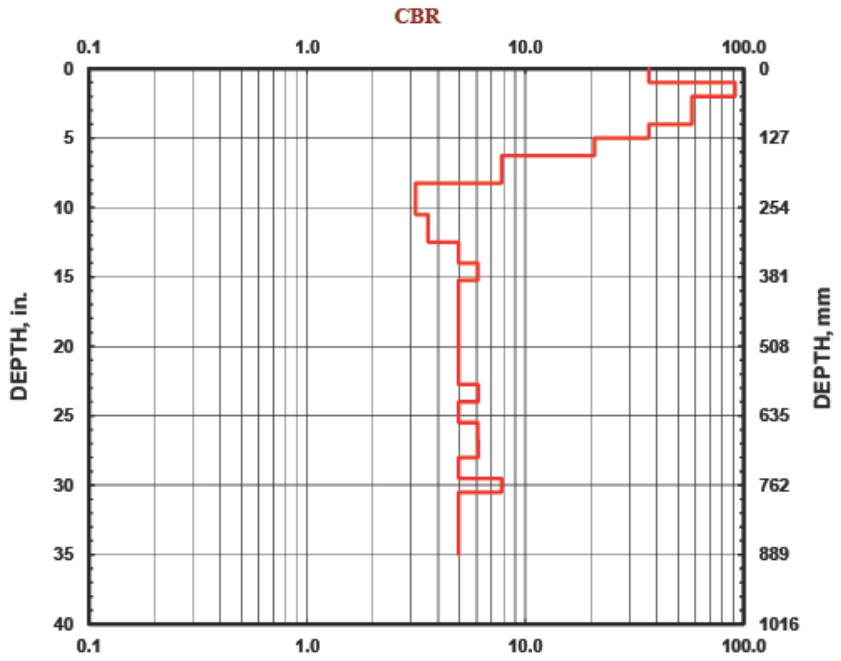
Project: *Road Safety Project* **Date:** 27-Jun-14

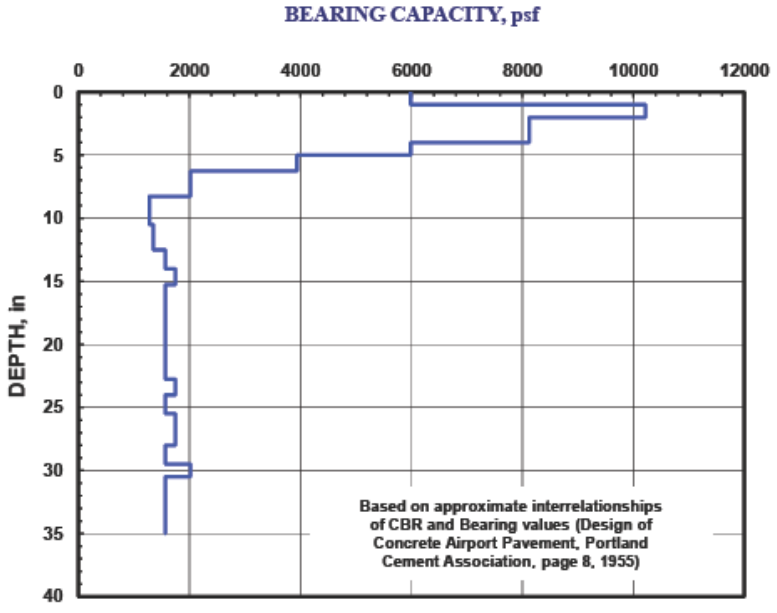
Location: Leslie's Resort **Soil Type(s):** Type in the soil type

Hammer: ○ 10.1 lbs. ○ 17.6 lbs. ◉ Both hammers used

Soil Type: ○ CH ○ CL ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
4	25.4	
9	50.8	
6	76.2	
6	101.6	
4	127	
3	158.8	
2	209.6	
1	266.7	
1	317.5	
1	355.6	
1	387.4	
1	425.5	
1	463.6	
1	501.7	
1	539.8	
1	577.9	
1	609.6	
1	647.7	
1	679.5	
1	711.2	
1	749.3	
1	774.7	
1	812.8	
1	850.9	
1	889	





DCP TEST DATA

File Name: DCP-6

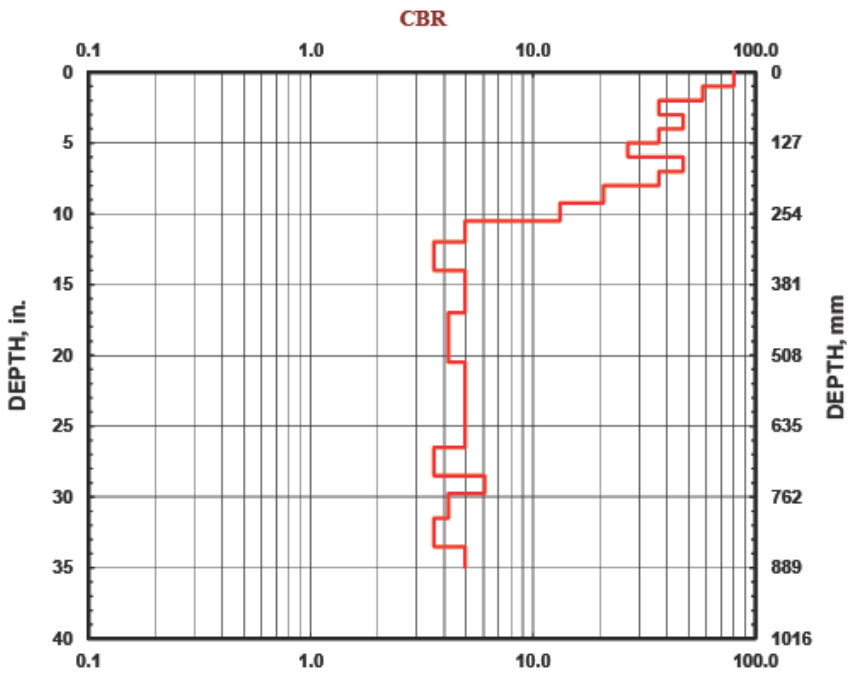
Project: *Road Safety Project* **Date:** 27-Jun-14

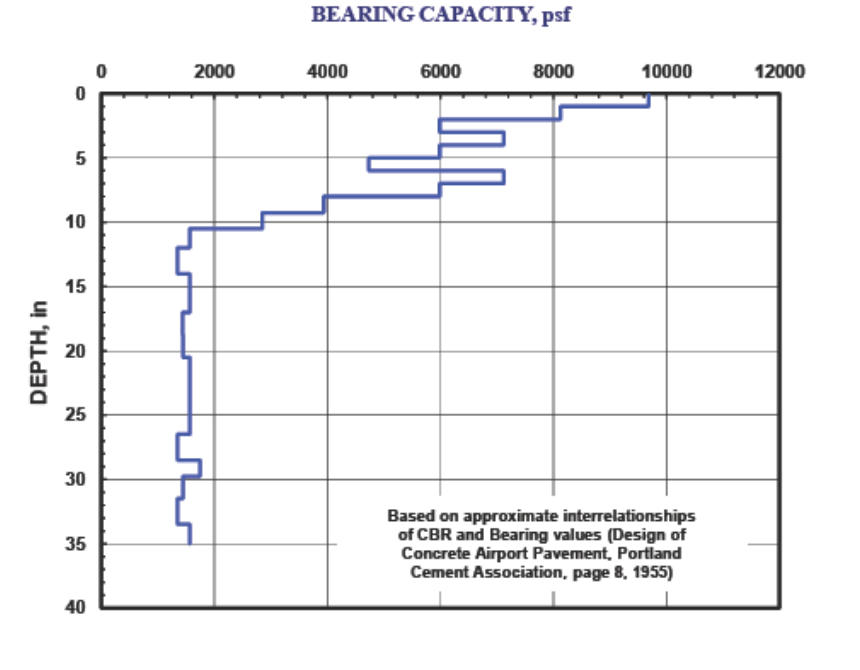
Location: Leslie's Resort (2) **Soil Type(s):** Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
8	25.4	
6	50.8	
4	76.2	
5	101.6	
4	127	
3	152.4	
5	177.8	
4	203.2	
3	235	
2	266.7	
1	304.8	
1	355.6	
1	393.7	
1	431.8	
1	476.3	
1	520.7	
1	558.8	
1	596.9	
1	635	
1	673.1	
1	723.9	
1	755.7	
1	800.1	
1	850.9	
1	889	





DCP TEST DATA

File Name: DCP-7

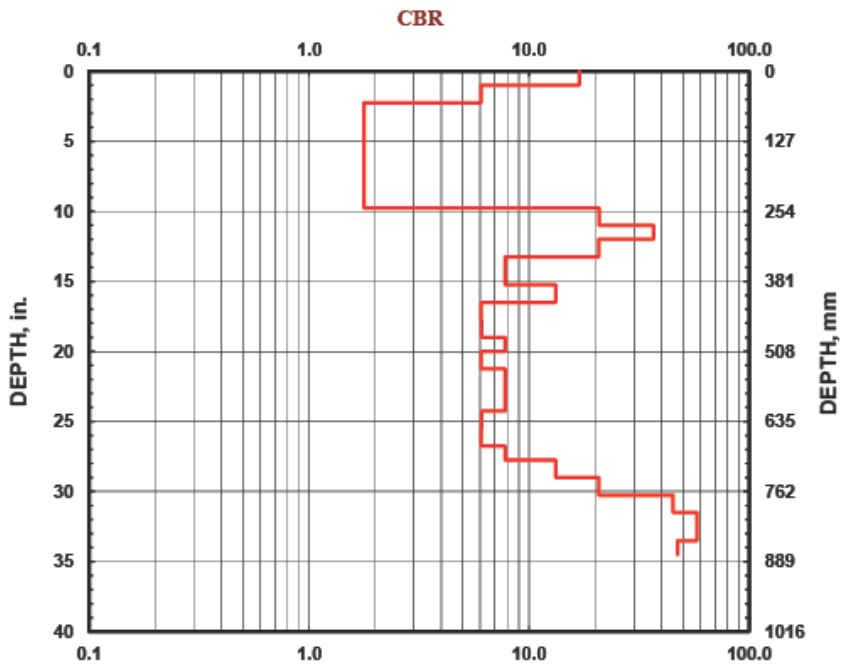
Project: *Road Safety Project* **Date:** 27-Jun-14

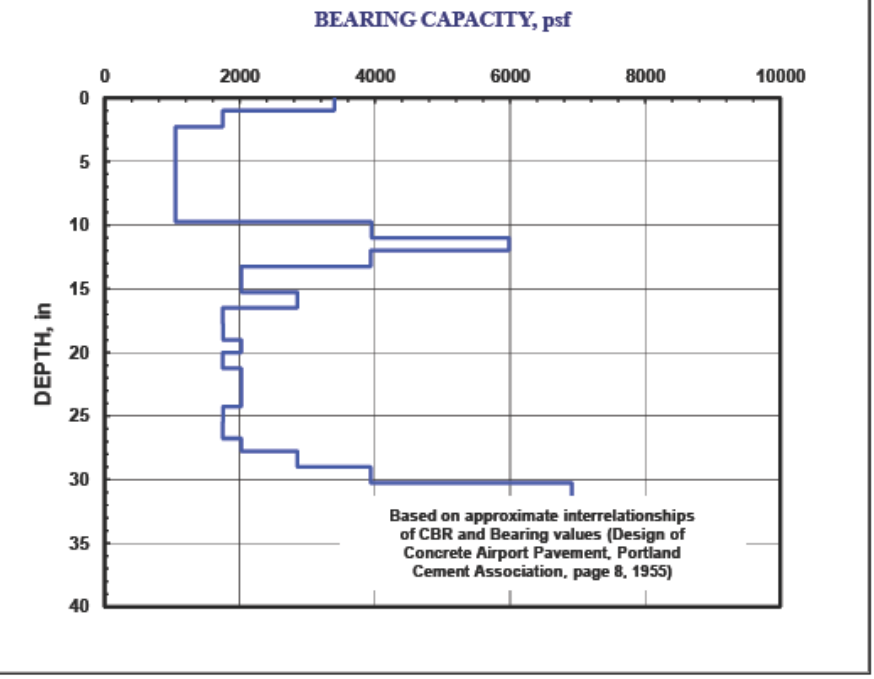
Location: By Btl Tower **Soil Type(s):** Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
2	25.4	
1	57.2	
1	152.4	
1	247.7	
3	279.4	
4	304.8	
3	336.6	
1	362	
1	387.4	
2	419.1	
1	450.9	
1	482.6	
1	508	
1	539.8	
1	565.2	
1	590.6	
1	616	
1	647.7	
1	679.5	
1	704.9	
2	736.6	
3	768.4	
6	800.1	
6	825.5	
6	850.9	
5	876.3	





DCP TEST DATA

File Name: DCP-8

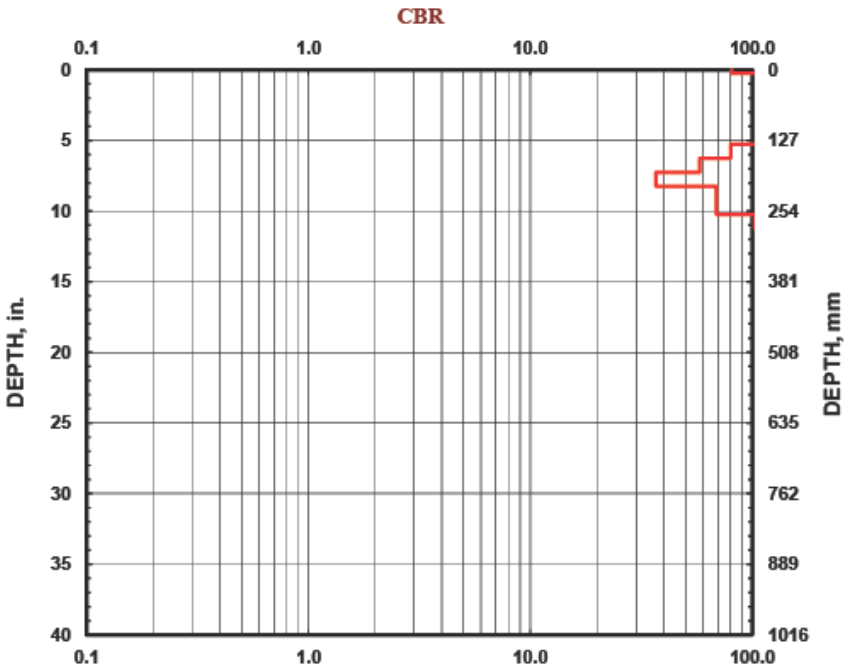
Project: *Road Safety Project* Date: 27-Jun-14

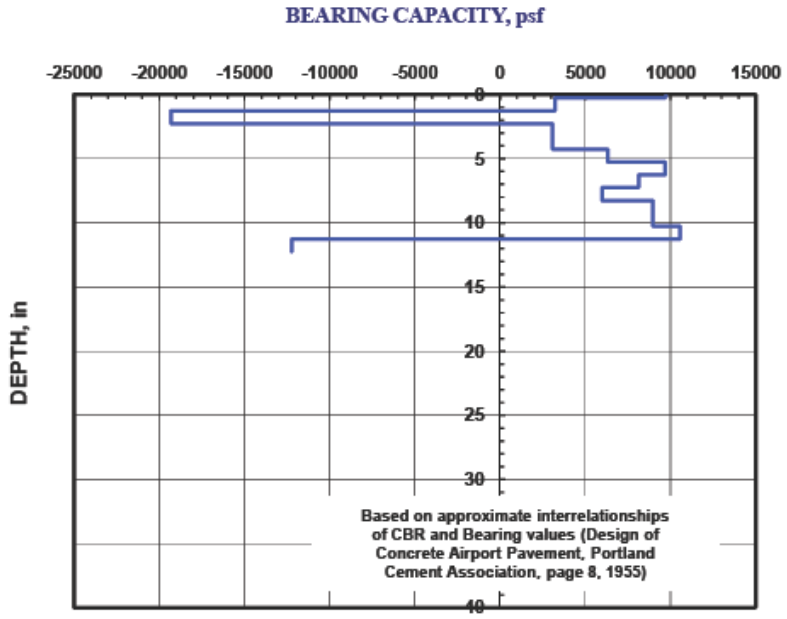
Location: 7.0 km By Btl Tower Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
2	6.3	
20	31.8	
28	57.2	
20	82.6	
20	108	
18	133.4	
8	158.8	
6	184.2	
4	209.6	
7	235	
7	260.4	
10	285.8	
26	311.2	





DCP TEST DATA

File Name: DCP-9

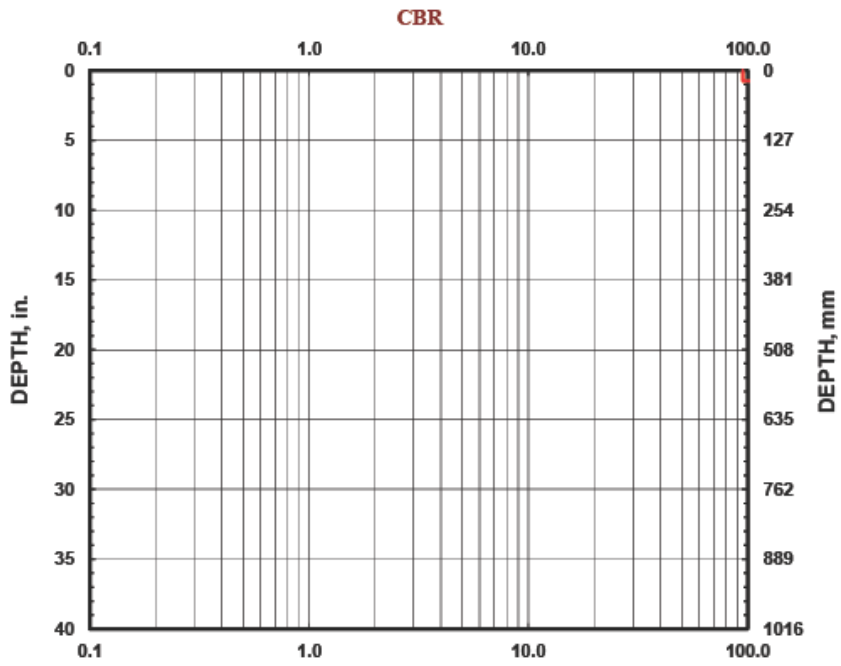
Project: *Road Safety Project*
Location:

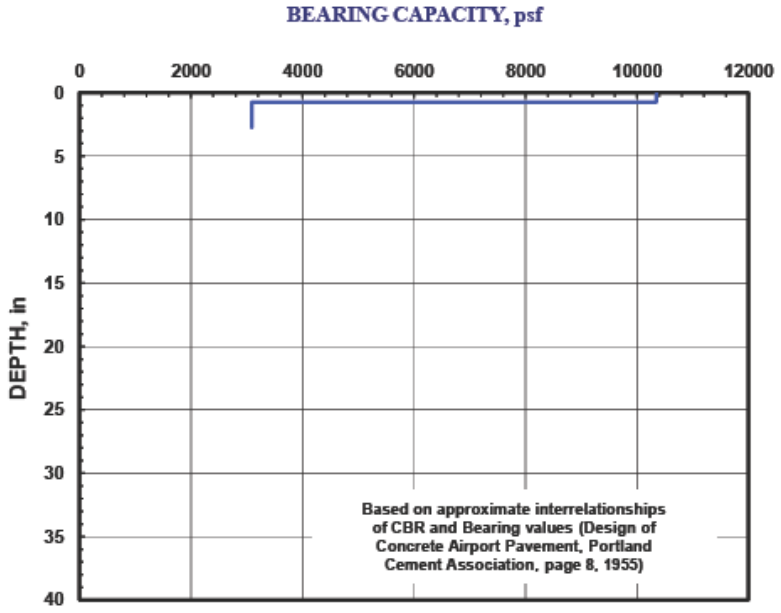
Date: 27-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
7	19.1	
20	44.5	
20	69.9	





DCP TEST DATA

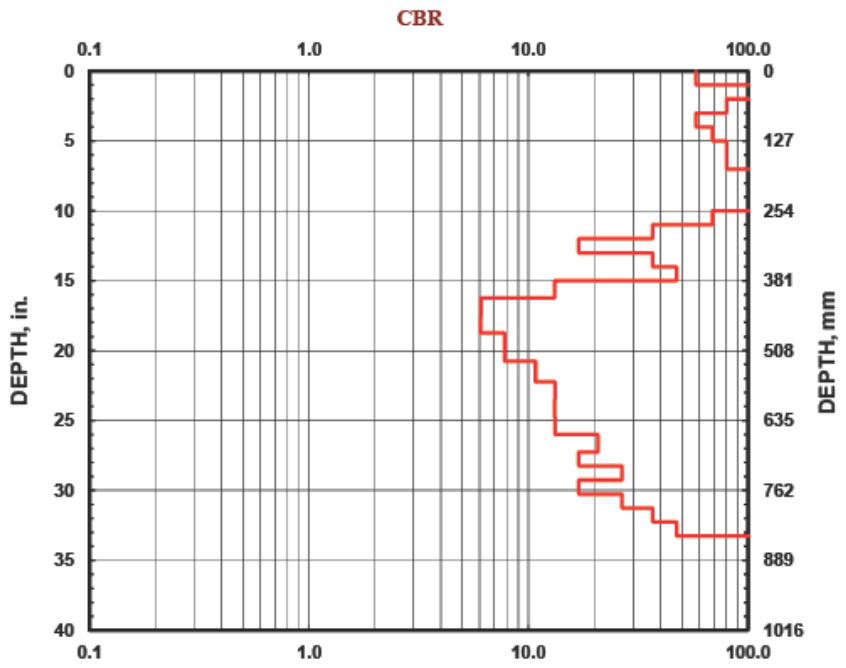
File Name: DCP-10

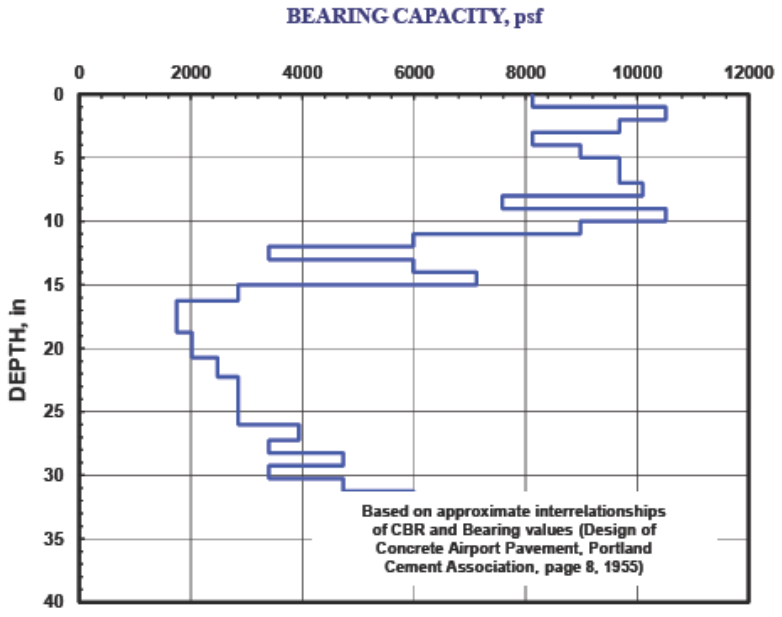
Project: *George Price Highway*
Location: 4.4 Teakettle Village
Date: 30-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
6	25.4	
13	50.8	
8	76.2	
6	101.6	
7	127	
8	152.4	
8	177.8	
14	203.2	
17	228.6	
13	254	
7	279.4	
4	304.8	
2	330.2	
4	355.6	
5	381	
2	412.8	
1	444.5	
1	476.3	
1	501.7	
1	527.1	
2	565.2	
2	596.9	
2	628.7	
2	660.4	
3	692.2	
2	717.6	
3	743	
2	768.4	
3	793.8	
4	819.2	
5	844.6	
11	870	





DCP TEST DATA

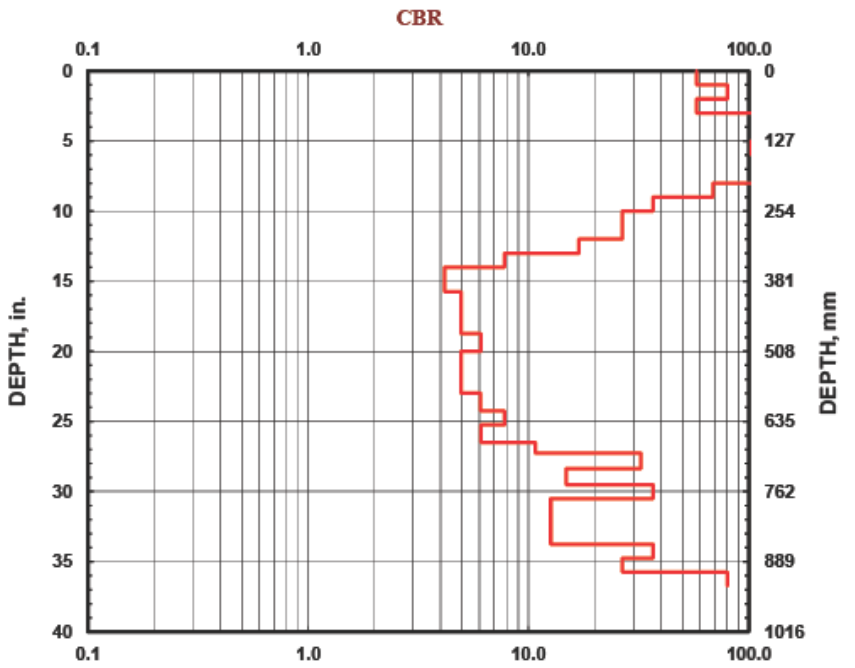
File Name: DCP-11

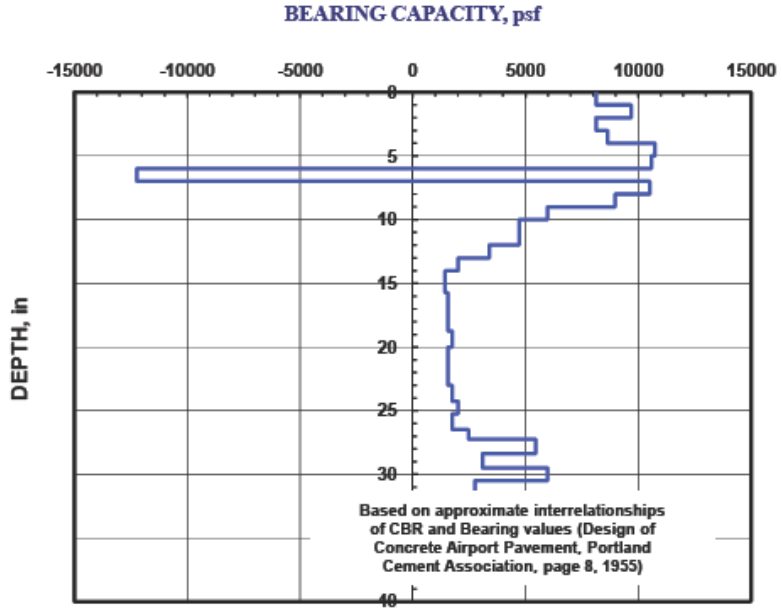
Project: *George Price Highway*
Location: 4.4 Teakettle Village
Date: 30-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
6	25.4	
8	50.8	
6	76.2	
16	101.6	
11	127	
10	152.4	
26	177.8	
13	203.2	
7	228.6	
4	254	
3	279.4	
3	304.8	
2	330.2	
1	355.6	
1	400.1	
1	438.2	
1	476.3	
1	508	
1	546.1	
1	584.2	
1	616	
1	641.4	
1	673.1	
1	692.2	
4	720.7	
2	749.3	
4	774.7	
5	857.3	
4	882.7	
3	908.1	
8	933.5	





DCP TEST DATA

File Name: DCP-12

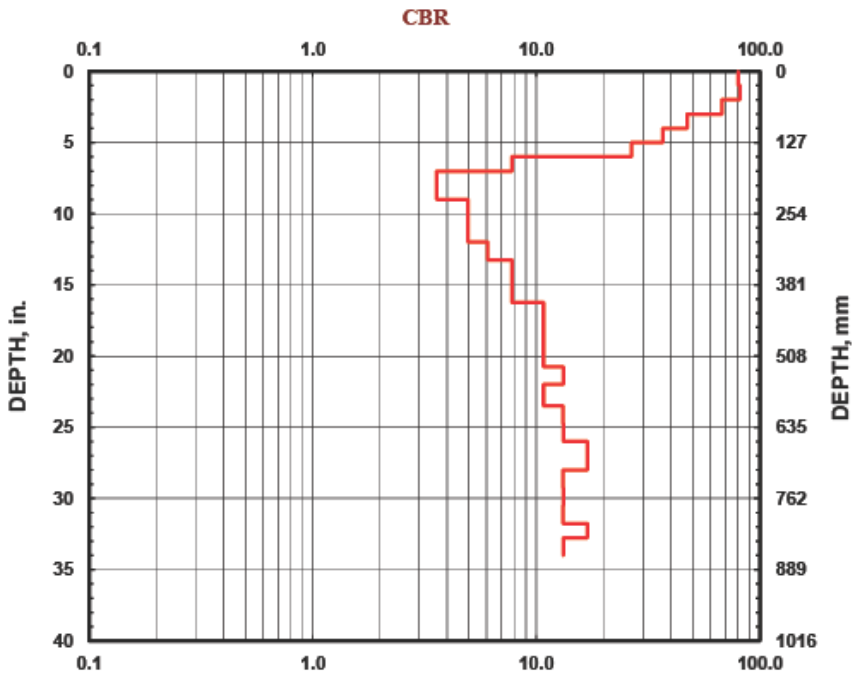
Project: *George Price Highway* **Date:** 30-Jun-14

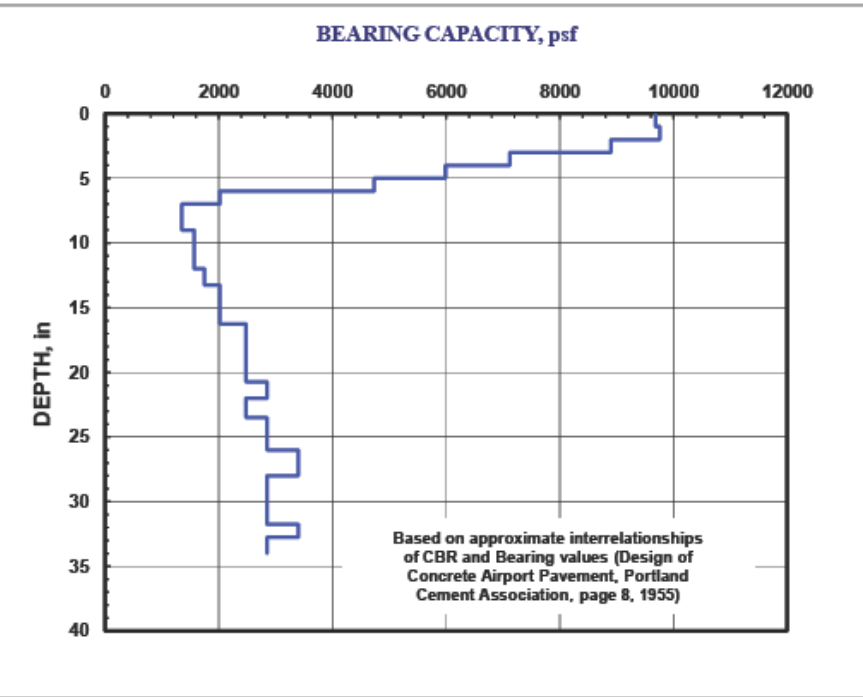
Location: 6.7 Ontario Village **Soil Type(s):** Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
8	25.4	
8	50.4	
7	76.2	
5	101.6	
4	127	
3	152.4	
1	177.8	
1	228.6	
1	266.7	
1	304.8	
1	336.6	
1	362	
1	387.4	
1	412.8	
2	450.9	
2	489	
2	527.1	
2	558.8	
2	596.9	
2	628.7	
2	660.4	
2	685.8	
2	711.2	
2	743	
2	774.7	
2	806.5	
2	831.9	
2	863.6	





DCP TEST DATA

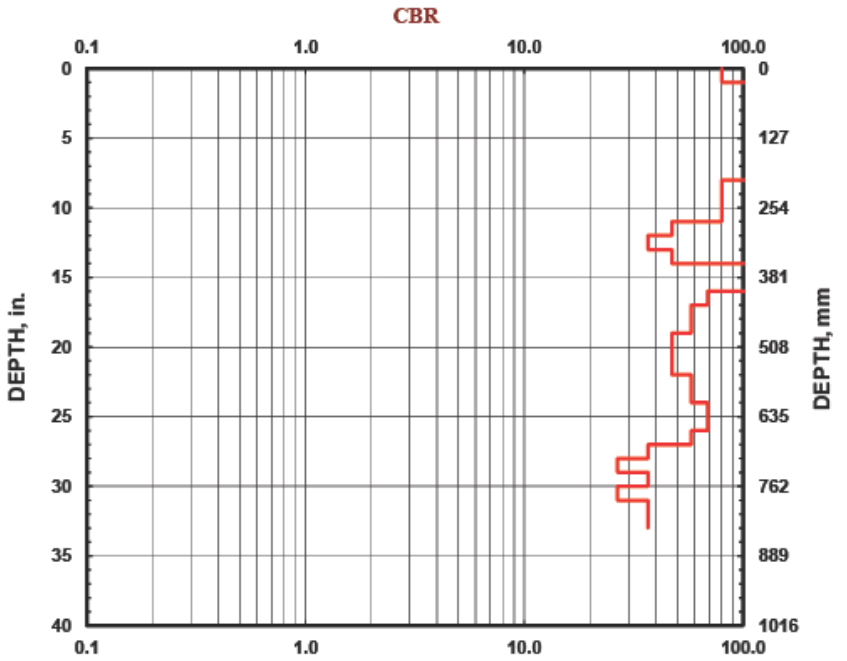
File Name: DCP-13

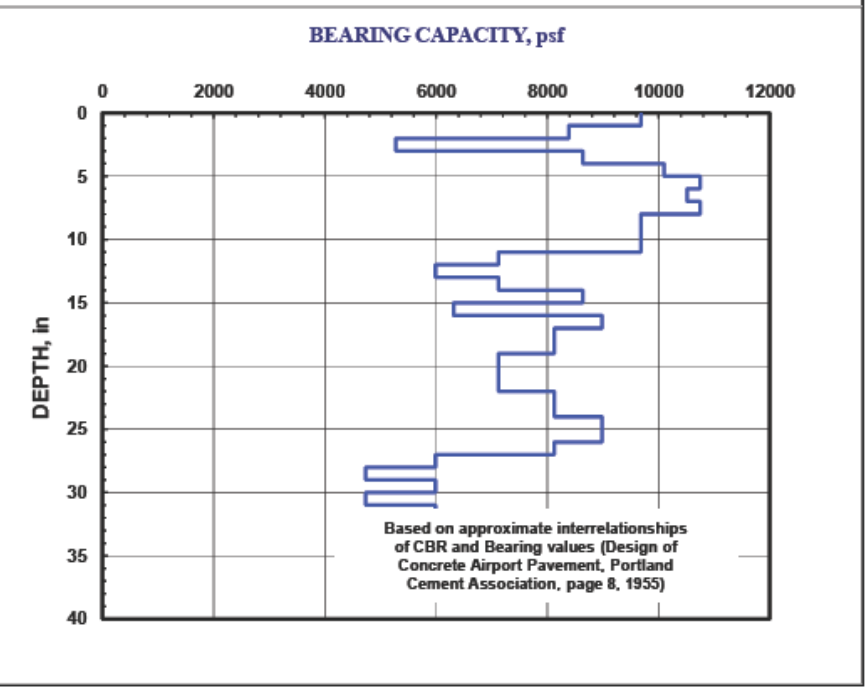
Project: *George Price Highway*
Location: 6.7 Ontario Village
Date: 30-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
8	25.4	
16	50.4	
19	76.2	
16	101.6	
14	127	
11	152.4	
13	177.8	
11	203.2	
8	228.6	
8	254	
8	279.4	
5	304.8	
4	330.2	
5	355.6	
16	381	
18	406.4	
7	431.8	
6	457.2	
6	482.6	
5	508	
5	533.4	
5	558.8	
6	584.2	
6	609.6	
7	635	
7	660.4	
6	685.8	
4	711.2	
3	736.6	
4	762	
3	787.4	
4	812.8	
4	838.2	





DCP TEST DATA

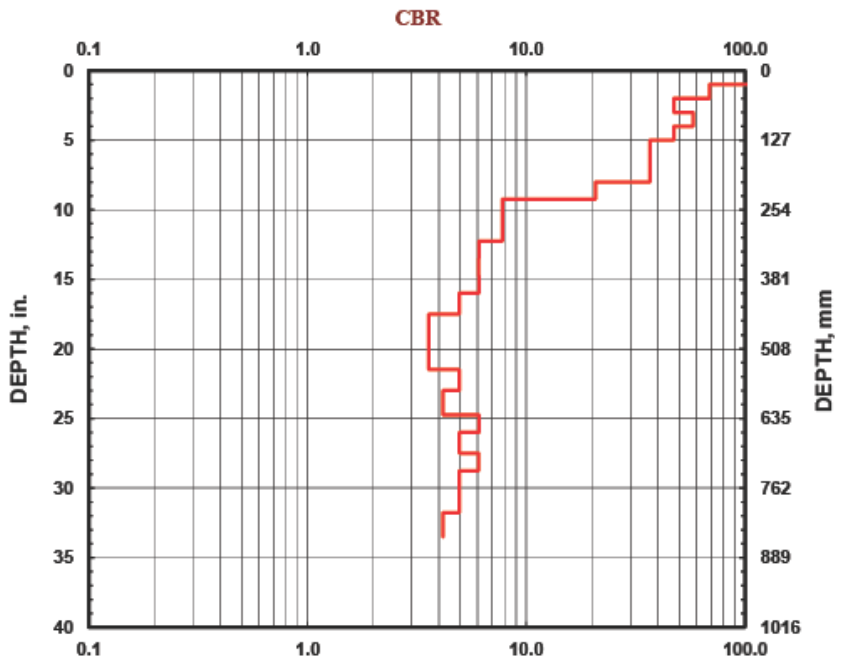
File Name: DCP-14

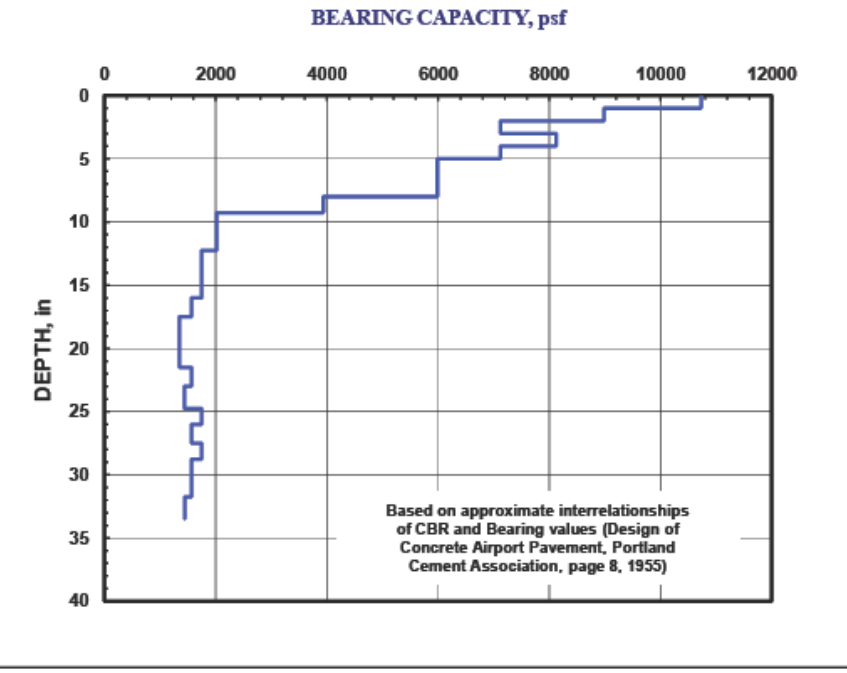
Project: *George Price Highway*
Location: 6.8 Ontario Village
Date: 30-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
12	25.4	
7	50.8	
5	76.2	
6	101.6	
5	127	
4	152.4	
4	177.8	
4	203.2	
3	235	
2	285.8	
1	311.2	
1	342.9	
1	374.7	
1	406.4	
1	444.5	
1	495.3	
1	546.1	
1	584.2	
1	628.7	
1	660.4	
1	698.5	
1	730.3	
1	768.4	
1	806.5	
1	850.9	





DCP TEST DATA

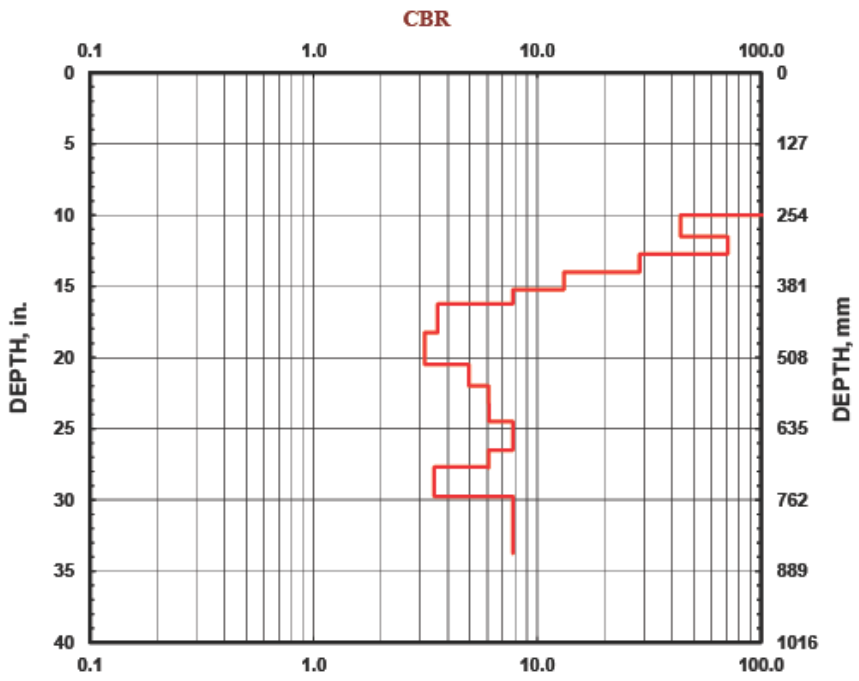
File Name: DCP-15

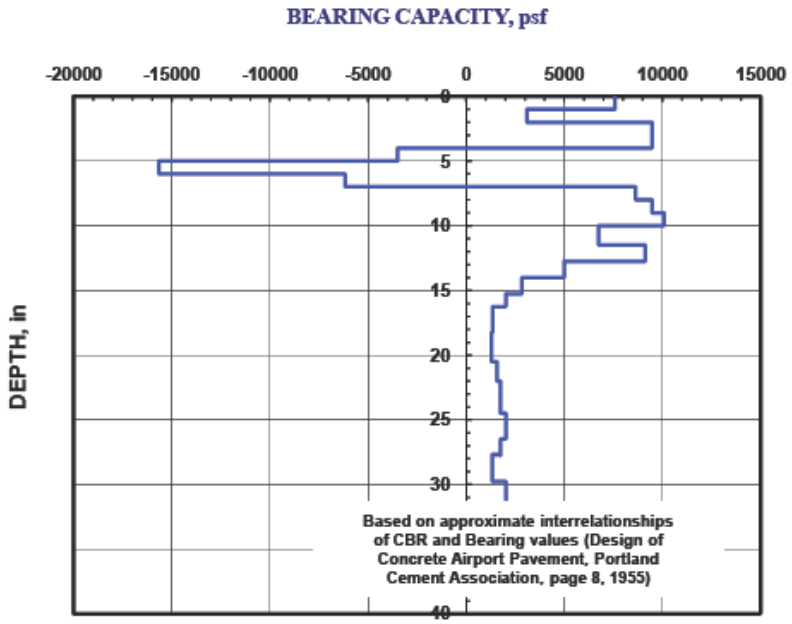
Project: *George Price Highway*
Location: 6.8 Ontario Village
Date: 30-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
17	25.4	
20	50.8	
15	76.2	
15	101.6	
23	127	
27	152.4	
24	177.8	
16	203.2	
15	228.6	
14	254	
7	292.1	
9	323.9	
4	355.6	
2	387.4	
1	412.8	
1	463.6	
1	520.7	
1	558.8	
1	590.6	
1	622.3	
1	647.7	
1	673.1	
1	704.9	
1	703.3	
1	755.7	
1	781.1	
1	806.5	
1	831.9	
1	857.3	





DCP TEST DATA

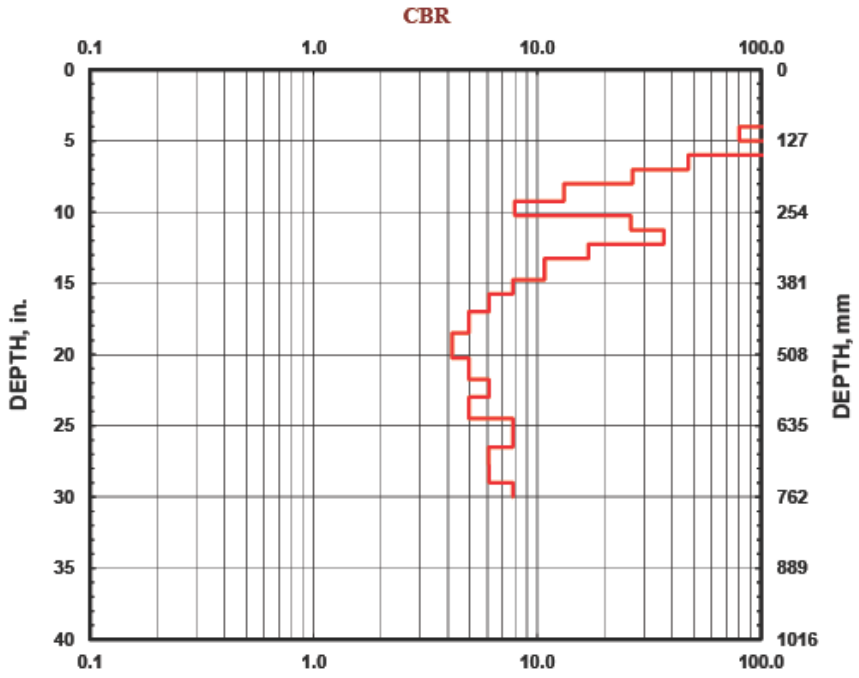
File Name: DCP-16

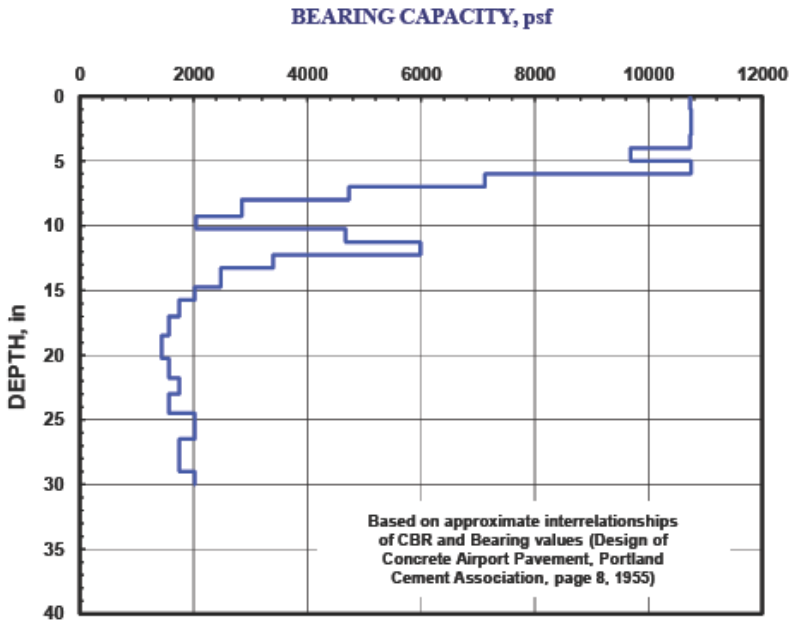
Project: *George Price Highway*
Location: 6.9 Ontario Village
Date: 30-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
12	25.4	
11	50.8	
11	76.2	
12	101.6	
8	127	
11	152.4	
5	177.8	
3	203.2	
2	235	
1	260	
3	285.8	
4	311.2	
2	336.6	
2	374.7	
1	400.1	
1	431.8	
1	469.9	
1	514.4	
1	552.5	
1	584.2	
1	622.3	
1	647.7	
1	673.1	
1	704.9	
1	736.6	
1	762	





DCP TEST DATA

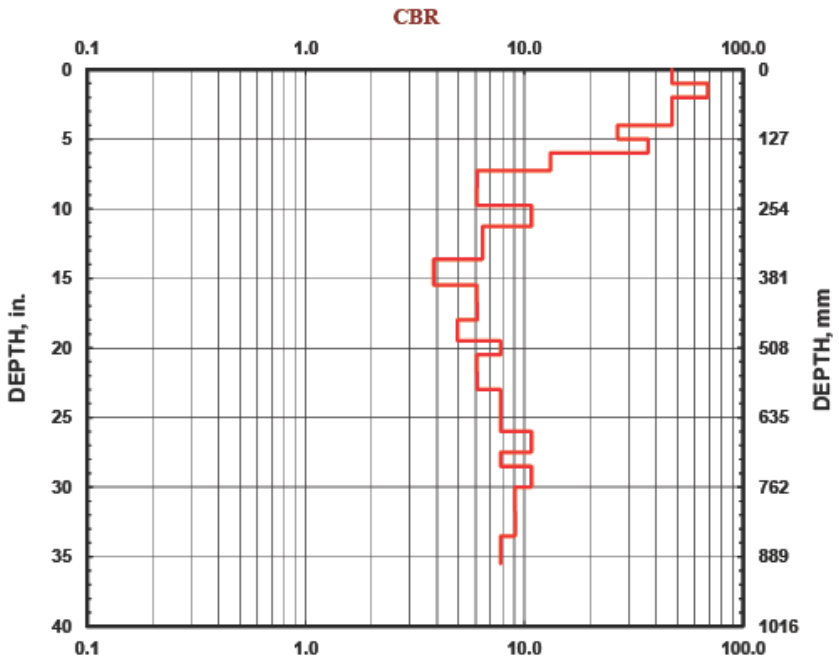
File Name: DCP-17

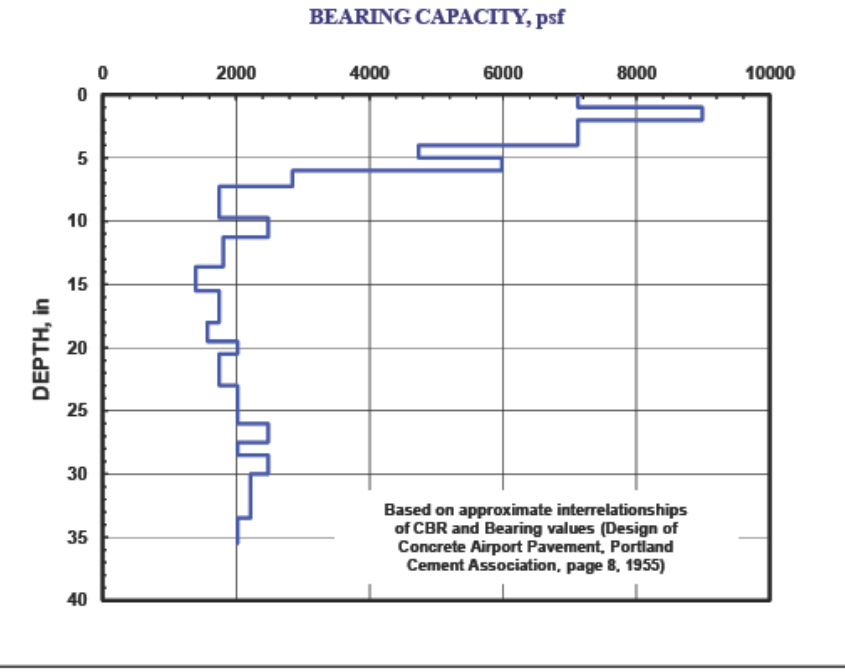
Project: *George Price Highway*
Location: 6.9 Ontario Village
Date: 30-Jun-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
5	25.4	
7	50.8	
5	76.2	
5	101.6	
3	127	
4	152.4	
2	184.2	
1	215.9	
1	247.7	
2	285.8	
2	346.1	
1	393.7	
1	425.5	
1	457.2	
1	495.3	
1	520.7	
1	552.5	
1	584.2	
2	635	
1	660.4	
2	698.5	
1	723.9	
2	762	
2	806.5	
2	850.9	
2	901.7	





DCP TEST DATA

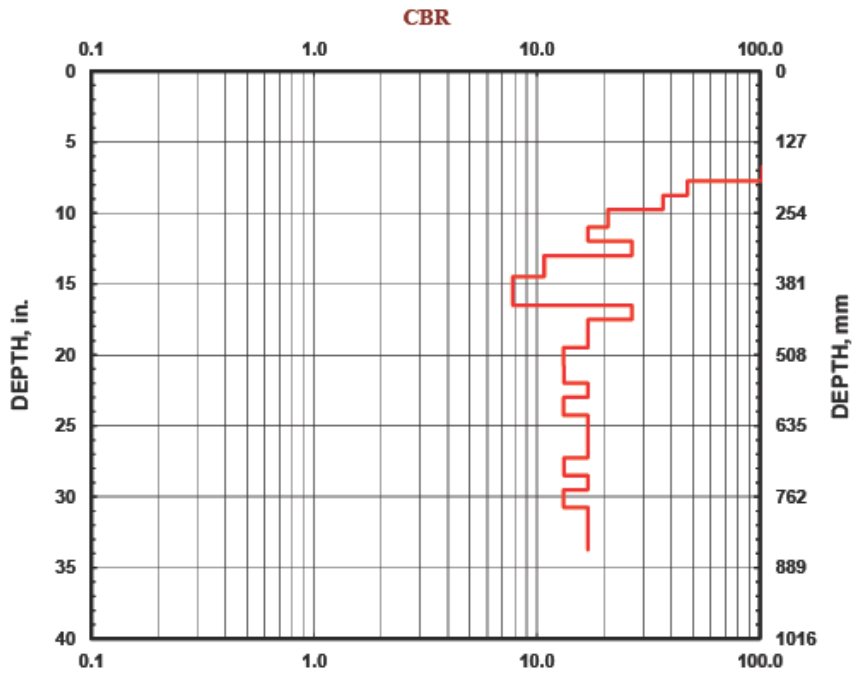
File Name: DCP-18

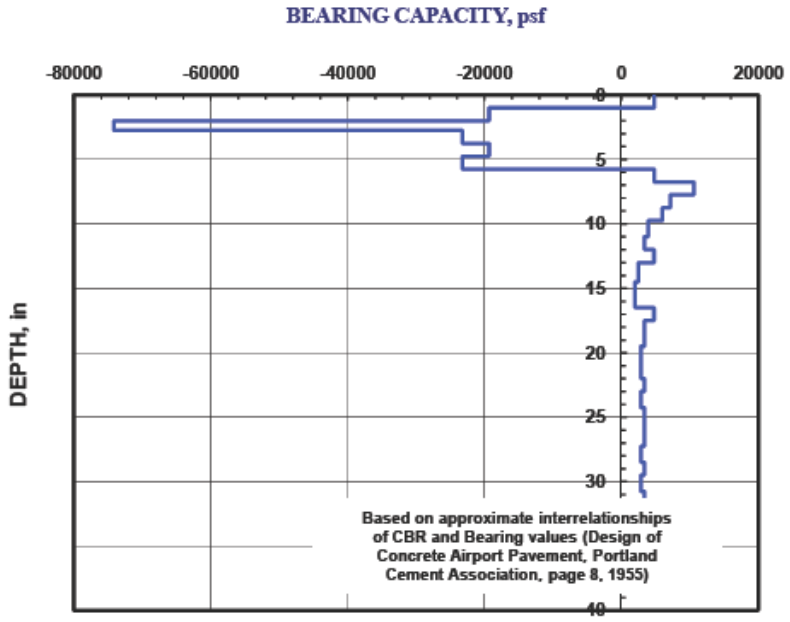
Project: *George Price Highway*
Location: 9.5 Mount Hope
Date: 2-Jul-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
19	25.4	
28	50.8	
29	69.9	
29	95.3	
28	120.7	
29	146.1	
19	171.5	
10	196.9	
5	222.3	
4	247.7	
3	279.4	
2	304.8	
3	330.2	
2	368.3	
1	393.7	
1	419.1	
3	444.5	
2	469.9	
2	495.3	
2	527.1	
2	558.8	
2	584.2	
2	616	
2	641.4	
2	666.8	
2	692.2	
2	723.9	
2	749.3	
2	781.1	
2	806.5	
2	831.9	
2	857.3	





DCP TEST DATA

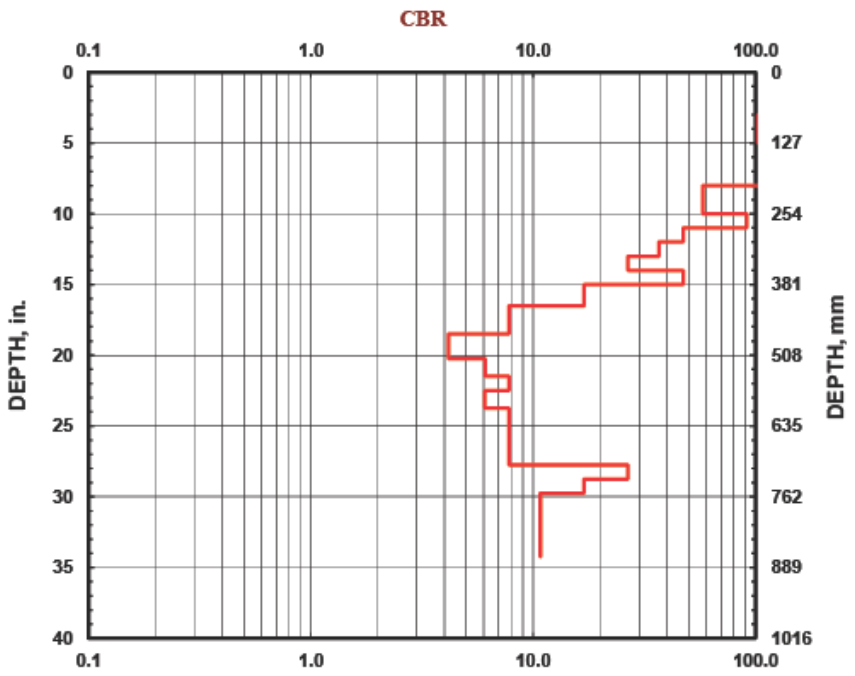
File Name: DCP-19

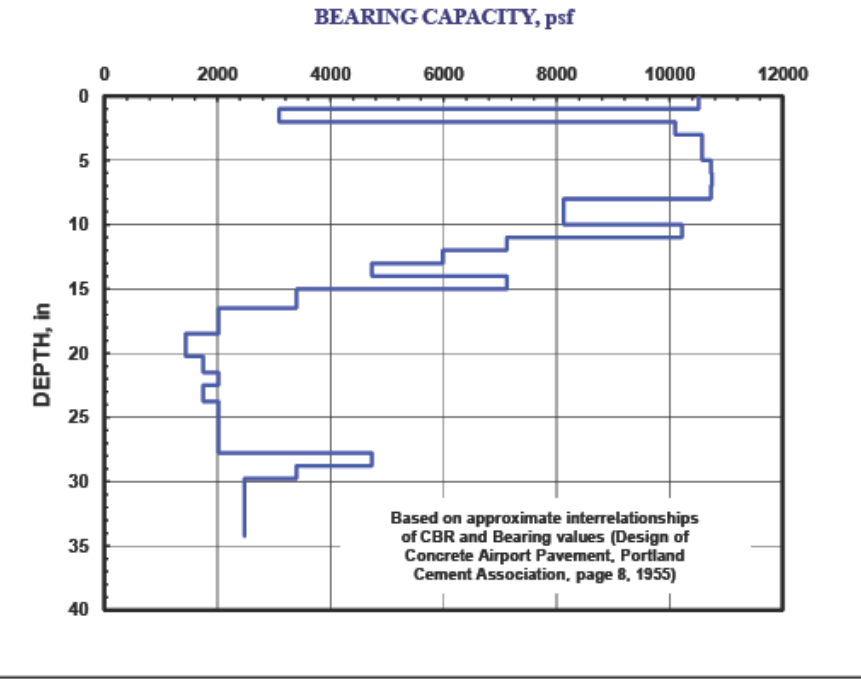
Project: *George Price Highway*
Location: 9.5 Mount Hope
Date: 2-Jul-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
13	25.4	
20	50.8	
14	76.2	
10	101.6	
10	127	
12	152.4	
11	177.8	
12	203.2	
6	228.6	
6	254	
9	279.4	
5	304.8	
4	330.2	
3	355.6	
5	381	
3	419.1	
2	469.9	
1	514.4	
1	546.1	
1	571.5	
1	603.3	
1	628.7	
1	654.1	
1	679.5	
1	704.9	
3	730.3	
2	755.7	
2	793.8	
2	831.9	
2	870	





DCP TEST DATA

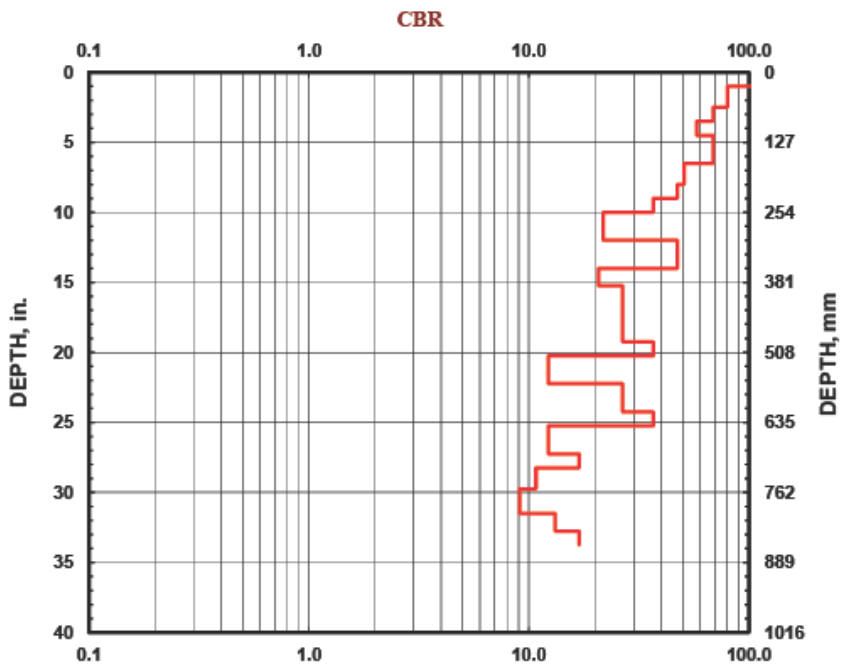
File Name: DCP-20

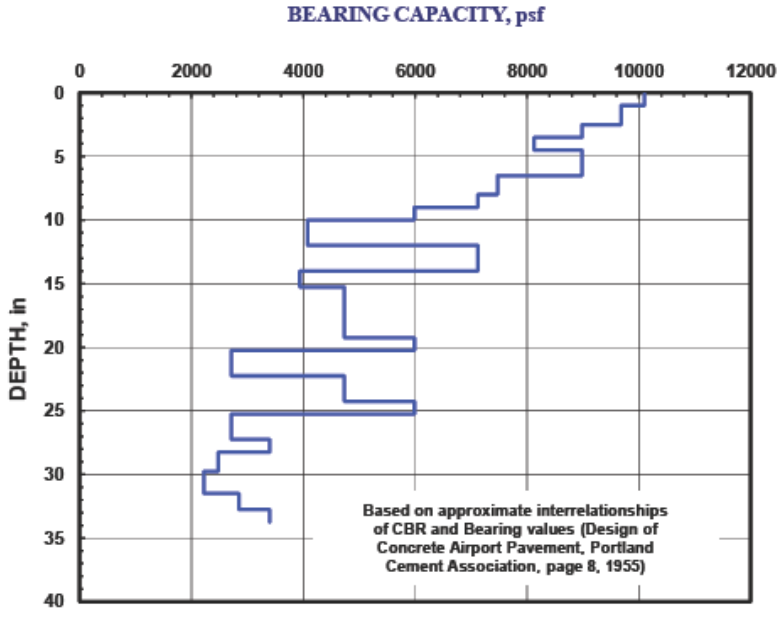
Project: *George Price Highway*
Location: 4.2 Benque Road
Date: 2-Jul-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
14	25.4	
12	63.5	
7	88.9	
6	114.3	
7	139.7	
7	165.1	
8	203.2	
5	228.6	
4	254	
5	304.8	
5	330.2	
5	355.6	
3	387.4	
3	412.8	
3	438.2	
3	463.6	
3	489	
4	514.4	
3	565.2	
3	590.6	
3	616	
4	641.4	
3	692.2	
2	717.6	
2	755.7	
2	800.1	
2	831.9	
2	857.3	





DCP TEST DATA

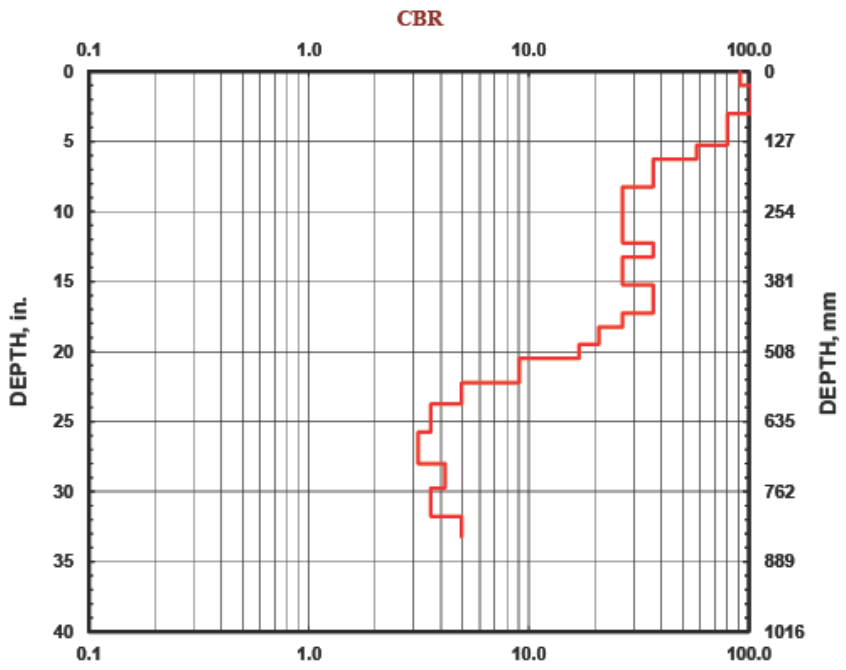
File Name: DCP-21

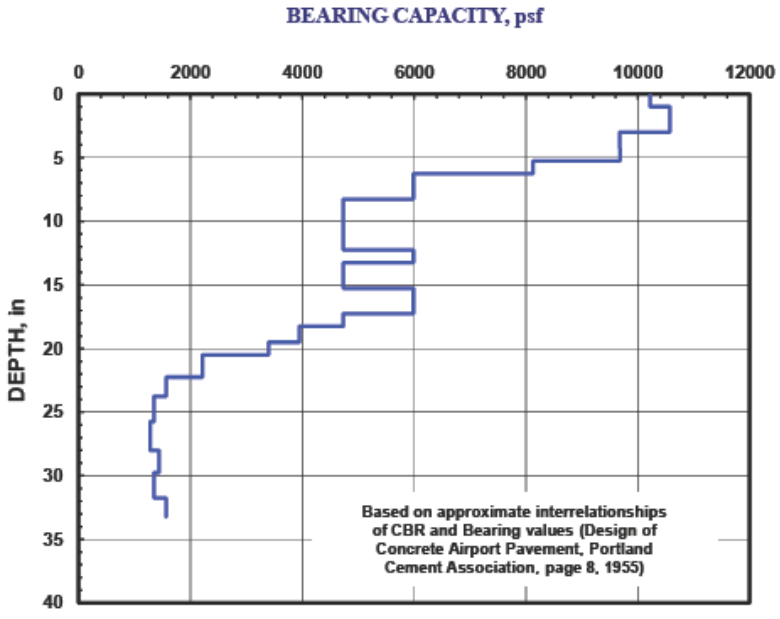
Project: *George Price Highway*
Location: 4.2 Benque Road
Date: 2-Jul-14
Soil Type(s): Type in the soil type

Hammer
- ○ 10.1 lbs.
- ○ 17.6 lbs.
- ◉ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	
9	25.4	
10	50.8	
10	76.2	
10	108	
8	133.4	
6	158.8	
4	184.2	
4	209.6	
3	235	
3	260.4	
3	285.8	
3	311.2	
4	336.6	
3	362	
3	387.4	
4	412.8	
4	438.2	
3	463.6	
3	495.3	
2	520.7	
2	565.2	
1	603.3	
1	654.1	
1	711.2	
1	755.7	
1	806.5	
1	844.6	





aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Roaring Creek Bridge	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 1

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1-6" 2'-0" 2'-6" 3'-0" 3'-6" 4-0" 4'-6" 5'-0" 5'-6" 6'-0" 6'-6" 7'-0" 7'-6" 8'-0" 8'-6" 8'-8"		BLACK SOIL BROWN CLAY (Loan). CREAM - BROWN CLAY (Stiff).

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Roaring Creek Bridge	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 2

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1'-6" 2'-0" 2'-6" 3'-0" 3'-6" 4'-0" 4'-6" 5'-0" 5'-6" 6'-0" 6'-6" 7'-0" 7'-6" 8'-0" 8'-6" 9'-0" 9'-6" 10'-0" 10'-6" 11'-0" 11'-6" 11'-8"		BLACK SOIL ORANGE - BROWN CLAY WITH SOME STONE AND BOULDERS. GRAY CLAY

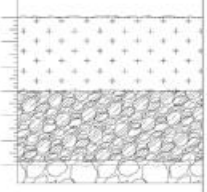
DESCRIPTION: NO WATER TABLE WAS OBSERVED, HOWEVER SIGNIFICANT FUMES (PRESUMED TO BE GASOLINE) WAS DISSIPATED DURING AND AFTER THE EXCAVATION.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	S CURVE	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 3

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1-6" 2'-0" 2'-6" 3'-0"		BLACK SOIL CREAM SAND, GRAVEL WITH SOME CLAY, COBBLE STONES AND BOULDERS. ROCK FRAGMENTS.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	S CURVE	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 4

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0"		
0'-6"		BLACK SOIL
1'-0"		
1-6"		CREAM SAND, GRAVEL WITH SOME CLAY, COBBLE STONES AND BOULDERS.
2'-0"		
2'-6"		
3'-0"		
3'-6"		
4'-0"		
4'-6"		BLACK SOIL WITH SOME GRAVEL AND CLAY.
5'-0"		
5'-6"		
6'-0"		
6'-5"		

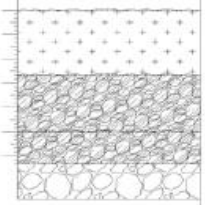
DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	S CURVE	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 5

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1'-6" 2'-0" 2'-6" 3'-0" 3'-2"		BLACK SOIL LIGHT BROWN CLAY, SAND AND GRAVEL WITH BOULDERS. CREAM CLAY, SAND AND GRAVEL WITH BOULDERS. ROCK FRAGMENTS.

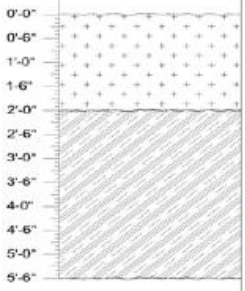
DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Spanish Lookout (Slip).	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 6

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" to 5'-6"		BLACK SOIL BROWN/ GREENISH CLAY

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Spanish Lookout (Slip).	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 7

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" – 1'-0"		BROWN CLAY WITH SAND AND GRAVEL.
1'-6" – 2'-0"		BLACK SOIL
2'-6" – 7'-0"		BROWN CLAY
7'-6" – 11'-10"		WHITE CLAY AND STONE.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Spanish Lookout (Slip).	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 8

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" – 0'-6"		BLACK SOIL
0'-6" – 1'-0"		BROWN CLAY WITH SAND AND GRAVEL.
1'-0" – 5'-6"		GRAY & BLACK CLAY.
5'-6" – 8'-6"		BROWN CLAY.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Barton Creek Bridge	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 9

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0"		BLACK SOIL
0'-6"		BROWN SAND WITH GRAVEL AND COBBLE STONE.
1'-0"		
1-6"		WHITE MARL, GRAVEL WITH COBBLE STONE AND BOULDERS.
2'-0"		
2'-6"		
3'-0"		
3'-6"		
4-0"		BROWN SAND WITH GRAVEL, COBBLE STONE AND BOULDERS.
4'-6"		
5'-0"		
5'-5"		

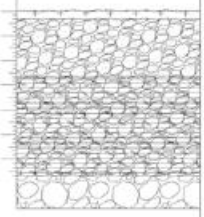
DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Garbutt Creek Bridge	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 10

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0"		BLACK SOIL
0'-6"		BROWN SAND WITH GRAVEL, COBBLE STONE AND BOULDERS.
1'-0"		
1-6"		
2'-0"		WHITE MARL WITH BOULDERS.
2'-6"		
3'-0"		
3'-4"		ROCK FRAGMENTS.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Garbutt Creek Bridge	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 11

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0"		
0'-6"		BLACK SOIL
1'-0"		BROWN SAND WITH GRAVEL AND BOULDERS.
1-6"		
2'-0"		WHITE MARL WITH GRAVEL.
2'-6"		
3'-0"		
3'-6"		BROWN SAND WITH GRAVEL, COBBLE STONE AND BOULDERS.
4-0"		
4-5"		ROCK FRAGMENTS.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Red Creek Bridge	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 12

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1-6" 2'-0" 2'-6" 3'-0" 3'-6" 4-0" 4'-6" 5'-0" 5'-6" 6'-0" 6'-6" 7'-0"		BLACK SOIL SOME WHITE MARL, CRUSHED SAND, GRAVEL WITH COBBLE STONE AND BOULDERS. BROWN CLAY WITH GRAVEL AND BOULDERS.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	Red Creek Bridge	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 13

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0"		
0'-6"		BLACK SOIL
1'-0"		WHITE MARL, GRAVEL WITH COBBLE STONE AND BOULDERS.
1-6"		
2'-0"		BOULDERS WITH SOME SAND AND GRAVEL.
2'-6"		
3'-0"		WHITE MARL WITH GRAVEL AND BOULDERS.
3'-6"		
4-0" 4-2"		BROWN SAND WITH GRAVEL, COBBLE STONE AND BOULDERS.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	San Jose Succotz	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 14

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0"		BLACK SOIL
0'-6"		RIVER SAND AND GRAVEL.
1'-0"		
1-6"		
2'-0"		SANDY GRAY CLAY WITH LIME STONE ROCKS.
2'-6"		
3'-0"		SANDY BROWN CLAY.
3'-6"		
4-0"		
4'-6"		
5'-0"		
5'-6"		
6'-0"		
6'-5"		

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	San Jose Succotz	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 15

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1'-6" 2'-0" 2'-6" 3'-0" 3'-6" 4'-0" 4'-6" 5'-0" 5'-6" 6'-0" 6'-6" 6'-9"		BLACK SOIL FINE BROWN SAND WITH A HINT OF BROWN CLAY.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	San Jose Succotz	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 16

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1-6" 2'-0" 2'-6" 3'-0" 3'-6" 4-0" 4'-6" 5'-0" 5'-6" 6'-0" 6'-2"		BLACK SOIL WHITE MARL WITH GRAVEL AND BOULDERS. FINE BROWN SAND WITH A HINT OF BROWN CLAY.

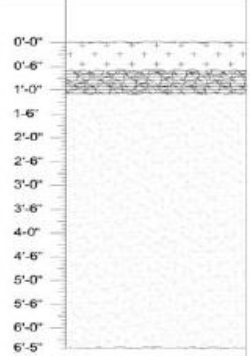
DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	San Jose Succotz	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 17

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1'-6" 2'-0" 2'-6" 3'-0" 3'-6" 4'-0" 4'-6" 5'-0" 5'-6" 6'-0" 6'-5"		BLACK SOIL WHITE MARL WITH GRAVEL AND BOULDERS. FINE BROWN SAND. 

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	San Jose Succotz	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 18

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0"		
0'-6"		BLACK SOIL
1'-0"		WHITE MARL WITH GRAVEL AND BOULDERS.
1-6"		
2'-0"		
2'-6"		
3'-0"		ROCK FRAGMENTS.
3'-3"		

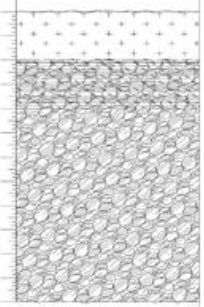
DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	San Jose Succotz	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 19

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1'-6" 2'-0" 2'-6" 3'-0" 3'-6" 4'-0" 4'-6" 5'-0" 5'-6" 6'-0"		BLACK SOIL WHITE MARL WITH GRAVEL AND BOULDERS. BROWN CLAY, SAND & GRAVEL WITH BOULDERS AND COBBLE STONES.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

aTa Lab **INSPECTION PIT**

CLIENT:	Ministry Of Works and Transport	**DATE OF TEST:**	July 10, 2014
PROJECT:	George Price Highway	**JOB NO:**	J1944/14
LOCATION:	San Jose Succotz	**TECHNICIAN:**	Anthony Thurton Jr.

INSPECTION PIT 20

TYPE OF BORING : TRENCH EXCAVATION
DIAMETER OF BORING : NA
WATER TABLE : NONE FOUND

DEPTH FT / INS	SOIL LEGEND	DESCRIPTION OF STRATA
0'-0" 0'-6" 1'-0" 1-6" 2'-0" 2'-6" 3'-0" 3'-6" 4-0" 4'-6" 5'-0" 5'-6" 5'-8"		BLACK SOIL WHITE MARL WITH GRAVEL AND BOULDERS. BROWN CLAY, SAND & GRAVEL WITH BOULDERS.

DESCRIPTION: NO WATER TABLE WAS ODSERVED.

Annex V: Climate Change Projections Belize

Climate Change Projections Belize

The results of analysis of climatic trends and future climate model projections for the western Caribbean region and Belize indicate that over the past 50 years temperatures have been rising steadily and are projected to continue along this trend; rainfall variability has increased, and will likely become even more pronounced in the future; increases in seasonal evapotranspiration rates noted over the recent past, while significant decrease in wet season moisture surpluses is foreseen; and global sea levels have risen over the past 130 years, and are forecast to continue rising during the 21st century.

The study show that for the period 1961-2013, the annual *average minimum* temperature at the Philip S.W, Goldson International Airport (PSWGIA) has been increasing at the rate of 0.028 °C per annum or has risen by 1.4 °C over the past 52 years. In the case of annual *average maximum* temperature for the period 1961-2013 at the PSWGIA, the analysis indicates that the average maximum temperature has been rising at the rate of 0.0133 °C per annum or about 0.6 °C in the past 45 years. The *annual average* temperature at the Philip Goldson International Airport has increased by 0.5 °C since 1961. The study show that the nights are warming up faster than the days, but in general the temperatures in Belize are rising.

A trend analysis of the historic rainfall for Belize City since 1887 to the present showed a 4.6 mm per annum decrease in rainfall or 46 mm decrease per decade, which translates to 480 mm decrease in annual rainfall over the past 126 years. Annual rainfall trend for the historic rainfall record 1901-2013 for central Belize (Mitchell, 2013) revealed an increasing trend of 7.6 mm per decade or 82 mm increase over the 108 years record. For the shorter rainfall record running from 1960-2013 for PSWGIA, the analysis shows a slight increasing trend of 1.4 mm per annum or 14 mm per decade, which amounts to 74 mm increase in annual rainfall totals for the past 53 years. Meanwhile, for northern Belize rainfall trend analysis for the period 1992 to 2013 at Towerhill indicates a rise of about 275 mm over the twenty-three years. In short, the trend analysis indicates that wet years have been more frequent at the end of the 20th century and the first decade of the 21st century, with higher frequency of short, but intense rainfall events as was experienced with the upsurge of tropical cyclone activity in the western Caribbean during the 1990-2010 decades.

Trend analysis for seasonal evapotranspiration rates (E) for central Belize indicate that the greatest increase occurred during the June – July – August (JJA) at the rate of 3.4 mm per season over the 30 year period 1980-2010. Meanwhile, global sea levels have been rising at the rate of 0.0162 cm per annum or have seen a rise of near 21 cm for the period 1880-2010 (CISRO, 2012).

Analysis of PRECIS-Echam5 Regional Climate Model (RCM) projections results suggested that Belize will experience temperature increases of near 2 ℃ by the 2050s under the IPCC A2 scenario, and almost 4 ℃ increase by the 2080s relative to the baseline period 1961-1990. RCM projections for the 2050s show percent change in rainfall in the order of -20 % to – 30 % from the reference period 1961-1990 under the A2 scenario (worst case), and around -50 % to -60 % change from normal by the 2080s.

Projections of atmospheric moisture deficit/surplus (P-E) show that by the 2080s, dry month deficit will decrease slightly, while the wet season months (JJA & SON) will see a decrease in moisture surpluses. This means that the dry seasons will be slightly less intense around the 2080s, but the wet seasons will become drier. The repercussions for rain-fed agriculture could be detrimental, to say the least.

Sea surface temperature are projected to rise at an average of 0.7 °C to 2.7 °C in the Caribbean by 2080.

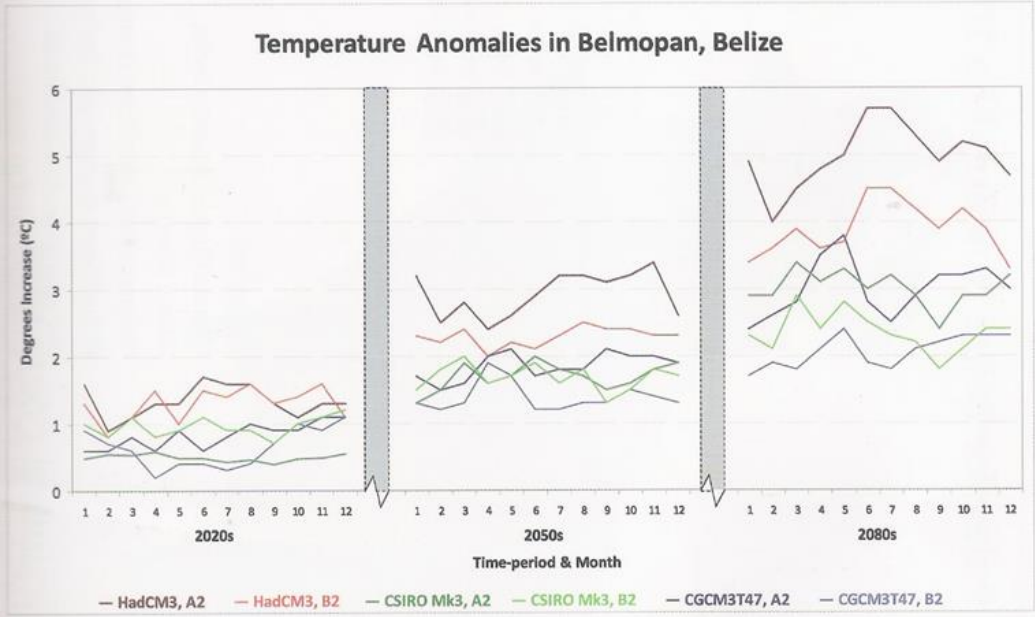
The coastal lowlands in northern Belize will be vulnerable to sea-level rise according to the global climate model projections. Between 2046 and 2065 the mean increase in sea levels for the different scenarios will range from 0.17 m to 0.3 m with 0.38 m being at the extreme value. For the period 2081 to 2100 this average increases and ranges between 0.4 m and 0.63 m with 0.82 m as the extreme.

Oak Ridge National Laboratory and NASA Meso-scale Modelling System, version 3.6, (RCM) for Mexico and Central America

Downscaled global model projections using the Oak Ridge National Laboratory and NASA Meso-scale Modelling System, version 3.6 for Central America (2005) at a resolution of 12 km, was used to project mean temperature and precipitation for Mexico, Central America and the Dominican Republic by personnel of the Water Centre for the Humid Tropics of Latin America and the Caribbean, CATHALAC (Anderson, *et al.* 2008). Using various GCMs results for boundary conditions and for both the A2 and B2 climate scenarios, the meso-scale model generated monthly temperature anomalies and per cent changes in rainfall from the baseline period 1961-1990 for the 2020s, 2050s and 2080s for Belize. Figure 1a-b shows the monthly anomalies of temperature and per cent change in rainfall for Belmopan, which was one of several outputs from the climate experiments.

The results show a warming trend from close to 1 ℃ increase in the 2020s to near around a median of 3 ℃ by the 2080s. Decreasing changes in rainfall will be greater in the May through October period, ranging from -25 % to near -60 % by the 2080s in the Belmopan area. Another output was a Climate Change Severity Index evaluated for the region, including Belize. The Climate Change Severity Index is a combination of the Temperature Severity Index and the Rainfall Severity Index. It shows that by the 2020s the Toledo and Corozal Districts, and the

highlands of the Cayo District will be approaching significant change in temperature and rainfall, while the rest of central and western Belize, including most of the Orange Walk District will experience significant changes that will vary annually.



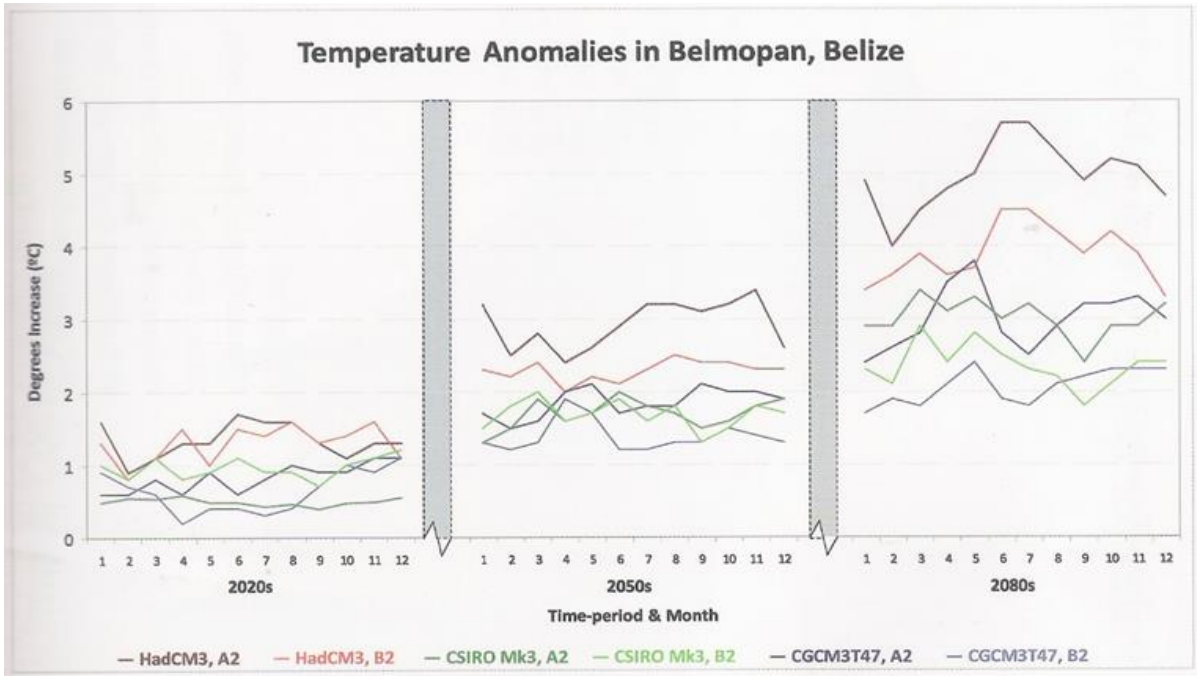


Figure 1 a-b: Temperature and Rainfall anomalies for Belmopan for the 2020s, 2050s and 2080s (Anderson, et. al. 2005)

PRECIS Climate Model Projections

Table 2 below shows a summary of the PRECIS-Echam4 A2 & B2 model projections of mean surface temperature (°C) and per cent (%) change in rainfall in June-July-August (JJA) for various localities in Belize for 2020-2025 and 2080-2085 relative to the baseline period 1970-2000. Mean surface temperatures at all localities in Belize are projected to rise to near 1.0 °C by 2020-2025 relative to the 1970-2000 climatology, and to near 4 °C by 2080-2085 (Table 2).

Table 2: Regional Model projections of mean surface temperature and % change in rainfall for some stations in Belize for 2020-2020 and 2080-2085 relative to the period 1970-2000

Station	**Temp Trend 1961-2013**	**PRECIS-Echam4 Projected Temperature Change deg. C**				**Rainfall Trend 1961-2013**	**PRECIS-Echam4 Projected % Change in *JJA* Rainfall**			
	deg. C/decade	**2020-2025**		**2080-2085**		**mm/decade**	**2020-2025**		**2080-2085**	
	± Min/Max/Mea	**A2**	**B2**	**A2**	**B2**	**±**	**A2**	**B2**	**A2**	**B2**
Libertad		0.8	1.3	4.2	2.9		-30.9	-25.1	-64.8	-54.5
Towerhill	- 0.20 °C (Mea T)	0.8	1.3	3.5	2.9	+ 120 mm	-32.6	-26.4	-68.9	-60.4
PSWGIA	+ 0.10 °C (Min T) + 0.15 °C (Max T)	1.1	1.3	4.0	2.9	+ 14 mm	-28.3	-24.5	-79.2	-74.0
CFarm		1.1	1.4	4.2	3.0		-10.3	-2.0	-65.2	-51.0
Melinda		0.6	1.0	3.0	2.2		-49.6	5.1	-79.3	-38.7
MayanKing		1.1	1.3	4.0	2.2		-13.5	-26.9	-50.5	-83.3
PGAgstat		1.1	1.4	4.1	3.0		0.1	-8.8	-15.6	-57.3
TRDP		1.1	1.3	4.2	3.1		-5.0	12.1	-4.6	-22.5

(Source: PRECIS RCM climate projections, CCCCC, Belize 2014)

Annex VI: Tree Species Recorded

Common Name	**Scientific name**	**location**	Observation
Whistling pine	*Cassuarina spp*	populated	
Bay cedar, Tapaculo	*Guazuma ulmifolia*	pop / riparian	
Melina	*Melina arborea*	populated	introduced
May flower	*Tabebuia pentaphylla*	pop / riparian	
Royal Palm	*Roystonea spp.*	populated	introduced
Tubroos	*Enterolobium cyclocarpum*	populated	
Lagerstriemia	*Lagerstroemia speciosa*	populated	introduced
Cedar	*Cedrela odorata*	pop / riparian	
Mahogany	*Swetenia machrophyla*	populated	
Rose apple	*Eugenia jambos*	pop / riparian	
Rubber tree	*Castia elastica*	Riparian	
Trumpet tree	*Cecropia peltata*	Riparian	
Avocado	*Persea americana*	populated	
Cohune	*Attalea cohune*	populated	
Granpa balls/ cojoton	*Stemmadenia donell-smithii*	pop / riparian	
Rain tree	*Samanea saman*	populated	
Mamee	*Calocarpum mamosum*	populated	
Black cordoncillo	*Piper amalgo*	Riparian	
Prickly yellow	*Zanthoxylum belizense*	Riparian	
Breadnut	*Brosimum alicastrum*	Riparian	
Violeta serrano	*Rinorea hummelii*	Riparian	
Black waddle		Riparian	
Cockspur	*Acasia cokii*	Riparian	
Aguacatillo	*Lauracea*	Riparian	
Bamboo	*Bambusa spp. (green)*	Riparian	
Erithrina/ Pito	*Erithrina spp.*	Riparian	
Bay leaf	*Sebestena moritiformis*	Riparian	
Hog plum	*Spondias mombin*	Riparian	
Bread fruit	*Artocarpus communis*	populated	
Cow sap		populated	
Red gumbolimbo	*Bursera simaruba*	pop / riparian	
Grandy betty	*Cupania belisense*	Riparian	
Bri-bri	*Inga edulis*	Riparian	
Spoon wood		Riparian	
Basket tie-tie		Riparian	
Lobster claw	*Heliconia spp.*	pop / riparian	
Strangler fig	*Ficus spp.*	pop / riparian	
Pacaya	*Chameadora tepejilote*	Riparian	

Hibiscus	*Hibiscus rosea*	populated	
Noni	*Morinda citrifolia*	populated	introduced
Mango	*Manguifera indica*	populated	
Lime	*Citrus spp.*	populated	
Craboo	*Birsonima crassifolia*	pop / riparian	
Succotz	*Licania platypus*	pop / riparian	
Malee apple		populated	
Plum	*Spondias purpuria*	populated	
Almond tree	*Terminalia catappa*	populated	
Ciruella	*Zisifus mauritanii*	populated	
Gold chalis/ butter cup	*Allamanda cathartica*	populated	
Travellers palm	*Ravenala madagascariensis*	populated	introduced
Izote	*Yuca elephantipes*	populated	
Cocoyol / Supa	*Acrocomia aculeata*	populated	
Bukut/ stinking toe	*Cassia grandis*	populated	
Coconut	*Cocus nucifera*	populated	
Fiddle wood	*Vitex gaumeri*	pop / riparian	
Black berry	*Eugenia spp.*	populated	
Flamboyant tree	*Delonix regia*	populated	
Bob	*Cocoloba spp.*	Riparian	
Kinep	*Jenipa spp.*	populated	
Cashew	*Anacardium occidentale*	populated	
Teak	*Tectona grandis*	plantation	introduced
kiebra muelas	*Tebetia peruliana*	populated	
Guava	*Psidium guahava*	populated	
polly red head/ Ix'kanan	*hamelia patens*	populated	
Golden plum	*Spondias spp.*	populated	
Heineken		populated	
Cotton tree	*Ceiba pentandra*	pop / riparian	
Billy webb	*Sweetia panamensis*	Riparian	
Silion	*Pouteria spp*	Riparian	
Madre cacao	*Gliricidia sepium*	pop / riparian	
Chicke	*Calophylum spp.*	populated	
African palm	*Elaeis guineensis*	populated	introduced
Bullet tree	*Bucida buceras*	pop / riparian	
lek, calabash	*Crescentia cujete*	populated	
Tambran	*Tamarindus indica*	populated	
Orange	*Citrus sinensis*	populated	

Salm wood	*Coridia alliodora*	pop / riparian	
Caimito	*Calophylum cainito*	populated	
Balchike		pop / riparian	
Bouganvilla	*Bougainvillea spp.*	populated	
Annona	*Annona muricata*	populated	
Provision bark	*Pachira aquatica*	Riparian	
Bamboo (yellow)	*Bambusa spp.*	Riparian	
Ficus	*Ficus benjamina*	populated	
Araucaria	*Araucaria*	populated	introduced
Akee	*Blighia sapida*	populated	
Negrito	*Simaruba glauca*	Riparian	
Fenix palm	*Cycas spp*	populated	
Polak	*Ochroma lagopus*	Riparian	
Sea grape	*Coccoloba uvifera*	populated	
Neem	*Asadirachta indica*	populated	introduced
Cericote	*Cordia dodecandra*	populated	
Shower of gold	*Cassia fistula*	populated	
Cow ockra		populated	
Pole wood	*Xylopia spp*	Riparian	
Trichilia	*Trichilia spp*	Riparian	
Aguacatillo	*Nectandra spp*	Riparian	
Santa maria	*Calophylum brasiliense*	Riparian	
Melastome	*Melastome spp*	Riparian	
Sapotillo	*Calocarpum Viride (Pittier)*	Riparian	
huevo de perro	*Tebetia spp.*	Riparian	
Bastars mahogany	*Mosquitoxylum jamaicense*	Riparian	
Quam wood	*Schizolobium parahybum*	Riparian	
Annona	*Annona spp*	Riparian	
	Leuhea speciosa	Riparian	
Soap tree	*Sapindus sapinaria*	Riparian	
	Cocoloba spp.	Riparian	
Bojon negro	*Cordia gerascantus*	Riparian	
water well tree	*Warszewiczia coccinea*	populated	
Jungle geranium	*Ixora macrothyrsa*	populated	
flame of the forest	*Spatodea campanulata*	populated	
Pink cassia	*Cassia javanica*	pop / riparian	
Franji pani	*Plumeria spp*	populated	
yellow poinciana	*Peltophorum dubium*	Riparian	
Jack fruit	*Artocarpus heterophyllus*	populated	

Sapodilla	*Manilkara zapota*	populated
Phylodendrum	*Dieffenbachia seguina*	Riparian
Achiotillo	*Bernardia interupta*	Riparian
Cabbage bark	*Lonchocarpus castilloi*	Riparian
Bull hoof	*Drypetes brownii*	Riparian
Copal	*Protium copal*	Riparian
Hingi hingi		Riparian
Escoba	*Crysophila argentea*	Riparian
Yemeri	*Vochysia hondurensis*	Riparian
Carbon	*Tetragastris panamensis*	Riparian
Nargusta	*Terminalia amazonia*	Riparian
Moho	*Helicarpus Belotia*	Riparian
Mylady	*Aspidosperma megalocarpon*	Riparian
glassy wood	*Guettarda combsii*	Riparian
Iron wood	*Dialium guianensis*	Riparian
Jesmo	*Lysiloma spp*	Riparian
female bullhoof	*Ampelocera hottlei*	Riparian
Moho, Majagua roja	*Sloenea spp*	Riparian
White mylady	*Aspidosperma stegomeris*	Riparian
wild cherry, Manax	*Pseudolmedia oxyphyllaria*	Riparian
White poison wood		Riparian
Naranjillo	*Zanthoxylum elephantiasis*	Riparian
Symphonia	*Symphonia globurifera*	Riparian
Fustic	*Chlorophora tinctoria*	Riparian
Guachipilin	*Diphysa robinoides*	Riparian
Sauce	*Salix humboldtiana*	Riparian
White bay cedar	*Luehea seemanii (Triana &Planch)*	Riparian

Annex VII: Fauna encountered along the Study Area

Scientific Name	Scientific Name	Common Name
MARSUPIALS – DIDELPHIMORPHIA Opossums - Didelphidae		
Didelphinae		
Water Opossum	*Chironectes minimus*	Water Dog, Yapok
Common Opossum	*Didelphis marsupialis*	Zorro, Tlacuache
Virginia Opossum	*Didelphis virginiana*	Possum, Zorro, Tlacuache
Mexican Mouse Opossum	*Marmosa mexicana*	
Robinson's Mouse Opossum	*Marmosa robinsoni*	Possum
Alston's Mouse Opossum	*Micoureus alstoni*	Woolly Mouse Opossum
Gray Four-eyed Opossum	*Philander opossum*	Common Gray Four-eyed Opossum, Four-eyes
Anteaters - Myrmecophagidae		
XENARTHRANS - XENARTHRA		
Silky Pygmy Anteater	*Cyclopes didactylus*	Silky Anteater, Pigmy Anteater
Northern Tamandua	*Tamandua mexicana*	Antsbear, Oso hormiguero
Armandilos - Dasypodidae		
Nine-banded Armadillo	*Dasypus novemcinctus*	Nine-banded Long-nosed Armandillo, Armadilly, Dilly, Ouetch
Bats - Chiroptera		Rat bats, Murcielagos
Sac-winged Bats - Emballonuridae		
Least Sac-winged Bat	*Balantiopteryx io*	Thomas' Sac-winged Bat
Shaggy Bat	*Centronyctes maximiliani*	Thomas' Bat
Northern White Bat	*Diclidurus albus*	Northern Ghost Bat
Greater Dog-like Bat	*Peropteryx kappleri*	
Lesser Dog-like Bat	*Peropteryx macrotis*	
Proboscis Bat	*Rhynchonycteris naso*	Brasilian long-nosed Bat
Greater White-lined Bat	*Saccopteryx bilineata*	
Lesser White-lined Bat	*Saccopteryx leptura*	

Scientific Name	Scientific Name	Common Name
Bulldog Bats - Noctilionidae		
Fishing Bat	*Noctilio leporinus*	Greater Bulldog Bat, Mexican Bulldog Bat
Mustached/Leaf-chinned Bats - Mormoopidae		
Ghost-faced Bat	*Mormoops megalophylla*	Leaf-chinned Bat, Peter's Ghost-faced Bat
Davy's Naked-backed Bat	*Pteronotus davyi*	
Common Mustached Bat	*Pteronotus pamellii*	Parnell's Mustached Bat
Lesser Mustached Bat	*Pteronotus personatus*	Wagner's Mustached Bat
Leaf-nosed Bats - Phyllostomidae		
Tailed Leaf-nosed Bats - Phyllostomiinae		
Woolly False Vampire Bat	*Chrotopterus auritus*	
Common Sword-nosed Bat	*Lonchorhina aurita*	Sword-nosed Bat, Tomes' Long-eared Bat
Long-legged Bat	*Macrophyllum macrophyllum*	
Orange-throated Bat	*Micronycteris brachyotis*	Dobson's Big-eared Bat
Common Big-eared Bat	*Micronecteris microtis*	*Micronycteris megalotis*(Syn.), Brasilian Big-eared Bat
Niceforo's Bat	*Micronectris nicefori*	Little Big-eared Bat
Schmidt's Big-eared Bat	*Micronecteris schmidtorum*	
Golden Bat	*Mimon bennettii*	*Mimon cozumelae* (Syn), Spear-nosed Bat
Striped Hairy-nosed Bat	*Mimon crenulaturn*	Striped spear-nosed Bat
Pale-faced Bat	*Phylloderma stenops*	Northern Spear-nosed Bat
Pale Spear-nosed Bat	*Phyllostomus discolor*	
Greater Spear-nosed Bat	*Phyllostomus hastatus*	Spear-nosed Bat
Pygmy Round-eared Bat	*Tonatia brasiliense*	
Davis' Round-eared Bat	*Tonatia evotis*	
Stripe-headed, Round-eared Bat	*Tonatia saurophila*	*Tonatia bidens*, Spix's Round-eared Bat
Fringe-lipped Bat	*Trachops cirrhosus*	
Greater False Vampire Bat	*Vampyrum spectrum*	Linnaeus' False Vampire Bat
Nectar-feeding Bats - Glossophaginae		
Brown Long-tongued Bat	*Glossophaga commissarisi*	Commissaris' Long-tongued Bat
Common Long-tongued Bat	*Glossophaga soricina*	Pallas' Long-tongued Bat

Scientific Name	Scientific Name	Common Name
Underwood's Long-tongued Bat	*Hylonycteris underwoodi*	
Dark Long-tongued Bat	*Lichonycteris obscura*	Chestnut Long-tailed Bat
Short-tailed Fruit Bats - Carollinae		
Silky Short-tailed Bat	*Carollia brevicauda*	
Hahn's short-tailed bat	*Carollia subrufa*	
Allen's short-tailed bat	*Carollia castanea*	
Seba's Short-tailed Bat	*Carollia perspicillata*	
Tail-less Fruit Bats - Stenodermatinae		
Intermediate Fruit-eating Bat	*Artibeus intermedius*	Large Fruit-eating Bat
Jamaican Fruit-eating Bat	*Atribeus jamaicensis*	
Great Fruit-eating Bat	*Atribeus lituratus*	Big Fruit-eating Bat
Pygmy Fruit-eating Bat	*Atribeus phaeotis*	*Dermanura phaeotis*
Toltec Fruit-eating Bat	*Atribeus toltecus*	*Dermanura tolteca*,Lowland Fruit-eating Bat
Watson's Fruit-eating Bat	*Atribeus watsoni*	*Dermanura watsoni*
Wrinkle-faced Bat	*Centurio senex*	
Unstriped Big-eyed Bat	*Chiroderma villosum*	Big-eyed Bat, Shaggy-haired Bat
Heller's Broad-nosed Bat	*Platyrrhinus helleri*	*Vampyrops helleri*
Little Yellow-shouldered Bat	*Sturnira lilium*	
Common Tent-making Bat	*Uroderma bilobatum*	
Little Yellow-eared Bat	*Vampyressa pusilia*	
Great Stripe-faced Bat	*Vampyrodes caraccioli*	San Pablo Bat
Vampire Bats - Desmodontinae		
Common Vampire Bat	*Desmodus rotundus*	
Hairy-legged Vampire Bat	*Diphylla ecaudata*	
Funnel-eared Bat - Natalidae		
Mexican Funnel-eared Bat	*Natalus stramineus*	
Disc-winged Bat - Thyropteridae		
Spix's Disc-winged Bat	*Thyroptera tricolor*	
Plain-nosed Bats - Vespertilionidae		
Van Gelder's Bat	*Bauerus dubiaquercus*	
Argentine Brown Bat	*Eptesicus furinalis*	
Western Red Bat	*Lasiurus blossevillii*	*Lasiurus borealis*, Hairy-tailed Bat, Red Bat
Southern Yellow Bat	*Lasiurus ega*	
Northern Yellow Bat	*Lasiurus intermedius*	

Scientific Name	**Scientific Name**	**Common Name**
Elegant Myotis	*Myotis elegans*	
Hairy-legged Myotis	*Myotis keaysi*	
Central American Yellow Bat	*Rhogeessa tumida*	Confused with *Rhogeessa aeneus*, Black-winged Little Yellow Bat but this species only known from the Yucatan.
Free-tailed Bats – Molossidae		
Black Bonneted Bat	*Eumops auripendulus*	Shaw's Mastiff Bat
Dwarf Bonneted Bat	*Eumops bonariensis*	Dwarf Mastiff Bat
Wagner's Bonneted Bat	*Eumops glaucinus*	Wagner's Mastiff Bat
Sandborn's Bonneted Bat	*Eumops hansae*	
Underwood's Bonneted Bat	*Eumops underwoodi*	Underwood's Mastiff Bat
Greenhall's dog-faced bat	*Molossops greenhalli*	
Black Mastiff Bat	*Molossus rufus*	*Molossus ater*
Lesser Mastiff Bat	*M. molossus*	Pallas' Mastiff Bat
Sinaloan Mastiff Bat	*M. sinaloae*	Allen's Mastiff Bat
Broad-eared Bat	*Nyctinomops laticaudatus*	Broad-eared Free-tailed Bat
MONKEYS - PRIMATES	Cebidae	
Howler Monkeys – Alouattinae		
Yucatan Black Howler-Monkey	*Alouatta pigra*	Mexican Black Howler Monkey, Baboon, Saraguato
Spider Monkeys – Atelinae		
Central-American Spider-Monkey	*Ateles geoffroyi*	Monkey, Mono
CARNIVORES – CARNIVORA Dogs - Canidae		
Gray Fox	*Urocyon cinereoargenteus*	Gato de Monte
Cats – Felidae Felinae		
Jaguaroundi	*Herpailurus yagouaroundi*	Halari, Onza, Leoncillo
Ocelot	*Leopardus pardalis*	Tiger-cat, Tigrillo
Margay	*Leopardus wiedii*	Tiger-cat, Tigrillo, Tigrillito
Puma	*Puma concolor*	Red Tiger, Leon

Scientific Name	**Scientific Name**	**Common Name**
Weasels - Mustelidae		
Otters – Lutrinae		
Neotropical River Otter	*Lontra Iongicaudis*	*Lutra longicaudis*,Southern River Otter, Water dog, Perro de Agua
Skunks - Mephitinae		
Striped Hog-nosed Skunk	*Conepatus semistriatus*	Polecat, Zorrillo
Spotted Skunk	*Spilogale putorius*	Polecat, Zorrillo
Weasels - Mustelinae		
Tayra	*Eira barbara*	Bush dog, Perro del monte, Cabeza blanca
Grison	*Galictis vittata*	Bushdog, Waterdog, Huron
Weasel	*Mustela frenata*	Long-tailed Weasel
Raccoon Family – Procyonidae		
Kinkajous - Potosinae		
Kinkajou	*Potos flavus*	Nightwalker, Mico de noche, Martucha
Raccoons and relatives - Procyoninae		
Ringtail	*Bassariscus sumichrasti*	Cacomistle, Ringtail cat, Mico de Noche, Mico de Leon
Coatimundi	*Nasua narica*	White-nosed Coati, Coati mundi, Quash, Pisote, Tejon
Raccoon	*Procyon lotor*	Northern Raccoon, Racoon, Mapache
PERISSODACTYLS - PERISSODACTYLA		
Tapir - Tapiridae		
Baird's Tapir	*Tapirus bairdii*	Central American Tapir, Mountain Cow, Danto, Tzimin
ARTIODACTYLS - ARTIODACTYLA		
Peccaries - Tayassuidae		
Collared Peccary	*Pecari tajacu*	*Tayassu tajacu*, Peccary, Queqeo
White-lipped Peccary	*Tayassu pecari*	Wari, Warree, Jawilla

Scientific Name	**Scientific Name**	**Common Name**
Deer - Cervidae		
Red Brocket	*Mazama americana*	Antelope, Cabrito
Gray Brocket Deer	*Mazama pandora*	Antelope, Cabrito (unconfirmed but likely present in bajo forest of the Orrange Walk District
White-tailed Deer	*Odocoileus virginianus*	Savanna Deer, Venado.
Bovids - Bovidae		
Cattle	*Bos taurus*	Feral cattle can still be found in the Upper Macal River valley after failed ranching efforts in the 1950ies
RODENTS - RODENTIA		
Squirrels - Sciuridae		
Deppe's Squirrel	*Sciurus deppei*	
Yucatan Squirrel	*Sciurus yucatanensis*	
Gopher - Geomyidae		
Hispid Pocket Gopher	*Orthogeomys hispidus*	Ground Mole, Taltusa
Spiny Pocket Mouse - Heteromyidae		
Forest Spiny Pocket Mouse	*Heteromys desmarestianus*	Desmarest's Spiny Pocket Mouse
Gaumer's Spiny Pocket Mouse	*Heteromys gaumeri*	Spiny Pocket Mouse
Mice and Rats - Muridae		
Old World Mice and Rats - Murinae		
House Mouse	*Mus musculus*	Raton
Norway Rat	*Rattus norvegicus*	Brown Rat, Charlie Price, Rata
Roof Rat	*Rattus rattus*	Black Rat, Reef Rat, Rata
New World Mice and Rats - Sigmodontinae		
Vesper Rat	*Nyctomys sumichrasti*	Sumichrast's Vesper Rat
Northern Pygmy Rice Rat	*Oligoryzomys fulvescens*	
Alfaro's Rice Rat	*Oryzomys alfaroi*	
Coues' Rice Rat	*Oryzomys couesi*	Marsh Rice Rat
Rusty Rice Rat	*Oryzomys melanotis*	Black-eared Rice Rat
Yucatan Vesper Mouse	*Otonyctomys hatti*	Yucatan Vesper Rat
Big-eared Climbing Rat	*Ototylomys phyllotis*	
Mexican Deer Mouse	*Peromyscus mexicanus*	
Harvest Mouse	*Reithrodontomys gracilis*	Slender Harvest Mouse

Scientific Name	**Scientific Name**	**Common Name**
Hispid Cotton Rat	*Sigmodon hispidus*	Pine ridge Rat
Northern Climbing Rat	*Tylomys nudicaudus*	Peter's Climbing Rat
Porcupines - Erethizontidae		
Mexican Porcupine	*Coendou mexicanus*	Mexican hairy Porcupine, Puercoespin
Pacas - Agoutidae		
Paca	*Agouti paca*	Gibnut, Tepesquintle
Agoutis - Dasyproctidae		
Central American Agouti	*Dasyprocta punctata*	Rabbit, Indian Rabbit, Guatusa, Liebre
RABBITS - LAGOMORPHA		
Leporidae		
Forest Rabbit	*Sylvilagus brasiliensis*	Bush Rabbit, Conejo

Annex VIII: Freshwater Fish of Belize

Scientific Name	Common / local name
Anguillidae	
Anguilla rostrata	American eel
Ariidae	
Bagre marinus	Gafftopsail sea catfish
Cathorops arenatus	
Hexanematichthys assimilis	Mayan sea catfish
Batrachoididae	
Batrachoides gilberti	
Carcharhinidae	
Carcharhinus leucas	Bull shark
Centrarchidae	
Micropterus dolomieui	Smallmouth bass (Introduced)
Centropomidae	
Centropomus ensiferus	Swordspine snook
Centropomus parallelus	Fat snook
Centropomus pectinatus	Tarpon snook
Centropomus poeyi	Mexican snook
Characidae	
Astyanax fasciatus	Banded astyanax, Billum
Brycon guatemalensis	Machaca, Macabil
Hyphessobrycon compressus	Mayan tetra, Billum
Cichlidae	
Amphilophus robertsoni	False fire-mouth cichlid
Archocentrus spilurus	Blue-eye cichlid

Scientific Name	Common / local name
Cichlasoma bocourti	Chisel-tooth cichlid
Cichlasoma octofasciatum	Jack Dempsey
Cichlasoma salvini	Yellow belly cichlid
Cichlasoma urophthalmus	Mexican mojarra, Mayan cichlid
Oreochromis niloticus	Tilapia (Introduced) Tilapia's in Belize also include *O. aureus, O. mossambicus and/or O. urolepis.*
Parachromis friedrichsthalii	Yellowjacket cichlid, Mus-mus
Parachromis motaguensis	False yellowjacket cichlid
Petenia splendida	Bay snook, Blanco
Thorichthys affinis	Yellow meeki
Thorichthys aureus	Blue flash, Golden fire-mouth cichlid
Thorichthys meeki	Firemouth cichlid, Panya gial
Vieja godmanni	Southern checkmark cichlid
Vieja intermedia	Northern checkmark cichlid
Vieja maculicauda	Blackbelt cichlid
Vieja synspila	Redhead cichlid
Clupeidae	
Dorosoma anale	Mexican river gizzard shad, Longfin gizzard shad
Dorosoma petenense	Threadfin shad
Cynoglossidae	
Symphurus plagiusa	Blackcheek tonguefish
Cyprinodontidae	
Cyprinodon artifrons	Yucatan pupfish
Cyprinodon variegatus artifrons	
Floridichthys polyommus	Ocellated killifish
Garmanella pulchra	Yucatan flagfish
Eleotridae	
Dormitator maculatus	Fat sleeper
Eleotris amblyopsis	Large-scaled spinycheek sleeper
Eleotris pisonis	Spinycheek sleeper
Gobiomorus dormitor	Bigmouth sleeper
Engraulidae	
Anchoa belizensis	Belize anchovy
Anchoa parva	Little anchovy
Lycengraulis grossidens	Atlantic sabretooth anchovy
Gerreidae	
Eugerres plumieri	Striped mojarra
Gerres cinereus	Yellow fin mojarra

Scientific Name	**Common / local name**
Gobiidae	
Awaous banana	River goby
Evorthodus lyricus	Lyre goby
Gobioides broussoneti	Violet goby
Gobiosoma yucatanum	Yucatan goby
Lophogobius cyprinoides	Crested goby
Haemulidae	
Pomadasys crocro	Burro grunt
Hemiramphidae	
Hyporhamphus roberti hildebrandi	Central American halfbeak
Heptapteridae	
Rhamdia guatemalensis	Guatemalan chulín
Rhamdia laticauda	Filespine chulín
Rhamdia typhla	Cave chulín (Endemic species)
Ictaluridae	
Ictalurus furcatus	Blue catfish
Lepisosteidae	
Atractosteus tropicus	Tropical gar
Megalopidae	
Megalops atlanticus	Tarpon
Mugilidae	
Agonostomus monticola	Mountain mullet
Joturus pichardi	Bobo mullet
Mugil gyrans	Fantail mullet
Mugil liza	Liza
Poeciliidae	
Belonesox belizanus	Topminnow, Pike killifish
Carlhubbsia stuarti	Barred livebearer
Gambusia luma	Sleek mosquito fish
Gambusia nicaraguensis	Nicaraguan mosquito fish
Gambusia puncticulata yucatana	Yucatan mosquitofish
Gambusia sexradiata	Teardrop mosquito
Heterandria bimaculata	Twospot livebearer
Phallichthys fairweatheri	Picotee livebearer
Poecilia mexicana	Shortfin molly
Poecilia orri	Mangrove molly
Poecilia petenensis	Peten molly
Poecilia teresae	Mountain molly (Endemic species)
Xiphophorus hellerii	Green swordtail
Xiphophorus maculatus	Southern platyfish

Scientific Name	Common / local name
Profundulidae	
Profundulus guatemalensis	
Rivulidae	
Rivulus marmoratus	Mangrove rivulus
Rivulus tenuis	Dogtooth rivulus
Sparidae	
Archosargus probatocephalus	Sheepshead seabream, Southern sheeps head
Synbranchidae	
Ophisternon aenigmaticum	Obscure swamp eel
Syngnathidae	
Pseudophallus mindii	
Syngnathus scovelli	Gulf pipefish
(Source: Fishbase)	

Annex IX Guanacaste National Park Birds

Bird List for Guanacaste National Park -128 Species Reported - July 4, 2001		
BBIS_#	**Common Name**	**Scientific name**
040160	Anhinga	*Anhinga anhinga*
040240	Snowy Egret	*Egretta thula*
040250	Little Blue Heron	*Egretta caerulea*
040280	Cattle Egret	*Bubulcus ibis*
040550	Turkey Vulture	*Cathartes aura aura*
040750	Solitary Eagle	*Harpyhaliaetus solitarius*
040760	Gray Hawk	*Asturina nitida*
040770	Roadside Hawk	*Buteo magnirostris conspectus*
040870	Ornate Hawk-eagle	*Spizaetus ornatus vicarius*
040980	Plain Chachalaca	*Ortalis vetula*
041050	Ruddy Crake	*Laterallus ruber*
041170	Sungrebe	*Heliornis fulica*
041250	Killdeer	*Charadrius vociferus*
041340	Spotted Sandpiper	*Actitis macularia*
041770	Pale-vented Pigeon	*Columba cayennensis*
041810	Short-billed Pigeon	*Columba nigrirostris*
041890	White-tipped Dove	*Leptotila verreauxi*
041920	Gray-chested Dove	*Leptotila cassini*
041930	Olive-throated Parakeet	*Aratinga nana*
041950	Brown-hooded Parrot	*Pionopsitta haematotis*
041960	White-crowned Parrot	*Pionus senilis*
041970	White-fronted Parrot	*Amazona albifrons*
041990	Red-lored Parrot	*Amazona autumnalis*
042090	Groove-billed Ani	*Crotophaga sulcirostris*
042230	Pauraque	*Nyctidromus albicollis*
042340	Vaux's Swift	*Chaetura vauxi*
042380	Long-tailed Hermit	*Phaethornis superciliosus*
042390	Little Hermit	*Phaethornis longuemareus*
042460	Green-breasted Mango	*Anthracothorax prevostii*
042520	Azure-crowned Hummingbird	*Amazilia cyanocephala*
042530	Rufous-tailed Hummingbird	*Amazilia tzacatl*
042600	Black-headed Trogon	*Trogon melanocephalus*
042610	Violaceous Trogon	*Trogon violaceus*
042650	Blue-crowned Motmot	*Momotus momota*
042680	Belted Kingfisher	*Ceryle alcyon*
042690	Amazon Kingfisher	*Chloroceryle amazona*

042700	Green Kingfisher	*Chloroceryle americana*
042740	Rufous-tailed Jacamar	*Galbula ruficauda*
042760	Collared Aracari	*Pteroglossus torquatus*
042770	Keel-billed Toucan	*Ramphastos sulfuratus*
042810	Golden-fronted Woodpecker	*Melanerpes aurifrons*
042890	Rufous-breasted Spinetail	*Synallaxis erythrothorax*
042920	Plain Xenops	*Xenops minutus*
042940	Tawny-winged Woodcreeper	*Dendrocincla anabatina*
042950	Ruddy Woodcreeper	*Dendrocincla homochroa*
042960	Olivaceous Woodcreeper	*Sittasomus griseicapillus*
042970	Wedge-billed Woodcreeper	*Glyphorhynchus spirurus*
043000	Ivory-billed Woodcreeper	*Xiphorhynchus flavigaster*
043020	Streak-headed Woodcreeper	*Lepidocolaptes souleyetii*
043040	Barred Antshrike	*Thamnophilus doliatus*
043080	Dot-winged Antwren	*Microrhopias quixensis*
043090	Dusky Antbird	*Cercomacra tyrannina*
043110	Black-faced Antthrush	*Formicarius analis*
043150	Greenish Elaenia	*Myiopagis viridicata*
043170	Yellow-bellied Elaenia	*Elaenia flavogaster*
043180	Ochre-bellied Flycatcher	*Mionectes oleagineus*
043200	Northern Bentbill	*Oncostoma cinereigulare*
043240	Yellow-olive Flycatcher	*Tolmomyias sulphurescens*
043260	Royal Flycatcher	*Onychorhynchus coronatus*
043400	Black Phoebe	*Sayornis nigricans*
043430	Bright-rumped Attila	*Attila spadiceus*
043470	Dusky-capped Flycatcher	*Myiarchus tuberculifer*
043490	Brown-crested Flycatcher	*Myiarchus tyrannulus*
043500	Great Kiskadee	*Pitangus sulphuratus*
043510	Boat-billed Flycatcher	*Megarynchus pitangua*
043520	Social Flycatcher	*Myiozetetes similis*
043540	Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*
043560	Tropical Kingbird	*Tyrannus melancholicus*
043570	Couch's Kingbird	*Tyrannus couchii*
043720	Red-capped Manakin	*Pipra mentalis*
043740	Gray-breasted Martin	*Progne chalybea*
043760	Mangrove Swallow	*Tachycineta albilinea*
043770	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
043830	Brown Jay	*Cyanocorax morio*
043850	Band-backed Wren	*Campylorhynchus zonatus*

043860	Spot-breasted Wren	*Thryothorus maculipectus*
043900	House Wren	*Troglodytes aedon*
043920	White-bellied Wren	*Uropsila leucogastra*
043930	White-breasted Wood-Wren	*Henicorhina leucosticta*
043960	Long-billed Gnatwren	*Ramphocaenus melanurus*
044040	Swainson's Thrush	*Catharus ustulatus*
044050	Wood Thrush	*Catharus mustelinus*
044060	Clay-colored Robin	*Turdus grayi*
044080	Gray Catbird	*Dumetella carolinensis*
044100	Tropical Mockingbird	*Mimus gilvus*
044120	White-eyed Vireo	*Vireo griseus*
044160	Yellow-throated Vireo	*Vireo flavifrons*
044280	Rufous-browed Peppershrike	*Cyclarhis gujanensis*
044290	Blue-winged Warbler	*Vermivora pinus*
044310	Tennessee Warbler	*Vermivora peregrina*
044350	Northern Parula	*Parula americana*
044380	Chestnut-sided Warbler	*Dendroica pensylvanica*
044390	Magnolia Warbler	*Dendroica magnolia*
044420	Yellow-rumped Warbler	*Dendroica coronata*
044430	Black-throated Green Warbler	*Dendroica virens*
044540	Black-and-white Warbler	*Mniotilta varia*
044550	American Redstart	*Setophaga ruticilla*
044570	Worm-eating Warbler	*Helmitheros vermivorus*
044580	Swainson's Warbler	*Limnothlypis swainsonii*
044590	Ovenbird	*Seiurus aurocapillus*
044600	Northern Waterthrush	*Seiurus noveboracensis*
044610	Louisiana Waterthrush	*Seiurus motacilla*
044620	Kentucky Warbler	*Oporornis formosus*
044650	Common Yellowthroat	*Geothlypis trichas*
044670	Hooded Warbler	*Wilsonia citrina*
044680	Wilson's Warbler	*Wilsonia pusilla*
044720	Yellow-breasted Chat	*Icteria virens*
044740	Bananaquit	*Coereba flaveola*
044750	Golden-hooded Tanager	*Tangara larvata*
044800	Yellow-throated Euphonia	*Euphonia hirundinacea*
044840	Blue-gray Tanager	*Thraupis episcopus*
044850	Yellow-winged Tanager	*Thraupis abbas*
044890	Red-throated Ant-Tanager	*Habia fuscicauda*
044920	Summer Tanager	*Piranga rubra*

044930	Scarlet Tanager	*Piranga olivacea*
044990	Grayish Saltator	*Saltator coerulescens*
045000	Buff-throated Saltator	*Saltator maximus*
045010	Black-headed Saltator	*Saltator atriceps*
045050	Blue-black Grosbeak	*Cyanocompsa cyanoides*
045130	Green-backed Sparrow	*Arremonops chloronotus*
045170	White-collared Seedeater	*Sporophila torqueola*
045320	Eastern Meadowlark	*Sturnella magna*
045330	Melodious Blackbird	*Dives dives*
045340	Great-tailed Grackle	*Quiscalus mexicanus*
045380	Orchard Oriole	*Icterus spurius*
045400	Yellow-tailed Oriole	*Icterus mesomelas*
045430	Baltimore Oriole	*Icterus galbula*
045440	Yellow-billed Cacique	*Amblycercus holosericeus*
Belize Biodiversity Information System Compiled by Chris Hecker, Belize Audubon Society 2001		

Annex X Sample Testing Instruments

Information on Instruments used during the ESIA

Instrument	Measurement Range/Acurracy	Ambient Standards
Casella MicroDust Pro- Particulate Monitor	**1µgm-3 to 2500 mgm-3 in single meter**	**EPA – 50 ug/m3 (annual mean)** **150 ug/m3 (daily concentration)**
JDC -Flowatch Flow Meter	**+/- 5 % from - 10° to + 50°C.**	**Air and Water Current Meter [kph, m/s, ft/s, Temp (F),]**
BW Technologies by Honeywell Gas Alert Multi-Gas (4) Meter	**Hydrogen Sulfide (H_2S) 0-200 ppm** **Carbon monoxide (CO) 0-1000 ppm** **Oxygen (O_2) 0-30.0%** **Combustible 0-100%** **Gases (%LEL) 0-5.0% v/v**	**Personal Exposure Limits (PEL)** **H2S – 10ppm/8hrs** **CO – 0-9 ppm (TWA) (WHO)** **O2 – 19.5% -23.5% (20.9% Average O2 in Ambient Air)** **LEL - <10% (safe level)**
Sper Scientific Sound Level Pen 840018	**Range: 32 ~ 130dB Accuracy ±1.5dB (under reference conditions, 94dB @ 1kHZ)**	**PEL for Noise - <80dB / 8hrs** **>80dB-85dB (require noise reduction equipment, e.g. PPE)**

More Versatile

1 Pro Plus Instrument
2 Single Port Conductivity Only
3 Single Port Cable
4 Single Port Cable with Conductivity
5 Dual Port Cable
6 Quatro Multiparameter Cable

Professional Plus Instrument General Specifications

Auto Stable	User-defined auto-stable function holds stable readings on display when criteria is met
Barometer	Built-in barometer
Buffer Recognition	Auto buffer recognition for US and NIST buffers
Certifications	RoHS, CE, WEEE, C-Tick, VCCI, FCC, IP-67, 1-meter drop test, Assembled in USA
Connectivity	USB 2.0; ProComm II communications saddle and USB cable included; user-upgradeable software via USB and website
Connector	MS (military spec) waterproof with bayonet lock
Data Management	Data Manager desktop software included; 100 user-defined folders and site names
Data Memory	5,000 data sets (data, date, time, user-defined info); 100 GLP files
Dimensions	8.3 cm width x 21.6 cm length x 5.6 cm depth (3.25 in x 8.5 in x 2.21 in)
Display	Graphic display with detailed Help; backlit display AND keypad
DO Membrane Response Times (T95; 100%-0) and Flow Dependence	1.25 mil PE = 8 seconds and 6 in/sec flow 2.0 mil PE = 17 seconds and 3 in/sec flow 1 mil Teflon® = 18 seconds and 12 in/sec flow
DO Sensors	Polarographic or galvanic field sensors; self-stirring polarographic BOD sensor for the lab
Field Cables	Standard lengths of 1, 4, 10, 20, or 30 meters - up to 100 meters on DO only cables; all 4-meter and longer cables include a cable management kit
Flow Cell	Single, dual and multiparameter Quatro cable all flow cell compatible
GLP Compliance	Yes; detailed GLP information is stored and is available to view, download or print
Lab Cables	BOD sensor includes 2-meter cable; 1 or 4 meters on lab pH, ORP and pH/ORP cables
Languages	English, Spanish, German, French, Italian, Norwegian, Portuguese, Japanese, Chinese (Simplified & Traditional)
Logging Modes	Single or Continuous
Operating Temperature	-10 to 60°C
Power	2 alkaline C-cells provide 80 continuous hours at ambient temperature without backlight; ProComm II saddle provides USB power or optional wall power, cigarette lighter, and universal cell phone charger options
Storage Temperature	-20 to 70°C
User ID	Optional user ID for data security
Warranty	3-year instrument; 2-year field cables
Waterproof	IP-67 (even with the battery cover off); floats
Weight with Batteries	475 grams (1.05 lbs)

System Specifications (Cable and Sensors)

	Sensor Type	Range	Accuracy	Resolution	Units	Calibration
Dissolved Oxygen (%) (temp comp range -5 to 45°C)	Polarographic or Galvanic	0 to 500%	0 to 200% (± 2% of reading or 2% air saturation, whichever is greater) 200% – 500% (± 6% of reading)	1% or 0.1% air saturation (user selectable)	%	1 or 2-points with zero
Dissolved Oxygen (mg/L) (temp comp range -5 to 45°C)	Polarographic or Galvanic	0 to 50 mg/L	0 to 20 mg/L (±2% of the reading or 0.2 mg/L, whichever is greater) 20 to 50 mg/L (±6% of the reading)	0.1 or 0.01 mg/L (user selectable); 0.1% air saturation	mg/L, ppm	1 or 2-points with zero
Temperature (Field rugged cables)		-5 to 70°C	±0.2°C (±0.3°C cables over 45-meters)		0.1°C	°C, °F, K
Temperature (Lab-grade)*		0 to 40°C	±0.35°C	0.1°C	°C, °F, K	
Conductivity**	Four electrode cell	0 to 200 mS/cm (auto range)	±0.5% of reading or 0.001 mS/cm, whichever is greater (1-, 4-m cable) ±1% of reading or 0.001 mS/cm, whichever is greater (20-m cable)	0.001 mS (0 to 500 mS); 0.01 mS (0.501 to 50.00 mS); 0.1 mS (50.01 to 200 mS)	µS, mS	1 point
Salinity	Calculated from conductivity and temperature	0 to 70 ppt	±1.0% of reading or 0.1 ppt, whichever is greater	0.01 ppt	ppt, PSU	1 point
pH	Glass Combination Electrode	0 to 14 units	±0.2 units	0.01 units	mV, pH units	1, 2, 3, 4, 5, or 6 point (user selectable); US, NIST or Custom Buffers
ORP	Platinum button	-1999 to +1999 mV	±20 mV in redox standards	0.1 mV	mV	1 point
Ammonium*** (ammonia with pH sensor)	Ion Selective Electrode	0 to 200 mg/L-N, 0 to 30°C	±10% of reading or 2 mg/L-N, whichever is greater	0.01 mg/L	mg/L-N, mV	1, 2, or 3 point (user selectable)
Nitrate***	Ion Selective Electrode	0 to 200 mg/L-N, 0 to 30°C	±10% of reading or 2 mg/L-N, whichever is greater	0.01 mg/L	mg/L-N, mV	1, 2, or 3 point (user selectable)
Chloride***	Ion Selective Electrode	0 to 1000 mg/L, 0 to 40°C	±15% of reading or 5 mg/L, whichever is greater	0.01 mg/L	mg/L-Cl-, mV	1, 2, or 3 point (user selectable)
Total Dissolved Solids (TDS)	Calculated from conductivity and temperature	0 to 100 g/L TDS constant range 0.30 to 1.00 (0.64 default)		0.001, 0.01, 0.1g/L	kg/L, g/L	
Barometer	Piezoresistive	375 to 825 mmHg	±1.5 mmHg from 0 to 50°C	0.1 mmHg	mmHg, inHg, mbar, psi, kPa, ATM	1 point

Instrument Only Specifications (at Ambient Temperature)

pH		-2.60 to 16.60	±0.1 mV (0.01 pH units)	0.1 mV (0.01 pH units)		
ORP		-1999 to +1999 mV	±0.5 mV	0.1 mV		
Conductivity		0.0 to 200 mS/cm each range	±0.1% FS ±1 digit for uS/cm to 0.1 mS/cm (range dependent)	0.0001 mS/cm or 0.1		
Dissolved Oxygen		0.00 to 90 mg/L; 0 to 550%	±0.2% FS (550% air saturation) ±1 digit (with 1.25 PE membrane at 10°C)	0.01 mg/L; 0.1% air saturation		
Temperature		-10 to 100.00°C	±0.2% FS ±1 digit	0.1°C	°C, °F, K	

*Lab-grade cables include 605107, -108, -109, 605177, -178, -179 ** Derived parameters can include resistivity, salinity, specific conductance, and total dissolved solids
***ISE sensors for freshwater only; 17-meter maximum depth

Casella Microdust pro Particulate Monitor

Introduction

The Microdust Pro from Casella USA is a portable, real time monitor for assessing the concentration of suspended particulate matter, and is probably the most versatile instrument available with the ability to measure from 1µgm^{-3} to 2500 mgm^{-3}. It is the only hand-held real-time dust monitor on the market capable of graphically presenting variations in dust concentration on a real time scrolling graph – no longer is it necessary to wait to analyze results on a PC.

Key benefits

- Wide range from 1µgm^{-3} to 2500 mgm^{-3} in single meter
- Data-logger with >15,700 readings
- Detachable probe
- TSP, PM_{10}, $PM_{2.5}$ or respirable measurements
- Firmware calibration and zero in the field
- 4 user defined calibration routines available for differing dust types
- Alkaline or rechargeable batteries or mains power
- 32bit *WinDustPro* PC software as standard

Applications

- Occupational health & safety monitoring
- Walk through surveys
- Site boundary monitoring & environmental measurement
- Industrial process monitoring
- Testing respiratory equipment or air filtration efficiency
- Research activities

Each Microdust Pro is individually **factory calibrated**, using a gravimetric technique. The instrument can be returned to this "factory" calibration setting at any time during its life by the use of a non-degradable **calibration insert** (supplied with every unit). An individual **gravimetric calibration** is also possible. This involves the simultaneous collection of a gravimetric (filtered) sample of the dust. In this way, two averages are collected over the exposure period. One is from the filter, whilst the other is provided by the averaging function within the instrument. It is then possible to derive the difference in these two figures and correct accordingly.

Operation and use

The Microdust Pro measures particulate concentrations using a near forward angle light scattering technique. Infrared light of 880nm wavelength is projected through the sampling volume where contact with particles causes the light to scatter. The amount of scatter is proportional to the mass concentration and is measured by the photo detector. By using a narrow angle of scatter (12-20°) the majority of light scattered is in the diffracted and refracted components, which minimizes the uncertainty associated with particle color, shape and refractive index.

real time scrolling display of concentration levels with user selectable time bases and auto ranging y-axis scale

The Microdust Pro features an internal logger that can store up to 15,700 data points over 32 separate runs. The logging interval can be set from 2 seconds to 10 minutes. At 2 seconds, it is possible to record 8.75 hours of data; at 5 minutes, this equates to a total logging time of 50 days. Recorded values include:

- Average concentration over the logging period (mgm^{-3})
- Maximum concentration over the logging period (mgm^{-3})
- Date and time stamp

Logged results are downloaded to the included MS Windows software package.

Casella USA
(800) 366-2966
info@CasellaUSA.com

CASELLA USA
CASELLA MICRODUST PRO PARTICULATE MONITOR
OVERVIEW

Technical Information	
Sensing Technique:	Near forward light scattering - 880nm infra red
Ranges:	All instruments provide 0 to 2500 mgm^{-3} over four ranges as standard:
Resolution:	0.001 mgm^{-3} (1μgm^{-3})
Operating Temp Range:	32 to 122 °F (0 to 50°C) non condensing
Storage Temp Range:	-4 to 131 °F (-20°C to +55°C)
Calibration:	Gravimetric method using 'Arizona Fine' calibration dust (ISO12103-1, A2)
Zero Stability:	±0.002 mgm^{-3}/ °C
Span Stability:	<0.7% FSD / °C
POWER	
Battery:	4 x AA / MN1500 cells - Alkaline or rechargeable NiCad
Operating Duration:	Alkaline (2700mAh) typically >20 hours NiCad cells (950mAh) typically >10 hours
Battery Charging:	Internal NiCad fast charger circuitry (with time-out protection)
Charge Rate:	Fast charge rate 450mA, Standby charge rate 55mA
Power Adapter:	Universal input voltage range 100-240VAC, 47-63Hz
Output:	12VDC @ 800 mA
GENERAL	
Analogue Output:	0 to 2.5 V_{DC} FSD, 500Ω output impedance (3ms update rate)
Keypad:	7 key tactile membrane
Weight:	Instrument only = 34.6 oz (0.97 Kg) (complete kit plus case = 10lb - 4.5Kg)
Dimensions:	Probe = 1.4 Ø x 11.6 in (35mm Ø x 290mm) total length Instrument H x W x D = 9.8 x 3.8 x 2.0 in (245 x 95 x 50mm)
Maintenance:	Factory cleaning required annually depending on measurement conditions
DISPLAY	
Display:	128 x 64 pixel LCD graphics panel with backlight
Displayed Values:	
Instantaneous reading:	Rolling average concentration over a user selectable period (1 to 60 sec)
Other readings:	AVE & MAX concentration since power on or reset
Scrolling Graphs:	100 / 200 seconds, 15 minutes or 60 minutes (Y Axis auto-ranging or fixed)
Battery voltage:	Battery Voltage with 'OK' / 'Low' status message.
CALIBRATION	
Factory Calibration:	Traceable isokinetic technique (wind tunnel) and ISO 12103-1
User Calibration:	Four user defined calibration settings available stored for later use.
Routine Calibration:	Firmware calibration for zero & span setting in the field by user. Optical calibration filter supplied (restores factory calibration)
DATA LOGGING	
Internal Memory:	64K EEPROM providing 15,700 data points
Logging Interval:	Adjustable from 2 to 600 seconds.
Recorded Values:	Average, spot, max & min concentration over logging period
Serial Interface:	RS232 up to 38.4K baud
Ordering Information	
176000A	Microdust pro kit in carrying case with standard accessories
176093A	Environmental enclosure with pump, adaptor and rechargeable battery pack
103214B	Gravimetric dust adaptor
103187B	Aspirated adaptor
103182B	Respirable dust adaptor
151280B	Size selective adaptor
103396B	Iso-kinetic adaptor (for use with stack sampler)

Casella USA
(800) 366-2966
info@CasellaUSA.com

CASELLA USA

ANNEXES

JDC -Flowatch Flow Meter

The FLOWATCH portable flowmeter is a versatile instrument designed for simple and accurate measurement of air and water flow. This instrument (flowmeter - thermometer) has been developed for use under challenging circumstances. Because of its different impellers, you can use it to measure almost any liquid or gaseous medium. The standard FLOWATCH kit comes complete with a display, 1.2 meter telescoping rod, carrying case and two flow sensors; one for water and one for air. Additional sensors are available, including a hanging water sensor with 15 meter cable.

Features:	Specifications:
- Instant speed, air or water. - Maximum and average speed. - Temperature - Minimum and maximum temperatures. - Windchill (when used as windmeter). - Replaceable sensors. - User selectable averaging period from 3 seconds to 24 hours. - EL Backlight. - Waterproof. - Floats. - 2 AA Batteries. - Aluminum base for tripod attachment. - Aluminum carrying case for all parts.	- Weight (Display Unit) - 8.3 oz (230 g),br> - Dimensions (Display Unit) - 2.5" × 2.5" × 5.1" (6.4 × 6.4 × 13 cm), - Dimensions (Included Case) - 25" × 13.5" × 3.5" (63.5 × 34 × 9 cm). - Flow Speed Units - km/h, mph, knots, m/s and cm/s. - Flow Speed Accuracy - +/- 5 % from - 10° to + 50°C. - Flow Speed Range - 2 to 150km/h. - Temp Units - °C, °F and windchill. - Temp Accuracy - +/- 1°. - Temp Functions - Current, minimum, average, maximum temperature and windchill factor.


GasAlert Quattro
multi-gas detector
H_2S
CO
O_2
LEL
Visual auditing, easy compliance
Rugged and reliable, the GasAlertQuattro four-gas detector combines a comprehensive range of features with simple one-button operation. With flexible power options, the GasAlertQuattro is always ready. The graphic LCD displays easy to identify icons that indicate operational information, such as bump test and calibration status for simplified onsite auditing. IntelliFlash provides continuous visual confirmation of detector operation and compliance. Suited to a wide range of industrial applications including confined space entry, the GasAlertQuattro is fully compatible with BW's MicroDock II automatic test and calibration system.
Easy one-button operation
Always ready when you are
Simple, visual compliance
QUATTRO
• Minimize costs and training with one-button operation
• Field-proven Surecell sensors offer an unprecedented performance in even the harshest environments
• Interchangeable power options with extended battery runtimes for longer shifts
WATER RESISTANT
BW Technologies by Honeywell
Wear yellow. Work safe.
See green.

Standard features of BW products:

- Continuous LCD shows real-time gas concentrations
- Compact and lightweight design makes it comfortable to wear
- Simple automatic calibration procedure; compatible with BW MicroDock II automatic test and calibration station
- Full function self-test of sensor(s), battery status, circuit integrity and audible/visual alarms on start up and continuous testing on sensor(s)
- Bright wide-angled visual alarm bars
- Built-in concussion-proof boot

GasAlertQuattro Specifications

Size	5.1 x 3.2 x 1.9 in. / 13.0 x 8.1 x 4.7 cm
Weight	- 11.15 oz. / 316 g (with rechargeable battery pack) - 11.92 oz. / 338 g (with alkaline battery pack)
Temperature	-4 to +122°F / -20 to +50°C
Humidity	10% - 100% RH (non-condensing)
Alarms	- Visual (six, red LEDs), vibrating, audible (95dB) - Low, High, STEL, TWA, OL (over limit)
Tests	Sensor integrity, circuitry, battery and audible/visual alarms on activation, battery (continuous), sensor (continuous)
Pump	Compatible with the Sampler motorized sampling pump
Battery life	AA alkaline: 14 hrs (+68 to 122°F / +20 to 50°C) Rechargeable: 20 hrs (+68 to 122°F / +20 to 50°C) 18 hrs (-4 to +32°F / -20 to 0°C)
User options	Confidence / compliance beep Confidence flash Set STEL interval Sensor on/off Latching alarms Safe display mode Force calibration Auto-zero on start up Flip display Combustible gas measurement (% LEL or % by volume methane) User-definable calibration gas concentration Force bump Language choices (five) Custom start up message Datalog interval
Ratings	EMI/RFI: Complies with EMC Directive 2004/108/EC IP66/IP67
Certifications and approvals	Class I, Div. 1, Gr. A, B, C, D **ATEX:** II 1 G Ga Ex ia IIC T4 **IECEx:** Ga Ex ia IIC T4 BR-Exia IIC T4
Warranty	Full two year warranty including all sensors

Additional GasAlertQuattro features:

- Powered by an interchangeable rechargeable battery pack or alkaline pack with 3 AA batteries
- One-button operation and straightforward user interface minimizes training
- Comprehensive datalogging and event logging capacity
- IntelliFlash verifies operation and compliance to both the user and supervisors from up to 20 ft. / 6.1 m
- Enhanced resistance to common industrial cross sensitive gases such as methanol and ethanol (CO and H_2S sensors)
- Multi-language support in English, French, German, Spanish and Portuguese
- Field-proven Surecell sensors offer an unprecedented performance in even the harshest environments.

Options and Accessories


MicroDock II compatible


Carrying holster


Auxiliary filter


Vehicle attachment

For a complete list of accessories, please contact BW Technologies by Honeywell.

Sensor Specifications

Gas	Measuring Range	Resolution
Hydrogen sulfide (H_2S)	0-200 ppm	0.1 ppm
Carbon monoxide (CO)	0-1000 ppm	1 ppm
Oxygen (O_2)	0-30.0%	0.1%
Combustible gases (%LEL)	0-100% LEL 0-5.0% v/v	1% 0.1%

Alarm setpoints for all sensors are user adjustable. Setpoint(s) are automatically displayed during instrument start up.

BW Technologies by Honeywell

Locally available from

Brandt Instruments, Inc.
18568 Oak Grove Pkwy
Prairieville, LA 70769
1-800-337-6291 / 225-673-6776
http://www.brandtinst.com
E-Mail: dbrandt@brandtinst.com

DUE TO ONGOING RESEARCH AND PRODUCT IMPROVEMENT, SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

The Sper Scientific Sound Level Pen

Type 2 sound meter with one-button operation

The Sper Scientific Sound Level Pen features a type 2 internal calibrator, one-button operation, low cost, auto-ranging and max hold in a mini size.

The Sper Scientific Sound Level Pen is the smallest, lightest, easiest to carry sound meter in the world. Despite its small size, the Sound Level Pen is a full function type 2[1] sound meter perfect for testing OSHA requirements and most other sound meter applications. Auto-ranging with simple one-button operation. Press once to begin reading sound levels. Press the button a second time and the display holds the maximum reading, updating as new maximums are reached. Hold the button for 2 seconds to turn the unit off. Measures the 32 ~ 130 dB range in the "A" scale, with an accuracy of ±1.5 dB. The display provides 0.1 dB resolution, under range, over range and low battery indicators. The Sound Level Pen calibrates electronically to its own internal oscillator[2] or external 2 Pt. Acoustical Calibrator 850016. Comes ready to use with two AAA batteries, instructions, calibration tool, and a wind screen. N.I.S.T. traceable certificate of calibration available.

Dimensions: 8" × 1½" × 1" (203 × 38 × 25 mm)
Weight: 4.3 oz (122 g)

[1] Meets ANSI S1.4 Type 2 and IEC61672-1 Class 2
[2] 94dB at 1kHz

Annex XI Water Sampling Sites

SITE			Coordinates	
ID#	Description River/Tributary	Way Point	Lat	Long
1	Mopan - Benque/Succotz	WP1	17.0787	-89.1367
2	Macal-Upper Stream	WP 2	17.1569	-88.0686
3	Macal-Down Stream	WP3	17.1734	-89.0718
4	Garbutt Creek - Central Farm/Galen Uni.	WP4	17.1591	-89.0662
5	Barton Creek – Riverwalk	WP5	17.2038	-88.9558
6	Belize - Iguana Creek Bridge	WP6	17.2235	-88.9091
7	Ontario Natural Spring	WP7	17.2607	-88.7895
8	Roaring Creek Bridge	WP8	17.2513	-88.795
9	Roaring Creek Riviera/Butte Rows	WP9	17.2513	-88.795

ANNEXES

Sampling Point

#1: Mopan River – Benque/Succotz

Sampling Point

#2: Macal River – Up Stream

Sampling Point

#3: Macal River – Down Stream

Sampling Point

#4: Garbutt Creek-Central Farm-Galen University

Sampling Point

#5: Barton Creek Riverwalk

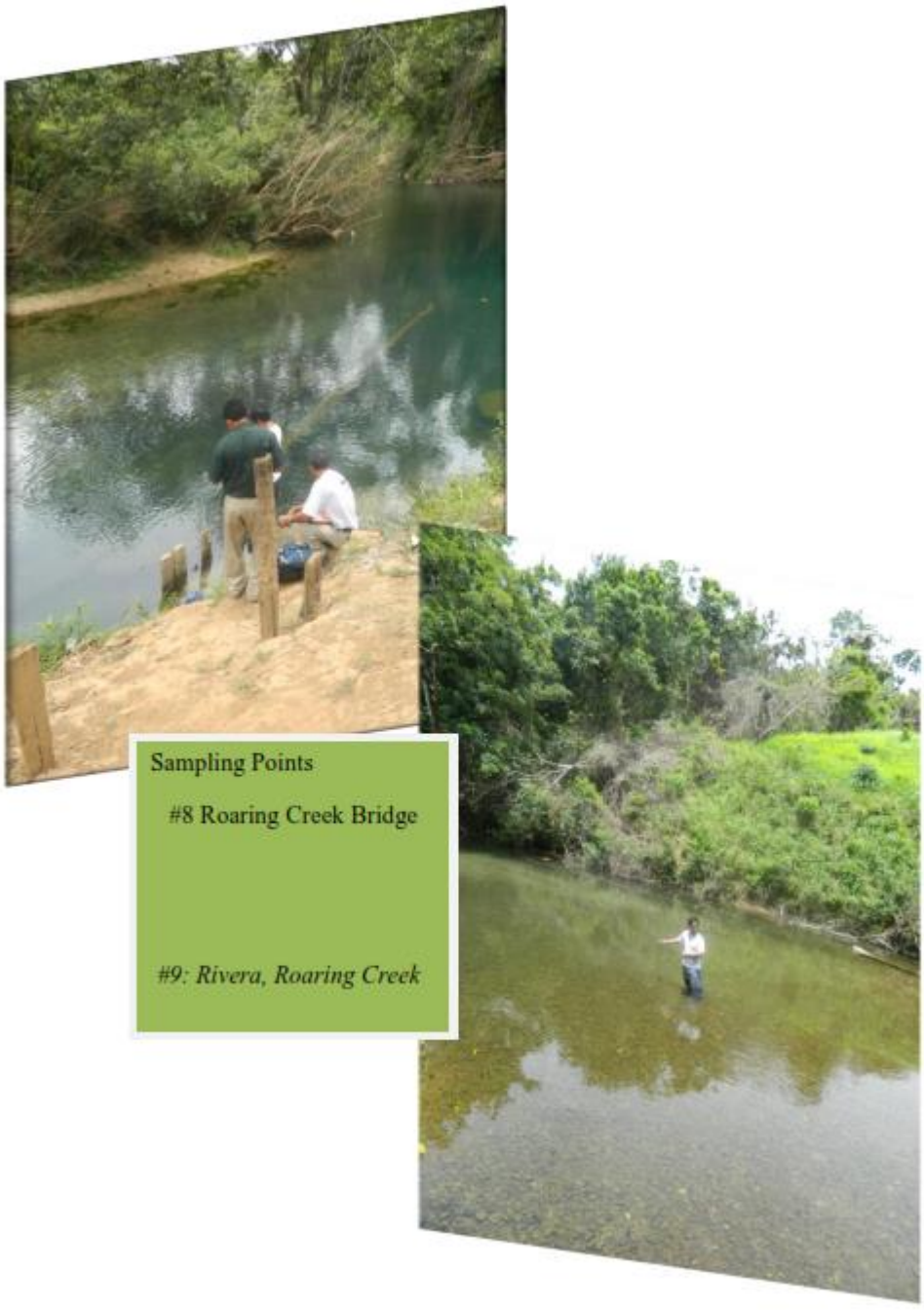
Sampling Point

#6: Iguana Creek Bridge

Sampling Point

#7: Ontario Water Fall

ANNEXES



Sampling Points

#8 Roaring Creek Bridge

#9: Rivera, Roaring Creek

Annex XII Water Analysis Results

Results of the In-situ Analysis Using the YSI Professional Plus Water Probe and Laboratory Water Analysis

Samples Taken June 27, 2014

			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9
	Time		**9:08 am**	**9:51 am**	**10:15 am**	**10:42 am**	**10:59 am**	**11:38 am**	**12:00 pm**	**12:36 pm**	**12:46 pm**
1	**Temp**	**°C**	27.6	28.2	28.6	26.3	26.4	26.3	26.7	28.9	29.5
2	**SPCond**	**mS/cm**	0.432	0.236	0.284	0.611	0.471	0.475	0.477	0.533	0.368
3	**Cond**	**mS/cm**	0.453	0.251	0.303	0.626	0.484	0.487	0.493	0.573	0.400
4	**Ammonium NH4-N**	**mg/l**	0.00	0.31	0.17	0.17	0.09	0.06	0.05	0.03	0.02
5	**Salinity**	**ppt**	0.21	0.11	0.13	0.29	0.23	0.23	0.23	0.25	0.17
6	**DO Sat**	**%**	51.8	48.3	47.4	40.9	45.6	45.5	48.5	46.3	48.0
7	**DO**	**mg/l**	4.05	3.74	3.65	3.28	3.65	3.66	3.87	3.54	3.64
8	**TDS**	**Mg/l**	280.2	153.4	184.6	393.5	306.2	308.7	310.0	344.5	239.2
9	**Baro**	**mmHg**	753.8	756.2	756.1	755.8	757.0	758.6	758.7	756.0	757.2

Water Samples Analysis											
National Water Quality Monitoring Programme - Public Health Bureau-Min. of Health Received: June 27, 2014 3:35 pm Analysis June 28 and July1, 2014											
			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9
	Time		9:00 am	10:00 am	10:30 am	10:45 am	11:30 am	12:45 pm	12:40 pm	12:30 pm	12:20 pm
10	pH	unit	8.03	7.86	7.84	7.61	7.66	8.23	8.05	7.93	7.83
11	Iron	mg/l	<0.01	0.17	0.16	<0.01	0.02	0.06	<0.01	0.05	<0.01
12	Orthophosphate (Phosphate)	ppm	0.4	0.11	0.10	0.14	0.06	0.07	0.10	0.06	0.01
13	Nitrate - N	mg/L	1.4	1.1	1.2	2.1	1.2	1.3	1.1	1.1	1.1
14	Sulphate (S)	ppm	5	9	13	6	9	6	<1	1	<1
15	Turbidity (Turb)	NTU	8.26	5.88	5.68	2.52	2.90	10.1	3.31	1.81	1.87
16	Conductivity (Cond)	uS/cm	460	255	291	587	481	379	529	481	483
17	Total Dissolved Solids (TDS)	mg/l	229	128	145	292	241	189	265	241	243

Water Samples Analysis											
National Water Quality Monitoring Programme - Public Health Bureau-Min. of Health Received: June 27, 2014 3:35 pm Analysis June 28 and July1, 2014											
18	**Alkalinity (ALK)**		206	104	104	284	214	164	242	232	226
19	**Chlorides (CHL)**	**mg/l**	1	1	1	1	1	1	1	1	1
20	**Tot. Hardness (Hardn)**	**mg/l**	256	136	160	342	268	216	272	270	284
21	**Fluoride (F)**		0.111	0.107	0.096	0.093	0.115	0.090	0.084	0.091	0.094
22	**Total Coliform**	**/100ml**	>160	>800	>800	800	>800	160	>800	>800	>800
23	**Faecal Coliform**	**/100ml**	160	160	140	40	100	60	160	200	100
24	**Escherichia coli (E. coli)**	**/100ml**	80	80	70	30	70	40	120	60	50
	TNTC - Too Numerous To Count N/D - Not Detected The W.H.O. Guideline for Total Faecal Coliform in drinking water is 0 counts/100ml										

Water Samples Analysis

Bowen and Bowen Waste and Wastewater Laboratory **Received: June 27, 2014 4:20 pm Analysis**

				Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9
	Time			9:00 am	10:00 am	10:30 am	10:45 am	11:30 am	12:45 pm	12:40 pm	12:30 pm	12:20 pm
25	**Chemical Oxygen Demand (COD)**	**LOD 0.7/3** **LOQ 40/150**	**mg/l**	2.0	2.1	2.6	<0.7	<0.7	1.1	6	<0.7	8

Belize Natural Energy Laboratory **Received: June 27, 2014 1:08 pm Analysis**

26	**Oil in Water**	**ppt**	0.00076	0.00059	0.00029	0.00155	0.00146	0.00073	0.01271	0.01298	0.01496

River/Tributary		Mopan Benque/ Succotz Jtc.	Macal Upper Stream	Macal Lower Stream	Garbutt Creek Central Farm/ Galen	Barton Creek Riverwalk	Belize Iguana Creek Bridge	Natural Spring Ontario Natural Spring	Roaring Creek Roaring Creek Bridge	Roaring Creek Rivera Site Butte Rows
Coordinates (Megellan GPS)		WP1	WP 2	WP3	WP4	WP5	WP6	WP7	WP8	WP9
	Lat	17.07869	17.15685	17.17337	17.15913	17.20384	17.22352	17.26072	17.25126	17.25130
	Long	-89.1367	-88.0686	-89.0718	-89.0662	-88.9558	-88.9091	-88.7895	-88.7950	-88.7950

TNTC - Too Numerous To Count N/D - Not Detected The W.H.O. Guideline for Total Faecal Coliform in drinking water is 0 counts/100ml LOD- Detection Limit LOQ-Quantification Limit

Bacteriological Water Sample Collection Form
Public Health Bureau

Sampler's Name: Mr.Fabro

Date Sample(s) Collected: 27.6.2014

District: Cayo

Method of analysis: Membrane Filtration

Indicate by ticking, the type of sample: [ ] Routine [ ] x Special [ ] Repeat

Was sample(s) sent with ice packs or ice [ ] x Yes [ ] No Was sample received cold [ ] x Yes [ ] No

FOR LABORATORY USE ONLY

Date Sample(s) analyzed: 27.6.2014

Time Incubation started: 5-6pm

Date & Time Incubation stopped: 28.6.2014 – 12pm

NATIONAL WATER QUALITY LAB MINISTRY OF HEALTH BELIZE

Bottle Number	Description of Where Sample(s) Collected From:	Time a.m.x p.m.	Type of Source Groundwater (G) Surface (S) Tank (T)	Type of Sample Grab (G) Split (S) Composite (C)	Type of Water Treated (T) Untreated (U)	Name of City Town Village	Total Coliform Per 100ml	Fecall Coliform Per 100ml	E.Coli Per 100 ml
1	Mopan river –(B.Viejo&Succotz)	9:00x	S	G	U		>160	160	80
2	Macal river upstream(after Hawksworth bridge)	10:00	S	G	U		>800	160	80
3	Macal river downstream	10:30	S	G	U		>800	140	70
4	Creek (Central Farm & Galen	10:45	S	G	U		800	40	30
5	Barton Creek (riverwalk)	11:30	S	G	U		>800	100	70
6	River – (Iguana Creek bridge)	12:45pm	S	G	U		160	60	40
7	Ontario spring	12:40pm	S	G	U		>800	160	120

Name of Analyst A. Flores

Bacteriological Water Sample Collection Form
Public Health Bureau

Sampler's Name: Mr.Fabro

Date Sample(s) Collected: 27.6.2014

District: Cayo

Method of analysis: Membrane Filtration

Indicate by ticking, the type of sample: ☐ Routine ☐ x Special ☐ Repeat

Was sample(s) sent with ice packs or ice ☐ x Yes ☐ No Was sample received cold ☐ x Yes ☐ No

FOR LABORATORY USE ONLY

Date Sample(s) analyzed: 27.6.2014

Time Incubation started: 5-6pm

Date & Time Incubation stopped: 28.6.2014 – 12pm

NATIONAL WATER QUALITY ... MINISTRY OF HEALTH BELIZE

Bottle Number	Description of Where Sample(s) Collected From:	Time a.m.x p.m.	Type of Source Groundwater (G) Surface (S) Tank (T)	Type of Sample Grab (G) Split (S) Composite (C)	Type of Water Treated (T) Untreated (U)	Name of City Town Village	Total Coliform Per 100ml	Fecall Coliform Per 100ml	E.Coli Per 100 ml
8	River –(by Roaring Creek bridge)	12:30pm	S	G	U		>800	200	60
9	River – (Rivero area –near Quality Poultry Rd.)	12:20pm	S	G	U		>800	100	50

Name of Analyst A. Flores

j

Chemical Sample Collection Form

Public Health Bureau

Sampler's Name: Mr. Fabro Date of sampling: 27.6.2014

District: Belize/Cayo Date of analysis: 28.6.&1.7.2014

Type of sample: ☐ x Grab ☐ Split ☐ Composite

Sample received with ice or ice packs: ☐ x Yes ☐ No

Type of water source: Surface water

Bottle No:	Time of collection	pH	Iron mg/l	Ortophosphates (mg/l)	Nitrate - N (mg/l)	Sulfate mg/l	Turb NTU	Cond	TDS mg/l	ALK mg/l	CHL mg/l	Hardn mg/l	F mg/l
1	9:00am	8.03	<0.01	0.4	1.4	5	8.26	460	229	206	1	256	0.111
2	10:00am	7.86	0.17	0.11	1.1	9	5.88	255	128	104	1	136	0.107
3	10:30am	7.84	0.16	0.10	1.2	13	5.68	291	145	104	1	160	0.096
4	10:45am	7.61	<0.01	0.14	2.1	6	2.52	587	292	284	1	342	0.093
5	11:30am	7.66	0.02	0.06	1.2	9	2.90	481	241	214	1	268	0.115
6	12:45pm	8.23	0.06	0.07	1.3	6	10.1	379	189	164	1	216	0.090
7	12:40pm	8.05	<0.01	0.10	1.1	<1	3.31	529	265	242	1	272	0.084
8	12:30pm	7.93	0.05	0.06	1.1	1	1.81	481	241	232	1	270	0.091
9	12:20pm	7.83	<0.01	0.01	1.1	<1	1.87	483	243	226	1	284	0.094

NATIONAL WATER QUALITY LABORATORY
MINISTRY OF HEALTH
BELIZE

Method of Analysis

pH –pH meter(electrode)

Iron – Colourimetric/UV-VIS Spectrophotometer

Ortophosphate- Colourimetric/UV-VIS Spectrophotometer

Nitrate - Colourimetric/UV-VIS Spectrophotometer

Sulfate - Colourimetric/UV-VIS Spectrophotometer

Turbidity (Turb) – Turbidimeter

Conductivity (Cond) – Conductivity meter (units of measurement: umhos/cm)

Total Disscolved Solids (TDS) – TDS meter

Alkalinity (ALK) – Titration with sulphuric acid

Chlorides (CHL) – Titration with mercuric nitrate

Total hardness (Hardn) – Titration with EDTA

Fluoride (F) – ISE meter (ion selective electrode)

Name of Analyst

NATIONAL WATER QUALITY LABORATORY
MINISTRY OF HEALTH
BELIZE

Belize Environmental Technologies
Belize City, Belize
Sample Collection

Sampling Date: June 27, 2014 Project: 6 Pit Rehab

Analyses Required: Bacti + Chemical Analysis

Site ID	Sample Type[1]	Sample Matrix[2]	Container Type[3]	Preservative[4]	Time Collected	Sampler's Initials
1	G	W	Plastic	No	9:00	
2	G	W	"	"	10:00	
3	G	W	"	"	10:30	
4	G	W	"	"	10:45	
5	G	W	"	"	11:30	
6	G	W	"	"	12:45	
7	G	W	"	"	12:40	
8	G	W	"	"	12:30	
9	G	W	"	"	12:20	

1. Sample Type: Grab or Composite.
2. Sample Matrix: water, sediment, etc.
3. Container Type: e.g., 1 L plastic bottle, 250 mL glass bottle, 100 mL Whirl-Pak bag, etc.
4. Preservative: indicate the concentration and amount used if applicable (e.g., H_2SO_4 to pH < 2).

Chain of Custody

Samples Collected by: M Fabro

Released to lab by: Juan Cawich Date: 27/6/14 Time: 3:35 pm

Received for lab by: A. Flores Date: 27/6/14 Time: 3:35 pm

Laboratory storage location: Public Health

File: BET2014 Chain of Custody

Page 6 of 6

BOWEN & BOWEN, LTD.
P.O. BOX 37 - #1 KING STREET
BELIZE CITY, BELIZE
CENTRAL AMERICA

Report No: 66-2014

Water & Waste Water Laboratory
Environmental and Drinking Water Analysis Services

WATER ANALYSIS REPORT

Request Information:

To:	Juan Rancheran	Customer:	Belize Environmental Technologies
From:	Wilbert Estrada		
Copy:	Manuel Lanza	Address:	Belize City
Country:	Belize	Report Date:	2014/6/27
Report No:	66-2014		

Sample ID	*Description:*	*Condition of sample at arrival:*
1	*NA*	*Normal, <20°C*
2	*NA*	*Normal, <20°C*
3	*NA*	*Normal, <20°C*
4	*NA*	*Normal, <20°C*
5	*NA*	*Normal, <20°C*
6	*NA*	*Normal, <20°C*
7	*NA*	*Normal, <20°C*
8	*NA*	*Normal, <20°C*
9	*NA*	*Normal, <20°C*

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.

Old Airport Road
Ladyville
Belize
Belize C.A

BOWEN & BOWEN, LTD.
P.O. BOX 37 - #1 KING STREET
BELIZE CITY, BELIZE
CENTRAL AMERICA

Report No: 66-2014

Water & Waste Water Laboratory
Environmental and Drinking Water Analysis Services

Details:

Sample ID:	1,2,3,4,5,6,7,8,9	Sampling Date:	2014/6/27
Sample point:	NI	Sampled by:	M Fabro
Sample Type:	Surface Water	Reception Date:	2014/6/27

Parameter	*LOD*	*LOQ*	*Unit of Meas.*	*Result 1*	*Result 2*	*Result 3*	*Result 4*	*Result 5*	*Result 6*	*Result 7*	*Result 8*	*Result 9*	*Method*	*Analysis Date*
ORGANIC CHEMISTRY														
Oxygen Demand, Chemical (COD)	0.7/3	40/150	mg/l	**2.0**	**2.1**	**2.6**	**<0.7**	**<0.7**	**1.1**	**6**	**<0.7**	**8**	HACH Method 8000	2014/6/27

Analysts:
Esbin Chi

Abbreviation/Considerations:

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

Comments:
Note: For microbiological analysis LOD and LOQ's refer to the optimal colony density that the method is designed to obtain, if any contamination, after culturing either full sample concentrates or at different dilution factors.

Authorized By: Manuel Lanza on: 2014/6/30

---- End of Report ----

Belize Environmental Technologies
Belize City, Belize
Sample Collection

Sampling Date: 27/6/14 Project: GPH Rehab

Analyses Required: C.O.D B.O.D

Site ID	Sample Type[1]	Sample Matrix[2]	Container Type[3]	Preservative[4]	Time Collected	Sampler's Initials
1	G	W	Plastic	NO	9:00	
2	G	W	"	"	10:00	
3	G	W	"	"	10:30	
4	G	W	"	"	10:45	
5	G	W	"	"	11:30	
6	G	W	"	"	12:45	
7	G	W	"	"	12:40	
8	G	W	"	"	12:30	
9	G	W	"	"	12:20	

1. Sample Type: Grab or Composite.
2. Sample Matrix: water, sediment, etc.
3. Container Type: e.g., 1 L plastic bottle, 250 mL glass bottle, 100 mL Whirl-Pak bag, etc.
4. Preservative: indicate the concentration and amount used if applicable (e.g., H_2SO_4 to pH < 2).

Chain of Custody

Samples Collected by: M Tzib

Released to lab by: Juan Pandersan Date: 27/6/14 Time: 4:20

Received for lab by: Justin Gibbs Date: 27/6/14 Time: 4:20

Laboratory storage location: B+B Lab.

File: BET2014 Chain of Custody

Page 6 of 6

BELIZE NATURAL ENERGY

Report ID: 140708IW01

Client: Department of the Environment

Sample Origin: Multiple/Fresh Water

Sample Date: 27-06-2014

Sample Time: Unspecified

Test: Oil In water

Sample Number	Sample Reference	Result (ppt)	Analyst
1	14070701-EW	0.00076	YG
2	14070702-EW	0.00059	YG
3	14070703-EW	0.00029	YG
4	14070704-EW	0.00155	YG
5	14070801-EW	0.00146	YG
6	14070802-EW	0.00073	YG
7	14070803-EW	0.01271	YG
8	14070804-EW	0.01298	YG
9	14070805-EW	0.01496	YG

Yadir Itan Guerra

8/7/14
Date

Belize Natural Energy LTD.
Laboratory
Ext. No. 150

Belize Environmental Technologies
Belize City, Belize
Sample Collection

Sampling Date: June 27 2014 Project: GPH Rehab

Analyses Required: Oil in water (Hydro carbon)

Site ID	Sample Type[1]	Sample Matrix[2]	Container Type[3]	Preservative[4]	Time Collected	Sampler's Initials
1	G	W	Plastic 1L	No	9:00	
2	G	W	"	"	10:00	
3	G	W	"	"	10:30	
4	G	W	"	"	10:45	
5	G	W	"	"	11:30	
6	G	W	"	"	12:45	
7	G	W	"	"	1240	
8	G	W	"	"	1230	
9	G	W	"	"	1220	

1. Sample Type: Grab or Composite.
2. Sample Matrix: water, sediment, etc.
3. Container Type: e.g., 1 L plastic bottle, 250 mL glass bottle, 100 mL Whirl-Pak bag, etc.
4. Preservative: indicate the concentration and amount used if applicable (e.g., H_2SO_4 to pH < 2).

Chain of Custody

Samples Collected by: M Fabro

Released to lab by: Juan Ramdhan Date: 27/6/14 Time: 1:08

Received for lab by: Albert Rodriguez Date: 27/6/14 Time: 1:08

Laboratory storage location: Iguana Creek BNE

File: BET2014 Chain of Custody

Page 6 of 6

ANNEXES

Annex XIII: Socio-Economic Baseline Survey Questionnaire

CONTROL VARIABLES				**C**
C1 HH IDN? ⓪①②③④⑤⑥⑦⑧⑨ ⓪①②③④⑤⑥⑦⑧⑨ ⓪①②③④⑤⑥⑦⑧⑨			**C2.** Date of Interview, ☐☐☐☐ 2014 (dd mm)	
C3. Interviewer name and code? Name _____ ☐☐			**C4.** Supervisor name and code? Name_____ ☐☐	
C5. CTVC: ⓪①②③④⑤⑥⑦⑧⑨ ⓪①②③④⑤⑥⑦⑧⑨	**CODES**	01 Belmopan 02 Roaring Creek 03 Camalote 04 Teakettle	05 Ontario 06 Blackman Eddy 07 Unitedville 08 Georgeville	09 Central Farm 10 Esperanza 11 Santa Elena 12 San Ignacio 13 San Jose Succotz 14 Benque Viejo
C6. Household Located along ROW? 1 Yes ◯ 2 No ◯			**C7.** Household Located Within Critical Spot? *1 Flooding* ◯ *2 Horizontal Alignment* ◯ *3 Vertical Alignment* ◯ *4 Other* ◯	

GOOD MORNING/AFTERNOON/EVENING, I AM FROM THE ***Belize Environmental Technologies Consultancy Firm;*** WE HAVE BEEN CONTRACTED BY THE MINISTRY OF WORKS (MOW) AND ARE GATHERING BASELINE INFORMATION FROM COMMUNITIES WHICH MAY BE IMPACTED BY THE PROPOSED REHABILITATION OF THE GEORGE PRICE FROM THE BELMOPAN JUNCTION (47.9) TO THE BENQUE VIEJO-GUATEMALA BORDER (79.4), INCLUSIVE OF THE ROARING CREEK BRIDGE.

THE QUESTIONNAIRE CONSISTS OF SEVEN (7) MAIN SECTIONS: DEMOGRAPHICS; ROAD TRANSPORT OVERVIEW; DISABILITY & HEALTH ; EMPLOYMENT STATUS AND ECONOMIC ACTIVITY; HOUSING, LAND TENURE & ASSETS; WATER & SANITATION; AND HIV-AIDS: KNOWLEDGE.

THE OBJECTIVES OF THE SURVEY ARE TO:

- ❑ UNDERSTAND THE SOCIOECONOMIC CONTEXT OF THE STUDY AREA, INCLUDING SOCIO-ECONOMIC, HISTORICAL, POLITICAL AND ECONOMIC CONDITIONS...
- ❑ UNDERSTAND THE EXPECTATIONS AND CONCERNS OF COMMUNITIES POTENTIALLY AFFECTED WITH REGARDS TO THE PROJECT.
- ❑ PROVIDE DATA THAT INFORMS THE IMPACT ASSESSMENT IN ORDER TO PREDICT AND EXPLAIN POTENTIAL PROJECT IMPACTS AS WELL AS ESTABLISH MITIGATION MEASURES; AND

WITH YOUR PERMISSION, I WOULD LIKE TO ASK YOU A FEW QUESTIONS ABOUT YOUR HOUSEHOLD AND MEMBERS. THE INTERVIEW WILL TAKE ABOUT 45 MINUTES. ALL THE INFORMATION OBTAINED WILL REMAIN STRICTLY CONFIDENTIAL. MAY I START NOW?

◯ *1 Yes, permission is given ⇨ Go to **QC14.** to record the time and then begin the interview.*

◯ *2 No, permission is not given ⇨ Complete **QC9**. Discuss this result with your supervisor.*

After Questionnaire for the household has been completed, fill in the following information:	
C8. Head of household Name and Person Number Name: _____ Person Number: **0 1**	
C9. Result of household interview: 1 Completed ..... ◯ 2 No one at home ..... ◯ 3 Refused ..... ◯ 4 Dwelling not found/destroyed ..... ◯ 5 Partially complete..... ◯ 6 Vacant dwelling/lot ..... ◯	**C10**. Survey Respondent? Name:_____ Person Number: ☐☐

7 No suitable respondent ..... ◯ 8 Other (*specify*)_____	**C11.** Number of household members: ☐☐

C12. Field edited by? (Supervisor Name and Code): ☐☐ Name _____	**C13.** Data entry clerk? (Name and Code): ☐☐ Name _____

C14. *Record the start time:* _____	**DEMOGRAPHICS** **DD**
	PLEASE TELL ME THE NAME OF EACH PERSON WHO USUALLY LIVES HERE, STARTING WITH THE HEAD OF THE HOUSEHOLD. [List the head of the household on line 01, followed by all other household members, their relationship to the household head, their sex, date of birth, age, ethnicity, school status, highest level of education completed, marital and union status.

Codes for D3: Relationship to head of household:

01 Head 02 Spouse/Partner 03 Child: Bio/Step/Foster/Adoptive 04 Son-In-Law / Daughter-In-Law	05 Niece / Nephew 06 Brother / Sister 07 Grandchild 08 Parent/Parent-in-law	09 Other relative 10 Non- relative 11 Domestic employee 98 Don't know

Codes for D9: EDUCATION

01 None 02 Primary 03 Secondary	04 VOTECH 05 Sixth Form 06 University(Bachelors/Masters/Doctorate)	07 = Other 98 DK

Codes for D7: ETHNICITY

01 Asian 02 African 03 Caucasian 04 Creole	05 East Indian 06 Garifuna 07 Maya 08 Mennonite	09 Mestizo 10 Other

***Codes for D10* MARITAL STATUS**

01 Never married 02 Married 03 Divorced 04 Widowed 05 Legally separated

***Codes for D11* UNION STATUS**

01 Married and living with spouse 02 Common-law relationship 03 Visiting partner relationship 04 Not in a union

D1. *Person Number*	**D2.** NAME	**D3.** RELATION-SHIP OF (*name*) **TO** THE HEAD OF HOUSE-HOLD?	**D4.** SEX? **1 Male** **2 FEMALE**	**D5.** DATE OF BIRTH? 98 DK			**D6.** AGE? 98 DK	**D7.** ETHNICITY?	**D8.** CURRENTLY ATTENDING SCHOOL? **[IF ON SUMMER VACATION, CODE AS YES]** **1 YES; 2 NO**	**D9.** HIGHEST LEVEL OF EDUCATION COMPLETED?	**D10.** MARITAL STATUS?	**D11.** UNION STATUS?	**D12.** LENGTH OF TIME LIVING IN COMMUNITY	**D13.** WHERE WERE YOU LIVING BEFORE COMING HERE?
Line	First and Last Name	**CODE**	**CODE**	dd	mm	yyyy	Age	**CODE**	**CODE**	**CODE**	**CODE**	**CODE**	Years	CTVC
01														
02														
03														
04														
05														
06														
07														
08														
09														

10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

Codes for D3: Relationship to head of household:

01 Head 02 Spouse/Partner 03 Child: Bio/Step/Foster/Adoptive 04 Son-In-Law / Daughter-In-Law	05 Niece / Nephew 06 Brother / Sister 07 Grandchild 08 Parent/Parent-in-law	09 Other relative 10 Non- relative 11 Domestic employee 98 Don't know

Codes for D7: ETHNICITY

01 Asian 02 African 03 Caucasian 04 Creole	05 East Indian 06 Garifuna 07 Maya 08 Mennonite	09 Mestizo 10 Other

Codes for D9: EDUCATION

01 None 02 Primary 03 Secondary	04 VOTECH 05 Sixth Form 06 University(Bachelors/Masters/Doctorate)	07 = Other 98 DK

Codes for D9: EDUCATION

01 None 02 Primary 03 Secondary	04 VOTECH 05 Sixth Form 06 University(Bachelors/Masters/Doctorate)	07 = Other 98 DK

ROAD TRANSPORT OVERVIEW	**RT**
RT 1. HOW WOULD YOU DESCRIBE THE GENERAL CONDITIONS OF THE GPH PASSING THROUGH YOUR COMMUNITY? 01 VERY POOR ◯ 02 POOR ◯ 03 NEUTRAL ◯ 04 GOOD ◯ 05 VERY GOOD ◯ 98 DK ◯	**RT2.** THREE OF THE MOST SERIOUS PROBLEMS CONCERNING THE GPH ARE? **TOP 3 [1=MOST SERIOUS]** 01 TOO MANY POTHOLES ___ 02 TOO DUSTY ___ 03 HIGHWAY TOO NARROW/SHOULD BE WIDENED ___ 04 NO STORM WATER/FLOODING DRAINAGE ___ 05 NO/INADEQUATE SPACE PEDESTRIANS/CYCLISTS ___ 06 OTHER:_____ 98 DK ◯
RT3. HOW WOULD YOU DESCRIBE THE CONDITION OF THE GPH WHEN IT RAINS? 01 VERY POOR ◯ 02 POO R ◯ 03 NEUTRAL ◯ 04 GOOD ◯ 05 VERY GOOD ◯ 98 DK ◯	**RT4.** HOW WOULD YOU DESCRIBE THE CONDITION OF THE GPH DURING THE DRY SEASON? 01 VERY POOR ◯ 02 POO R ◯ 03 NEUTRAL ◯ 04 GOOD ◯ 05 VERY GOOD ◯ 98 DK ◯
RT5. HOW WOULD YOU DESCRIBE THE LEVEL OF DUST ON AND AROUND THE GPH? 01 NO DUST ◯ 02 DUST CAUSES SOME PROBLEMS ◯ 03 DUST IS A MAJOR PROBLEM ◯ 98 DK ◯	**RT6.** HAS THE DUST EVER CAUSED HEALTH PROBLEMS? 01 YES ◯ 02 NO ◯ 98 DK ◯
RT7. WHAT IS YOUR HH MAIN FORM OF TRANSPORT? 01 WALKING ◯ 02 DRIVE OWN CAR ◯ 03 DRIVEN (FAMILY/FRIEND) ◯ 04 BICYCLE ◯ 05 MOTORBIKE 06 DRIVE WORK VEHICLE ◯ 07 PUBLIC TRANSPORT ◯ 08 OTHER:_____ 98 DK ◯	**RT8.** WHAT METHOD OF TRANSPORT DO YOU USE TO GET TO WORK? 00 NOT APPLICABLE ◯ 01 WALK ◯ 02 DRIVE OWN CAR ◯ 03 SOMEONE ELSE'S CAR ◯ 04 BICYCLE ◯ 05 MOTORBIKE ◯ 06 DRIVE WORK VEHICLE ◯ 07 PUBLIC TRANSPORT ◯ 08 OTHER:_____ 98 DK ◯
RT9. HOW WOULD YOU RATE THE EXPERIENCE OF TRAVELLING THE GPH BY VEHICLE? 01 VERY UNCOMFORTABLE ◯ 02 UNCOMFORTABLE ◯ 03 NEUTRAL ◯ 04 COMFORTABLE ◯ 05 VERY COMFORTABLE ◯ 98 DK ◯	**RT10.** HOW SAFE WOULD YOU RATE THE EXPERIENCE OF TRAVELLING THE GPH BY FOOT? 01 VERY UNSAFE ◯ 02 UNSAFE ◯ 03 NEUTRAL ◯ 04 SAFE ◯ 05 VERY SAFE ◯ 98 DK ◯
RT11. DO YOU THINK THE GPH WOULD BENEFIT FROM IMPROVED STREET LIGHTING? 01 YES _____ 02 NO ◯ 98 DK ◯	**RT 12.** HOW MUCH DOES YOUR HH SPEND ON TRANSPORT EACH WEEK? BZ$

ROAD TRANSPORT OVERVIEW	RT
RT13. WHAT IN YOUR OPINION CAUSES THE MOST SAFETY CONCERNS ON THE GPH? **TOP 3 [1=HIGHEST CONCERN]** 01 TOO MANY POTHOLES ___ 02 TOO DUSTY ___ 03 HIGHWAY TOO NARROW/SHOULD BE WIDENED ___ 04 NO STORM WATER/FLOODING DRAINAGE ___ 05 NO/INADEQUATE SPACE PEDESTRIANS/CYCLISTS ___ 06 PEOPLE WALKING ON THE ROAD ___ 07 PEOPLE DRIVE TOO FAST ___ 08 DRIVERS DRINKING ALCOHOL AND DRIVING ___ 09 NO/POOR STREET LIGHTING ___ 10 DANGEROUS/STEEP CURVES ___ 11 OTHER:_____ 98 DK ◯	**RT14.** WHICH OF THE FOLLOWING ROAD FEATURES ARE MOST IMPORTANT TO YOU? **TOP 3 [1=MOST IMPORTANT]** 01 STREET LIGHTING ___ 02 FOOTPATHS ___ 03 DRAINAGE ___ 04 SPEED LIMITS ___ 05 POLICING ___ 06 BUS STOPS/SHELTERS ___ 08 EMERGENCY PHONES NEAR BUS STOPS ___ 09 SPEED HUMPS ___ 10 PEDESTRIAN CROSSINGS ___ 11 ROAD SAFETY SIGNAGE ___ 12 OTHER: _____ 98 DK ◯

ROAD TRANSPORT OVERVIEW	RT
RT15. HOW WOULD AN IMPROVED GPH AFFECT YOU/YOUR HH THE MOST? **TOP 3 [1=MOST IMPORTANT]** 01 BETTER ACCESS TO SERVICES, E.G. SCHOOLS, HEALTH CARE, STORES, ETC. ◯ 02 FASTER TRAVELLING TIME ◯ 03 MORE BUSINESS ◯ 04 SAFER ROAD FOR PEDESTRIANS, ESPECIALLY CHILDREN AND WOMEN ◯ 05 NEW JOB OPPORTUNITIES ◯ 06 MORE MONEY ◯ 07 OTHER 98 DK ◯	**RT16.** HAVE YOU/ANYONE IN YOUR HH EVER BEEN INVOLVED IN AN ACCIDENT/INJURED ON THE GPH? 01 YES _____ _____ 02 NO ◯ 98 DK ◯

DISABILITY AND HEALTH **H**

H1. PERSON NUMBER	**H2.** DOES (NAME) HAVE ANY DIFFICULTY WITH: A SEEING (EVEN WITH GLASSES)?	B HEARING (EVEN WITH FEARING AID)	C COMMUNICATING/SPEAKING?	D WALKING/CLIMBING STAIRS?	E SELF-CARE?	F OTHER?	**H3.** HAS (NAME) EVER BEEN DIAGNOSED BY A MEDICAL DOCTOR WITH ANY LONGSTANDING OR RECURRING ILLNESS(ES)? [MULTIPLE ENTRIES ALLOWED; SEPARATE WITH A COMMA]	**H4.** ANY ILLNESS, INJURY OR OTHER HEALTH PROBLEM IN THE PAST MONTH?	**H5.** IF YES, DID YOU VISIT A HOSPITAL/HEALTH CENTRE/CLINIC? WHERE?
Line	CODE	CODE	CODE	CODE	CODE	CODE	CODE	ILLNESS	Name of Facility, if Yes
01									
02									
03									
04									

05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

Codes for H2: DISABILITY

01 No difficulty	04 Cannot do it at all
02 Some difficulty	05 DK/NS
03 Lots of difficulty	

Codes for HL3: LONGSTANDING ILLNESS

01 Arthritis/rheumatism;	05 Hypertension (High blood pressure)	09 Heart disease	98 DK/NS
02 Kidney disease	06 Sickle cell anaemia	10 = Lupus	
03 Asthma	07 Glaucoma	11 Autism	
04 Diabetes	08 Cancer	12 = Other (specify)	

EMPLOYMENT STATUS AND ECONOMIC ACTIVITY [14+]							E
E1. *Person Number*	**E2.** WHAT IS (NAME)'S EMPLOYMENT STATUS? 01 EMPLOYED FULL-TIME 02 EMPLOYED PART-TIME 03 WANTS TO WORK, BUT CAN'T FIND JOB/TIRED OF LOOKING 04 ABLE TO WORK, BUT DOESN'T WANT TO 05 UNABLE TO WORK DUE TO A DISABILITY	**E3.** LAST WEEK, DID (NAME) DO ANY WORK FOR PAY, PROFIT OR FAMILY GAIN FOR AT LEAST 1 HOUR? 01 YES, **SKIP** TO E5. 02 NO 98 DK	**E4.** LAST WEEK, DID (NAME) DO ANY OF THE FOLLOWING ACTIVITIES FOR PAY, PROFIT OR FAMILY GAIN FOR AT LEAST 1 HOUR? **[READ OUT LIST FROM CODE TABLE BELOW]** 01 YES 02 NO **SKIP** TO E6. 98 DK	**E5.** IN THEIR MAIN JOB, WHAT CATEGORY OF WORKER IS (NAME)?	**E6.** OCCUPATION? IF HOMEMAKER, WRITE IN HOMEMAKER	**E7.** LAST **MONTH**, WHAT WAS (NAME) INCOME? BZ $	**E8.** MAIN SOURCE OF INCOME? 01 SALARY 02 EARNINGS SELLING PRODUCE 03 MONEY SENT BY FAMILY NOT LIVING IN BELIZE 04 OTHER (SPECIFY)
Line	CODE	CODE	CODE	CODE	OCCUPATION	BZ$	CODE
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							

18							
19							
20							

...Codes for E4: ECONOMIC ACTIVITIES

Sell food/pastries/sweets from home or snacks at market/bus stop/school; Cleaning yard/cutting grass; Cleaning offices; Babysitting; Sewing for pay; Subsistence farming; Washing, ironing and cleaning clothes; Nurse's aide; Car washing; Barbering/hairdressing/ braiding; Bicycle cart deliveries; Drive taxi; Sell craft items; Basket weaving; Any other activity forpay, profit or family gain

Codes for E5: MAIN JOB [WORKER CATEGORY]

01 Own business/self-employed with paid help	05 Paid employee - Private/NGO
02 Own business/self-employed without paid help	06 Paid employee - International Organisation/Embassy
03 Paid employee - Government (central or local)	07 Unpaid family worker
04 Paid employee - Quasi Government	98 DK/NS

HOUSING, LAND TENURE AND ASSETS — A

A1. WHAT TYPE OF DWELLING DOES THIS HH OCCUPY?

01 UNDIVIDED PRIVATE HOUSE…….◯
02 Part of a private house ..... ◯
03 Flat, apartment, condominium..... ◯
04 Combined business and dwelling..... ◯
05 Dwelling attached to business..... ◯
06 Town house..... ◯
07 Duplex ..... ◯
08 Barracks ..... ◯
09 Out-room ..... ◯
10 OTHER (SPECIFY)

_____

98 DK/NS..... ◯

A2.1 HOW MANY ROOMS IN THIS HOUSEHOLD?

NUMBER OF ROOMS ☐☐

A2.2 HOW MANY ROOMS ARE USED FOR SLEEPING?

NUMBER OF BEDROOMS ☐☐

A3. *Main material of the dwelling floor.*

Natural floor
01 Earth /Sand ..... ◯
Rudimentary floor
02 Wood planks..... ◯
Finished floor
03 Polished wood ..... ◯
04 Ceramic tiles ..... ◯
05 Cement ..... ◯
06 Other (*specify*) _____

A4. *Main material of the roof.*

Natural roofing
01 No Roof ..... ◯
02 Thatch /Palm leaf ..... ◯
Rudimentary Roofing
03 Wood planks ..... ◯
04 Cardboard ..... ◯
Finished roofing
05 Metal ..... ◯
06 Wood ..... ◯
07Ceramic tiles ..... ◯
08 Cement ..... ◯
09 Roofing shingles ..... ◯
10 Other (*specify*) _____

A5. *Main material of the exterior walls.*

Natural walls
01 No walls ..... ◯
Rudimentary walls
02 Plywood ..... ◯
03 Cardboard ..... ◯
04 Reused wood ..... ◯
Finished walls
05 Cement ..... ◯
06 Stone with lime /cement..... ◯
07 Bricks..... ◯
08 Cement blocks ..... ◯
09 Wood planks / shingles ..... ◯
10 Other (*specify*) _____

A6. WHAT TYPE OF FUEL DOES YOUR HOUSEHOLD MAINLY USE FOR COOKING?

01 Electricity ..... ◯
02 Liquefied Petroleum Gas (LPG) ..... ◯
03 Kerosene..... ◯
04 Charcoal ..... ◯
05 Wood..... ◯
06 Other (*specify*) _____

A7. DOES YOUR HOUSEHOLD HAVE:

	1 Yes	2 No
1 Electricity	◯	◯
2 Radio	◯	◯
3 Television	◯	◯
4 Non-mobile telephone	◯	◯
5 Refrigerator	◯	◯
6 Bicycle	◯	◯
7 Motorcycle / Scooter	◯	◯
8 Car / Truck	◯	◯
9 Boat with motor	◯	◯

A8. DO YOU OR SOMEONE LIVING IN THIS HOUSEHOLD OWN THIS DWELLING?

01 Own ◯ WHO: WRITE PERSON NUMBER

A9. Does any member of this household own any land that can be used for agriculture?

01 Yes ..... ◯

_____ 02 Rent ◯ 03 Other (Not owned or rented) ◯	02 No ..... ◯ ⇨ *GO TO* ***A11***
A10. HOW MANY ACRES OF AGRICULTURAL LAND DO MEMBERS OF THIS HOUSEHOLD OWN? ACRES ___ ___	**A11**. DOES THIS HOUSEHOLD OWN ANY LIVESTOCK, HERDS, OTHER FARM ANIMALS, OR POULTRY? Yes ..... 1 No ..... 2 ⇨ *GO TO* ***WS1***

A12. How many of the following animals does this household have, if any?

1. Cattle, milk cows, or bulls			
2. Horses, donkeys, or mules			
3. Goats			
4. Sheep			
5. Chickens			
6. PIGS			

ENVIRONMENT: WATER AND SANITATION **WS**

WS1. WHAT IS THE MAIN SOURCE OF DRINKING WATER FOR YOUR HOUSEHOLD? 01 PIPED WATER 11 PIPED INTO DWELLING ◯ 12 PIPED INTO COMPOUND, YARD OR PLOT ◯ 13 PIPED TO NEIGHBOUR ◯ 14 PUBLIC TAP /STANDPIPE ◯ 02 DUG WELL 21 PROTECTED WELL ◯ 22 UNPROTECTED WELL ◯ 03 WATER FROM SPRING 31 PROTECTED SPRING ◯ 32 UNPROTECTED SPRING ◯ 04 RAINWATER COLLECTION ◯ 05 TANKER-TRUCK ◯ 06 CART WITH SMALL TANK / DRUM ◯ 07 SURFACE WATER (RIVER, STREAM, DAM, LAKE, POND, CANAL, IRRIGATION CHANNEL) ◯ 08 BOTTLED WATER ◯ 09 OTHER (SPECIFY)	WS2. WHAT IS THE MAIN SOURCE OF WATER USED BY YOUR HOUSEHOLD FOR OTHER PURPOSES SUCH AS COOKING AND HANDWASHING? 01 PIPED WATER 11 PIPED INTO DWELLING ◯ 12 PIPED INTO COMPOUND, YARD OR PLOT ◯ 13 PIPED TO NEIGHBOUR ◯ 14 PUBLIC TAP /STANDPIPE ◯ 02 DUG WELL 21 PROTECTED WELL ◯ 22 UNPROTECTED WELL ◯ 03 WATER FROM SPRING 31 PROTECTED SPRING ◯ 32 UNPROTECTED SPRING ◯ 04 RAINWATER COLLECTION 05 TANKER-TRUCK ◯ 06 CART WITH SMALL TANK / DRUM ◯ 07 SURFACE WATER (RIVER, STREAM, DAM, LAKE, POND, CANAL, IRRIGATION CHANNEL) ◯ 08 BOTTLED WATER ◯ 09 OTHER (SPECIFY)
WS3. WHERE IS THAT WATER SOURCE LOCATED? 01 IN OWN DWELLING ◯ ⇨ *Go to* ***WS6*** 02 IN OWN YARD / PLOT ◯ ⇨ *Go to* ***WS6*** 03 ELSEWHERE ◯	WS4. HOW LONG DOES IT TAKE TO GO THERE, GET WATER, AND COME BACK? NUMBER OF MINUTES 98 DK ◯
WS5. WHO USUALLY GOES TO THIS SOURCE TO COLLECT THE WATER FOR YOUR HOUSEHOLD? 01 ADULT WOMAN ◯ 02 ADULT MAN ◯ 03 FEMALE CHILD (UNDER 15) ◯	WS6. DO YOU DO ANYTHING TO THE WATER TO MAKE IT SAFER TO DRINK? 01 YES ◯ 02 NO ◯ ⇨ *Go to* ***WS8***

04 MALE CHILD (UNDER 15) ◯ 98 DK ◯	98 DK ◯ ⇨ *Go to* ***WS8***
WS7. WHAT DO YOU USUALLY DO TO MAKE THE WATER SAFER TO DRINK? 01 BOIL ◯ 02 ADD BLEACH / CHLORINE ◯ 03 STRAIN IT THROUGH A CLOTH ◯ 04 USE WATER FILTER (CERAMIC, SAND, COMPOSITE, ETC.) ◯ 05 SOLAR DISINFECTION ◯ 06 LET IT STAND AND SETTLE ◯ 07 OTHER (SPECIFY)_____ 98 DK ◯	WS8. WHAT KIND OF TOILET FACILITY DO MEMBERS OF YOUR HOUSEHOLD USUALLY USE 01FLUSH 11 FLUSH TO PIPED SEWER SYSTEM ◯ 12 FLUSH TO SEPTIC TANK ◯ 13 FLUSH TO PIT (LATRINE) ◯ 14 FLUSH TO SOMEWHERE ELSE/UNKNOWN PLACE / NOT SURE /DK WHERE ◯ 02 PIT LATRINE 21 VENTILATED IMPROVED PIT LATRINE (VIP) ◯ 22 PIT LATRINE WITH SLAB ◯ 23 PIT LATRINE WITHOUT SLAB /OPEN PIT ◯ 03 COMPOSTING TOILET ◯ 04 BUCKET ◯ 05 NO FACILITY, BUSH, FIELD ◯ 06 OTHER (SPECIFY)_____
WS9. DO YOU SHARE THIS FACILITY WITH OTHERS WHO ARE NOT MEMBERS OF YOUR HOUSEHOLD? 01 YES ◯ 02 NO ◯	

HIV/AIDS: KNOWLEDGE **HA**

HA1. HAVE YOU EVER HEARD OF AN ILLNESS CALLED AIDS?
01 Yes ..... ◯
02 No ..... ◯

HA2. CAN PEOPLE REDUCE THEIR CHANCE OF GETTING THE AIDS VIRUS BY HAVING JUST ONE UNINFECTED SEX PARTNER?
01 Yes ..... ◯
02 No ..... ◯
98 DK ..... ◯

HA3. CAN PEOPLE REDUCE THEIR CHANCE OF GETTING THE AIDS VIRUS BY USING A CONDOM EVERY TIME THEY HAVE SEX?
01 Yes ..... ◯
02 No ..... ◯
98 DK ◯

HA4. CAN PEOPLE GET THE AIDS VIRUS FROM MOSQUITO BITES?
01 Yes ..... ◯
02 No ..... ◯
98 DK ..... ◯

HA5. CAN PEOPLE GET THE AIDS VIRUS BY SHARING FOOD WITH A PERSON WHO HAS THE AIDS VIRUS?
01 Yes ..... ◯
02 No ..... ◯
98 DK ◯

HA6. IS IT POSSIBLE FOR A HEALTHY-LOOKING PERSON TO HAVE THE AIDS VIRUS?
01 Yes ..... ◯
02 No ..... ◯
98 DK ◯

HA7. CAN THE VIRUS THAT CAUSES AIDS BE TRANSMITTED FROM A MOTHER TO HER BABY:

	Yes 01	No 02	DK 98
1. DURING PREGNANCY	◯	◯	◯
2. DURING DELIVERY	◯	◯	◯
3. BY BREASTFEEDING	◯	◯	◯

- END -

C15.
Record the end time:

_____

Annex XIV: Summary of Village Chairpersons Focus Group Discussion

Date: June 21, 2014; 10:00 – 12:00 a.m.

Village/Community	Name?	Sex: Male or Female?	Position on Council:	Contact No?
Camalote	Oliver Wiltshire	M	Chairperson	668-6770
Camalote	Isidro Ho	M	Councillor	622-8607
Blackman Eddy	Yolanda Molina	F	Chairperson	605-5135
Unitedville	Miguel Juan	M	Chairperson	601-4551/629-0516
Georgeville	Rosetta Williams	F	Chairperson	605-0684
Teakettle	Marcos Kingston	M	Chairperson	633-2623
	Timoteo Vanegas	M	Vice-Chairperson	660-3491

General Description of Village/Community [main issues/problems; main environmental problems; main economic/livelihood activities; community life; …]?

Camalote: Best village in Cayo south, has great potential to develop into model community, active in sporting activity, greater part of the pop. engaged a professional occupation; room for improvement in working relationships between villagers, two main areas prone to flooding, roads off the highway needs improvement, problem with garbage on and off main highway, has great potential for farming projects, needs a police sub-station and health center.
Blackman Eddy: Flooding including road by football field, burial ground, new site, need for drainage, most work outside village/ inside village-subsistence farming, St. Martin de pores school has dayerns hill exiting school forcing kids into road, need for street lights, community needs renovation, no health centre, recent influx of immigrants
Unitedville: Shoulders needed for highway and bus stops; villagers engaged primarily as restaurateurs, fast food, grocers, farmers, labourers, masons and contractors; terrain is hilly, when it rains, run-off damages roads/streets
Georgeville: major issues/recommendations: pedestrian ramp, drainage, stagnant water, garbage disposal, youth unemployment, many churches, access to water(up hill), electricity for new area, and upgraded health center
Teakettle: Drainage system; garbage collection; upgrading of feeder roads; Cleaning of the highway; street lighting; burial ground, off road

ANNEXES

Community Assets/Infrastructure and Services?

Type	Available		Contact Person	Comments
	Yes	No		
Education	4		Preschool- Carol Banner, Primary- Francis Avalla Alfred Serano	620-4626 incline to enter exit school a problem
Health	1	2	Dr. Gonzalez	Needs a health centre
Security: Police, Fire,	1	2	PC Medina	Needs a police-sub station
Community Centre	4		Village chairpersons	Under renovation Needs major renovation
Cultural/Heritage sites	3			Maya ruin that needs to be cleared out, trace of Mayan presence in the area Burial ground, football field Archaeological sites/lower Dover
Culverts 6 shops				Recently installed culverts that needs culvert head Village needs major attention by hill

Main concerns and problems associated with the GPH and possibly arising from the proposed road works?

Flooding in two areas of main highway, needs more lighting, speed bumps and sidewalks

Flooding in front football field, has 2 pedestrian ramps, noisy with large Mennonite trucks, needs at least 3 bus stops, edge of road too high from shoulders

Drains at the Mountain Pine Ridge needs to open up so water can flow; need speed bumps at football field; pedestrian ramp and sign post; children have great difficulty crossing road….

Main benefits from the proposed road project?
Beautification better means of Transportation, employment opportunity, road safety, improve flooding problems

Employment, addressing all the problems mentioned
Reduced damage to vehicles/tires
Decrease road accidents
Increase safety for road users

Jobs for community; upgraded road; improved road safety

Safety improvements in relation to the proposed GPH rehabilitation?
Road signs, lighting, shoulders for culverts
Signage and speed bumps

Safe road for children; street lights and road signage

Any Other points of interest?

Community meeting (place: community centre, day: Sunday, time: 4:00PM)

Need reflectors on road especially on curves, bridges and school3

Sat/Sun best time for meeting

ANNEXES

Annex XV: Summary of Youth and Cyclists Focus Group Discussion

Date: June 30, 2014; 3:00 – 4:00 p.m.

Participant	**Village/Community**:	Sex: Male or Female?	Contact Info?
Marilla G. Matus	Georgeville Village	F	634-5551
Rhonda Robateau	Blackman Eddy Village	F	636-5912; rhondarobateau@yahoo.com ,
Tamira Martinez	Camalote Village	F	634-7355; tmart505@yahoo.com
Shamira Young	Roaring Creek Village	F	669-8252
Shasta Soberanis	Esperanza Village	M	636-3084; brown_gial@yahoo.com
Kaylon Kingston	Teakettle Village	M	626- 1046/660- 9094; kaylon96@yahoo.com
Kieran Fuller	Camalote Village	M	626- 2517; kierfuller@gmail.com
Daren Tun	Teakettle Village	F	652-6744; darrentun@yahoo.com
Shawn Lopez	Camalote Village	M	605-6812
Celestine Chacon	Camalote Village	F	-
James Dyer	Esperanza Village	M	-
Mark Chavarria	Georgevill	M	663-8221

Main concerns and problems associated with the GPH (existing) and those possibly arising from the proposed road works (new)?	
Existing Concerns/Problems	New Concerns/Problems
Highway is too narrow Highway easily damaged by rain, too much pot holes; Lack of drainage; Highway needs to be widened; Broken edges on road Too much dust When it rains, road conditions are terrible Reckless driving	More traffic and speeding on highway Fast approaching traffic Need more speed bumps Proper lighting Noise pollution Dust from works Better pavement

Main benefits from the proposed road project?
More job opportunities
More attraction from local and international visitors
Faster travelling time to healthcare facilities

Safety improvements in relation to the proposed GPH rehabilitation?	
Street lights	Better drainage
Traffic signs	Sidewalks
Pedestrian crossings	More bus stops

8. Any other points of interest?

More bus stops

ANNEXES

Annex XVI: Summary of Women and Educators Focus Group Discussion

Date: June 30, 2014; 3:00 – 4:00 p.m.

Participant	**Village/Community**:	Sex: Male or Female?	Role
Avella Francis	Camalote	F	Principal, Primary School
Carol Banner	Camalote	F	Principal, Preschool
Nadia Ireland	Teakettle	F	Principal, Primary School
Alfred Serrano	Blackman Eddy	M	Principal, Primary School
Efrain Cocom	Unitedville	M	Principal, Primary School
Rosetta Williams	Georgeville	F	Chairperson
Ida Bennett	Georgeville	F	Principal, Primary School
Chrisdy Gordon	Blackman Eddy	F	Resident
Shakera Berry	Georgeville	F	Resident
Elvira Duart	San Jose Succotz	F	Resident
Melida Espana	San Jose Succotz	F	Resident

Main concerns and problems associated with the GPH (existing) and those possibly arising from the proposed road works (new)?	
Existing Concerns/Problems	New Concerns/Problems
Unsafe, speeding	More traffic and speeding on highway
Highway is too narrow	Fast approaching traffic
Highway easily damaged by rain, too much pot holes;	Need more speed bumps
	Proper lighting
Lack of drainage;	Noise pollution
Highway needs to be widened;	Dust from works
Broken edges on road	Better pavement
Too much dust	Pedestrian crossings(school children/elderly)
When it rains, road conditions are terrible	Need highway patrols
Reckless driving	Loss of livelihood during construction period

Main benefits from the proposed road project?
Comfortable ride
Faster travelling time to healthcare facilities and work
More job opportunities
Increased visitors/tourists to area
More attraction from local and international visitors

Safety improvements in relation to the proposed GPH rehabilitation?	
Street lights	Better drainage
Traffic signs	Sidewalks
Pedestrian crossings	More bus stops

8. Any other points of interest?

Annex XVII: Institutional Contacts

Institution	Name	Post
Belize Tourist Board	Michael Arana	Statistician
Statistical Institute of Belize	Diana Castillo-Trejo	Data Dissemination Manager
Statistical Institute of Belize	Marvin Moody	Statistician II