For Submission to:

China Harbour Engineering Company Limited
4th Floor North
Courtleigh
Corporate Centre
8 St. Lucia Avenue
Kingston 5

Environmental Impact Statement (EIS)

of

Alignment Changes at
K101 +440 – K101 +695
(St. Benedict's Church),
K102 +690 – K103 + 020
(Cane River),
K03 +440 – K103 +695
(Bull Bay Community Football Field)
K105 +055 – K105+500
(Pond Side)

and at

K111 + 858 – K114 + 145
(Mezgar Gardens to Grants Pen)

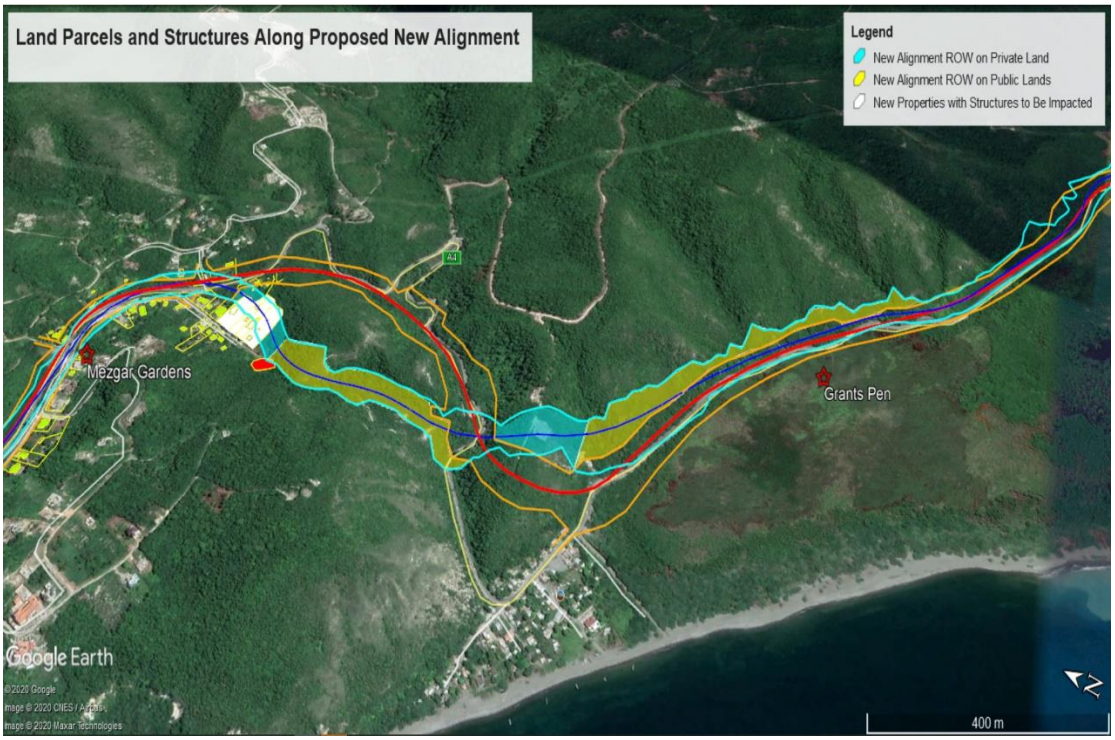
for the

Southern Coastal Highway Improvement Project

from

Harbour View to Yallahs Bridge

May 29, 2020



CONRAD DOUGLAS & ASSOCIATES LIMITED

14 Carvalho Drive, Kingston 10, Jamaica W.I.

(876)929-0023 / 0025 / 8824

info@cdaestech.com; cdaestech@hotmail.com; conraddouglasnassociatesltd@gmail.com

www.cdaestech.com

"Quality Service at its Best" | "Science & Technology for Sustainable Development"

Environmental Impact Statement (EIS)

of

Alignment Changes at
K101 +440 – K101 +695
(St. Benedict's Church),
K102 +690 – K103 + 020
(Cane River),
K03 +440 – K103 +695
(Bull Bay Community Football Field)
K105 +055 – K105+500
(Pond Side)

and at

K111 + 858 – K114 + 145
(Mezgar Gardens to Grants Pen)

for the

Southern Coastal Highway Improvement Project

from

Harbour View to Yallahs Bridge

Prepared for:

China Harbour Engineering Company Limited

4th Floor North
Courtleigh
Corporate Centre
8 St. Lucia Avenue
Kingston 5

Prepared by:

Conrad Douglas & Associates Limited

Suite #2, 14 Carvalho Drive, Kingston 10, Jamaica, W.I.
Tel: (876) 929-0023 / 0025 / 8824
Fax:- (876) 960-2014
Email: info@cdaestech.com | cdaestech@hotmail.com
Website: www.cdaestech.com

May 29, 2020

Proprietary Restriction Notice

Table of Contents

List of Figures

Page Number

List of Tables

Page Number

List of Acronyms

CD&A	Conrad Douglas & Associates Limited
CHEC	China Harbour Engineering Company Limited
EIA	Environmental Impact Assessment
EL	Environmental Licences
EP	Environmental Permit
FHWA	Federal Highway Association
GIS	Geographical Information System
JNSH	Jamaica North South Highway
JNSHC	Jamaica North South Highway Company Limited
NEPA	National Environment & Planning Agency
NRCA	Natural Resources Conservation Authority
NROCC	National Road Operating & Construction Company
NWA	National Works Agency
ToR	Terms of Reference
WRA	Water Resources Authority

1 Executive Summary

1.1 Preamble

China Harbour Engineering Company (CHEC) engaged the services of Conrad Douglas & Associates Limited (CD&A) to prepare an Environmental Impact Statement (EIS) on proposed amendments to the Southern Coastal Highway Improvement Project (SCHIP), which is proposed for construction between Harbour View to Yallahs Bridge, St. Thomas.

The project was preliminarily designed by Stanley Consultants Inc, and an EIA conducted based on this preliminary design. The project was subsequently permitted by the National Environment & Planning Agency (NEPA). However, on further examination of the design it became necessary to improve the corridor to gain greater efficiencies. This require that the designs be changed in some locations and that an amendment be sought to the permit.

This EIS was done based on the following:

i. The presentation of an initial EIS Scope of Work to CDA by CHEC for all the proposed alignment changes,
ii. Further revision to the scope of work for the proposed alignment changes based on a joint consultation with NEPA by: the NWA, CHEC, Stanley Consultants Inc (SCI), and CD&A. The revised Scope of Work for the EIS was presented to CHEC by SCI on March 10, 2020 in the form a letter received from the NEPA outlining the submission requirements to apply for the permit amendment.
iii. A second revision to the Scope of Work for the EIS based on an agreed approach between the Project Owners (NWA) and the contractor (CHEC) to jointly meet the submission requirements outlined by the NEPA on March 10, 2020

The EIS was conducted over the period February 17, 2020 to April 23, 2020 and is concerned with the revised scope of work agreed to by CHEC and the NWA for jointly meeting the submission requirements outlined by NEPA on March 10, 2020.

1.2 Approach & Methodology

Several approaches and methodologies using international best practices were employed in preparing the EIS. This involved:

- Remote sensing using satellite imagery
- Review of engineering designs and the proposals for the changes. The proposed changes are as follows:
    1. Minor change in alignment at St Benedicts Catholic Church
    2. Minor change in Alignment in proximity to the Cane River Bridge,
    3. Minor change in alignment at Bull Bay Football Field
    4. Minor change in alignment at Pondside Community
    5. Major change in alignment at Mezgar Gardens
    6. Significant change in alignment at Grants Pen
- Review of geotechnical survey information including slope protection methods during and after construction.
- The regulatory framework was also reviewed.
- Ground-truthing the corridor with special reference to the locations at which it is proposed to make the changes in the design while making observations and taking a photographic record and aerial imagery of the area.
- Conducting interviews with landowners in the areas in which changes are to be made
- Carryout surveys of the flora and fauna in the area
- Conducting noise modelling on an area in proximity to St. Benedict's Church to determine whether or not it would be necessary to design and construct noise barriers.
- Analysis of the potential impacts on the modified design and mitigation measures
- Environmental monitoring & evaluation plan.

The proposed changes to the alignment were conceived by both the NWA and the contractors for the project. This Environmental Impact Statement (EIS) is concerned with all the alignment changes that are proposed for the SCHIP. Findings

Our findings are as follows:

- ✓ The project is to be located in a coastal tropical maritime environment. The alignment runs on the southern coast from Harbour View, Kingston to Yallahs, St. Thomas. The environment is preponderantly xerophytic. Please see introduction for the project description.
- ✓ Flora & fauna assessments in the area showed that there will not be any impact on any threatened or endangered lifeforms.
- ✓ The wetlands will not be impacted
- ✓ All buildings on the St. Benedict's Church were within the Federal Highway Association (FHWA) criteria of 67 dBA for the category B- Land Use. However, one building was found to have areas approaching the criteria of 67 dBA (within 3dBA of the area). A noise wall was designed to effect adequate attenuation of 5-10 dBA as recommended by the FHWA.
- ✓ There were no additional or new impacts identified.
- ✓ The new alignment is an improvement over the original design.
- ✓ We found that the existing Environmental Monitoring & Evaluation Plan was adequate for the proposed modification.

1.3 Conclusions & Recommendations

Based on our findings that:

1. there are no new or additional types of impacts arising from the amendments to the alignment when compared with what was previously proposed for the alignment.
2. the noise modelling has shown that there will be no exceedance of the FHWA noise criteria.
3. Alignment traverses a new area of land in which there are some farming and residences. However, in informal interviews with the landowners they stated that they had no objections with the change,
4. The new alignment will comply with the regulatory framework,
5. The new highway alignment will increase efficiency and traffic flows along the traffic route

We recommend that NEPA consider providing the amendments to the permits in order to enable construction of the Southern Coastal Highway Improvement Project to proceed.

2 Introductions

The National Works Agency (NWA), the Permittee in this case for the project is the Government entity tasked with the management and development of the main roads in Jamaica. This mandate is stipulated by the Main Roads Act. The NWA falls within the Ministry of Economic Growth and Job Creation (MEGJC) and is the main government organization directly responsible for Jamaica's main road network and bridges. The mission of the NWA is to "*plan, build and maintain a reliable, safe and efficient main road network and flood control system, which: protect life and property; support the movement of people, goods and services; reduce the cost of transportation; promote economic growth and quality of life; and protect the environment*."

The Government of Jamaica has a vision of major highway facilities running along the coast around the entire island to ensure effective access to towns and natural resources along the coastline. The development of the Northern Coastal Highway that spans Negril to Port Antonio on the north Coast was the first phase in the development of this island ring road.

The Southern Coastal Highway Improvement Project (SCHIP) involves the development of highway alignments (upgrades or new alignment) along these two corridors and specifically:

- Segment 1 - Port Antonio, Portland to Harbour View, St. Andrew, approximately 110 km along the southern and eastern coast of the island, traversing the three parishes of St. Andrews, St. Thomas and Portland; and
- Segment 2 - Negril, Westmoreland to Mandeville, Manchester, with a total length of approximately 130 km and located within the three parish boundaries of Westmoreland, St. Elizabeth, and Manchester.

For implementation purposes, the section from Port Antonio to Kingston the construction was planned to be done in lots. The seven lots are:

1. 1A – Kingston (Harbour View) to Yallahs
2. 1B- Yallahs to Morant Bay
3. 1C - Morant Bay to Manchioneal
4. 1D - Manchioneal to Boston
5. 1E - Boston to Fairy Hill
6. 1F - Fairy Hill to Williamsfield
7. 1H - Williamsfield to Port Antonio (Bryan's Bay)

The NWA applied for an Environmental Permit in 2016 for the construction of the SCHIP (Segment One Port Antonio to Harbour View Segment 2 Mandeville to Negril) and submitted an EIA for the project. In October 2017 an EIA specific to the first phase of the Southern Coastal Highway was submitted as part of the application for the project. The design development was being guided by Consulting Engineering firm Stanley Consultants and the Permitting process was guided by Environmental Consultants C.L Environmental. An EIA was completed within the environment of the proposed route of the highway by C.L. Environmental and submitted to NEPA in October 2017 for review and approval. The basis of the EIA submitted during the permitting process was the conceptual/preliminary design for the highway prepared by Stanley Consultants and accepted by the NWA, which approximated the final design for the purposes of obtaining the Environmental Permit in order that contractors can be engaged and project costs can be developed.

The environmental Permit for the construction of the highway EP# 2016-01017-EP00018 was issued on 12 March 2018 based on the information presented in the EIA and the feedback from the public during the public consultation phase of the EIA process. The Permitted activities are as follows:

- The road alignment begins at the eastern end of the new Harbour View Bridge and continues eastwards adjacent to the main road leading to Eleven Miles Bull Bay. The road diverts south at eleven miles towards the Sun Coast Adventure Park before rejoining the existing road leading towards Grants Pen and continues to Albion St. Thomas before ending at the western end of the Yallahs Bridge.
- The road is approximately 17.4km in total length -with the new alignment (106+700-109+500) extending for 2.8km between 10 and 12 miles Bull Bay.
- The 2.8km new alignment will be constructed mainly by excavation through cut and fill similar to sections of the road between 12 Miles and Grants Pen.
- The new road is proposed to be a four lanes dual carriage way between Harbour View and Albion/Easington Road intersection after which it continues towards the Yallahs Bridge as two lanes.
- The highway will include the construction of three major land bridges across the existing rivers and will as best as possible remove all steep curves/bends from the existing road.
- All bridges and crossing are to be constructed to accommodate the free movement of debris from the surrounding watersheds and river systems which is currently a major issue along sections of the alignment (Bull Bay).

- The highway corridor will include the acquisition of over 600 parcels which are -within the alignment and will impact approximately 391 structures to include homes, church, schools, clinic, grocery shops and hair dressing parlours, jerk huts, commercial businesses, retail establishments, boundary walls retaining walls, home gardens and a section of the Bull Bay Football field and office building.

IMPACTED STRUCTURES	% TOTAL STRUCTURES TO BE IMPACTED
Homes	55.8
Bus Stops/ Garages	5.6
Shops and Stalls	26.9
Others (Schools, church, gardens, walls, football field)	11.8

- The new highway will be equipped with new and expanded drains at the following main intersections (Wickie Wackie, Pond Side Comer, Bull Bay Foot Ball Field, Grants Pen to Albion main road). In addition new culverts and detention ponds will be installed in areas where none exist and flood waters which currently settles on the main road will be channelled to - existing improved drains and new drains thus reducing the current flooding problems along sections of the existing road and conveying storm water from the new road to defined drainage features. The road will also be raised in some areas to mitigate against inundation and storm surge impact.
- The speed limit for the most part will be 80km/hr.
- The entire project is projected to last for 26 months.

The government of Jamaica has contracted China Harbour Engineering Company Limited (CHEC) to implement this major infrastructure project. With contracting completed, CHEC is detailing the final designs to ensure that all standards for road construction and operations are met with regard to:

1. road safety,
2. vehicular fuel efficiency,
3. environmental change minimization,
4. social and economic impacts minimization, to name a few:

During this process of construction design finalization, tweaks are made to the alignment that may vary from insignificant to major departures from the conceptual/preliminary designs supplied during the permitting phase.

The Environmental permit requires that any change in alignment must have the approval of the NEPA to be implement. The conceptual/preliminary alignment and the areas of alignment adjustment are shown in Figure 2-1 below. Therefore, on this basis this report is being prepared to outline the major departures from the permitted alignment for the SCHIP. Also present are the potential impacts of the changes as well as mitigation measures to be implemented if the potential impacts are deemed to be very adverse to the environment of the development.

In finalizing negotiations with SCI, NWA, GOJ and the impacted communities, detail designs and ensuring that the company's environmental standards were maintained, a number of updates and amendment to the preliminary designs were necessary.

These include changes as outlined below:

1. Minor change in alignment at St Benedicts Catholic Church
2. Minor change in Alignment in proximity to the Cane River Bridge,
3. Minor change in alignment at Bull Bay Football Field
4. Minor change in alignment at Pondside Community
5. Major change in alignment at Mezgar Gardens
6. Significant change in alignment at Grants Pen

CDA was engaged by CHEC to prepare the EIS for the amendments. This engagement was guided by an initial scope of works prepared by CHEC. Subsequently, the National Environment and Planning Agency invited the permittee – NWA and its affiliates for the construction of the project, to discuss the proposed changes and to determine the details that were required for reviewing the request for changes. As a result of this meeting the initial scope of work was modified to incorporate NEPA's requirements. Further discussions between the Contractor and the Permittee resulted in further amendments to the scope of works. The ToRs are presented in Appendix I.

The rationale and justifications for the changes proposed above are presented herein. The benefits of the changes are also included.

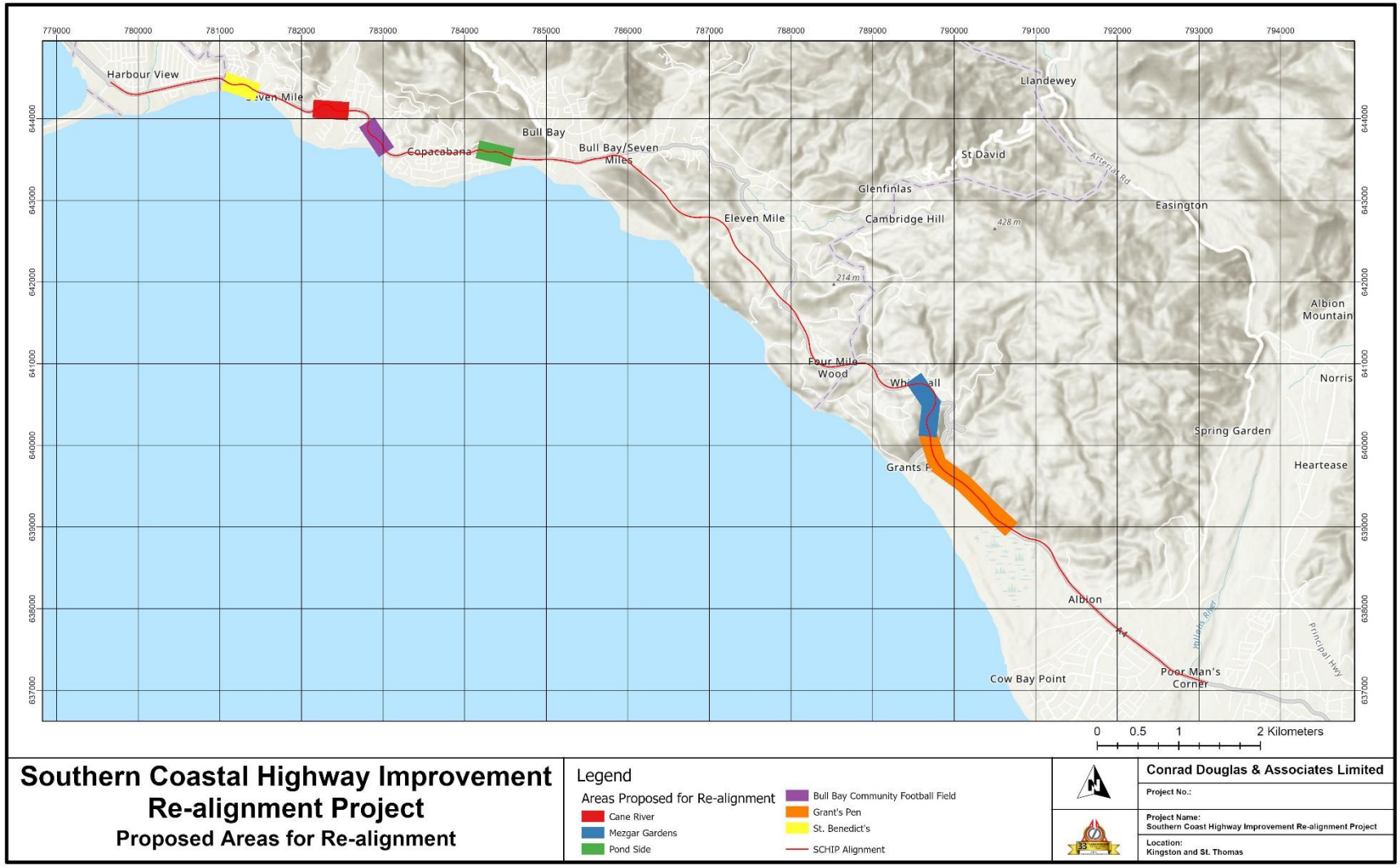


Figure 2-1. Southern Coastal Highway Improvement Project – Phase 1 with Areas for Alignment Adjustment Highlighted

3 Review of the Regulatory Framework

The Policy, Legal and Administrative Framework done for the Environmental Impact Assessment[1] remains unchanged. The listing reviewed are provided below:

- Town and Country Planning Act (TCP Act), 1957 (Amended 1987)
- Parish Councils Act 1901 (Amended 2007)
- Land Development and Utilization Act 1966
- Local Improvement Act 1944
- Registration of Titles Act 1989
- Land Acquisition Act 1947
- Main Roads Act 1932
- Beach Control Act 1956 and the Beach Control (Amendment) Act 2004
- Building Act 2016
- Vision 2030
- Protected Areas System Master Plan: Jamaica 2013 – 2017
- Policy for the National System of Protected Areas 1997
- Natural Resources Conservation Authority Act 1991
- The Natural Resources Conservation (Permit and Licences) Regulations 1996 and (Amendment) Regulations 2015
- The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order 1996 and (Amendment) Order 2015
- Wild Life Protection Act 1945 and Wild Life Protection (Amendment of Second and Third Schedules) Regulations 2016
- The Forest Act 1996
- The Endangered Species (Protection, Conservation and Regulation of Trade) Act 2000 (Amended 2015)
- Water Resources Act 1995
- Draft Policy and Regulation for Mangrove & Coastal Wetlands Protection
- The Jamaica National Heritage Trust Act 1985
- Water Quality Standards

[1] Environmental Impact Assessment Final Report Southern Coastal Highway Improvement Project Part B (ii) Works – Harbour View to Yallahs Bridge Ministry of Economic Growth & Job Creation January 2018, CL Environmental Co. Ltd.

- Noise Abatement Act 1997
- The Natural Resources Conservation Authority (Air Quality) Regulations, 2002
- The Clean Air Act 1964
- Public Health Act 1985
- The National Solid Waste Management Authority Act 2001
- The Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations 2003
- United Nations Convention on Biological Diversity
- Convention on Wetlands of International Importance especially as Waterfowl Habitat, "Ramsar Convention" 1971
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The EIA compares the noise modelling results against the recommended limit of 45 dBA for Silence Zones as defined in the **Jamaica Nosie National Standards (JNNS)**. However, it should be noted that the JNNS explicitly indicates that the standards do not include the mechanical noise from motor vehicles. Therefore, the JNNS Silence Zone standard of 45dBA is most appropriately interpreted as the level that must be achieved by non-motor vehicular, non-mechanical emission sources when they impact a Silence Zone. As such, as far as the JNNS is concerned, there is no national standard for noise impact from motor vehicle mechanical noise within a Silence Zone.

Therefore, the noise modelling results that obtain in this report are compared against the **United States Federal Highway Administration (FHWA) Noise Abatement Criteria** which restricts traffic impact on "*noise, resulting from the natural and mechanical sources and human activity, considered to be usually present in a particular area*". The application of the FHWA is especially appropriate since the FHWA's TNM2.5 will be used to model noise emissions resulting from predicted traffic. The NAC levels are presented in Table 8-1 below.

Table 3-1: FHWA Noise Abatement Criteria

Activity Category	Sound Level (dBA)		Description of Activity Category
	L_{eq}(1-hr)	L_{10}(1-hr)	
A	57 (Exterior)	60 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.

Activity Category	Sound Level (dBA)		Description of Activity Category
	L_{eq}(1-hr)	L_{10}(1-hr)	
B	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	--	Undeveloped lands.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

4 Rationale for Changes

In an attempt to make the project more environmentally friendly and reduce risks for environmental damage as well as meet the negotiated conditions of the contract with project stakeholders and community interests, a number of changes are proposed for alignment of the SCHIP highway between Harbour View and Yallahs Bridge. A summary of the proposed changes are provided in Table 4-1 below.

Summary of Amendments
to the
Southern Coastal Highway Improvement Project Segment 1A
at
Harbour View, St Andrew to Yallahs, St Thomas Bay
CHANGE MATRICES

The following information outlines the characteristics of the project that were permitted using information contained in the EIA for Southern Coastal Highway Improvement Project Part B (ii) Works – Harbour View to Yallahs Bridge, and the proposed amendments after further detailing for Construction Drawings and review of biophysical conditions existing in the environment and incorporation of more current state of the art methodologies and technologies.

Table 4-1: Change Matrices

Change Activity	Permitted – March 2018	Proposed Amendment – April 2020
Project Activity 1: Road Construction		
1. Location	**St. Benedict's – Along existing road**	**St. Benedicts – Along existing road but corridor moved 10 m south.** This will affect commercial and residential parcels adjacent to the shoreline
a. Capacity	Four Lanes	Four Lanes
2. Location	**Cane River -Seven Miles Bull Bay**	**Cane River -Seven Miles Bull Bay**
a. Capacity	Four (4) Lanes	Four (4) Lanes

Change Activity	Permitted – March 2018	Proposed Amendment – April 2020
Project Activity 1: Road Construction		
2. Location *(continued)*	**Cane River -Seven Miles Bull Bay** *(continued)*	**Cane River -Seven Miles Bull Bay** *(continued)*
b. Alignment	Continuous four lanes	Roundabout to be installed west of existing bridge
3. Location	**Bull Bay Community Football Field**	**Bull Bay Community Football Field**
a. Capacity	Four Lanes	Four Lanes
b. Alignment	South of Football Field along existing main road	A few meters further south of Football Field along existing main road
c. Structures Impacted	Possibility of Clubhouse being impacted	No structures impacted
4. Location	**Pondside Community**	**Pondside Community**
a. Alignment	Along existing main road with encroachment into existing pond	Along existing main road with corridor shifted north to avoid encroachment on pond and its habitats.
b. Structures Impacted	6	14
5. Location	**Mezgar Gardens in vicinity of the existing main road**	**Mezgar Gardens approximately 200 m west of existing main road**
a. Capacity	Four (4) lanes	Four (4) lanes
b. Alignment	Eastern face of hill adjacent to existing main road	Western face of hill adjacent to existing main road

Change Activity	Permitted – March 2018	Proposed Amendment – April 2020
Project Activity 1: Road Construction		
5. Location *(continued)*	**Mezgar Gardens in vicinity of the existing main road** *(continued)*	**Mezgar Gardens approximately 200 m west of existing main road** *(continued)*
c. Slope and Drainage	The alignment from Twelve Mile to Grants Pen is along the existing roadway with curve flattening to meet the design specifications. This section of the road also passes through hilly terrain with a maximum slope of 8% and with major cuts and fills in some sections. The cuts and fills will generate sediment which will require measures to control the migration of these sediments. Drainage channels are also steep and energy dissipaters to reduce runoff velocity and scouring will be required.	Same Philosophy for design and slope and drainage management
d. Properties Impacted	10	11
6. Location	**Grants Pens in the vicinity of the existing main road**	**Grants Pen north of existing main road**
a. Capacity	4 lanes	**4 lanes**
b. Alignment	Along the existing main road	**An elevated section along the southern face of the hill north of existing main road.**

Change Activity	Permitted – March 2018	Proposed Amendment – April 2020
Project Activity 1: Road Construction		
6. Location *(continued)*	**Grants Pens in the vicinity of the existing main road** *(continued)*	**Grants Pen north of existing main road** *(continued)*
c. Slope and Drainage	The alignment from Grants Pen to Albion between 114+000 and 115+300 runs at the toe of the hill to the north and borders a wetland to the south. The gradient in this area is very flat and makes effective drainage very challenging. It could also lead to clogging of the drainage systems due to slow flow velocities. To mitigate this problem, the road is raised and the culvert sizes increased using box culverts instead of pipe culverts to allow for greater flow depth. This ensures that even if the culvert is partially blocked, flow through the culvert will still occur until maintenance work is carried out. There will be some impact on the wetlands during construction however there is not expected to be any long-term damage	**Alignment runs upslope of wetlands and gradually reduces in elevation to the existing road after passing the wetlands** **The road is elevated and will drain towards the wetland** **No impact on wetland anticipated**
d. Structures Impacted	1	1

These changes will improve constructability and the economics of the projects with the savings to be incurred with the removal of the extensive soil treatments that were necessary with the conceptual/preliminary alignment.

4.1 Realignment at St. Benedicts Church in Harbour View

4.1.1 Original Rationale for Alignment at St. Benedict's

"alignment alternatives within a 2-kilometre-wide corridor along existing road for both segments were evaluated in order to determine preferred alignments for each segment. The selection of the preferred alignments was conducted objectively and involved the identification of 27 measurable evaluation criteria (see section 9.2.1 fir listing of criteria) by a Steering Committee established for the SCHIP (see section 5.1 for details of members). Nine alignment alternative sections were identified in Segment 1 by the NWA and Stanley Consultants and eight in Segment 2. The design team developed alignment alternatives for each section and improvements to the existing road were considered as an alternative. Each alignment alternative developed by the design team was evaluated for each evaluation criterion. The alternative with the highest score was selected. The Feasibility Study Report presented all conceptual design plans for the preferred alternative, as well as an economic appraisal of the preferred alternative.

The results of the alignment alternative selection were carried forward into a design concept. A continuous alignment was developed for each segment that consisted of the alignment alternatives developed and minor improvements to the existing road connecting these alternatives. The design for each segment was further developed by a profile, the addition of climbing lanes and laybys"

4.1.2 Amendment Rationale

The demolition of the existing wall would compromise the structures that are supported presently. This new alignment will provide greater distance between the roadway and the sensitive receptors to the noise generated by the traffic on the roadways.

This will ensure that noise standards are maintained without risk to the existing structures.

The realignment will also improve the safety of road with the addition of sidewalks against the existing walls. Traffic will therefore be father away from the sensitive receptors in the community.

4.1.3 Flora & Fauna Assessment

The realignment is an incorporation of 10 m along the southern boundary of the permitted roadway. There are no significant flora or fauna species within this corridor. The general area is mainly commercial activity. All native species have been removed as a result of the activities in the area over time.

4.2 Realignment in Proximity to Cane River Bridge – Seven Miles Bull Bay

4.2.1 Original Rationale

"alignment alternatives within a 2-kilometre-wide corridor along existing road for both segments were evaluated in order to determine preferred alignments for each segment. The selection of the preferred alignments was conducted objectively and involved the identification of 27 measurable evaluation criteria (see section 9.2.1 fir listing of criteria) by a Steering Committee established for the SCHIP (see section 5.1 for details of members). Nine alignment alternative sections were identified in Segment 1 by the NWA and Stanley Consultants and eight in Segment 2. The design team developed alignment alternatives for each section and improvements to the existing road were considered as an alternative. Each alignment alternative developed by the design team was evaluated for each evaluation criterion. The alternative with the highest score was selected. The Feasibility Study Report presented all conceptual design plans for the preferred alternative, as well as an economic appraisal of the preferred alternative.

The results of the alignment alternative selection were carried forward into a design concept. A continuous alignment was developed for each segment that consisted of the alignment alternatives developed and minor improvements to the existing road connecting these alternatives. The design for each segment was further developed by a profile, the addition of climbing lanes and laybys"

4.2.2 Amendment Rationale

The installation of a round about west of the existing bridge and the new bridge to be constructed will improve traffic flow. This will allow for vehicles to make an "about turn" since this functionality is not available along this section of the corridor as a result of the concrete median proposed along this stretch of upgraded roadways. The commercial/industrial activities in area will also require the improved access that the round about will provide for medium and large trucks to be able to go east and west along the highway.

4.2.3 Flora & Fauna Assessment

The realignment is a redesign for better and safer traffic flow of the permitted roadway. The change is along the permitted corridor There are no significant flora or fauna species within this section of the corridor. The general area is mainly commercial and residential. All native species have been removed as a result of the activities in the area over time.

4.3 Alignment Change at Bull Bay Community Foot ball Field

4.3.1 Original Rationale

"alignment alternatives within a 2-kilometre-wide corridor along existing road for both segments were evaluated in order to determine preferred alignments for each segment. The selection of the preferred alignments was conducted objectively and involved the identification of 27 measurable evaluation criteria (see section 9.2.1 fir listing of criteria) by a Steering Committee established for the SCHIP (see section 5.1 for details of members). Nine alignment alternative sections were identified in Segment 1 by the NWA and Stanley Consultants and eight in Segment 2. The design team developed alignment alternatives for each section and improvements to the existing road were considered as an alternative. Each alignment alternative developed by the design team was evaluated for each evaluation criterion. The alternative with the highest score was selected. The Feasibility Study Report presented all conceptual design plans for the preferred alternative, as well as an economic appraisal of the preferred alternative.

The results of the alignment alternative selection were carried forward into a design concept. A continuous alignment was developed for each segment that consisted of the alignment alternatives developed and minor improvements to the existing road connecting these alternatives. The design for each segment was further developed by a profile, the addition of climbing lanes and laybys"

4.3.2 Amendment Rationale

Based on the results of the community consultation exercises during the EIA process, it was re-enforced that the community football field was of great importance to the community and as a result the alignment was shifted to avoid all the infrastructure associated with this community asset. The proposed adjusted alignment will have no impact on the administrative building and will provide improved access to the facility.

4.3.3 Flora & Fauna Assessment

The realignment is a slight movement of the permitted roadway corridor to the south along the existing main road. There are no significant flora or fauna species within this section of the corridor. The general area is mainly commercial and residential activity. All native species have been removed as a result of the activities in the area over time.

4.4 Alignment Change at Pondside Community

4.4.1 Original Rationale

"alignment alternatives within a 2-kilometre-wide corridor along existing road for both segments were evaluated in order to determine preferred alignments for each segment. The selection of the preferred alignments was conducted objectively and involved the identification of 27 measurable evaluation criteria (see section 9.2.1 fir listing of criteria) by a Steering Committee established for the SCHIP (see section 5.1 for details of members). Nine alignment alternative sections were identified in Segment 1 by the NWA and Stanley Consultants and eight in Segment 2. The design team developed alignment alternatives for each section and improvements to the existing road were considered as an alternative. Each alignment alternative developed by the design team was evaluated for each evaluation criterion. The alternative with the highest score was selected. The Feasibility Study Report presented all conceptual design plans for the preferred alternative, as well as an economic appraisal of the preferred alternative.

The results of the alignment alternative selection were carried forward into a design concept. A continuous alignment was developed for each segment that consisted of the alignment alternatives developed and minor improvements to the existing road connecting these alternatives. The design for each segment was further developed by a profile, the addition of climbing lanes and laybys"

4.4.2 Amendment Rationale

This proposed amendment has the following rationale:

1. Reduce risk of possible impacts on pond in the community
2. Reduced risk of the interaction of project construction team with endangered crocodiles that have habitat in the pond

The proposed alignment provides a remedy for the omission of analysis of poor soil conditions around Ocean Lake in Stanley's Consultants Inc's original geological report. SCI had sketched the conceptual/preliminary alignment in these poor soils, and would therefore demand a costly amount of soil treatment to build in this area. Without the proper and effective complete treatment the alignment in this area is impractical. An agreement was made between the Employer and CHEC that the design speed to be adjusted and alignment to be shifted to north. This measure will ensure that the lake is preserved in its present state and there's less impact to the whole community. For the cut of the hill a drainage system was developed to drain to the pond.

4.4.3 Flora & Fauna Assessment

The realignment is 10 m movement of the permitted roadway corridor to the north. There are no significant flora or fauna species within this section of the corridor. The general area is mainly farming activity. All native species have been removed as a result of the activities in the area over time.

4.5 Alignment Change at Mezgar Gardens

4.5.1 Original Rationale

"alignment alternatives within a 2-kilometre-wide corridor along existing road for both segments were evaluated in order to determine preferred alignments for each segment. The selection of the preferred alignments was conducted objectively and involved the identification of 27 measurable evaluation criteria (see section 9.2.1 fir listing of criteria) by a Steering Committee established for the SCHIP (see section 5.1 for details of members). Nine alignment alternative sections were identified in Segment 1 by the NWA and Stanley Consultants and eight in Segment 2. The design team developed alignment alternatives for each section and improvements to the existing road were considered as an alternative. Each alignment alternative developed by the design team was evaluated for each evaluation criterion. The alternative with the highest score was selected. The Feasibility Study Report presented all conceptual design plans for the preferred alternative, as well as an economic appraisal of the preferred alternative.

The results of the alignment alternative selection were carried forward into a design concept. A continuous alignment was developed for each segment that consisted of the alignment alternatives developed and minor improvements to the existing road connecting these alternatives. The design for each segment was further developed by a profile, the addition of climbing lanes and laybys"

4.5.2 Amendment Rationale

The conceptual/preliminary alignment followed the existing road closely in order to have access for material delivery and access to the worksite in general.

Traffic Management: In the conceptual/preliminary design the proposed roadway is aligned alongside the existing main road. Due to the constraint of the valley and cliff areas adjacent to the alignment the space available is not adequate for construction of a temporary road to maintain continuous operation of the existing traffic during construction.

It is therefore safer, given the road slopes, windiness and the heavy usage by large loaded trucks that construction traffic be removed from the main road in this area. This will allow for a more efficient construction process while opening new land with upgraded access for development.

Drainage: The conceptual/preliminary alignment in K112-K113 impacts the existing main water channel. According to SCI's survey and analysis there is an existing blocked culvert with appropriate capacity which detains flood water temporarily within the catchment area. To alleviate this condition the conceptual/preliminary alignment would require the construction of a 1.2m diameter pipe culvert of length about 350m. This would be at a great cost to the project which was not budgeted.

Subsoil Treatment: New ground investigation data (collected during contracting process), indicates the presence of poor soft ground under the conceptual/preliminary alignment road embankment to the south of K113 to K115. This has to be properly treated in order to provide adequate foundation stability and capacity to sustain the road operation. CHEC estimated that the area of poor soils requiring treatment in the vicinity of station K113+000 according to the conceptual/preliminary alignment is approximately 15,000㎡, to depths of 6 to 8 meters. This is a significant charge for additional cost due to the subsoil treatment of the conceptual/preliminary alignment is used in this area. Hence the re-alignment is proposed to avoid these cost.

4.5.3 Flora & Fauna Assessment

The detailed Flora and Fauna Assessment is presented in Section 5 below .

4.6 Alignment Change at Grants Pen

4.6.1 Original Rationale

"alignment alternatives within a 2-kilometre-wide corridor along existing road for both segments were evaluated in order to determine preferred alignments for each segment. The selection of the preferred alignments was conducted objectively and involved the identification of 27 measurable evaluation criteria (see section 9.2.1 fir listing of criteria) by a Steering Committee established for the SCHIP (see section 5.1 for details of members). Nine alignment alternative sections were identified in Segment 1 by the NWA and Stanley Consultants and eight in Segment 2. The design team developed alignment alternatives for each section and improvements to the existing road were considered as an alternative. Each alignment alternative developed by the design team was evaluated for each evaluation criterion. The alternative with the highest score was selected. The Feasibility Study Report presented all conceptual design plans for the preferred alternative, as well as an economic appraisal of the preferred alternative.

The results of the alignment alternative selection were carried forward into a design concept. A continuous alignment was developed for each segment that consisted of the alignment alternatives developed and minor improvements to the existing road connecting these alternatives. The design for each segment was further developed by a profile, the addition of climbing lanes and laybys"

4.6.2 Amendment Rationale

The permitted road impacted the wetland which is habitat for the endangered crocodile and protected mangroves. The re-alignment removes the road edge from within the wetland and reduces the potential impact on the wetland habitat and its inhabitants.

No mangrove clearing is anticipated, and no relocation of species is anticipated with this updated alignment.

4.6.3 Flora & Fauna Assessment

The detailed Flora and Fauna Assessment is shown in Section 5 below.

5 Fauna and Flora Assessment

5.1 Introduction

The fauna and flora studies were carried out in the areas for the proposed road alignment on March 26 and 29, 2020, in the parish of St Thomas. The study areas include Mezgar Gardens and Grants Pen.

The main objective study was to identify the presence of any rare, endemic, protected or endangered species or any species with special conservation needs. The vegetation type was categorised as dry limestone scrub forest exhibiting different levels of disturbance. In the area there are limestone outcrops and little soil.

Figure 5-1: Typical Vegetation Type – Dry Limestone Scrub Forest

5.2 Methodology

The fauna and flora assessments were conducted along the transects which were located in or close to the path of the proposed Highway (Figure 5-2).

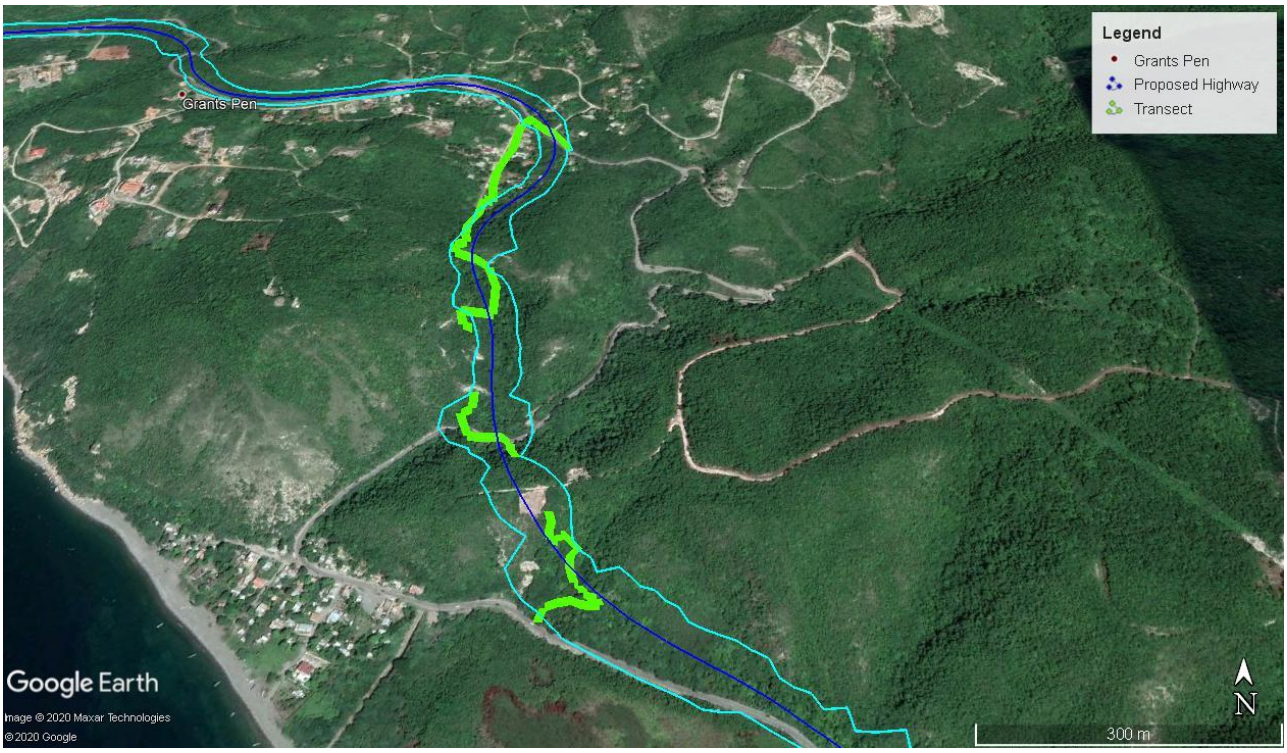


Figure 5-2: The transects used to compile the fauna and flora list

5.2.1 Plant

All vegetation encountered within 2.5 meter on either side of the path along the proposed road was recorded. For each species, the name, perceived dominance and its growth form was noted. The dominance was graded using the DAFOR scale (i.e. D=dominant, A= abundant, F= frequent, O=occasional and R=rare). The common names of most of the species sighted were assigned in-situ. In the case of unknown species, voucher specimens were collected to be identified at The University of the West Indies (UWI) Herbarium. All plants were identified to the species level by examining morphological features such as leaf arrangement, leaf pattern, and pattern of branching and morphology of floral and fruiting structure in conjunction with the use of Adam's (1972) Flowering Plants of Jamaica and preserved reference specimens of the herbarium.

Table 5-1: DAFOR scale used to categorize the fauna and flora

	Total number of Fauna or Flora observed
Dominant	≥ 20
Abundant	15 – 19
Frequent	10 – 14
Occasional	5- 9
Rare	< 4

5.2.2 Avifauna assessment

The survey (line transect) methodology entailed walking along the path for the proposed road at a steady pace for a given distance noting all birds seen or heard (Bibby et al. 1998). The bird species encountered were recorded on Ebird App by Cornel Lab. The Merlin App by Cornel Laboratory was used in the bird identification, with its extensive library of Jamaican bird species including pictures and audio. The bird surveys were carried out over 2 days.

5.2.3 Herpetological assessment

The herpeto-fauna assessment was carried out along the proposed path for the road alignment. The main areas searched include trees and stone piles. All specimens encountered were identified to the species level as best as possible. If they could not be classified in the field, specimens were captured and pictures were taken for further identification using Amphibians and Reptiles of Caribbean Islands keys (Caribherp, 2015) and Amphibians and reptiles of the West Indies (Schwartz & Henderson, 1991). The specimens were then released after examination. Community members encountered during the assessment were also interviewed to not the reptiles they encountered in the area emphasis was placed on the snakes.

5.2.4 Insect assessment

The insect assessment was carried out during daylight over 1 day. The possible hiding places for insects within the habitat were carefully searched. This include tree trunks, leaves and dry wood. A sweep net was used to collect insects from the foliage and also flying insects. Most of the insects encountered in the field were identified on the spot; however, insects which could not be identified in the field were collected and identified using entomology collections at the University of the West Indies, Mona.

5.3 Results / Discussion

5.3.1 Plant

52 species of plants were encountered during the assessment, where the majority were shrubs plant species from 27 families were encountered, most of them being climbers and shrubs. The presence of certain species such as mango (*Mangifera indica)*, guango (*Samanea saman*) and Guinep (*Melicocca bijuga*), was an indicator of the anthropogenic disturbances on the vegetation, as these are species associated with the proximity of human settlement. The mature trees observed during the assessment, the species includes: Mango (*Mangifera indica)*, Guinep Spanish elm (*Cordia gerascanthus*), Fig(*Ficus citrifolia)* and red birch (*Bursera simaruba*). These were observed along the water way or gullies on the property. It was along the channel that we notice the largest trees in the area.

Of the 52 plant species found within the study site, only 3 were endemic species (*Hylocereus triangularis*), Leafy Passion Flower *(Passiflora perfoliata)*, and White Cedar (*Tabebuia riparia)*. The national flower, Lignum vitae was also observed on the property.

No species encountered during this study is deemed to have any special conservation status. It should also be noted that the endemics plants found in the were common throughout the survey area.

Table 5-2: The Plant Species Identified During the Assessment

Common name	Scientific name	Distribution	DAFOR	Status
Acacia	*Prosopis juliflora*	Locally common	F	
Agave	*Agave sobolifera*	Locally abundant	O	
Barberry bullet	*Erythroxylum confusum*	Common	R	
Bastard Cedar	*Guazuma ulmifolia*	Very common	O	
Bastard Cherry	*Ehretia tinifolia*	Very Common	F	
Bitter Damsel	*Simaruba glauca*	Locally abundant	R	
Bull Hoof	*Bauhinia divaricata*	Common	O	
Burn Wood	*Metopium brownei*	Common	R	
Calabash tree	*Crescentia cujete*	Common	R	
Cockspur	*Macfadyena unguis*	Very common	O	
Coralita	*Antigonon leptopus*	Common	F	
Cotton	*Cebia pentandra*	Common	O	
Deadly Nightshade	*Echites umbellata*	Common	A	
Dildo Pear	*Stenocereus hystrix*	Very common	O	
Dog wood	*Piscidia piscipula*	Common	O	
Fig	*Ficus citrifolia*	Locally common	O	
Fustic Tree	*Chlorophora tinctoria*	Common	O	
God orkra	***Hylocereus triangularis****	**Locally common**	**O**	**Endemic**

Common name	Scientific name	Distribution	DAFOR	Status
Ground Orchid	*Oeceoclades maculata*	Common	F	
Guango	*Samanea saman*	Common	O	
Guinea grass	*Panicum maximum*	Very Common	D	
Guinep	*Melicocca bijuga*	Very common	A	
Ipomea	*Ipomoea acuminata*	Common	F	
Jointer	*Piper amalago*	Occasional	O	
Lantara camara	*Lantana camara*	Very common	O	
Lead tree	*Leucaena leucocephala*	Very common	D	
Leafy Passion Flower	***Passiflora perfoliata***	**Occasional**	**R**	**Endemic**
Lignum vitae	*Guiacum officinale*	Common	O	National flower
Logwood	*Haematxoylon campechianum*	Common	F	
Maiden plum	*Comocladia pinnatifolia*	Common	F	
Mango	*Mangifera indica*	Very common	R	
Mustard Shrub	*Capparis ferruginea*	Common	O	
Poinciana	*Delonix regia*	Common	R	
Prickly Pear	*Opuntia spinosissima*	Locally abundant	O	
Red birch	*Bursera simaruba*	Common	O	
Rosemary	*Croton linearis*	Common	O	
Senna Tree	*Cassia emarginata*	Common	F	
Snake plant	*Dracaena trifasciata*	Very common	F	
Spanish Elm	*Cordia gerascanthus*	Common	R	
Spanish Needle	*Bidens pilosa*	Very common	F	
Strong Back	*Morinda royoc*	Common	O	
Sword Bush	*Phyllanthus angustifolius*	Common	R	
Vervine	*Stachytarpheta jamaicensis*	Very common	O	
Water grass	*Commelina diffusa*	Very Common	A	
White Cedar	***Tabebuia riparia***	**Occasional**	**R**	**Endemic**
White Sea Grape	*Coccoloba krugii*	Common	R	
Wild Poponax	*Acacia tortuosa*	Common	R	
Wild Sage	*Cordia humilis*	Very common	A	
Wild tambrind	*Pithecellobium arboreum*	Common	O	
Woman's Tongue	*Albizia lebbeck*	Locally common	O	
Yellow Elder	*Tecoma stans*	Locally abundant	D	
	Amyris elemifers	Common	O	

5.3.2 Avifauna assessment

A total of 30 bird species were observed during the assessment. Of the birds identified, 11 were endemics, 3 endemic subspecies, 3 migrants and 13 residents (Table 5-3). The birds observed in the survey are typical of the dry limestone. These species indicative of anthropogenic disturbances include Grassquits, Kingbirds, doves, warbler, flycatchers and vireos (Downer & Sutton, 1990). Of the 11 endemic birds, 6 were non-forest dependent and 5 forest dependent.

Three migrant bird species were observed during the study. This includes two winter migrants, the American Redstart and the Praire Warbler and one Summer Migrant, the Black Whiskered Vireo. There was a low number of winter migrants, who normally arrived on the Island as September and normally begins to migrate as early as March. There was a large number of the Summer Migrant, who start arrived in the island in the month of March.

Overall none of the birds encountered in the study had any special conservation status.

Table 5-3: Bird Species Observed During the Survey

Proper Name	Scientific Name	Occurrence	IUCN Status	DAFOR
American Kestrel	Falco sparverius	Resident	Least Concern	R
American Redstart	Setophaga ruticilla	Migrant	Least Concern	O
Bananaquit	Coereba flaveola	Endemic subspecies	Least Concern	A
Black-faced Grassquit	Melanospiza bicolor	Resident	Least Concern	F
Black-whiskered Vireo	Vireo altiloquus	Migrant	Least Concern	F
Caribbean Dove	Leptotila jamaicensis	Resident	Least Concern	O
Common Ground Dove	Columbina passerina	Resident	Least Concern	O
Greater Antillean Grackle	Quiscalus niger	Resident	Least Concern	O
Jamaican Euphonia	**Euphonia jamaica**	**Endemic**	**Least Concern**	**R**
Jamaican Lizard-Cuckoo	**Coccyzus vetula**	**Endemic**	**Least Concern**	**R**
Jamaican Mango	**Anthracothorax mango**	**Endemic**	**Least Concern**	**O**
Jamaican Oriole	Icterus leucopteryx	Endemic subspecies	Least Concern	R
Jamaican Pewee	**Contopus pallidus**	**Endemic**	**Least Concern**	**R**
Jamaican Spindalis	**Spindalis nigricephala**	**Endemic**	**Least Concern**	**R**
Jamaican Tody	**Todus todus**	**Endemic**	**Least Concern**	**R**
Jamaican Vireo	**Vireo modestus**	**Endemic**	**Least Concern**	**R**
Jamaican Woodpecker	**Melanerpes radiolatus**	**Endemic**	**Least Concern**	**O**

Proper Name	Scientific Name	Occurrence	IUCN Status	DAFOR
Loggerhead Kingbird	Tyrannus caudifasciatus	Resident	Least Concern	O
Northern Mockingbird	Mimus polyglottos	Resident	Least Concern	O
Olive-throated Parakeet	**Eupsittula nana**	**Endemic**	**Not Threatened**	**O**
Prairie Warbler	Setophaga discolor	Migrant	Least Concern	R
Red-billed Streamertail	Trochilus polytmus	Endemic	Least Concern	F
Sad Flycatcher	**Myiarchus barbirostris**	**Endemic**	**Least Concern**	**R**
Smooth-billed Ani	Crotophaga ani	Resident	Least Concern	O
Turkey Vulture	Cathartes aura	Resident	Least Concern	O
Vervain Hummingbird	Mellisuga minima	Endemic subspecies	Least Concern	O
White-crowned Pigeon	Patagioenas leucocephala	Resident	Near Threatened	R
White-winged Dove	Zenaida asiatica	Resident	Least Concern	O
Yellow-faced Grassquit	Tiaris olivacea	Resident	Least Concern	F
Zenaida Dove	Zenaida aurita	Resident	Least Concern	O

5.4 Herpeto-fauna

Only one species of amphibian was identified in the study. This includes the introduced *Eleutherodactylus johnstonei* was heard calling throughout the property (**Table 5-4**).

Only 7 species of reptiles were confirmed during the study. This includes 6 species of lizards and 1 species of snake. All of them were endemic except the native Galliwasp, *Celestus crusculus*. None of these species have any special conservation status although they are endemic.

It should be noted that the status of *all* endemic reptilian and amphibian species are of concern primarily due to the distribution of their populations which is limited to Jamaica. However, none of the species will be threatened or become extinct as a result of the proposed development.

Table 5-4: Herpeto fauna observed during the assessment

Species	Common name	Classification	Species Status	IUCN	DAFOR
Eleutherodactylus johnstonei	Lesser Antillean Frog	Amphibian	Introduced	Least concern	F
Anolis grahami	Jamaican Turquoise Anole	Reptile	Endemic	Near threatened	O
Anolis lineatopus	Jamaican Gray Anole	Reptile	Endemic	Near threatened	A
Anolis opalinus	Jamaican Opal-bellied Anole	Reptile	Endemic	Not Assessed	R
Celestus crusculus	Jamaican Galliwasp	Reptile	Native	Near threatened	R
Anolis garmani	Jamaican Giant Anole	Reptile	Endemic	Near threatened	O
Sphaerodactylus argus	Ocellated geckos	Reptile	Endemic	Near threatened	F
Tropidophis sp	Jamaica Dwarf Boa	Reptile	Endemic	Near threatened	R

5.4.1 Insect assessment

Fifty teen species of insects were collected during the day survey (Table 5-5). Of the 15 species, there were 3 endemic subspecies of Lepidopera, *Anartia jatrophae jamaicensis Heliconius charitonius simulator* and Mestra Dorcas. It should be noted that there were no insects of special conservation need.

Table 5-5: Insect identified in the day survey using a sweep net

Family	Species	Common Name	DAFOR	Status	IUCN Red list
Lepidoptera					
Heliconiidae	Heliconius charitonius simulator	The Jamaican Zebra	R	Resident	Not accessed
Heliconiidae	Dryas iulia delila	Julia	R	Resident	Not accessed
Lycaenidae	Leptotes cassius theonus	The Cassius Blue	D	Resident	Not accessed
Lycaenidae	Leptotes perkinsae	Miss Perkins's Blue	O	Resident	Not accessed
Nymphalidae	Anartia jatrophae jamaicensis		R	Endemic subspecies	Not accessed
Nymphalidae	Mestra dorcas	Jamaican Mestra, Dorcas	F	Endemic subspecies	Not accessed
Papilionidae	Papilio andraemon	The Andraemon Swallowtail	O	Resident	Not accessed
Papilionidae	Battus polydamas jamaicensis	The Jamaican Polydamas	O	Resident	Not accessed

Family	Species	Common Name	DAFOR	Status	IUCN Red list
Pieridae	Ascia monuste eubotea	The Antillean Great White	O	Resident	Not accessed
Pieridae	Eurema nise nise	Cramer's Little Sulphur	O	Resident	Not accessed
Pieridae	Phoebis sennae sennae	The Cloudless Sulphur	F	Resident	Not accessed
Non-Lepidoptera					
Apidae	Apis mellifera	Honey Bee	O	Resident	Not accessed
Buprestidae	Un. id. sp.	Metallic Wood boring beetle	R	Resident	Not accessed
Vespidae	Polistes crinitus	Common Paper Wasp	R	Resident	Not accessed
Myrmicinae	1 spp. black biting ants unidentified	Biting Ants	F	Resident	Not accessed
Thomisidae	1 unidentified spp.	Crab Spiders	R	Resident	Not accessed

5.4.2 Crustaceans

Several soldier crabs (*Coenobita clypeatus*) were observed foraging throughout the property.

5.5 Conclusion

- The majority of the 33 bird species found on the property have become accustomed to urban life and are expected to transition without difficulty with the development, or find adjacent habitat.
- Of the arthropods observed on the property, no species were identified with any special conservation needs.

6 Identification of Structures Potentially Impacted

During the site visits of March 19 and 23 occupiers of lands (residents and farmers) in the vicinity of the proposed new right of way were interviewed.

In general, the interviewees were aware of the planned work and had seen surveyors in recent time. They indicated no objection to the project as they thought it was important. They were very much concerned with the start up date for the project as they were interested in the availability of work.

The NWA has responsibility for land management and right of way management for the contractor to execute the project unhindered. CD&A recommends that more detailed studies if needed be carried out by the NWA during their land acquisition process.

The community is, however, not averse to the development of the road.

Figure 6-1 below shows the proposed new alignments as well as the conceptual/preliminary alignment between Mezgar Gardens and the Yallahs River Bridge. The new alignment is hashed in yellow and blue where it departs from the old alignment. Four (4) new parcels of land with structures on them will be impacted by the proposed new alignment. These would not have been impacted by the conceptual/preliminary alignment. There are nine (9) structures in the Mezgar – Grants Pen area that will be impacted by the road alignment (4 would have been impacted by the conceptual alignment). Therefore, five of these structures proposed to be impacted were not envisaged in the conceptual/preliminary alignment. Another thirteen (13) structures in the Albion area will also be impacted (11 of these would have been impacted by the conceptual alignment) while 5 that were impacted on the conceptual/preliminary alignment will not be impacted. The detailed impact and alignment adjustments are presented in the zoomed images in Figure 6-2 below.

In Pondside nine (9) new structures will be impacted. The detailed impact and alignment adjustments are presented in the zoomed images in Figure 6-3 below.

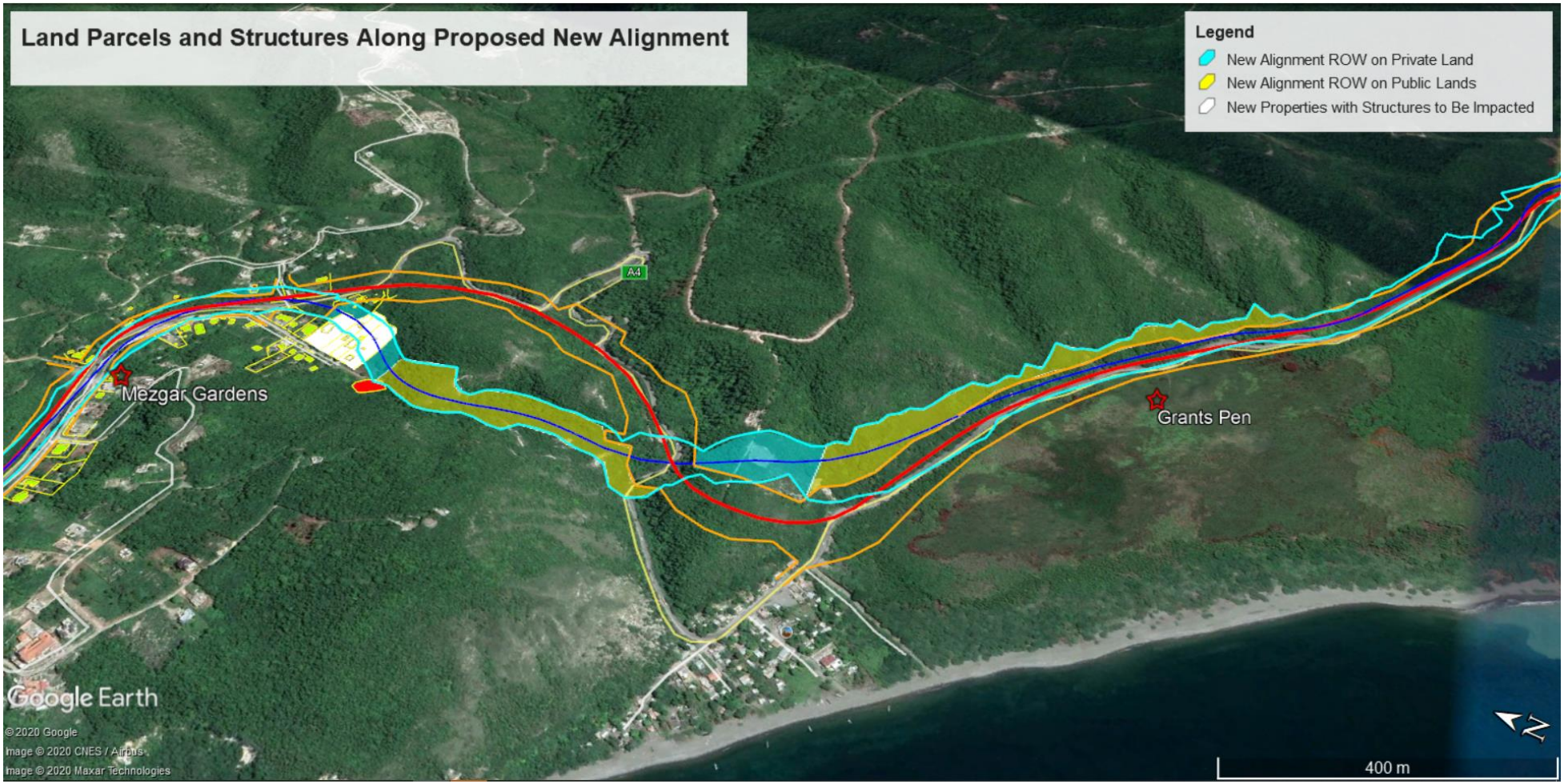


Figure 6-1: Proposed New Alignment in Mezgar Grants Pen Area with structures in the Alignment highlighted

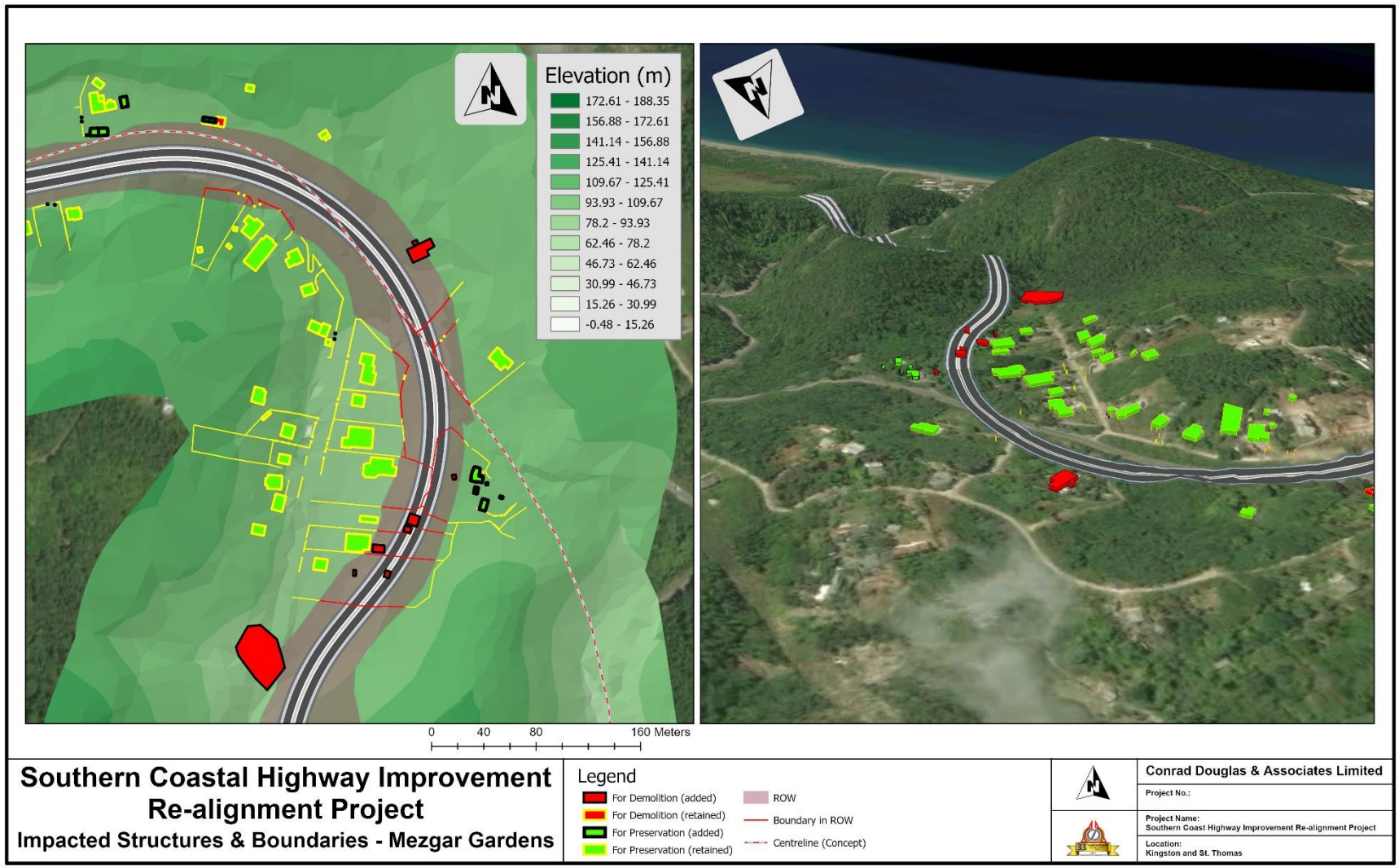


Figure 6-2: Detail of Alignment Adjustment on Structures in Megzar Gardens Housing Scheme

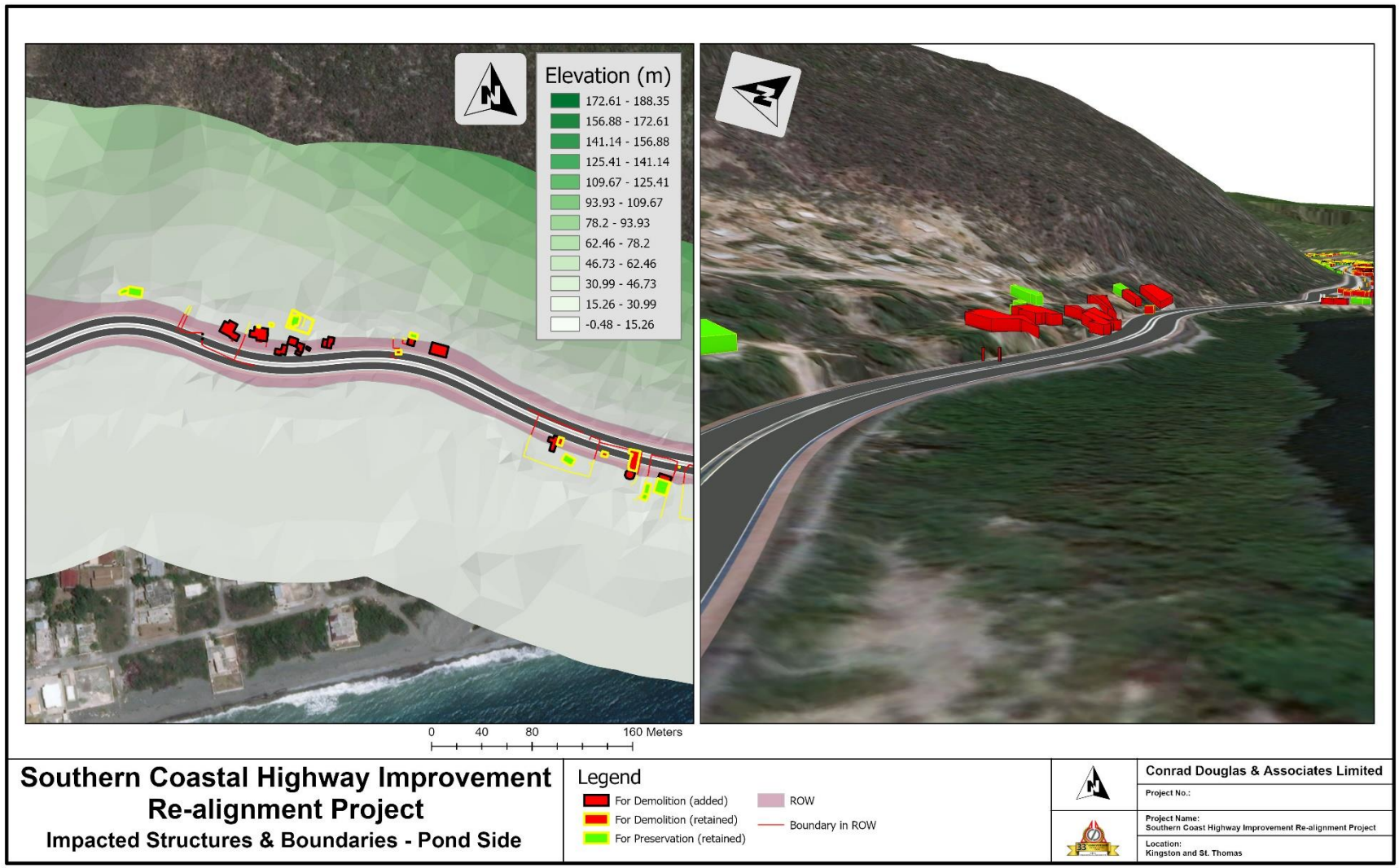


Figure 6-3. Detail of Alignment Adjustment on Structures in the Pond Side Area of Bull Bay

7 Geotechnical Considerations for Slope Stability for the Alignment through Mezgar Gardens and Grants Pen

China Harbor Engineering Company (CHEC) carried out an extensive geotechnical investigation along the alignment route through Mezgar Gardens and Grants Pen from **K112 +440 to K113 +920**. This is shown in Figure 7-1 below.

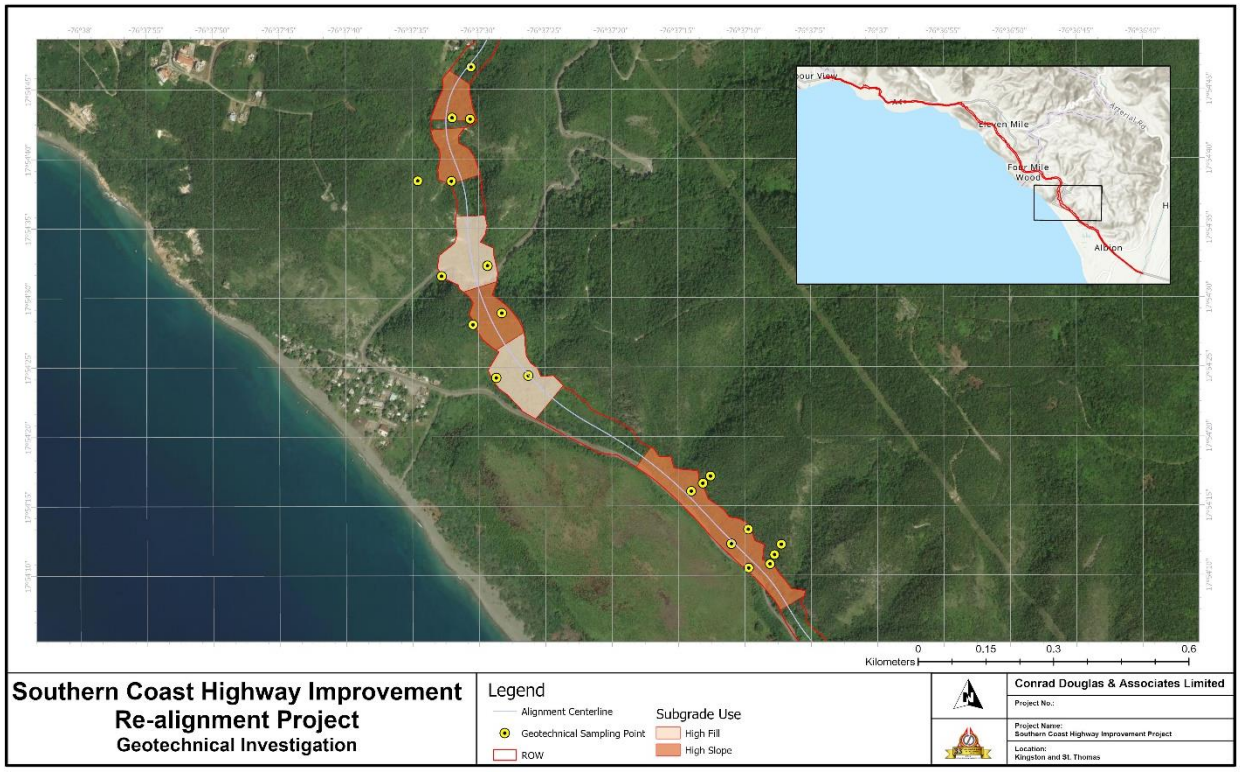


Figure 7-1: Section through Mezgar Gardens and Grants Pen covered by Geotechnical Investigation

The findings of the Geotechnical Investigation are summarized in Table 7-1 below as follows:

- The Physical Description of the Proposed Cuts and Fills inclusive of the maximum heights of the graded and fill slopes including maximum and minimum slope gradients
- The description of strata based on bore logs obtained from standard field and laboratory test inclusive of layer thickness, soil type, engineering property and JTG C20-2011 Earthwork Grade and Classification
- The slope protection and monitoring during and after excavation along with subgrade preparation for fill as recommended by the Geotechnical Engineer

The detailed report with the elevation profiles of the proposed slope grades and fills can be provided upon request.

Table 7-1: Summary of Geotechnical Investigation for K112 +400 to K113 +920 inclusive of Slope Protection Measures

Station Interval	Physical Description of Proposed Cut or Fill	Strata Description					Slope Protection and Monitoring (During and After Excavation)
		No.	Thickness	Soil Type	Engineering. Property	JTG C20-2011 Earthwork Grade / Classification	
K112 +440 – K112 +540`	• High Slope subgrade in the left side of the alignment for a length of 100m. • The subgrade is mainly made by excavation, half-filled & half-dug • The maximum excavation height of the alignment center is approximately 10.4m, and • The maximum excavation height of the slope is approximately 27.6m • Graded slopes of 1:1 (left) • Fill slope of 1:1.5 (right side)	1	0.6m	Poorly graded, subangular Cobbles and some clay of mostly limestone	Poor	II / General Soil	• Slope grade excavations will be limited to 8-10m • A 2m platform will be reserved for each grade of slope excavation with appropriately positioned intercepts, drainage ditches, and drain holes. • Effective slope surface protection in the form of active or passive nets and grass planting will be carried during excavation to provide ongoing prevention of rock fall into the operating phase. • During excavation, backfill or grouting will be carried out for potential dissolution holes within the influence range of subgrade bearing layer to ensure that the bearing layer has sufficient safety thickness and prevent karst collapse. • During slope excavation the strength of any exposed highly weathered limestone will be monitored for the weakening phenomenon when exposed to water. • Slope displacement monitoring will be carried out during construction.
		2	6.9m	Highly Weathered Limestone	General	III / Hard Soil	
		3	1.5m	Distinctly Weathered Limestone	Good	V / Medium Strong Rock	
		4	16.2m	Highly Weathered Limestone	Relatively Good	IV / Weak Rock	

Station Interval	Physical Description of Proposed Cut or Fill	Strata Description					Slope Protection and Monitoring (During and After Excavation)
		No.	Thickness	Soil Type	Engineering. Property	JTG C20-2011 Earthwork Grade / Classification	
K112 +560 – K112 +480	• High Slope subgrade in the right side of the alignment for a length of 120m. • The subgrade is mainly made by excavation, half-filled & half-dug • The maximum excavation height of the alignment center is approximately 8.5m, and • The maximum excavation height of the slope is approximately 42m • Graded slopes of 1:1 (left side) • Fill Slopes of 1:1.5 (right side)	1	2.3-4.8m	Poorly graded, subangular Cobbles and some clay of mostly limestone	General	II / General Soil	• Slope grade excavations will be limited to 8-10m • A 2m platform will be reserved for each grade of slope excavation with appropriately positioned intercepts, drainage ditches, and drain holes. • Effective slope surface protection in the form of active or passive nets and grass planting will be carried during excavation to provide ongoing prevention of rock fall into the operating phase. • During excavation, backfill or grouting will be carried out for the possible dissolution holes within the influence range of subgrade bearing layer to ensure that the bearing layer has sufficient safety thickness and prevent karst collapse. • During slope excavation the strength of any exposed highly weathered limestone will be monitored for the weakening phenomenon when exposed to water. • Slope displacement monitoring will be carried out during construction.
		2	3.1m	Highly Weathered Limestone	General	III / Hard Soil	
		3	8.6-28.2m	Distinctly Weathered Limestone	Good	IV / Weak Rock	
K112 +760 – K112 +920	• High fill subgrade of length 160m, with a maximum fill height of approximately 28.3m.	1	4.0m	Poorly graded, subangular Cobbles and some clay of mostly limestone	General	n/a	• Loose cobbles will be removed from the surface of cobble stratum followed by compaction of the stratum's middle and lower parts which will be used

Station Interval	Physical Description of Proposed Cut or Fill	Strata Description					Slope Protection and Monitoring (During and After Excavation)
		No.	Thickness	Soil Type	Engineering. Property	JTG C20-2011 Earthwork Grade / Classification	
	• Max/Min fill slopes of 1:1.5/1:2	2	4.0-8.1m	Highly Weathered Limestone	Good	n/a	as the bearing layer (of sufficient thickness) for the subgrade foundation. • Coarse granular stone will be used as the filler when filling the subgrade.
		3	4.0m	Distinctly Weathered Limestone	Good	n/a	
K112 +920 – K113 +060	• High slope subgrade in both sides of the alignment for a length of 140m. • The maximum excavation height of the alignment center is approximately 6.1m, and • The maximum excavation height of the slope is approximately 23.2m. • Max/Min graded slopes of 1:0.75/1:1.25	1	5.0m	Poorly graded, Cobbles and some clay of mostly limestone	Poor	II / General Soil	• Slope grade excavations will be limited to 8-10m • A 2m platform will be reserved for each grade of slope excavation with appropriately positioned intercepts, drainage ditches, and drain holes. • Measurements and analyses will be carried out during the excavation process to monitor the potential for the formation of unstable wedges. Adequate reinforcement will be applied as necessary to ensure slope stability. • During excavation, backfill or grouting will be carried out for the possible dissolution holes within the influence range of subgrade bearing layer to ensure that the bearing layer has sufficient safety thickness and prevent karst collapse. • During slope excavation the strength of any exposed highly weathered limestone will be monitored for the weakening phenomenon when exposed to water. • Slope displacement monitoring will be carried out during construction.
		2	2.7-10.4	Highly Weathered Limestone	General	III / Hard Soil	
		3	14.3-17.3	Distinctly Weathered Limestone	Good	IV / Weak Rock	
		4	6.3	Moderately Weathered Limestone	Good	V / Medium Strong Rock	

Station Interval	Physical Description of Proposed Cut or Fill	Strata Description					Slope Protection and Monitoring (During and After Excavation)
		No.	Thickness	Soil Type	Engineering. Property	JTG C20-2011 Earthwork Grade / Classification	
K113 +060 – K113+220	• High fill subgrade of length 160m, with a maximum fill height of 9.5m at the center. • Max/Min fill slopes of 1:1.5/1:1.75	1	2.3-4.0	Poorly graded, subangular Coarse Gravel of mostly limestone	General	n/a	• Loose cobbles will be removed from the surface of cobble stratum followed by compaction of stratum's middle and lower parts which will be used as the bearing layer (of sufficient thickness) for the subgrade foundation. • Coarse granular stone will be used as the filler when filling the subgrade. • The setting of effective water diversion and drainage measures will be done around the embankment to prevent Mudstone from softening.
		2	2.7-8.7	Residual Soil with mudstone	General	n/a	
		3	1.0-5.4	Highly Weathered Mud Stone	General	n/a	
K113 +460 – K113+920	• High Slope subgrade in the left side of the alignment for a length of 460m. • The subgrade is mainly made by local excavation, half-filled & half-dug • The maximum excavation height of the alignment center is approximately 6.1m, and • The maximum excavation height of the slope is approximately 30.3m	1	0.9-1.6m	Cobbles	Poor	II / General Soil	• Slope grade excavations will be limited to 8-10m • A 2m platform will be reserved for each grade of slope excavation with appropriately positioned intercepts, drainage ditches, and drain holes. • Measurements and analyses will be carried out during the excavation process to monitor the potential for the formation of unstable wedges. Adequate reinforcement will be applied as necessary to ensure slope stability. • During excavation, backfill or grouting will be carried out for the possible dissolution holes within the influence range of subgrade bearing layer to ensure that the bearing layer has sufficient safety thickness and prevent karst collapse. • During slope excavation the strength of any exposed highly weathered limestone will be monitored for the weakening phenomenon when exposed to water.
		2	2.3-3.0m	Gravel	Poor	II / General Soil	
		3	0.6m	Clay	General	III / Hard Soil	
		4	1.4-10.2	Highly Weathered Limestone	General	IV / Weak Rock	

Station Interval	Physical Description of Proposed Cut or Fill	Strata Description					Slope Protection and Monitoring (During and After Excavation)
		No.	Thickness	Soil Type	Engineering. Property	JTG C20-2011 Earthwork Grade / Classification	
	• Max/Min graded slopes of 1:0.75/1:1 (left side) • Fill slope of 1:1.5 (right side)	5	3.3-35.3m	Distinctly Weathered Limestone	Good	V / Medium Strong Rock	• Slope displacement monitoring will be carried out during construction. • The soft soil layer at the foot of the slope will be removed from the road bed. This will be done by engineering methods such as changing and filling, dumping rockfill and extruding silt method, mud displacement by blasting and other methods before filling.
		6	2.4m	Moderately Weathered Limestone	Good	III / Hard Soil	

8 Noise Modelling

8.1 Noise Standards, Regulations, Criteria and Guidelines

The EIA compares the noise modelling results for the proposed noise wall design at St. Benedict's Church and Primary School in Harbour view (see Figure 8-1 below) against the recommended limit of 45 dBA for Silence Zones as defined in the **Jamaica Nosie National Standards (JNNS)**. However, it should be noted that the JNNS explicitly indicates that the standards do not include the mechanical noise from motor vehicles. Therefore, the JNNS Silence Zone standard of 45dBA is most appropriately interpreted as the level that must be achieved by non-motor vehicular, non-mechanical emission sources when they impact a Silence Zone. As such, as far as the JNNS is concerned, there is no national standard for noise impact from motor vehicle mechanical noise within a Silence Zone.

Therefore, the noise modelling results that obtain in this report are compared against the **United States Federal Highway Administration (FHWA) Noise Abatement Criteria** which restricts traffic impact on "*noise, resulting from the natural and mechanical sources and human activity, considered to be usually present in a particular area*". The application of the FHWA is especially appropriate since the FHWA's TNM2.5 will be used to model noise emissions resulting from predicted traffic. The NAC levels are presented in Table 8-1 below.

Figure 8-1: Eastbound (Left) and Westbound (Right) Perspectives of St. Benedict's Church and Primary School in Harbour View

Table 8-1: FHWA Noise Abatement Criteria

Activity Category	Sound Level (dBA)		Description of Activity Category
	L_{eq}(1-hr)	L_{10}(1-hr)	
A	57 (Exterior)	60 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	--	Undeveloped lands.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

The equivalent **FHWA Category** to the **JNNS Silence Zone Standard** is **Category B** highlighted in **.** Table 8-1 above. Therefore, modelling results will be compared against the criteria limit of **67dBA** in assessing the traffic impact.

Noise abatement measures in the form of a noise barrier were applied for impacts approaching or exceeding the FHWA criteria. Where feasible, noise barriers sought to provide noticeable and effective attenuation by providing a **5–10 dBA reduction** in highway traffic noise levels as recommended by the FHWA.

For the purpose of this report, sound levels **3dBA** (or less) below the FHWA criterion are defined as approaching the FHWA criterion.

8.2 Model Definition

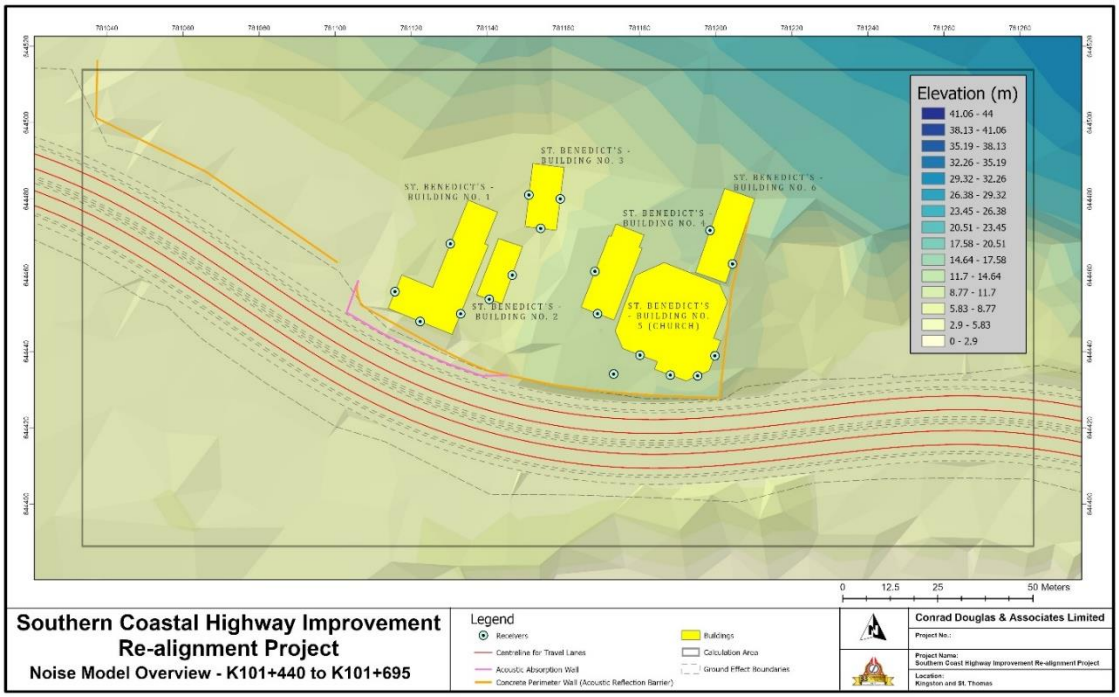


Figure 8-2: Overview of Model Inputs Inclusive of Elevation and Receivers

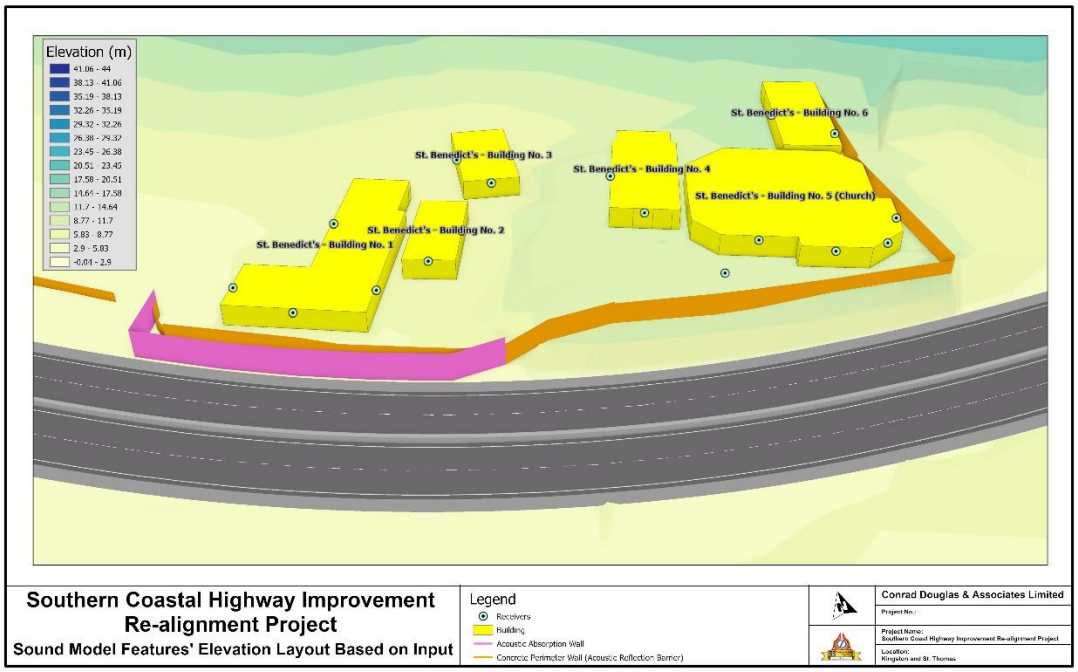


Figure 8-3: Confirmation of Elevation Layout (Overall Model Domain)

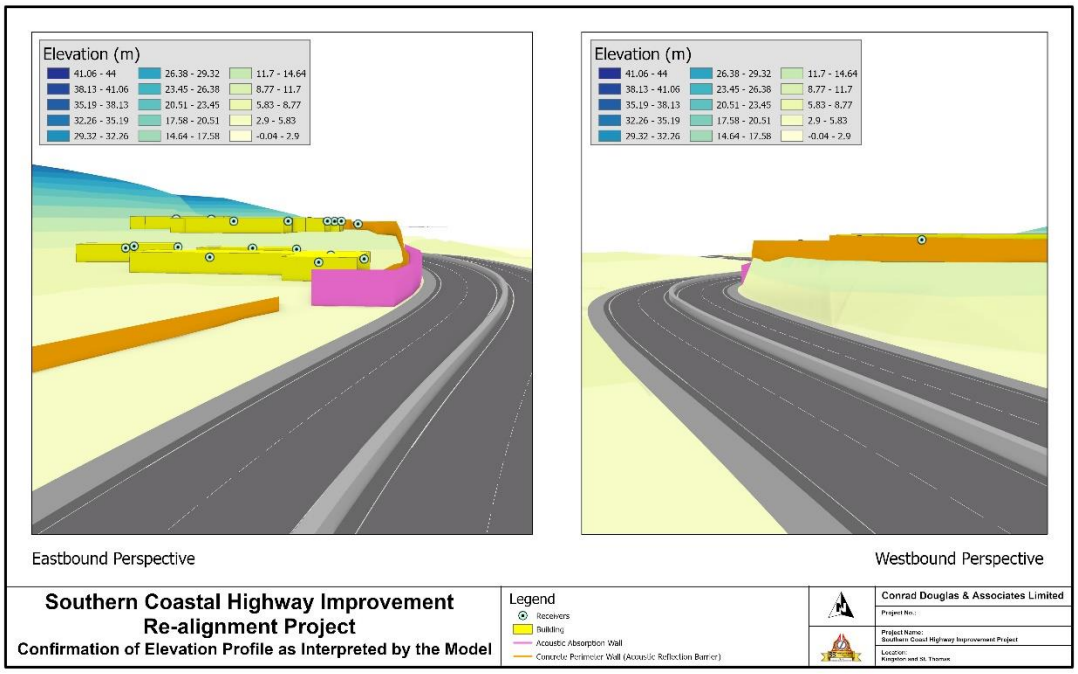


Figure 8-4: Confirmation of Elevation Layout (Eastbound and Westbound Perspectives)

8.2.1 Digital Ground Model

In pre-processing the digital ground model data, a regular grid was used to model the terrain profile in the strip area for the proposed alignment. This was done to ensure that the geospatial representation of the dual carriageway would adequately represent the design profile at final grade when set to the triangulated digital ground model generated by SoundPLAN. This was achieved by:

- Developing a geospatial representation of the centreline elevation profile for the alignment based on the design elevation data provided by CHEC,
- Interpolation of the elevation profile data at 5 -10m intervals matched to the stationing points along the alignment.
- Developing the transverse profile of the alignment based on the Cross Fall Slope for the travel lanes, marginal strips, sidewalk, utility corridors, hard Shoulders, and earth shoulders.
- Using an elevation buffer zone within the right of way to protect the uniformity of the data along the road during triangulation.

Pre-processing of the DGM data was also carried out by imposing appropriate uniform base elevations within the DGM for structures of interest whose profiles would influence (or be influenced

by) the propagation of sound in those areas. Elevations were also imposed within the DGM that would adequately align the elevation profile of the modelled terrain with critical areas of the terrain observed during ground truthing.

Table 8-2: Base Elevation of Critical Structures in the Noise Model

Structure	Assigned Base Elevation
St. Benedict's – Building No. 1	6.28
St. Benedict's – Building No. 2	6.53
St. Benedict's – Building No. 3	6.92
St. Benedict's – Building No. 4	11.46
St. Benedict's – Building No. 5 (Church)	11.5
St. Benedict's – Building No. 6	12.0
St. Benedict's – S. Boundary Wall (Church)	11 – 11.8
St. Benedict's – Main Driveway N. Curb Wall	6.23-12

8.2.2 Ground Zones

Ground zones for absorption/reflection were defined within a maximum distance of 500ft of the travel lanes. This was done to reduce the extreme effect of the model's built-in ground effects function in either over-predicting or under-predicting sound levels at large distances. The following ground zones were integrated into the noise model in predicting the impacts of terrain on sound propagation:

Table 8-3: Ground Zones Input in Model

TNM Category	Section of Model Domain
Lawn (Mixture of dirt and vegetation)	▪ Surrounding Terrain
Loose Soil	▪ Alignment Right of Way
Pavement	▪ Sidewalks and Utility Corridors ▪ Marginal Strips, Verges, Median Areas

8.2.3 Existing Structures

The geospatial location and height of existing structures were determined from a combination of primary and secondary data.

Several structures (buildings and walls) were directly input into the model on the basis of geospatial information provided by CHEC. Several other structures were input based on aerial drone imagery of the site that was georeferenced to the buildings spatially referenced by CHEC. This was done in

order to normalize the geospatial information for the uniform insertion of additional structures since the receivers were to be placed on the façade of buildings already geospatially referenced by CHEC.

All buildings were given a height of 3m with a single floor, and assigned reflection losses of 1dB.

The perimeter walls for the property were observed as dense concrete blocks. Therefore, they were modelled as hard concrete noise barriers each with a Reflection Loss (as defined by SoundPLAN) of 1 dB. The elevation profiles for the perimeter wall are listed in the table below and depicted in Figure 8-4 and Figure 8-3 above.

Table 8-4: Estimated Elevation Profile of Existing Perimeter Wall

UTM Coordinates		Base Elevation (m)	Wall Height (m)
Eastings (m)	Northings (m)		
319384.8	1985448	11.3	3
319389.7	1985467	12	3
319381.3	1985419	11.81	2.5
319380.1	1985419	11.81	2.5
319375.1	1985420	11.81	2.5
319370.2	1985420	11.81	2.5
319365.2	1985420	11.8	2.5
319355.2	1985421	10.95	2.5
319350.2	1985421	10.78	2.5
319338.1	1985423	11	2.5
319338.1	1985423	11	2.5
319330.5	1985425	9	2.5
319325.7	1985426	5.83	2.5
319320.8	1985427	5.49	2.5
319320.8	1985427	5.49	3
319316.2	1985429	5.1	3
319311.7	1985431	5.05	3
319307.3	1985433	4.73	3
319302.9	1985436	4.91	3
319287.3	1985445	4.36	3
319281.4	1985456	4.61	1.5
319247.1	1985480	5.14	1.5
319247.1	1985480	5.14	1.5
319218.2	1985495	4.22	1.5
319218.8	1985510	4.02	1.5

8.2.4 Emission Sources

The hourly traffic volume was determined assuming a K-factor of 10% and an Annual Average Daily Traffic (AADT) of 18,400. The K-factor of 10% was selected from the design basis for the level of service required for the forecasted traffic during 2035 as outlined in Traffic Survey Report

It should be noted the report also applied a K-factor of 8.5% to the historical data prior to 2013. This was done to normalize the historical data for AADT and subsequent application with the then present 2013 data set. Therefore, for the purpose of the noise assessment, the k-factor 10% is a conservative design estimate and a reasonable and consistent assumption in capturing the Design Volume Traffic.

Predicted traffic was simulated in each travel lane shown in Figure 8-2 above in accordance with following additional assumptions:

- The design volume traffic estimated from the AADT is split evenly between the eastbound and westbound carriageways
- Traffic in the left and right travel lanes of the same carriage way is distributed in the ratio 60:40
- All Heavy Trucks were assumed to travel only in the left travel lane
- The wearing course for the travel lanes can be classified in the TNM category of **densely graded asphaltic concrete**

Similar computations were carried out using a K-factor of 8.5% for the 2013 AADT of 13,100 reported in the Traffic Survey and Axel Load Report.

The emission table based on the calculation grid applied to the model domain is presented in Table 8-5 below.

The impact of noise reflected by the median barrier was predicted separately using the Image Roadway Technique to simulate the effective traffic volume and ground zone conditions (within the alignment) that would produce the same effect as the noise reflected by the median barrier for the design volume. The predicted sound levels from this technique were logarithmically applied (where appropriate) to the results obtained from modelling the absolute design parameters, inclusive of the median barrier. This is considered as best practice when using the **TNM 2.5 model** and is especially relevant given the height of the receptors relative to, and their horizontal distances from, the median.

A map showing the regions impacted by the predicted median reflections of both eastbound and west bound traffic, for a minimum receiver height of 2m above ground level, are shown in Figure 8-5 below. This is based on criteria proposed for the Image Roadway Technique, with considerations for terrain and alignment features.

It should be noted that only median reflections caused by **eastbound traffic** were considered for this assessment since the impact receptor(s) of interest are located on that side of the alignment. Therefore, all noise and noise contour maps depicted in this report only account for the same. All other areas ignore the impact of median reflections caused by westbound traffic.

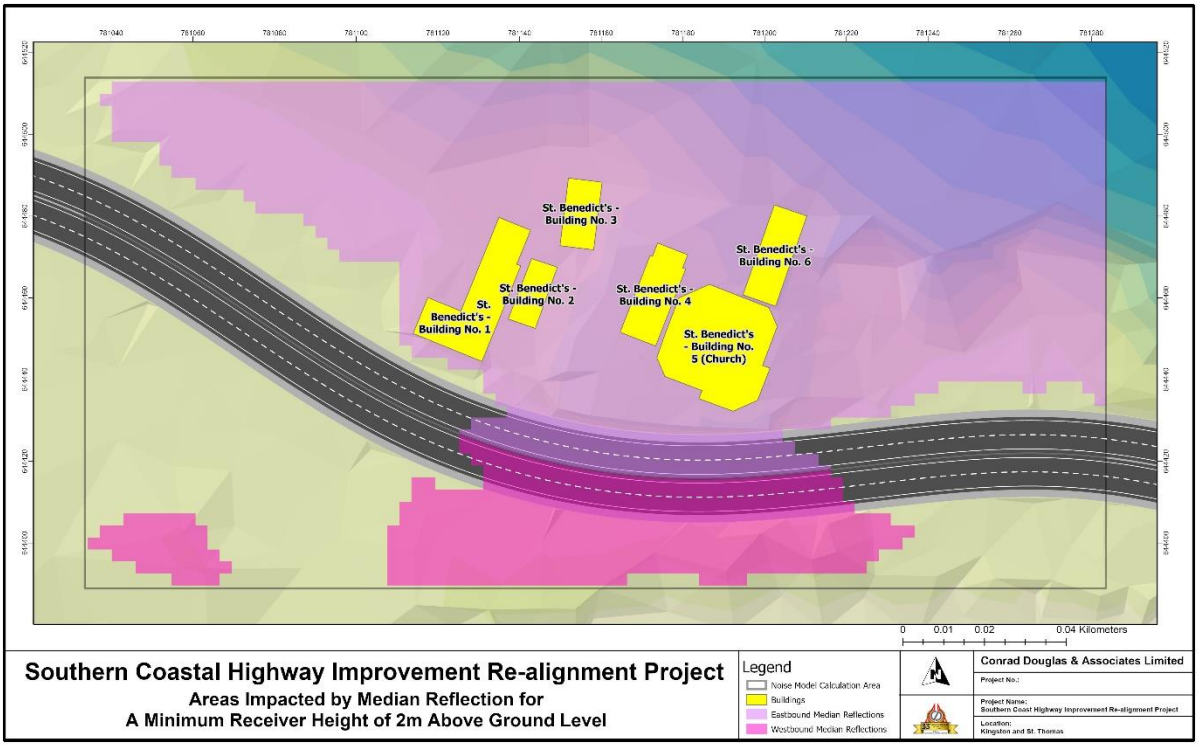


Figure 8-5: Areas Impacted by Median Reflection within the Calculation Area for a Minimum Receiver Height of 2m Above Ground Level

Table 8-5: Emission Table for 2013 and Forecasted 2035 Traffic Volumes (based on Input and Model's Calculation Grid)

Station (km)	ADT (Veh/24h)		Traffic values				Road surface	Gradient (Min / Max) %
	Year 2013	Year 2035	Vehicles type	Day (Veh/h)		Speed (km/h)		
				Year: 2013	Year 2035			
S1 - Carriageway Left Lane EB Traffic direction: Eastbound								
101+440	8112	13407	Total	338	559	-	DGAC (dense-graded asphaltic concrete)	-1.3 / 1.4
			Automobiles	283	468	65		
			Medium trucks	45	75	65		
			Heavy trucks	10	17	65		
S1 - Carriageway Right Lane EB Traffic direction: Eastbound								
101+440	5249	8673	Total	219	361	-	DGAC (dense-graded asphaltic concrete	-1.2 / 1.4
			Automobiles	189	312	65		
			Medium trucks	30	50	65		
			Heavy trucks	-	-	65		
S1 - Carriageway Right Lane WB Traffic direction: Westbound								
101+440	5309	8770	Total	336	365	-	DGAC (dense-graded asphaltic concrete)	-1.3 / 1.3
			Automobiles	301	332	65		
			Medium trucks	30	33	65		
			Heavy trucks	4	-	65		
S1 - Carriageway Left Lane WB Traffic direction: Westbound								
101+440	8054	13310	Total	221	555	-	DGAC (dense-graded asphaltic concrete)	-1.3 / 1.3
			Automobiles	201	498	65		
			Medium trucks	20	50	65		
			Heavy trucks	-	6	65		

8.2.5 Receivers

A total of eighteen (18) receivers were modelled to closely represent the impact of traffic noise emissions on buildings of interest. All receptors were placed on the façade of buildings or along faces where noise reflection may cause significant impact owing to other surrounding structures and the immediate terrain. The location of these receiver are listed below and shown in Figure 8-2 above.

Table 8-6: Receiver Geospatial Location

Structure /Location	Building Side	Receiver Name	UTM Co-ordinates		Elevation (m)
			Eastings (m)	Northings (m)	
Building No. 1	South west	BDCT1_R1	319302.82	1985440.3	8.68
Building No. 1	North west	BDCT1_R2	319296.28	1985448.2	8.68
Building No. 1	North west	BDCT1_R3	319310.98	1985460.59	8.68
Building No. 1	South east	BDCT1_R4	319313.48	1985442.2	8.68
Building No. 2	East	BDCT2_R5	319327.16	1985452.19	9.32
Building No. 2	South	BDCT2_R6	319321.06	1985445.92	9.32
Building No. 3	West	BDCT3_R7	319331.75	1985473.18	9.32
Building No. 3	South	BDCT3_R8	319334.75	1985464.36	9.32
Building No. 3	East	BDCT3_R9	319339.99	1985472.06	9.32
Building No. 4	West	BDCT4_R10	319348.89	1985452.93	13.86
Building No. 4	South	BDCT4_R11	319349.46	1985441.83	13.86
Building No. 5	South	BDCT5_R12	319360.49	1985430.86	13.9
Building No. 5	South	BDCT5_R13	319368.41	1985425.53	13.9
Building No. 5	South east	BDCT5_R14	319375.59	1985425.25	13.9
Building No. 5	East	BDCT5_R15	319380.17	1985430.48	13.9
Building No. 6	East	BDCT6_R16	319385.05	1985454.51	14.4
Building No. 6	West	BDCT6_R17	319379.25	1985463.37	14.4
St. Benedict's - Church Lawn	-	BDCT-Church Lawn_R18	319353.51	1985425.97	13.31

8.2.6 Calibration

The calibrated values for temperature (28.6^{0}C) and pressure (1013 Pa) from the previous sound model reported in the January 2018 EIA were taken as the same for the present model. Although the modeling approach to the dual carriage way appears to be different from that of the EIA, this is thought not to have affected the applicability of the calibration values to the present model since: (a) both models apply TNM2.5 as the predictive method implemented through the same SoundPLAN software, and (b) the previous model was calibrated using the existing single lane carriage way.

Calibrating the model for the existing terrain features, and structures based on the receiver locations was not possible given the lack of access to the property. This limitation is not expected to be significant since: the model has already been calibrated for pressure and temperature; the DGM was generated using surveyed data; and ground truthing was carried out to confirm conservative estimates for critical structures such as the existing southern perimeter wall for the property.

8.2.7 Noise Abatement Walls

A noise abatement wall was modelled 0.3 m from the Utility Corridor of the proposed alignment south east of Building No's 1, 2 and 3. The purpose of the wall is to provide adequate and effective noise attenuation in keeping with the FHWA recommendation of 5-10dBA for receivers approaching the FHWA criterion of 67dBA.

The noise abatement wall is depicted in Figure 8-2, Figure 8-4, and Figure 8-3 above. The profile of the wall is terms of base height and elevation are shown in the table below.

Table 8-7: Elevation Profile of Noise Wall

UTM Coordinates		Base Elevation (m)	Wall Height (m)
Eastings	Northings		
319286.71	1985451.36	4.4	4
319283.53	1985442.87	4.5	4
319285.29	1985441.82	4.5	4
319293.44	1985436.95	4.7	4
319301.77	1985432.70	4.8	4
319310.31	1985428.99	4.9	4
319319.07	1985425.82	5.0	4
319325.66	1985425.95	5.8	4

8.3 Modelling Results

The noise impacts of 2035 traffic predicted on receivers from modelling are shown in Table 8-8 below and depicted in the noise map shown in Figure 8-6 below.

Noise Contour maps for the 2013 and 2035 are shown, in Figure 8-7 to Figure 8-10 below. The figures depict the FHWA Critrion of 67dBA and the regulated sound level of 70 dBA prescribed by NEPA as the maximum impact along the right of way.

The results from modelling are as follows:

- The FHWA Noise Abatement Criterion of 67dBA is met at all eighteen (18) receptors assessed without the application of noise abatement measures
- Predicted sound levels at two (2) of the eighteen (18) receivers approach the 67dBA FHWA criterion.
- Adequate attenuation was achieved with noise reductions of 7.3 and 5.8 dBA by using a absorption wall 4m high and 55m long with a reflection loss of 4dB (as defined by SoundPLAN).

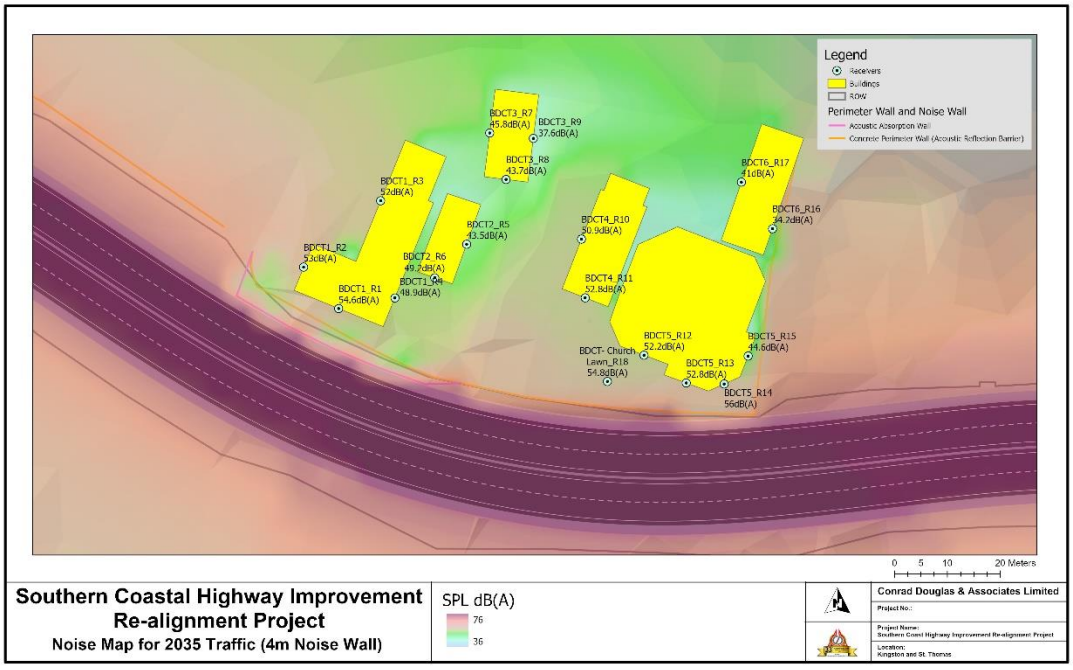


Figure 8-6: Noise Impact of 2035 Traffic on Receivers with the Proposed Noise Wall

Table 8-8: Modelling Results for the Reported 2013 traffic and the Forecasted 2035 Traffic

Key	
Within FHWA Criteria	
Approaches FHWA Criteria	
Exceeds FHWA Criteria	
FHWA Criteria not applicable	

w/o.NP	*denotes 'without Noise Protection*
w NP	*denotes 'with Noise Protection*
w. Med. Reflects	*denotes 'with Median Reflections*

Receiver name	Year: 2013			Year: 2035		
	SPL w/o NP (w Med. Reflect.) dBA	Sound Level w NP (w Med. Reflects.) dBA	Reduction Level dBA	SPL w/o NP (w Med. Reflect.) dBA	Sound Level w NP (w Med. Reflects.) dBA	Reduction Level dBA
BDCT1_R1	64.2	56.9	7.3	66.4	59.1	7.3
BDCT1_R2	61.9	56.1	5.8	64.1	58.3	5.8
BDCT1_R3	55.4	54.9	0.5	57.6	57.1	0.5
BDCT1_R4	55.1	51.3	3.8	57.2	53.5	3.7
BDCT2_R5	48.1	46.1	2	50.3	48.3	2
BDCT2_R6	55.3	51.9	3.4	57.5	54.1	3.4
BDCT3_R7	41.1	40.7	0.4	43.3	42.9	0.4
BDCT3_R8	47.9	46.6	1.3	50	48.8	1.2
BDCT3_R9	48.8	48.6	0.2	51	50.8	0.2
BDCT4_R10	57	55.4	1.6	59.1	57.6	1.5
BDCT4_R11	54.8	53.3	1.5	56.9	55.5	1.4
BDCT5_R12	58.1	58.1	0	60.2	60.2	0
BDCT5_R13	46.8	46.9	-0.1	49	49.1	-0.1
BDCT5_R14	55.9	55.2	0.7	58.1	57.4	0.7
BDCT5_R15	55.7	54.4	1.3	57.9	56.6	1.3
BDCT6_R16	51.6	51.6	0	53.8	53.8	0
BDCT6_R17	45.9	45.7	0.2	48	47.9	0.1
BDCT_R18	58.2	57.2	1	60.4	59.4	1

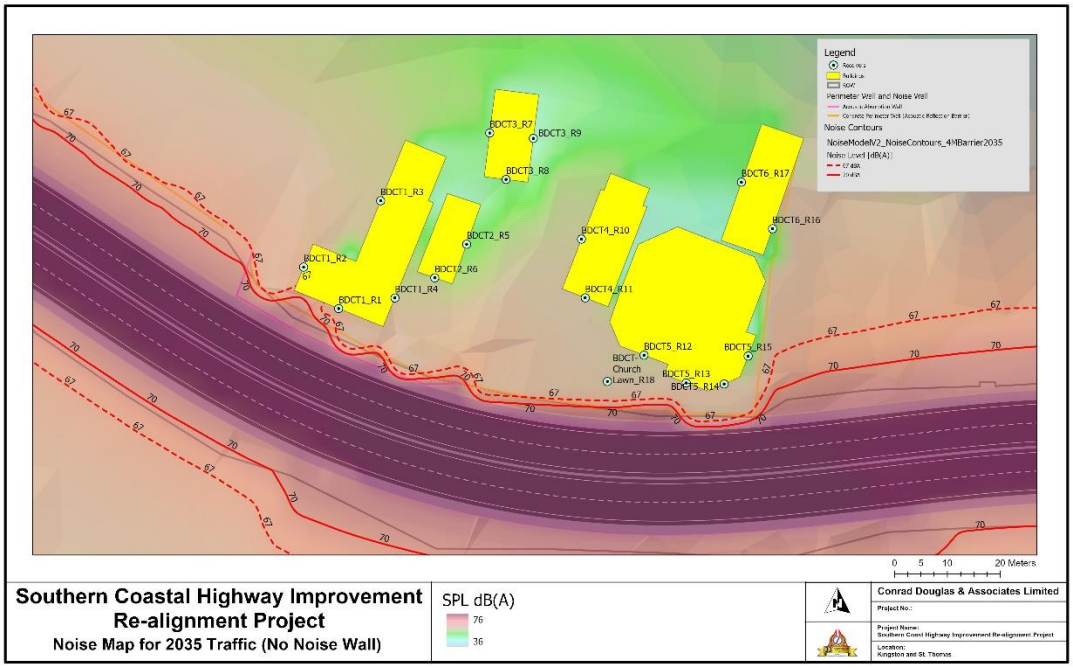


Figure 8-7: Noise Map with Permit and FHWA Criteria Limit Noise Contours for 2035 Traffic with No Noise Wall

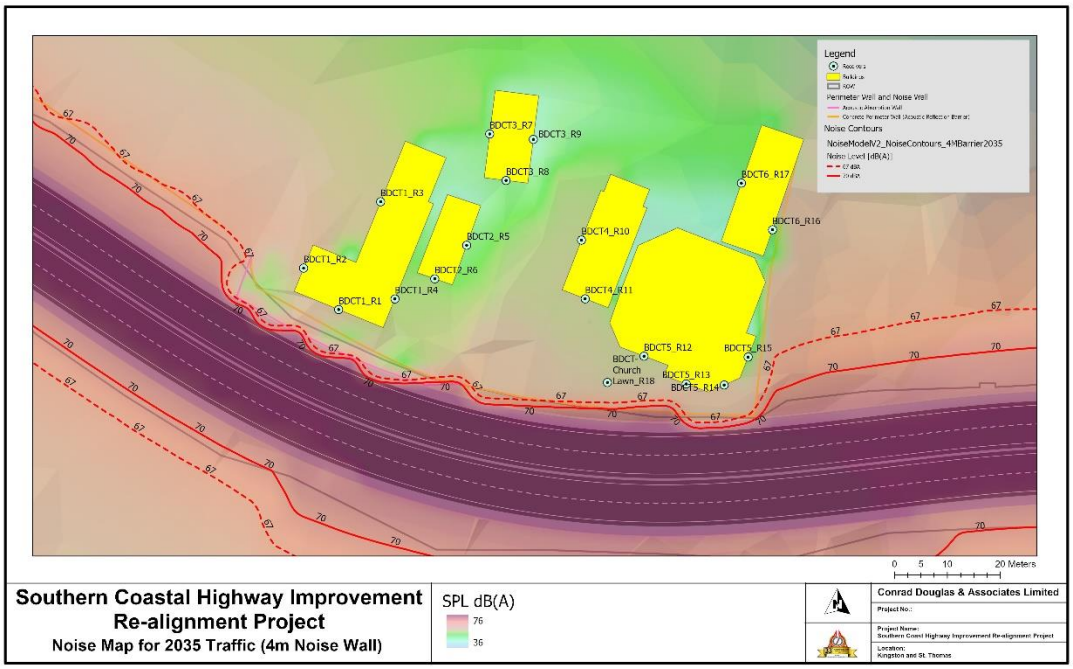


Figure 8-8: Noise Map with Permit and FHWA Criteria Limit Noise Contours for 2035 Traffic with 4m Noise Wall

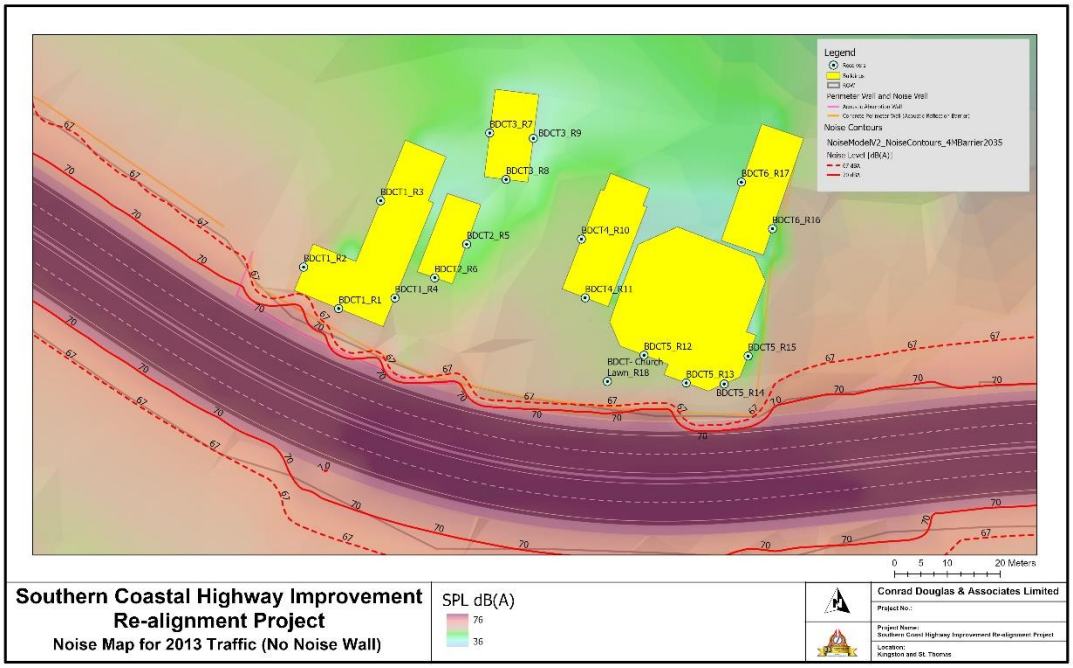


Figure 8-9: Noise Map with Permit and FHWA Criteria Limit Noise Contours for 2013 Traffic with No Noise Wall

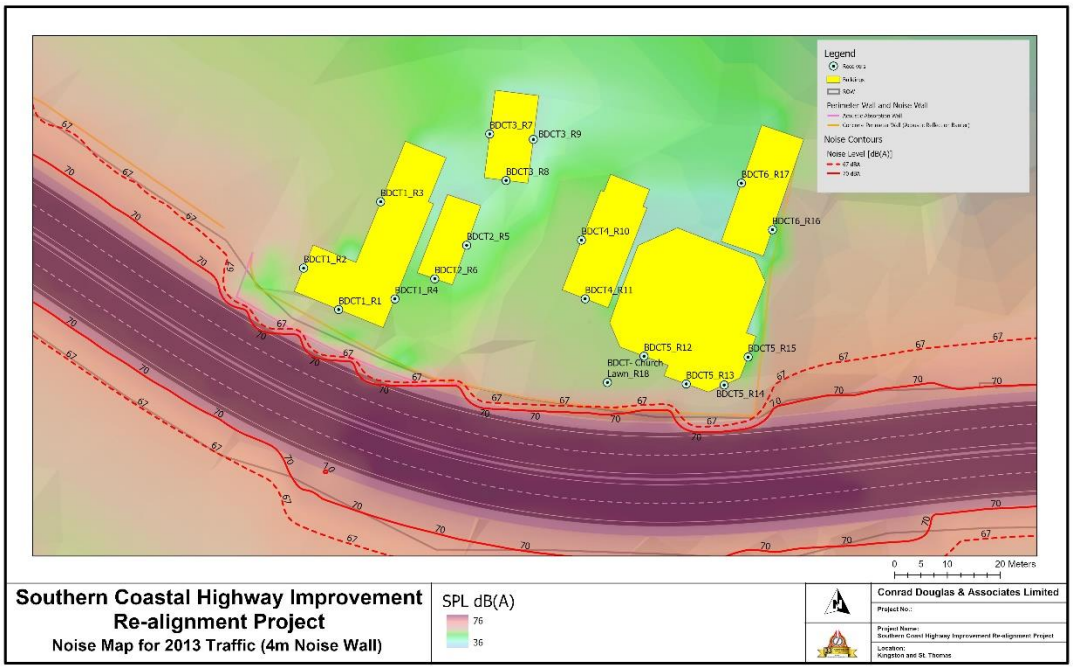


Figure 8-10: Noise Map with Permit and FHWA Criteria Limit Noise Contours for 2013 Traffic with 4m Noise Wall

8.4 Conclusions:

The JNNS does not define any restrictions on the noise impact of vehicular mechanical noise emissions on the four (4) land use categories defined in that standard. The JNNS explicitly cites this limitation, and is therefore not appropriate for highway noise assessments.

CD&A therefore applied the FHWA Noise Abatement Criteria to predict the impact of the 2035 traffic forecasted by Stanley Consultants Inc. in their Traffic Report and Axle Load Survey for the Southern Coastal Highway Improvement Project.

Our conclusions from the noise model carried out by CD&A are as follows:

- The FHWA Noise Abatement Criterion of 67dBA is met at all eighteen (18) receivers assessed without the application of noise abatement measures
- Predicted sound levels at two (2) of the eighteen (18) receivers approach (within 3dBA) the 67dBA FHWA criterion.
- Adequate attenuation was achieved with noise reductions of 7.3 and 5.8 dBA by using a absorption wall 4m high and 55m long with a reflection loss of 4dB (as defined by SoundPLAN).
- Feasible and noticeable attenuation may also be may also be achieved for receivers **BDCT1_R4** and **BDCT2_R6** by increasing the height of the noise barrier to a height to 5m and extending it to the west to a total length of 63m. However, this will require significant modifications to the property's ingress and egress , and may not be worth the attenuation gains because:
    i. the receivers neither approach or exceed the FHWA criterion of 67dBA, and
    ii. the potential impact on aesthetics

9 Impact Identification & Mitigation

9.1 Impact of the proposed development

The proposed development is expected to have minimal negative impacts on the fauna and flora assessed in the area. This is due to the fact that the development will be occurring in a highly disturbed area that has been significantly modified throughout the area for years. No species of special conservation status were encountered which could have impacted current plans for the proposed hotel developments.

The road will not result in large scale removal of vegetation. However, it should be noted that the removal of vegetation will normally have an impact on the movement of animals from one area to another. This would mainly affect the movement of some of the Herps (snakes, lizards and amphibian). However, all the herps identified in the study are widely distributed in the area and would not need any special conservation activities for the survival of the species.

With reference to the EIA prepared for the Project in 2017, the proposed realignment will add no new potential impacts compared to the conceptual/preliminary alignment. The new alignment will mitigate some potential impacts identified in the 2017 EIA.

These mitigation measures include:

1. The proposed alignment will reduce the impact on flora and fauna by avoiding waterbodies (ponds and wetlands) along its length
2. The proposed alignment will improve the safety of the roadway by install sidewalks in built up areas such as St. Benedict's Church and school and round about at Seven Miles Bull Bay.
3. The new alignment will open new areas for development especially in areas between Mezgar Gardens and Grants Pen.

9.2 Recommended Changes to EP# 2016-01017-EP00018

The following changes to the permit issued for the SCHIP are being recommended to accurately reflect the details of the planned highway:

1. Under "Description of the Permitted Activity"

a. Under first bullet – "*The road alignment begins at eastern end of the new Harbour View Bridge"* should be replaced with "*The road alignment begins at the Harbour View Roundabout*"

b. Under last bullet – *"The entire project is projected to last for 26 months"* should be replaced by *"The project is a design build and the implementation period is 36 months"*

References

Adams, C.D. 1972. Flowering plants of Jamaica. University of the West Indies. 848 pp.

Bibby, C., M. Jones, and S. Marsden. (1998). Expedition field Technique: Bird Surveys. London: Royal Geographical Study.

Brown, F.M. and B. Heineman. 1972. Jamaica and its butterflies. E.W. Classey, London. 478 pp.

Downer, A. and R. Sutton. 1990. Birds of Jamaica. Cambridge: Cambridge University Press. 152 pp.

Ecosystems Management Branch NEPA. 2011. Bat Management Plan for Jamaica. Kingston: NEPA.

NEPA. (2015). *Birds of Industry Cove.* Kingston: National Environmental and Planning Agency.

Garraway, E. and A.J. Bailey. 2005. Butterflies of Jamaica. McMillan Caribbean. 122 pp.

Genoways, Hugh H, John W Bickham, Robert J Baker, and Carleton J Phillips. 2005. "Bats of Jamaica." Mammalogy Papers: University of Nebraska State Museum 1:51.

Johnson, N.F. and C.A. Triplehorn. 2005. Borror and DeLong's Introduction to the Study of Insects. Brooks Cole. 888 pp.

Koenig, Susan. 2015. Bats General Information. April. Accessed January 11, 2020. https://www.cockpitcountry.com/Bats.html.

Raffaele, J. 1998. A Guide to the Birds of the West Indies. Princeton University Press. 511 pp.

Riley, N.D. 1975. A Field Guide to Butterflies of the West Indies. Collins, London. 224 pp.

Schwartz A. and R.W. Henderson. 1988. West Indian Amphibians and Reptiles: A checklist. Milwaukee Public Museum, Contributions in biology. No. 74.

Smith, D.S, L.D. Miller, and J.Y. Miller. 1994. The Butterflies of the West Indies and South Florida. Oxford University Press. 264 pp.

Wunderle, J.M. 1994. Census methods for Caribbean land birds. Gen. tech, S0-98.

Appendix I: Terms of Reference

NATIONAL ENVIRONMENT & PLANNING AGENCY

10 & 11 Caledonia Avenue, Kingston 5, Jamaica W.I. Tel: (876) 754-7540/3 Fax: (876) 754-7595-6 Tollfree: 1-888-991-5005
E-mail: ceo@nepa.gov.jm, Website: http://www.nepa.gov.jm

Ref: 2016-03017-EP00018

10 March 2020

Mr. Everton Hunter
Chief Executive Officer
National Works Agency
140 Maxfield Avenue
Kingston 5

Dear Mr. Hunter,

Re: Amendment to Environmental Permit Issued under the Natural Resources Conservation Authority (NRCA) Act, 1991, in respect of the Construction of a New Highway from Harbour View, Kingston to Morant Bay, St. Thomas.

The National Environment and Planning Agency (NEPA) write in reference to meeting of Monday 10 March 2020 to discuss and clarify pertinent matters related to the captioned project.

As agreed at the meeting the National Works Agency (NWA) and its consultants are required to satisfactorily comply with the following-

1. Submission of a comprehensive project brief detailing the proposed amendments to the alignment (hard and electronic copy):
2. The submission of final alignment for the new highway including the KMZ file.
3. Submission of documentation indicating all agreements and or proof of ownership for additional lands to be impacted within the scope of the project.
4. **Submission of an Environmental Statement to include the following main areas**

St Benedict Church
The applicant is required to provide detailed justifications for the proposed realignment of the road further south towards the marine environment and removal of the proposed noise wall. This should be accompanied by detailed mitigation measures for any impact this shift may have on the coastline.

Cane River Bridge
Detailed description of the new Cane River Bridge and the associated environmental impacts and mitigation measures, based on the proposed changes.

Any reply or subsequent reference to this communication should be addressed to the Chief Executive Officer, to the attention of the officer dealing with the matter, and the reference quoted where applicable.

Managing and protecting Jamaica's land, wood and water
A Government of Jamaica Agency

Bull Bay Football Field and Pondside Community
The applicant should provide detail justifications for this proposed change in the alignment in addition to the environmental impacts and supporting mitigation measures.

Mezgar Gardens and Grants Pen
This proposed major change will require the submission of a detailed Flora Fauna Assessment report and a social survey regarding possible impact of the realignment on properties previously un-impacted by the highway in accordance with a Terms of Reference to be agreed on with the Agency.

In addition, the shift to the north in the vicinity of Grants Pen should also include mitigation measures for potential slope instability concerns which could develop as a consequence of the change.

5. **The undertaking of public consultation with the general public on the proposed changes in accordance with NEPA's guideline for conducting public consultation non- Environmental Impact Assessment Projects (*see attached for easy reference*)**

6. The submission of a new Environmental Permit application for the new two lane bridge at Bull Bay St. Thomas

The Agency wishes to reiterate that the quality, completeness and timeliness of aforementioned submissions as agreed is critical to ensuring the timely review of the proposed amendments.

Please be reminded as well that the documents are required to bear the stamp/seal of the registered and licensed professional *(e.g. Commissioned Land Surveyor, Architect, Surveyor, Engineer etc.)* who prepared same.

Should you require any further clarification and/or additional information, please contact the undersigned Mr. Gregory Bennett, Director- Applications Management Division via Tel.# 754-7540 ext. 2001/e-mail: gbennett@nepa.gov.jm

Yours sincerely,
National Environment and Planning Agency

Gregory Bennett
Director Applications Management Division
For Chief Executive Officer/Government Town Planner

Copy: Mr Alfonso Marshall, NWA