EXECUTIVE SUMMARY
ENVIRONMENTAL IMPACT ASSESSMENT
HIGHWAY 2000 - PORTMORE CAUSEWAY

The Report

This document presents the findings of the Environmental Impact Assessment of the proposed Portmore Causeway upgrading and bridge construction. The EIA was conducted in support of the environmental permit application submitted to the National Environment and Planning Agency and meets the Terms of Reference approved by that regulatory agency. The Portmore Causeway project is a component of Phase 1A of the Highway 2000 project being developed by TransJamaican Highway Ltd. under contract with the Government of Jamaica.

Highway 2000

Phase IA of the Highway 2000 Project includes Kingston to Sandy Bay and the Portmore Causeway and Dyke Road. Phase 1B will see the construction of the highway from Sandy Bay to Williamsfield in Manchester. Construction for the section from Kingston to Sandy Bay has already commenced and includes:

- Doubling of the Old Harbour Bypass by construction of the a second two lane carriageway, reconstruction of the northern ramps of the interchange and extension of the main toll plaza with maintenance centre, with the tolling operation of the Kingston to Sandy Bay section as an open system
- The tolling of the two lanes of the existing Old Harbour Bypass (km 21.0 to 33.7) and the implementation of a main toll plaza on the east of the eastern ramps
- Construction of a four lane highway (2x2) between Kingston and Bushy Park with interchanges at Mandela Highway (km 0.3), Portmore Access Road (km 1.2) and Spanish Town (km 7.4) and the implementation of a ramp toll plaza on the eastbound ramps of the Spanish Town interchange.

The Project

Highway 2000 (H2K) is one of the Government of Jamaica's landmark Millennium Projects. It will link Kingston to Montego Bay, through the parishes of Kingston & St. Andrew, St. Catherine, Clarendon, Manchester, St. Elizabeth, Westmoreland and St. James. The Highway will also connect Bushy Park and Ocho Rios, traversing the parishes of St. Catherine and St. Ann. The total length of the highway is approximately 230 km, with an anticipated right-of-way of 100m.

A Strategic Environmental Assessment (SEA) of the proposed highway development was commissioned by the National Development Bank of Jamaica Ltd., the executing agency for the project. The SEA was conducted by Dessau-Soprin International Ltd., of Canada in association with local partners including Environmental Solutions Ltd. (Development Bank of Jamaica Ltd, 2000 a-e). The SEA recommended issues for detailed project-level Environmental Impact Assessment (EIA) which would be necessary to support the application for an environmental permit. Within the Kingston to Williamsfield corridor ten areas were recommended for EIA studies. These were Portmore, Portmore Causeway, Rio Cobre, Bushy Park, Freetown, Rio Minho, Milk River, Sandy Bay, Porus and Williamsfield. These areas were selected because of issues related to community, infrastructure, settlements, economic enterprise, relocation, loss of economic activity, proposed interchanges, water resources, hazard vulnerability, hydrology, coastal dynamics, air quality and noise.

The Portmore Causeway crosses Hunt's Bay and links the parishes of Kingston and St. Catherine, in the region of Gordon Cay and Fort Augusta, respectively. Currently the Causeway supports two lanes of traffic only and in an effort to improve traffic flow, directional changes occur during the weekdays. The Causeway upgrading provides for a new 2 x 3-lane highway from Kingston to Portmore leading over a new Hunt's Bay Bridge. A main toll plaza, located to the west of the bridge will be constructed. The Toll Plaza will provide 21 lanes as well as an Operation and Maintenance Centre. In addition

a 2-lane urban highway through Portmore along the existing Dyke Road, will be upgraded and remain untolled.

The construction camp for this segment of Highway 2000 will have facilities for site offices, workshop and storage yard, and other related facilities including fuel storage. Approximately 30,000 m^2 of land will be required and the site proposed is that area which formerly housed the Jam World Entertainment Centre. This site is not currently used and is owned by the Government of Jamaica.

The Hill Run Quarry located in March Pen, Hellshire which now also supplies material for other segments of Highway 2000, will be a main supplier for the Portmore Causeway section. Where additional material sources **may** be required, only licensed suppliers will be utilized. Additional permits will be applied for, as required, prior to utilizing new sources.

After completion of the new bridge, the old bridge will be demolished. Detailed method and scheduling for demolition of the existing bridge has not yet been finalized. Blasting works will be minimized. The bridge spoil will be removed from the marine environment and disposed of at a designated disposal site, within the Riverton City Landfill.

EIA Methodology

Baseline data for the Portmore Causeway study area was collected using the following methods:

- Windshield Survey
- Site Reconnaissance
- Aerial Survey
- Analysis of Maps and Plans
- Literature Review
- Desk Top Research
- Public Consultations

- Field Studies
- Laboratory Analyses
- Charette Style Consultations

Information was gathered on the existing physical environment, particularly as related to geology, topography, soils, hydrology and drainage, coastal dynamics, riverine water quality, air quality and noise. The status of the flora and fauna of the study area were determined by a review of literature relevant to the area, and an assessment of both terrestrial and aquatic environments. Investigations were also conducted on the socio-economic environment which included housing settlements, zoning and land acquisition, land use and Municipal Status, Traffic, Transportation and Access Roads, Demographics, Livelihoods, Fisherfolk, Community Facilities, Solid Waste Management, Proposed Developments, Recreational Activities, and Archaeological and Cultural Heritage.

Legislative and Regulatory Considerations

The Natural Resources Conservation Act was passed in the Jamaican Parliament in 1991 and provided the basis for the establishment of the Natural Resources Conservation Authority (NRCA) with primary responsibility for ensuring sustainable development in Jamaica through the protection and management of Jamaica's natural resources and control of pollution. Sections 9 and 10 of the NRCA Act stipulate that an Environmental Impact Assessment (EIA) is required for new projects and existing projects undergoing expansion.

The environmental Permit and License System (P&L), introduced in 1997, is a mechanism to ensure that all developments in Jamaica meet required standards in order to minimize negative environmental impacts. The P&L System is administered by NEPA, through the Applications Section (formerly the Permit and License Secretariat). Permits are required by persons undertaking new development which fall within a prescribed category. Under the NRCA Act of 1991, the NRCA is authorized to issue, suspend and revoke permits and licences if facilities are not in compliance with the environmental standards and conditions of approval stipulated. An applicant for a Permit or License

must complete an application form as well as a Project Information Form (PIF) for submission to the NRCA.

Physical Environment

The existing causeway site lies at sea level on land which was reclaimed. Topography of the area on either end of the causeway is flat and the bridge is anchored at the intersection of Hunt's Bay and Kingston Harbour (Figure 7.1). Kingston Harbour, located on the south coast of Jamaica extends 16.7 km in an east-west direction and 6.5 km in a north-south direction at its widest points. Sand mining at the western end of the proposed alignment on the Dyke Road has occurred over the years. The soil at the site is relatively thin, less than 0.2 m. Typically it occurs as a dark-brown to black organic or peaty soil in some areas or silty clay in other areas.

There is no evidence of any major geological structures such as faults traversing the project area. No major displacement along a zone of weakness is anticipated, and there would be no complications of drainage along fault-directed courses.

Several rivers and gullies discharge into Hunt's Bay. These include the major inflows of the Rio Cobre, Duhaney River (Fresh River) and the Sandy Gully, and relatively minor inflows from the Waterford Canal, the Jew Gully and at least 5 other minor gullies. A 50-yr flood event would be associated with a very slow moving tropical depression as might typically occur outside the hurricane season. The average maximum velocities through the Causeway Bridge opening are very high, up to 2.4 m/sec.

A detailed map of the Kingston Metropolitan Area showing seismic hazard assessment is presented. The map shows site-corrected earthquake ground motions that have a 10% chance of being exceeded in 50 years, and site specific study areas for which geotechnical investigations are necessary. These areas include Portmore, the area surrounding Hunt's Bay, the Kingston coastline and the Causeway itself. Geotechnical

investigations have been undertaken as part of the engineering design and are available (JENTECH Consultants).

A study was completed in the Preliminary Design Phase of Highway on the Portmore Causeway to determine the design water levels along the Causeway; to characterize the urban hydrology of the Portmore area in order to design stormwater flows; and to carry out an ecological assessment of the mangroves and benthic community in the project area. The study showed that the static water level rise due to extreme hurricane wind and wave conditions was greater than that due to extreme stormwater runoff conditions.

Regarding urban hydrology, the Highway will cross two major stormwater drainage features – the UDC Town Centre Drain and the Waterford Canal.

The air quality data show that ambient particulate (PM10) levels, for respirable particulates, are currently within the recommended guidelines. The existing levels are however very close to the recommended standard, and leaves very little margin for the accommodation of dust generated by construction works.

The baseline noise measurements indicate that some sections of the road corridor are noisy falling within the category of 'busy roads' as detailed by the World Bank Guidelines, while the noise levels measured in the residential areas fall within the category of 'quiet roads'.

The proposed highway is expected to impact both directly and indirectly on the Rio Cobre and Duhaney Rivers, Hunt's Bay and Kingston Harbour. Kingston Harbour currently receives industrial effluent from shore based industries, discharge from urban drainage channels, sewage effluent and terrestrial run-off from the riverine inputs. Concentration of pollutants in Hunt's Bay has increased considerably over the last twenty years and studies have shown that the eutrophication of Kingston Harbour can only be reversed by control of the domestic and industrial waste presently released into it. The

baseline data generated for the surface water systems show considerable organic contamination and high bacterial loading.

Biological Environment

The terrestrial vegetation in the areas along the proposed alignment is dominated by modified vegetative communities particularly scrubland this includes coastal vegetation, terrestrial vegetation adjacent to the dyke road and fringing areas of development.

The area of the Portmore Causeway is bordered by Hunt's Bay to the north and Kingston Harbour to the south. Immediately east and west, are the Industrial Zone and residential areas of the Kingston Metropolitan Area and Portmore, respectively. Seabird species were observed and recorded through wetland areas and across the Hunt's Bay.

Migratory ducks have been recorded in Jamaica but little is known of their status or distribution. One species, the West Indian Whistling Duck *Dendrocygna arborea*, is internationally classified as vulnerable. Kingston Harbour and its environs are known habitats for several species of resident and migratory ducks.

The American Crocodile (*Crocodylus acutus*) is native to Jamaica and is protected under both national and international legislation. Known habitats include the southern drainages of the island, which include the Rio Cobre, as well as the mangrove habitats of the Kingston Harbour. The Waterford Canal, which will be crossed by the Highway also has crocodiles and they are usually sighted by residents in the early morning and afternoon hours.

Mangroves exist along sections of the proposed alignment. The mangroves by Dawkins Pond provides a habitat for several species of waders and shore birds. The dominant species is the Black Mangrove (*Avicennia germinans*) with the aerial roots or pneumatophores visible, on both sides of the existing road. Approximately 60% of the lands in the Skeet Club will be utilized for the highway alignment.

Socio-economic Environment

Analysis of the social environment of the Portmore Causeway segment of Highway 2000 must take account of the characteristics of the project site as well as the service areas of the project, in that the causeway serves as the main access route between the business districts of the Kingston Metropolitan Area (KMA) and the residential and commercial areas southwest of the KMA. The Port of Kingston and its related operations, the Tinson Pen aerodrome, transportation hubs, commercial, retail and wholesale enterprises, industrial plants, boating, fishing, and residential settlements all form part of the social setting of the project.

Settlement within the project area is dominated by the Causeway fishing village, but the residential areas of Portmore, Greater Portmore, Hellshire, Braeton and Port Henderson, all with their respective housing subdivisions and support services, are significant to the project in that it is the growing population in these areas which has created the demand for an upgraded arterial link to the KMA.

Causeway north (eastern end) is dominated by the operations of the Port of Kingston which accommodates the major general cargo port and container terminal for Jamaica, and transshipment port for the subregion. All the services associated with port operations such as berthing, warehousing, cargo clearance and distribution, trucking, government agencies and others, are found in the area of Port Bustamante. In addition the eastern section of the Harbour accommodates berthing operations for oil tankers, wheat, cement, and gypsum.

The Port is a major economic unit and plays a substantial role in the island's economy, as Jamaica is strategically placed as a transshipment port.

The existing Causeway alignment intersects Marcus Garvey Drive, which runs east to west from downtown Kingston, to the three mile intersection where it joins Spanish Town and Hagley Park Roads. An industry lined thoroughfare linking downtown Kingston with major areas of the Kingston Metropolitan Area, Marcus Garvey Drive is a

high density traffic corridor for entering and leaving the city, particularly during the early morning and late afternoon peak periods.

Based on recent studies, an average of 37,000 vehicles use the Portmore Causeway each day for travel to and from the downtown Kingston area, and other parts of the KMA.

A study by the Social Development Commission in 2002 revealed a total of 103 shacks (or camps as called by the fisherfolk) on the seaward side of the Causeway bridge and 34 shacks on the northern side. Approximately 1300 fisherfolk currently utilize the areas although the SDC has listed 160 fisherfolk with ID's and 95 residents (in 17 families) living at the Causeway Fishing Beach.

Over the past two decades fish vending along the causeway has increased, to the extent that at times, especially on weekends, a section of the main road near the bridge has become a drive-through fish market with patrons coming from both the Kingston and Portmore side. Despite several announcements regarding the need to address the critical environmental issues that have been generated (public health, sanitation, traffic hazards, visual aesthetics), the colony of fishers and vendors has continued to flourish. The quarter mile stretch of the Causeway on the Portmore side of the bridge, is lined on both shoulders with clusters of unsightly shacks which serve as shops and dwelling units for both fishers and vendors.

Recent data provided by the Fisheries Division (Environmental Solutions Ltd, 2002) indicates that the Causeway/Hunt's Bay location has some 734 registered fishermen. Fishing is undertaken in Hunt's Bay, Kingston Harbour, on the Pedro Banks, St. Thomas and as far west as St. Elizabeth. In 1996 the population of boats berthed on the Causeway was a modest 25 to 40 although an additional small number were kept at Dawkins Pond nearby. The Fisheries Division reports approximately 103 boats on the Causeway beach, but a recent report has reported some 146 boats counted in 2002, with 126 of these berthed on the inside of Hunt's Bay.

Fisherfolk are currently illegally occupying Government-owned lands within the proposed right-of-way along the Causeway. NROCC, as the Grantor, is responsible for land acquisition, and for the provision of a corridor free of encumbrances to the Developer for construction of the highway, and the operation of a limited access Toll Road.

Two listed sites under the Jamaica National Heritage Trust Act are located in the project area. The Site of Passage Fort (Puerto de Caguaya), site of the first port in the Kingston Harbour, is a listed site and is located just south-south-west of the mouth of the Waterford Canal. The Highway alignment will cross the Site of Passage Fort. No structures are visible and the JNHT has been asked to provide information on this site. Fort Augusta is also a listed site under the Jamaica National Heritage Trust Act. The Fort is currently used as a Women's Prison. Highway 2000 will not impact Fort Augusta.

Consideration of Alternatives

Other options for the alignment for the Portmore Causeway section of Highway 2000 have been considered.

1. The Port Authority under took and completed land reclamation in the north eastern part of Hunt's Bay to accommodate port expansion. The alignment as originally designed would result in the container terminal's operation being divided by the highway's six-lane dual-carriageway. Given the completion of the PAJ's reclamation programme the Highway alignment was reconsidered, at the request of the Port Authority of Jamaica, to run along the western perimeter of the Port Authority's reclaimed area. Suitable access to the Port Authority's facilities has been discussed, between NROCC and the Port Authority.

2. The Jamaica Institute of Engineers (JIE) (Farquharson Institute of Public Affairs, 2001) in their viewpoint on Highway 2000 raised some specific issue with regard to alignment of the Portmore Causeway section. The JIE proposed an interchange

at Six Miles, to pick up traffic from Kingston, rather than further west on the Mandela Highway at Caymanas in the vicinity of the Rio Cobre Bridge. From Six Miles the JIE proposal is for the alignment to run west-south-westerly connecting at the Greater Portmore Intersection. From the JIE's point of view, this would be more feasible in routing traffic from Kingston onto the Highway. The JIE sees the inclusion of the Portmore Causeway in the Highway 2000 Project as a means of ensuring toll revenue from the citizens of Portmore. Revenue is a critical component of the cost-benefit for the Highway 2000 Project, and the JIE feels that the interests of the citizens of Portmore have been betrayed. The JIE realises the need for upgrading of the existing Causeway bridge, but feels that this upgrade should be undertaken separately by the Government of Jamaica, and should not be included in the Highway 2000 toll project.

3. No alternatives to the alignment along Dyke Road, Dawkins Drive, nor along the existing Causeway Bridge have been proposed by any other entity.

The existing bridge approach is just above sea-level and the bridge has a clearance of 8.75 m. This has resulted in a very distinct hump on the bridge, which reduces long range visibility and has been the cause of many traffic accidents. The new bridge design will result in 'flattening' the bridge and reducing the existing 'hump'. The vertical alignment of the bridge will be designed in accordance with the design speed of the Highway.

The bridge span has been an issue of considerable debate over the years since its construction. The creation of the solid fill Causeway and the bridge resulted in a narrowing of the connection between the Hunt's Bay and Kingston Harbour, significantl reduction in the flow between them, and in continued deterioration of water quality and ecological conditions in the Bay. The reduced opening has also resulted in a 'jet-stream' effect of material passing from Hunt's Bay into the Harbour.

In a letter to the Environmental Solutions Ltd. regarding consultations on the bridge span, Mr. Cowell Lyn, a Coastal Engineer and Project co-ordinator for the Kingston Harbour Rehabilitation Project (administered by the National Environment and Planning Agency and funded by the Inter-American Development Bank) stated although it might be possible to increase the span of the bridge, it was his considered opinion *"that such concessions would not be likely to restore, to any worthwhile extent, the original productive functions of the Bay"*. Of greater importance is the cross-sectional area under the bridge so that the *"channel could be either wide and shallow or narrow and deep – so long as it would let out the design flood flow without scouring the footings of the bridge piers"*.

The design of the proposed new Causeway Bridge does not impact on the width and depth of the existing channel. In fact the new bridge is marginally wider than the existing bridge, and has one less pier than the existing, which represents one less obstructive unit to the flow.

The Construction Camp Site currently in operation for other segments of Highway 2000 is located at Bodles in St. Catherine. However, this site cannot be used for the Portmore Causeway section as it would result in high costs for transportation of material.An option for the Construction Camp Site was the PAJ's newly reclaimed area at Newport West in the north eastern section of Hunt's Bay. This site was not considered feasible as it is at the eastern-most extremity of the alignment and would involve high transportation costs to the western end of the alignment in the Christian Pen area.

A second option for the Construction Camp Site is the Jam World site located between the Dyke Road and the Rio Cobre. This site is centrally located with regard to the Highway alignment, and has adequate space. The Commissioner of Lands has approved the use of this area for the Highway 2000 Construction Camp. However, this location is in the floodway of the canalised Rio Cobre, near the river mouth, and is prone to flooding. **This is the preferred option of the Contractor**. However, the Contractor has

indicated their intent to raise the base of structures approximately 1m above the existing level and to construct a small dyke.

A third option, that was considered is the newly reclaimed Port Authority land at Fort Augusta. The Port Authority has begun filling in the area between the existing road and the Fort Augusta Road, which will be included in the Port of Kingston expansion facilities. This area is centrally located with respect to the alignment, is undergoing a period of consolidation, and it is proposed that some of this land be utilised by the Highway for the construction of the 21-lane toll plaza**.**

The 'No Action Alternative' describes the situation and impacts that would occur if the project was not implemented. If the project, as proposed is not implemented, the existing bridge would continue to be used, exacerbating the issues related to traffic congestion and to the demise in the structural integrity of the bridge. Several options have been explored for additional earth materials including the dredging of sea sand; obtaining dredge spoil from the Port Authority's dredging operations, which has been disposed of just outside the Harbour mouth; dredging at the mouth of the Rio Cobre; and obtaining dredge spoil from the approved maintenance dredging project for Hunt's Bay.

Potential Negative Impacts and Mitigation Measures

Some potential negative impacts have been identified on the physical, biological and social environments. These impacts have been identified for site preparation, construction and operational phases, with the consideration of cumulative impacts, and are presented in the table below with recommended mitigation measures.

Alignment - Potential Impacts and Mitigation Measures		
	Potential Impacts	***Mitigation Measures***
• **Over gullies**	The Highway crosses the Waterford Canal at 194+500.	Drainage structures have been designed to ensure continuous flow thus preventing ponding and flooding. A 100-year return period has been used for major structures and the overall drainage system has been designed to accommodate flash floods and catastrophic events which characterize the area.
• **Through existing vegetative stands**	Vegetative stands are all modified vegetation including scrubland and wasteland. There are no stands of primary vegetation along the current alignment.	Landscaping should include trees and shrubs as appropriate in order to maintain airshed purification functions.
• **Through mangroves**	The alignment will go through mangroves along the south-western corner of Hunt's Bay and Dawkins Pond.	Discussions should be held with NEPA to determine the feasibility of the establishment of Wetlands Mitigation Banking in Jamaica, or for the identification of a suitable site or existing mangrove replanting project, into which Highway 2000 can contribute to the re-establishment of mangroves to replace acreage removed.
• **Land Acquisition**	Land acquisition for the required acreage is the responsibility of the National Roads Operating and Constructing Company (NROCC).	The land required for the Portmore Causeway alignment is 100% Crown Lands. All negotiations between NROCC and the Commissioner of Lands are complete (NROCC, 2003).
• **Existing local roads and access**	Points have been identified where the Highway will cross or intersect with existing local roads.	Access will be provided at the following points: ❖ Portmore Road to access the Mandela Highway

		Interchange ❖ Dawkins Drive Interchange to facilitate access to Portmore ❖ Fort Augusta Interchange ❖ Newport West Industrial Area ❖ Marcus Garvey Interchange
• **Archaeological and cultural resources**	Two sites in close proximity to the Highway alignment are listed by the JNHT as heritage sites. These are the Site of Passage Fort (Puerto de Caguaya) just south-south west of the Waterford Canal and Fort Augusta, which extends into Kingston Harbour. Fort Augusta is not expected to be impacted by the Highway construction.	1. The Jamaica National Heritage Trust (JNHT) has already been contacted and made aware of the highway alignment. 2. The JNHT has been requested to provide any additional information that they see pertinent to these sites. 3. The JNHT should be allowed to conduct a Watching Brief during the site preparation and construction phases, and to perform Rescue Archaeology as appropriate.
• **Coastal Filling**	Coastal filling will be required to facilitate the Highway alignment. Filling will be required in the north east section of Hunt's Bay in the vicinity of several gullies that drain Cockburn Gardens, Marcus Garvey Drive and Spanish Town Road. This area is prone to flooding (Figure 7.1) Filling activities can result in increased turbidity in the coastal zone which can result in settling of earth materials on the benthic	1. An application has already been submitted to NEPA for a Beach Licence for foreshore modification to conduct the filling as required. 2. Signs must be posted facing landward and seaward indicating that an application to conduct foreshore modification works has been submitted to NEPA. 3. Construction methods will consider and minimize additional silt loading in the coastal waters. 4. The Highway 2000 project must ensure that the

	environment. Additionally, one area is adjacent to the recently filled Port Authority of Jamaica area, which has resulted in an alteration of the originally proposed alignment. The PAJ reclamation will result in the Highway alignment extending farther west into Hunt's Bay than previously expected.	highway construction does not restrict flow from existing drainage channels, particularly in the north east section of Hunt's Bay. 5. Inter-agency dialogue must be initiated in order to resolve the issues related to potential flooding in the north east section of Hunts Bay.
Around the Port Authority of Jamaica's reclaimed land	In the east of Hunt's Bay the Port Authority of Jamaica has completed land fill in order to expand their terminal operations. This expansion was approved after planning for Highway 2000 was started. The Developer now has to adjust the alignment in this area as the Highway cannot bisect the Port Authority's operations. The fill was completed on top of existing peaty substrate, which has the potential to slump as it is not designed to have a high bearing capacity. This has been experienced along the eastern section of the existing causeway and has required continued maintenance (Cowell Lyn, Pers. Com.)	The fill area in the eastern corner of Hunt's Bay should be removed, leveled to grade and re-filled using proper engineering techniques to carry the load of the 4-lane Highway, and for the peaty substrate. This could include layering of geotextiles to ensure maximum bearing capacity. Although initial costs, may be high long term costs in continued maintenance of the Highway, resulting from slumping of the road, could be higher.
Crossing the Railway Line	The alignment crosses the railway in the vicinity of Chainage 197+000 on the Dyke Road (Plate 16). Recommendations for the entire Highway 2000 project, made in the Strategic Environmental Assessment (Development Bank of Jamaica, 2000 a-d) included the maintenance of the railway right-of-way, at all crossings, so as to	The railway line must not be sterilized at this point and the level crossing should remain.

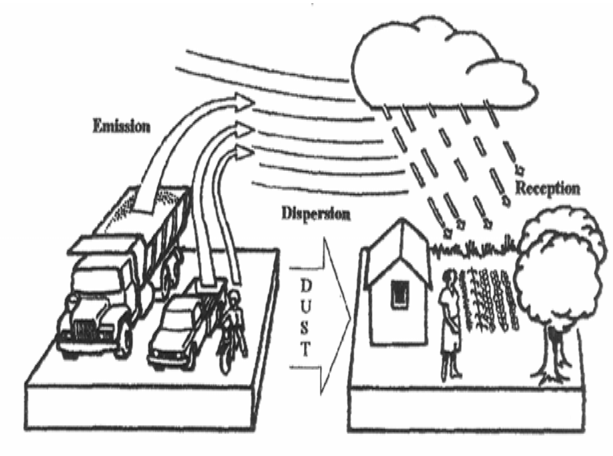
	avoid sterilization of the railway.	
Marcus Garvey Drive Interchange	The interchange proposed at the intersection of Highway 2000 with Marcus Garvey Drive is a cause for serious consideration due to the proximity of the flight paths and the critical envelope of the Tinson Pen Aerodrome. Also under consideration is an at-grade intersection which will maintain the design speed of the highway. Additional engineering solutions are also being considered.	The Tinson Pen flight paths and critical envelope have been assessed by the engineering design team and the interchange has been designed to take account of the flight path requirements and not to form an obstruction. In response to queries from NEPA regarding this interchange a letter was prepared by TransJamaican Highway on May 14, 2003 with the following clarification: "*In order not to form an obstacle to aircraft operations and eventual aerodrome extension, a grade separated interchange has been designed, with an overpass and loop located approximately 600m in the west of the actual intersection. The parts of the future road which are located within the 15% envelope needed for plane arrivals and departures are not more elevated than the existing road – this means in the average less than 0.60 m above ground level. The new road forms by no means an obstacle to aircraft operations".*

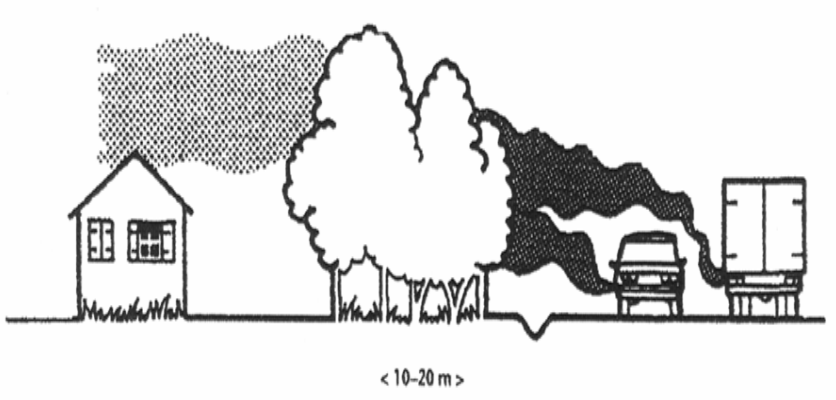
Natural Environment – Potential Impacts and Mitigation Measures		
Environmental Aspect	**Potential Impacts**	**Mitigation Measures**
Hydrology and Drainage	Impacts on hydrology and drainage are both direct and indirect. They relate to all phases of the development and to high volume events (major drainage) as well as to drainage requirements for run-off from more frequent events (minor drainage). The Causeway spans the outlet of Hunt's Bay which receives storm run-off from several major and minor drainage channels as described in Section 7.1.4 and these systems require careful engineering to avoid blockage of flow. The natural drainage is north to south and the highway alignment varies from east-west and north-south. Inadequately designed hydraulic structures could result in a negative impact to the highway, existing infrastructure and properties adjacent to the highway. Direct impacts involve: ➢ Storm channel outlets into Hunt's Bay ➢ Ponding ➢ Siltation ➢ Pollution ➢ Water Supply	1. Surface drainage design considers both the major and minor systems. The major system is the route followed when the minor system is exceeded. 2. The engineering design has used the 100-yr. event as design criterion for major drainage, including bridge openings, to accommodate flash floods and catastrophic events, which typify the area. 3. Storm water runoff (more frequent events) will be handled by curbs, channels, catch basin inlets, storm sewer\s, minor swales and roadside ditches. These have been designed to prevent ponding and flooding of the highway and adjacent properties. 4. Maintenance dredging at the mouth of the Rio Cobre and The Sandy Gully would assist in the free flow of water from Hunt's Bay into the Harbour and reduce build up of sediments. The guiding principles for the design of the highway in relation to drainage are: ➢ All bridges and culverts over 5.0 m in total opening width are designed to pass the 100 year storm with a minimum freeboard of 1.0 m between lowest point on bridge and high water level. ➢ Culverts under 5.0 m opening width are designed to pass 25-yr storm with minimum 600 mm freeboard between the edge of the road and high water

	Indirect impacts involve: ➢ Pollution ***Site Preparation and Construction Impact*** A major consideration is the flow from Hunt's Bay into Kingston Harbour. Construction of the Causeway Bridge over thirty years ago resulted in restricted flow from the Bay into the Harbour, causing semi-stagnation of the Hunt's Bay, a decline in shrimp and fin fisheries and increased sedimentation. Hunt's Bay prior to the Causeway played a significant role in the flushing of Kingston Harbour. The proposed alignment runs parallel to the Rio Cobre River along the Dyke Road and crosses the Waterford Canal. Widening the Dyke Road and the existing Causeway will remove some vegetative cover and the paved surfaces will result in the reduction of percolation of water through the soil at the level that currently obtains. The low-lying topography is also currently susceptible to ponding.	level during 100-yr storm event. ➢ Scour protection will be provided where necessary. ➢ Highway profiles must be consistent with major drainage to enable free flow. The gullies that currently run under the road must be maintained, and design must ensure that there is no blockage of the existing channels. In the north-eastern section of Hunt's Bay where land filling is required, gullies will have to be extended to ensure that their channels remain open. The two gullies to be crossed (UDC Town Drain and the Waterford Canal) are accommodated in the engineering design. If these principles are adhered to, the potential for flooding, as a consequence of the highway construction, should be negligible. ***Operation Phase*** During the operation phase the mitigation measures incorporated in the engineering design should prevent problems of ponding on the Highway. Scheduled inspections and maintenance of drainage channels is critical.

Hazard Vulnerability	Impacts during site preparation or construction relate to the effect of flood events and stormwater run-off on the project as well as the effect of activities on the ability of Hunt's Bay and the Harbour to accommodate storm surges and seismic events. Flooding is a major natural hazard to be encountered by construction of the highway, and the major impact is derived from the effect of extreme runoff on the site and the low-lying nature of the topography. The area adjacent to the Skeet Club by Dawkins Drive is also prone to flooding. With respect to man-made/technological hazards, accidents can occur as a result of construction activities directly on-site and as a result of activities off-site, such as transportation of equipment and materials. Storm surge is also a risk as the alignment crosses the Kingston Harbour. Health and safety aspects must be considered related to workers during the Construction Phase and the motoring public during the Operation Phase. ***Operation Phase*** During the operation phase the mitigation measures incorporated in the engineering design should prevent	1. Design of bridges, culverts and drainage channels have taken account of the 100-year event and the channels are therefore expected to handle the flood flows. 2. The area adjacent to the Skeet Club which is prone to flooding and other areas that will require fill, will be elevated to approximately 1m in order to minimise the flood hazard. 3. Shoreline protection has been engineered to include rip-rap. 4. Site preparation and construction schedules should take account of the traditional rainy season between May and October, and of the hurricane season from June to November, during which tropical systems sometimes cause flood rains. Extraordinary tropical systems have also caused problems of supersaturated soils, so that schedules should factor this eventuality. 5. A safety management plan including traffic handling and equipment management procedures should be developed as part of the construction scheduling. 6. A Public Education Programme specifically on highway use should be developed for the general public. 7. The integrity of the dyke is of critical importance. Vegetation stabilizes the banks and serves to prevent undermining of the integrity of the dyke from erosion. 8. Sedimentation of the Waterford Canal must be avoided by using silt screens during the construction phase. 9. Garbage along the route should be removed and properly disposed of to

	problems associated with hazards. Safety is a major consideration and it is strongly recommended that a targeted driver education campaign be mounted to ensure acceptable driving practices, and to meet the requirements of the toll road. The existing bridge has a distinct hump which limits visibility and has been the cause of many accidents. Mitigation of this has been included in the engineering design. The design of the new bridge will be similar to the existing bridge with the exception that the approaches will be raised by 5 m. This will result in a significant levelling of the bridge to eliminate the existing hump and the associated hazards. This is also essential in order to maintain the design speed of the Highway at 90 km/h. The clearance under the bridge will not be negatively affected.	prevent wash down into the canals.
Air Quality	***Site Preparation and Construction Phase*** Analysis of road construction activities indicates that the movement of trucks and heavy-duty equipment to and from the project area will be responsible for the greatest amount of dust emissions. Construction activities will also result in the removal of vegetation that will expose and loosen soil which can become airborne with medium to strong winds. This would add fugitive dust to the	1. Watering of un-vegetated areas and stripped road surfaces along which construction vehicles and trucks travel will control dust emissions by up to 70%. A full-time watering truck should be maintained on site for watering road surfaces as needed to minimize fugitive dust emissions. Over-saturated conditions, which would cause outgoing trucks to track mud onto public streets, should be avoided. Watering would not be necessary on days when rainfall exceeds 2.5 mm (0.01 inch).

	area, which is already dust prone because of previous land clearance. The transport of aggregate for road and drainage culvert construction will also contribute to the fugitive dust levels. Construction vehicles will emit air contaminants such as nitrogen and sulphur oxides as well as particulates.  **Illustration of Dispersion of Dust Emissions** ***Operation Phase*** The main air impacts during the operational phase will be an increase in the concentration of vehicular emissions as a consequence of the expected increased vehicular throughput. There are currently no vehicular emissions	2. Stock piling of earth materials for construction should be carried out within temporarily constructed enclosures to limit fugitive dust. Vehicles transporting earth materials should be covered en route. Mixing equipment should be sealed properly and vibrating equipment should be equipped with dust removing devices. Stockpiles of fines should be covered on windy days. 3. A monitoring program for dust is recommended to assess the effectiveness of control measures in meeting ambient air quality standards. 4. Provide dust masks to operators in order to protect them from dust impacts. 5. Take account of prevailing wind direction and plant tall leafy and dense vegetation between roads and human settlements to filter pollutants. Vegetation should also be planted on the Dyke Road to prevent erosion.

	standards for Jamaica. However, improved traffic movement is expected to reduce idling time and therefore the level of carbon monoxide (CO) emissions.	 **Illustration of the Effect of Vegetative Barriers on Vehicle Emissions**

Noise	*Site Preparation and Construction Phase* The noise level is expected to increase during site preparation and construction with the use of heavy machinery and earth moving equipment. Existing noise levels are significant along the stretch of road between Marcus Garvey Drive and the Causeway Bridge as a result of the port operations. ***Operation Phase*** The toll plaza which will have 21 booths is expected to generate high levels of noise.	***Site Preparation and Construction Phase*** **1.** Although not expected to create a significant negative impact, noise impacting on the public from construction activities can be minimized by limiting noisy construction activities to the hours between 7 am and 6 pm, where construction is in close proximity to residential areas. Service construction machinery and vehicles at regular intervals in order to keep noise to a minimum. ***Operation Phase*** 2. The use of vegetative barriers, defined as a series of narrow and dense trees and shrubs planted near the roadside can significantly reduce roadside noise. Vegetative barriers have been shown to reduce noise by 1-3 dB. 3. The toll plaza will be sited near to Fort Augusta (where there are no residential communities) and adjacent to the proposed Port Authority expansion site.
Surface Water Quality	***Construction Phase*** The water quality data obtained from the present survey indicate trends, which are of concern. In general high organic loading and fecal coliform levels occur in most of the surface waters. The data show that the surface water bodies in the project area are being impacted from commercial and residential activities (untreated sewage	***Construction Phase*** 1. Measures to control or limit sedimentation of streams and gullies during the construction phase will include storage of earth materials within containment berms 2. The deployment of silt screens as required at gullies and streams during the construction of bridges and culverts. 3. The deployment of sediment traps during filling in the coastal

	effluent, deposition of human waste, commercial effluent, contaminated storm water runoff). The major water quality impacts likely due to the proposed road/bridge construction work are listed below: • Increased suspended solid loading (sediments and garbage) to the surface waters (from earth moving activities and terrestrial run-off) • Increased bacterial levels due to indiscriminate disposal of human waste (particularly construction camp activities). • Oil and grease from heavy equipment and trucks. ***Operation Phase*** Of the likely impacts, the most important relate to contaminated storm drainage.	environment. 4. The engineering design has incorporated measures for slope stabilization and reinforcement at the approach to bridges. This serves to prevent slope failure, which not only undermines the bridge approach but also results in the wash down of soil into streams and gullies. 5. The proper removal and disposal of construction spoil, so as not to block drains and gullies. 6. Take all necessary measures to prevent refuse (solid waste) and wastewater produced in construction camps from entering into drains and water bodies. 7. Provision of portable chemical toilets at work sites, with appropriate sanitary arrangements for disposal of the contents.

Vegetation	***Site Preparation and Construction Phase*** The vegetation identified along the Causeway alignment comprises, secondary scrubland, overgrown pasture, and thorny scrubland dominated by *Acacia sp*. No significant rare, threatened, endangered or endemic species are expected to occur in these areas. These areas provide green space, which assists in the purification of the air shed by removal of carbon dioxide and release of oxygen. Additionally, the areas provide host plants for species of insects, reptiles, amphibians, butterflies and birds. Site preparation and construction activities will remove several acres of these vegetative stands removing the airshed purification function and some habitat. Removal of the vegetation, at areas along the Dyke Road, will also expose top-soil which can be washed into streams and gullies during rainfall events. Stands of mangrove (5.5 ha) will have to be cleared. This will remove habitat for waterfowl as well as removal of airshed purification functions.	1. Vegetation will have to be cleared to provide land for the proposed road works. Clearing of the vegetative stands should be carried out on a phased basis to reduce the amount of exposed top soil that can be washed down in rainfall events. 2. To continue to provide airshed functions of purification it is recommended that verges be replanted with trees and shrubs where appropriate. 3. Additionally, tree planting should be carried out to form shelter belts, windbreaks, noise buffers, slope stabilization bands, erosion control and for aesthetic appeal. 4. Selection of plants for landscaping should consider the following: habitat suitability, trees of national interest, flowering trees and shrubs. 5. Replanting of mangroves should be done in consultation with NEPA. ***Operation Phase*** 6. Vegetation planted for landscaping buffers and for aesthetic appeal should be maintained, and a maintenance programme should be established and implemented.

Fauna	***Site Preparation and Construction*** Birds located in the modified vegetative communities and the mangrove stands will relocate when their habitat is removed. Species along the proposed alignment such as reptiles are also highly mobile and should also relocate to adjacent similar habitats. Insects, snails and other groups with low mobility may suffer from loss of specimens, as a result of heavy machinery and the use of earth moving equipment. ***Operation Phase*** ***Impact*** Once the highway is completed there is always the risk of increased access to rural areas resulting in poaching of wildlife	1. Landscaping and vegetation buffers, as well as mangrove replanting, will result in the replacement of some habitat for selected species. 2. Birds will relocate to adjacent suitable habitats. 3. It is not expected that poachers will be a threat, as targeted species such as Jamaica's endemic parrots do not occur in this area. 4. Encroachment by squatters could result in degradation of areas. As a Toll Road, the highway will be limited access and will be enclosed by fencing thereby reducing the possibility of encroachment from the road way. 5. Plant and animal communities immediately outside the project corridor should not be at risk.
Marine Ecology	***Site Preparation and Construction Phase*** The marine environment can be affected by increased levels of sedimentation and siltation through clearing of vegetation and exposure of top soil, terrestrial wash down of stock piled earth materials and release of fines during construction and the filling of coastal areas. Additionally, construction of revetments and sea walls will permanently alter the coastline, changing wave dynamics and resulting in loss of benthos and associated marine flora and fauna, in these	1. During site preparation and construction earth materials stock piled should be contained by a berm to prevent this material being carried to the coastal waters in terrestrial runoff during rainfall events. 2. Additionally, during land reclamation and construction of the revetments, appropriate measures should be taken to reduce suspended solids loading. This could include the use of silt screens and sediment traps. 3. Oil and grease which may be generated from construction

	three areas. However, the revetments themselves may create a new habitat resulting in the establishment of other species.	equipment should not be allowed to run into the sea and should be properly stored and disposed of, off site, to prevent washdown in terrestrial run-off during rainfall events. 4. Construction camp and work areas should be adequately equipped with portable chemical toilets to prevent the discharge of raw sewage into the marine environment. 5. During the operation phase treatment of landscaped medians and verges should be carried out with organic fertilizers and pesticides to reduce terrestrial run-off of toxic chemicals.

Landfilling	Impacts on the marine environment are possible from activities related to land filling. These include: ➢ increased turbidity as a result of sedimentation from filling exercises ➢ coastal erosion resulting from inadequate shoreline protection	1. Construction methods will consider and minimize additional silt loading in the coastal waters. 2. Shoreline protection works have been engineered to mitigate shoreline erosion. Engineering design includes rip-rap along the entire length of the alignment where it runs along the coastline, on both the northern and southern sides of the road. These designs are detailed in Figure 2.4.
Mangroves	***Site Preparation and Construction Phase*** Loss of stands of mangroves. Loss of mangroves will result in the removal of nesting and roosting habitat for birds, alteration of the ecology of the area and removal of shoreline protection.	*Site Preparation and Construction Phase* It is recommended that discussions be held with NEPA, the regulatory agency, regarding the establishment of a wetlands mitigation bank in Jamaica. This would require the evaluation of potential sites, the determination of the most suitable site and the expertise to seed and manage the area, as determined by NEPA. The establishment of a wetlands mitigation bank would not only serve the purpose of re-establishing mangroves removed as a result of the Highway 2000 project, but also have the long-term impact of providing an ecological viable area to facilitate future proposed developments in implementing the mitigation measure of mangrove replacement, as required. Replanting mangroves through a wetland mitigation bank will provide nesting and roosting habitat for birds, provide vegetation for airshed purification and provide coastal protection for that area.

	Operation Phase Removal of mangroves will remove coastal protection and expose the Highway to daily tidal activity and storm surge, possibly resulting in shoreline erosion and undermining the integrity of the road.	***Operation Phase*** Shoreline protection works have been engineered to mitigate shoreline erosion. Engineering design includes rip-rap along the entire length of the alignment where it runs along the coastline, on both the northern and southern sides of the road.
Dredging ***Disposal of Dredge Spoil***	***Site Preparation and Construction Phase*** Dredging can result in the following negative impacts: ➢ loss of benthos ➢ modification of current and wave patterns ➢ increase in turbidity through suspended solids loading ➢ dispersion of contaminated sediments ➢ degradation of pelagic habitats ➢ damage to fishing gear, ➢ increased ambient noise levels reduction of visual aesthetics ➢ obstruction of shipping traffic ➢ Identification and approval of suitable disposal site ➢ Leakage of sediments during transport to disposal site ➢ Increased turbidity over inshore habitats	The following mitigation measures should minimise the negative impacts: 1. Apply careful control of dredge cutter head and restrict digging to specified boundaries 2. Apply control of ladder swing speed and cutter head rotation speed to minimise sediment dispersion 3. Do no overfill hopper which can result in spillage 4. Deploy silt screens down-current of dredge activity 5. Advise local communities and port interests of times of dredging activity 1. Permitting requirements must be met through NEPA for any dredge activity and use of site for disposal 2. Monitoring is required for vessel logs and records for each disposal trip

	➢ Sedimentation of benthic habitat in disposal area ➢ Smothering of any benthic biota	

Social Environment – Potential Impacts and Mitigation Measures		
Environmental Aspect	**Potential Impacts**	**Mitigation Measures**
Land-use and Zoning	***Site Preparation and Construction Phases*** Relocation of the Causeway fishing village will be the major land use impact in that the toll road will be privately owned and access will be limited to toll users.	***Site Preparation and Construction Phases*** The following alternatives have been suggested for relocation of fisherfolk on the Causeway, in order to minimize potential negative impacts: 1. Relocation of fisherfolk from the southern side of the Causeway to the northern side, with a shift in the alignment, thereby allowing the fishing community to remain in the same area. 2. Relocation of the landing beach, to a nearby site, in collaboration with the Fisheries Division of the Ministry of Agriculture. 3. Relocation of residential areas, to an area in Lesser Portmore, in collaboration with the National Housing Trust. 4. Contribution to the establishment of the Portmore Market, through the provision of a wet area, to facilitate fish vending.

	Operation Phase During the operation phase the Highway is not expected to have any additional significant negative impacts on aspects of land use and zoning. The impacts identified in the construction phase will obtain for the operation of the highway.	
Traffic, Transportation and Access Roads	***Site Preparation and Construction Phase*** Site preparation and construction activities will impinge on traffic flow in the areas where the Highway connects or crosses existing roads. This will include the Marcus Garvey Intersection, access to Port Authority of Jamaica, access to Tinson Pen Aerodrome, Dyke Road and access to Portmore. However, through-way will have to be maintained and obstruction to traffic minimised. Where interior roads will be truncated, the alternate routes should be clearly communicated. The proximity of the Tinson Pen Aerodrome to the Marcus Garvey Intersection, is a major concern for potential negative impacts on flight operations.	***Site Preparation and Construction Phase*** 1. Scheduling of construction work should seek to minimise disruption to traffic flow and allow for the movement of material and heavy equipment. 2. Arrangements for parking and storage of material should be made as far off-site as is feasible for efficient operations. 3. Discussions should be held early with relevant stakeholders to determine their needs and requirements and to advise them of the construction schedule. 4. Public notices by the print and electronic media should also be posted in order to make the general public aware of the construction schedule and to provide construction updates. 5. Properly trained flag persons and road side signs should also alleviate discomfort to commuters.

	Access to the operations of the Port Authority of Jamaica may be impacted by the Highway alignment and construction. Residents of Portmore desirous of using the Toll Road, as well as other commuters using the Portmore Causeway Bridge will see increased transportation costs, through the payment of the toll.	6. Mitigation measures for the Marcus Garvey Intersection will be incorporated in the design phase. Engineering solutions have been determined to ensure that the Tinson Pen flight paths remain free on encumbrances in the specified envelope. 7. The Port Authority of Jamaica has requested that the alignment of the Highway be adjusted to allow for the Port's expansion. This has been agreed by NROCC and will be facilitated at a cost to the Port Authority. 8. In addition to the Toll Road, there will remain an un-tolled option for cpmmuters, as specified under the Toll Roads Act (2001). This will be the Mandela Highway.
	Site Preparation and Construction Phase The siting of the construction camp may have potential negative impacts related to traffic, transportation and access.	***Site Preparation and Construction Phase*** 1. Several site options were considered and the site at Jam World appears to be the most feasible option 2. Proper signage and flag persons will be required to provide traffic management into and out of the camp site. 3. Public notification of the camp site location will be required . 4. Schedule of movement of heavy vehicles should be prepared.
	Operation Phase The operational phase of the upgraded artery will involve a	1. The first segment of Highway 2000 to be open and tolled – the Old Harbour Bypass – will already have been in operation for a few years prior to the completion and tolling of the Portmore

	toll for users. Imposition of a toll will be a relatively new concept for Jamaicans, and residents have been accustomed to using the Causeway and bridge free of cost.	Causeway. 2. The Old Harbour Bypass began operating as a toll road in August 2003. Notwithstanding this fact, mitigation of negative impacts in this regard, will require considerable dialogue and education will need to be implemented with all stakeholders to minimise objections to the new tariff for this alignment. 3. A major mitigation measure will also be provided in an alternative untolled route to Portmore from downtown Kingston. This route passes via Marcus Garvey Drive, Three Miles, Six Miles, Mandela Highway and the Greater Portmore Intersection.
Business Enterprises	***Site Preparation and Construction Phase*** Some businesses have the potential to be affected by the Highway construction. These include: 1. Tinson Pen Aerodrome 2. Port Authority Newport West Industrial Area 3. Portmore Shopping Centre	***Site Preparation and Construction Phase*** 1. Discussions have been held during the design phase with various Government agencies and businesses that are likely to be impacted by the Highway construction. Stakeholder meetings have been facilitated by NROCC and have included the Portmore Citizens' Association, Portmore Foundation Ltd., Civil Aviation Authority, Airports Authority of Jamaica, Port Authority of Jamaica, Jamaica Railway Corporation and the Urban Development Corporation 2. All parties have been made aware of the proposed highway alignment and have been involved in the process of optimizing the Portmore Causeway alignment.

	Operation Phase Impacts during the operation phase will include increased levels of traffic noise and atmospheric pollutants.	***Operation Phase*** 1. Vegetation buffers and physical barriers should be constructed as appropriate in the vicinity of business enterprises to reduce the levels of noise and noxious fumes that may affect management and staff.
Employment	*Site Preparation and Construction Phase* Employment opportunities will be created during the site preparation and construction phases. This will mostly be unskilled labour for the duration of the construction activities. Additionally, economic opportunities will involve the sourcing of construction material and linkages created with local and regional suppliers and industries.	***Site Preparation and Construction Phase*** 1. Casual labour will find employment and this is expected to be a positive impact for surrounding communities. 2. Workers should be briefed on traffic management, solid and liquid waste disposal, dust management, parking, idling of equipment and oil spill control. 3. The "politicization" of employment opportunities often poses some challenge to contractors, and the need for security and relevant dialogue have to be factored into construction planning.
Solid Waste Management	***Site Preparation and Construction Phase*** Solid waste generated from the site preparation and	***Site Preparation and Construction Phase***

	construction activities will include construction debris, vegetation, solid waste from beaches, the demolished bridge and solid waste generated from the construction camp.	1. Construction sites generate considerable waste and provision must be made for suitable separation and storage of waste in designated and labelled areas on the site and site camp. 2. Collection of waste by certified contractors and disposal at the Riverton City Landfill as recommended and approved by the National Solid Waste Management Authority. 3. Any hazardous waste should be separated and stored in areas clearly designated and labeled, for future entombing and disposal as directed by the National Solid Waste Management Authority. 4. Worker training should include instructions on how to dispose of food and drink containers emphasizing the need to protect the Harbour and the gateway to Kingston. 5. Construction camps and work areas along the proposed alignment must be adequately equipped with portable chemical toilets. 6. Portable chemical toilets must be provided, maintained and removed by a certified contractor.
Proposed Developments	There are proposed developments that may have an impact on the Highway. The main development is the expansion of the Port Authority of Jamaica's facilities to include dredge and fill in the east of Hunt's Bay. This development has had three	1. Highway 2000 has been n discussion with the PAJ regarding access to PAJ's Fort Augusta site. 2. Dredge material for the Soapberry Lands should be supplied after the requirements of Highway 2000 are met.

	major negative impacts: 1. The Highway alignment had to be altered to accommodate this fill area and is now proposed for the outer boundary of this fill area. This has resulted in altering the engineering design to re-route the alignment, accommodate the fill area and provide the PAJ with access to their new site. 2. The fill area is currently undergoing a period of consolidation. This will have to be completed before the bearing capacity and integrity can be determined as suitable to accommodate the Highway.	3. Inter-agency dialogue is required concerning the future of Hunt's Bay and the various proposed developments 4. Construction work in the area of the PAJ's filled area will have to take into consideration the newly filled substrate and ensure that settlement is fully completed.
	Proposed development projects likely to be impacted by the Highway are: 1. Port Authority of Jamaica's container terminal expansion at Fort Augusta. The PAJ has been given permission to fill the area between Fort Augusta and the existing causeway to facilitate expansion of terminal facilities. 2. Kingston and St. Andrew Water and Sanitation Project. This project proposes the construction of sewage treatment ponds on the Soapberry lands north of Hunt's Bay and the eventual disposal of treated effluent into the Bay. Dredge material from the	

	current Hunt's Bay maintenance dredging (Section 8.4) was proposed for the Soapberry Lands to facilitate construction of sewage treatment facilities. Issues related to the Hunt's Bay's function as a siltation basin for Kingston Harbour and the jet effect of water exiting from the Bay, in relation to the proposed discharge of sewage effluent are discussed in a report by Environmental Solutions Ltd. (Environmental Solutions Ltd, 2003).	
Public Health and Safety	***Site Preparation and Construction Phase*** The upgrading is expected to improve safety during the operational phase given the design standards which will improve visibility and standards for speed. In addition, the bridge at this time needs major maintenance, having been heavily utilized over the past twenty-five years. Preparation and construction will involve disturbance of material on the floor of the Hunt's Bay and the adjacent areas of the Kingston Harbour. Concern has been expressed about toxicity of this material.	***Mitigation Measures*** 1. To minimise risk to the public the construction activities which will directly affect the movement of traffic and pedestrians, should be properly scheduled and standard construction techniques for sign–posting and flagging should be adhered to. 2. Dust control by wetting is essential to prevent aggravation of the already poor air quality. 3. Unnecessary idling of construction related vehicles should be discouraged. 4. Proper sign posting of speed limits and entrances and exits. 5. Proper disposal of any dredge spoil as recommended and

	Preparation and construction will also involve demolition of the existing bridge, transportation and storage of significant volumes of construction material, and proper disposal of construction spoil and any hazardous waste. Increased levels of fugitive dust and construction noise are also public health issues as the air quality is already deteriorated in this region and noise and activity levels are high.	approved by the National Solid Waste Management Authority and the National Environment and Planning Agency. 6. Workers exposed to contaminated drainage channels should be given protective gear (gloves, vests, water boots)
	Operation Phase Improper use of Highway ramps, exits and interchanges can result in traffic accidents.	***Operation Phase*** 1. An extensive Highway Public Education Programme should be designed and implemented to make commuters aware of proper procedures on the Highway. This should include aspects related to tolling, lane changing, use of ramps, and access and exits. Enforcement of Highway legislation and procedures will be required.
Recreation	Impacts on recreation will be indirect as a result of disruption of traffic and access. This is expected to be short-to medium term and limited to the preparation and construction phases. Application of the toll will increase the cost of transportation	

	to these facilities, but improvement in the quality of the road will reduce travel time. The long-term impact of the toll on these facilities can only be determined after the opening of the toll road.	
Archaeological and Cultural Heritage	*Site Preparation and Construction Phase* If site preparation and construction activities begin without proper archaeological studies and the opportunity for rescue archaeology the following negative impacts could occur: ➢ Increased unwanted public access to existing sites & new sites. ➢ Increased risk of damage to artifacts. ➢ Increased risk of modifying the integrity of the site. ➢ Destruction of known sites. ➢ Damage to components of the site. ➢ Loss of the context, when moving components of heritage site. ➢ Reduction of value of the heritage components. ➢ Destruction of heritage site and components. ➢ Loss of unknown archaeological sites. ➢ Loss of clues to the understanding of past cultures and historical events. ➢ Loss of unique cultural insight for Jamaica's past.	***Site Preparation and Construction Phase*** 1. The Jamaica National Heritage Trust has been involved in discussions about the occurrence of possible sensitive areas along the Highway alignment, particularly Passage Fort and Fort Augusta (Appendix VII). 2. The JNHT has been specifically requested to provide information on the listed sites in the project area, in order to determine potential impacts on these sites. 3. The JNHT should be given an opportunity to conduct a Watching Brief during the construction phase and to perform Rescue Archaeology if any artifacts are discovered at the Site of Passage Fort. Fort Augusta is outside the proposed alignment.
	Operation Phase Damage to artifacts and heritage sites can occur if open access	***Mitigation Measures*** 1. Any sites discovered should be properly secured to reduce

	is maintained.	public access and interference. 2. Heritage sites should be demarcated with interpretive signs.
Relocation of Fisherfolk	Currently, there is illegal occupation of Government-owned lands within the proposed right-of-way along the Causeway. The area is occupied by fisherfolk and is used for residence, a landing beach and vending of fish. Unsanitary conditions prevail and the fisherfolk will have to be removed from the highway corridor.	NROCC has sought to have an orderly removal and relocation of the fisherfolk and their businesses using socially acceptable guidelines, notwithstanding the absence of a relevant law or regulations. The details of the relevant issues have been outlined to NEPA in a letter from NROCC. NROCC is seeking to do the following: 1. Land has been identified in the area known as Portmore Villas and NROCC has approached the National Housing Development Corporation to obtain their assistance in making land available for purchasers. 2. NROCC is in discussions with the Ministry of Agriculture and the Fisheries Division to identify a suitable landing beach on the SW of Hunt's Bay. This area is a small mangrove promontory to the east of the Skeet Club. The Fisheries Division will inform NROCC of the requirements for the establishment of a Fishing Beach at this point. 3. The Portmore Foundation Ltd. an NGO has obtained a lease from the UDC for the establishment of a market. This market will include a wet area for meat and fish. NROCC has been approached by the Foundation for assistance in establishing the market. **4. Another option still under consideration is a shifting of the alignment north between chainage 191+600 and 192+200.**

		This would result in the fishermen occupying the south side of the road remaining where they are, and those on the north side being shifted within the village, and not away from the village. The first three mitigation measures identified would result in improved residential conditions for the fisherfolk, as well as more sanitary facilities for the provision of fish to the public. A shift in the alignment would result in minor dislocation to only some members of the fishing village, thereby maintaining their existing conditions. Provision of improved sanitary conditions is being considered by NROCC.
Sourcing, Transport and Deployment of Fill Material	**Site Preparation and Construction Phase** The main impacts related to the dredging activities are: ➢ Increased levels of suspended sediments ➢ Mixing of different soil layers ➢ Creation of loose spill layers ➢ Disturbance of substrate ➢ Dilution of sediment ➢ Increased levels of noise Capping and other special fill materials will also be sourced	Although the dredging operations are being carried out by other parties, the following mitigation measures are recommended for implementation as some of the dredge material will be utilised for the Highway construction: 1. Good dredging practice to minimise sediment suspension and dispersal at the dredging site 2. Deployment of a silt barrier south of the dredging operations and across the mouth of the Rio Cobre to prevent sediment transport into Hunts' Bay and further into Kingston Harbour 3. Advise local residents, fishers and other stakeholders, prior to

	from Hill Run Quarry in Hellshire, a licensed quarry which is currently being used by Bouygues Travaux Publics Jamaican Branch for the Old Harbour Bypass Dualization and the Kingston to Bushy Park segments of Highway 2000. This material will be trucked into the project area. The main impacts related to the transportation of the earth materials from Hill Run are: ➢ Increased traffic ➢ Movement of heavy vehicles ➢ Hazards from uncovered trucks ➢ Increased levels of fugitive dust	commencement, of the intended dredging operations, associated increase in noise levels and timetable for dredging operations 4. Environmental monitoring of the project must be done to ensure the use of silt screens, stockpiling of dredge material at the approved sites and stockpiling in approved quantities 5. Routine surveillance and maintenance of the pipeline In order to minimise the impacts related to haulage of earth materials, the following mitigation measures must be implemented : 1. Public notice about the increased use of the roads for transporting earth materials 2. Use of flagmen and signage where appropriate to alert the travelling public 3. Covering of all trucks with tarpaulins to minimise fugitive dust and airborne particles 4. Wetting of surfaces as appropriate to minimise fugitive dust 5. Stipulation of speed limits for truckers

Potential Positive Impacts

Several potential positive impacts have been identified. Although scrubland, secondary growth and mangroves will be lost in the process of vegetation clearance during site preparation and construction, landscaping along the highway will restore vegetative matter and provide habitats for some species, during the operation phase. Vegetative buffers and landscaping will facilitate continued air-shed purification functions.

During site preparation and construction employment will be generated for several categories of workers including casual labourers, skilled and unskilled workers, as well as suppliers of goods and services.

During the operation of the road it is anticipated that there will be many positive impacts. These will relate to the movement of goods and services in a shorter time, reduction of wear and tear on vehicles, as well as reduction in levels of stress and frustration experienced during traffic congestion. Health and safety are always an issue when a new road is opened with more lanes and with a higher design speed than the existing road. Safety on the roads is expected to improve in the long term, with a more efficient road network and the associated driver education programme to be implemented.

Other possible positive impacts related to cultural heritage, include the discovery of new archaeological sites, opportunities for interpretive sign posting of sites, and increased access for heritage tours.

Stakeholder Consultations

Public consultations for the project have involved three types of consultations, Consultations with Stakeholders, Community Meetings, and Information Sharing with the General Public/Targeted Groups.

Several presentations on Highway 2000 have been held over the last four years, which have been organised by the Development Bank of Jamaica Ltd. These have included the

following sessions at Montego Bay, Mandeville, University of Technology, Jamaica Institute of Environmental Professionals, Kingston, Chambers of Commerce and Parish Councils and the Lions Club of Portmore. These sessions have involved presentations by the Highway 2000 Project Office on the Highway and other Millennium Projects, the engineering aspects of the Highway, the environmental issues and other issues related to traffic, tolling, and financing.

Consultations and interviews have been held with relevant stakeholders including government agencies and ministries, property owners, business enterprises and potential commuters. During the SEA process consultations were also held with various groups including environmental scientists with specific expertise, and other related professionals, as well as with Environmental Non-Governmental Organizations/Community Based Organizations and Government Agencies. In addition, Expert Consultations were held with stakeholders and specialists in related disciplines.

NROCC and Environmental Solutions Ltd. have facilitated several Stakeholder Meetings which have included the following agencies and organizations: Portmore Citizens' Association, Portmore Foundation Ltd., Civil Aviation Authority, Airports Authority of Jamaica, Port Authority of Jamaica, Jamaica Railway Corporation, Urban Development Corporation, National Works Agency, Ministry of Agriculture and the Fisheries Division. A community meting was held in Portmore in 2002 under the auspices of the Lions Club of Portmore, to advise the citizens of the area about the proposed highway 2000 development for the Causeway alignment and bridge.

One community meeting is scheduled for Portmore, to present the findings of the Environmental Impact Assessment, as required by the National Environment and Planning Agency (NEPA). The results of this community meeting will be submitted as a separate report, to NEPA, but will still form a part of the EIA process. A Communications Schedule was also prepared and implemented by the Development Bank of Jamaica Ltd.

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