IMPLEMENTATION PLAN

OF

GEOTECHNICAL INVESTIGATION

FOR THE

FIRST-STAGE CONTAINER TERMINAL PROJECT

IN

PORTLAND BIGHT PORT, JAMAICA

CCCC WATER TRANSPORTATION CONSULTANTS CO., LTD

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Content:

1. Project Summary 1
2. Work Scope 3
   - 2.1. Purpose of Geotechnical Investigation 3
   - 2.2. Codes and Standards 3
   - 2.3. Plane and Elevation Control System 3
   - 2.4. Definition of Exploratory Boreholes 3
   - 2.5. Contents of Geotechnical Investigation 6
3. Technical Specification 7
   - 3.1. Location and Height Measurement 7
   - 3.2. Drilling 7
   - 3.3. Sampling 7
   - 3.4. SPT 7
   - 3.5. Laboratory Test 8
   - 3.6. Reporting 8
4. Methodology 9
   - 4.1. Process Flow Sheet 9
   - 4.2. Borehole Location and Elevation Measurement of Ground Level 10
   - 4.3. Drilling 10
   - 4.4. Sampling 11
   - 4.5. SPT 11
   - 4.6. Laboratory testing 11
5. Main Equipment List and Specifications 12
6. Project Management Organization 14
7. Project Schedule 16
8. Health Safety and Environment Management 16
   - 8.1. Objectives 16
   - 8.2. General Safety Rules 17
   - 8.3. Environmental Management 18
   - 8.4. Flora, Fauna and Benthos Assessment 19
   - 8.5. Emergency Action Plan 19

1. Project Summary

The first phase of the Portland Bight development requires a geotechnical investigation, which is a component of the feasibility study for the project. The proposed development is located in the south coast of the parish of Saint Catherine in Jamaica, with straight-line distance of 7.5km from east-west highway, 17km from Spanish Town and 30km from Kingston. The overall proposed project area consists of both Goat Islands and a section of the main land, just north of – the Goat Islands (Refer to Fig. 1.1). The conceptual proposal is to develop the Goat Islands into container terminals, and the land on the main lands into an industrial zone. The magnitude and phasing of the proposed development will depend on the geotechnical and other feasibility studies that are required to assess its suitability.

The objective of this project is to create a container transshipment terminal, and an international logistics, manufacturing center and cargo distributing centers in the Caribbean and Middle America trading areas. The current concept proposes that the development will commence with the port construction, with a gradual development of the port logistics and near port industries, and ultimately develop into a large scale, modern comprehensive port area and near port industrial zone.

In accordance with the proposed development phases, an initial 830 metres of coastline is needed for the container transshipment zone with an adjacent area behind the coast line for the bonded logistics zone (Refer to Fig. 1.2).

The type of marine structure will be designed based on information obtained from the geotechnical investigation. In addition, it is conceptualized that the Port Area at the Goat Islands will be connected to the main land area with a bridge and causeway infrastructure, such that there is negligible impact on the existing water circulation.

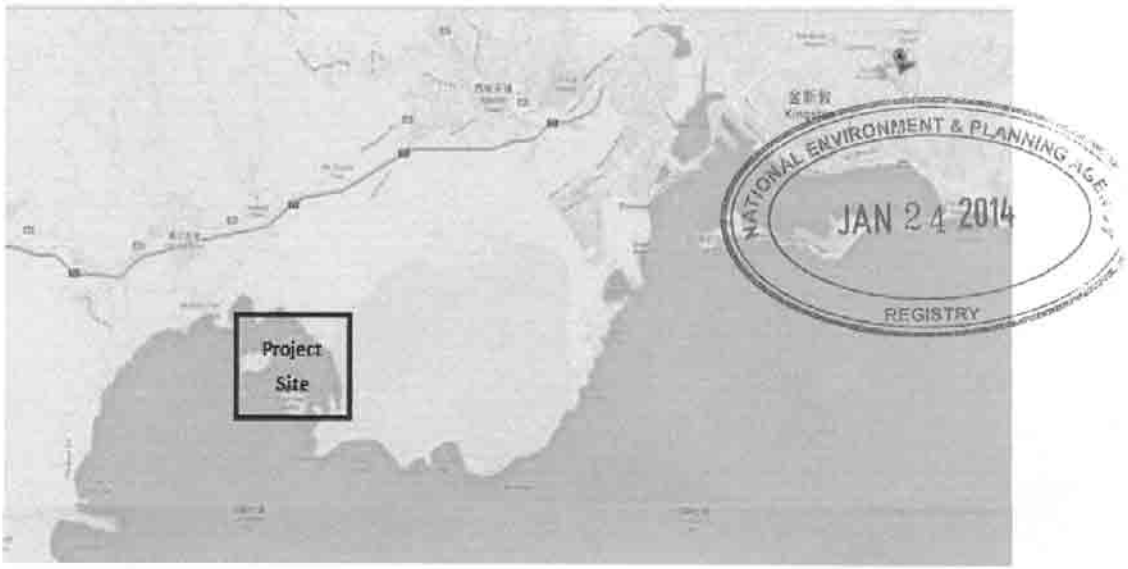


Fig.1.1 Schematic of the Proposed Project Location

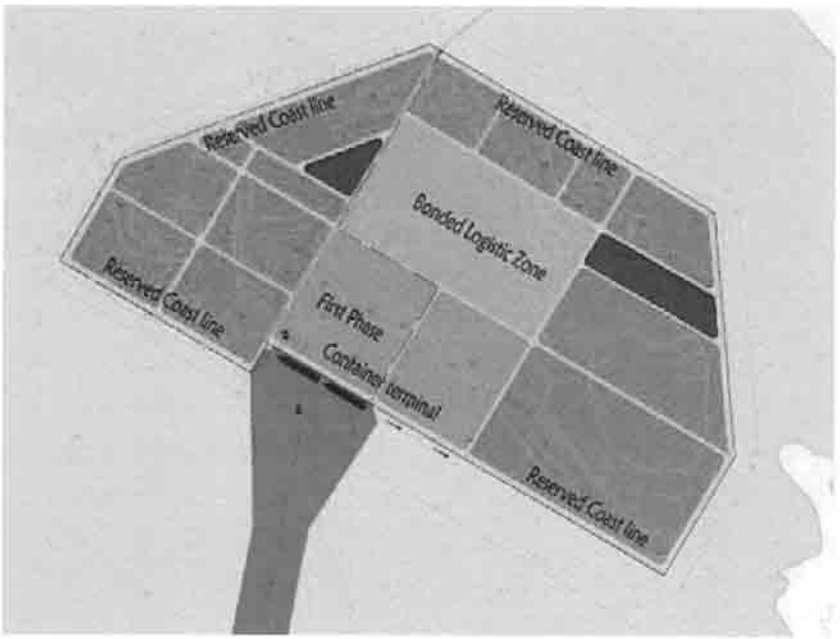


Fig. 1.2 Proposed General Layout of the Project

This document has been prepared by CCCC Water Transportation Consultants Co., Ltd (PDI), the design and investigation team of China Harbour Engineering Company (CHEC) and is under direction from CHEC to execute the work according to local laws and regulations.

2. Work Scope

2.1. Purpose of Geotechnical Investigation

The purpose of the work is to investigate initially the strata distribution, the adverse geological condition then to determine the physical and mechanical indices to design the proposed facility. The main aims are to obtain:

a) Type and distribution of land, type of bay and river, bank slope feature, change of scour and silting, overall stability of slope;

b) Subsoil strata's feature, distribution regulation, forming age, genetic type, degree of weathering, buried condition and outcrop;

c) Geological structure and earthquake condition related to the project;

d) Adverse geological condition and underground water condition;

e) An analysis of the engineering geological condition of each section, the bearing stratum and recommend suitable construction site.

2.2. Codes and Standards

The codes and standards should be ASTM and other international versions.

2.3. Plane and Elevation Control System

The latitude and longitude coordinates will be adopted as Plane control system and local theoretical lowest tide level as height datum (or perform based on CD firstly, and convert to theoretical lowest tide level after getting the transformational relation).

2.4. Definition of Exploratory Boreholes

2.4.1. Borehole Layout

The distance between adjacent boreholes is 1km~2km, and a total of 26 boreholes (12 sampling borehole and 14 SPT boreholes) will be executed over the project area, refer to "Borehole Layout Plan" for borehole distribution and table of "Borehole Coordinates".

There are 5 boreholes onshore (Fig 2.1(c)); the others are offshore (Fig 2.1(b)).

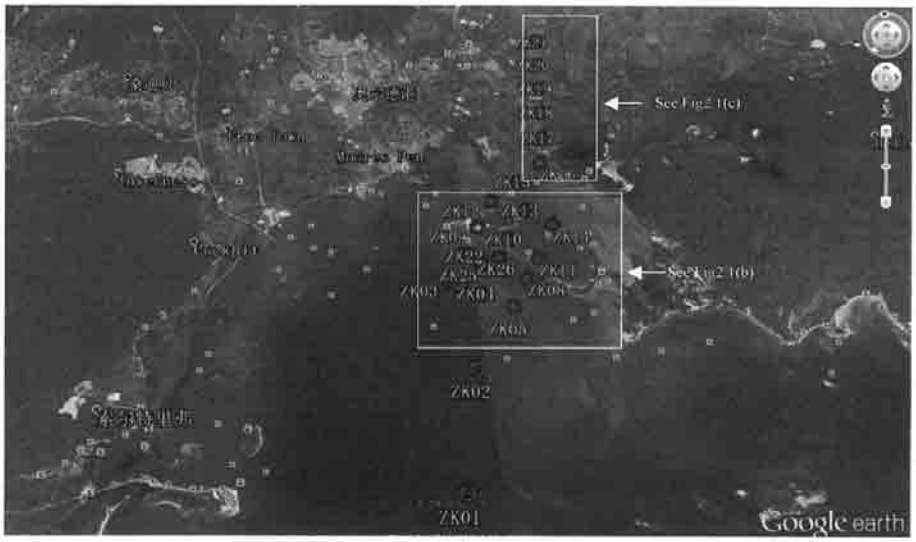


Fig 2.1(a) General Borehole Layout Plan

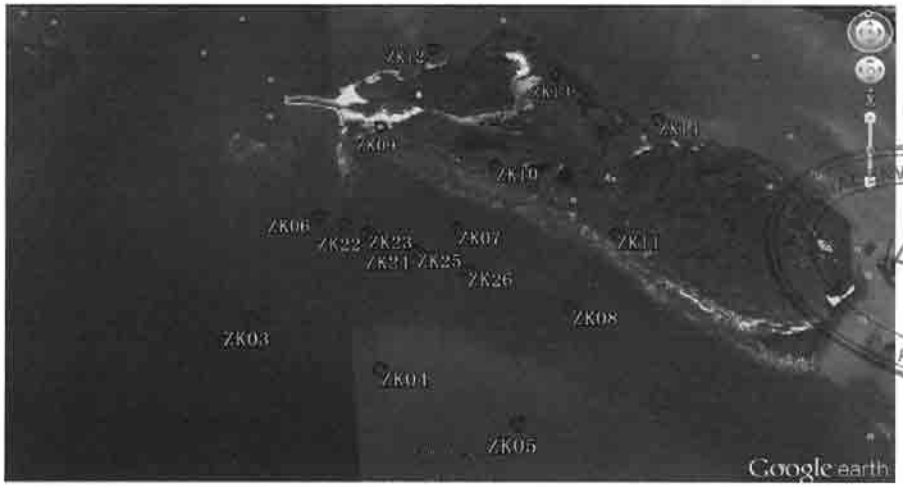


Fig 2.1(b) Offshore Borehole Layout Plan

Fig 2.1(c) Onshore Borehole Layout Plan

Table 2.1 Borehole Coordinates

No.	Borehole type	coordinate	
		longitude	latitude
ZK01	sampling borehole	77°05'10.3"W	17°48'39.7"N
ZK02	SPT borehole	77°04'48.3"W	17°50'29.2"N
ZK03	sampling borehole	77°05'4.0"W	17°51'59.4"N
ZK04	SPT borehole	77°04'34.6"W	17°51'42.9"N
ZK05	sampling borehole	77°04'5.2"W	17°51'26.4"N
ZK06	SPT borehole	77°04'46.8"W	17°52'27.5"N
ZK07	sampling borehole	77°04'17.3"W	17°52'11.2"N
ZK08	SPT borehole	77°03'47.9"W	17°51'54.4"N
ZK09	sampling borehole	77°04'29.5"W	17°52'55.7"N
ZK10	SPT borehole	77°04'0.0"W	17°52'39.1"N
ZK11	sampling borehole	77°03'30.5"W	17°52'22.7"N
ZK12	SPT borehole	77°04'12.1"W	17°53'24.0"N
ZK13	sampling borehole	77°03'42.7"W	17°53'7.2"N
ZK14	SPT borehole	77°03'13.3"W	17°52'50.8"N
ZK15	sampling borehole	77°03'41.2"W	17°53'44.3"N
ZK16	SPT borehole	77°03'14.7"W	17°54'4.8"N
ZK17	sampling borehole	77° 3'0.67"W	17°54'46.73"N
ZK18	SPT borehole	77°02'58.9"W	17°55'9.0"N
ZK19	sampling borehole	77°02'56.0"W	17°55'41.4"N
ZK20	SPT borehole	77°02'53.1"W	17°56'13.9"N
ZK21	sampling borehole	77°02'49.5"W	17°56'45.9"N
ZK22	sampling borehole	77°04'40.9"W	17°52'24.3"N
ZK23	SPT borehole	77°04'35.0"W	17°52'21.0"N
ZK24	sampling borehole	77°04'29.0"W	17°52'17.6"N
ZK25	SPT borehole	77°04'23.3"W	17°52'14.3"N
ZK26	SPT borehole	77°04'11.4"W	17°52'7.6"N

2.4.2. Borehole Depth

The drilling depth of boreholes shall be controlled as follows:

a) In the proposed wharf and the land area: the depth of drilling should be controlled at ≤3m into stable layer and N (the blow count of SPT) ≥100, or at

1 ~ 2m into medium weathered rock or 6m into highly weathered rock with apparent feature to be named.

b) In the proposed channel area: the depth of drilling shall be controlled at ≤3m into stable layer and N (the blow count of SPT) ≥100, or at 1 ~ 2m into rock with apparent feature to be named, or to -23m (CD).

2.5. Contents of Geotechnical Investigation

2.5.1. Sampling and SPT

a) Boreholes for sampling: Soil sample should be taken at vertical intervals of 1.0m-1.5m in clayey layer and in sandy soil layer should be carried SPT test at 1.5m interval and at 1.0m interval in rock.

b) Boreholes for SPT: SPT test in the borehole should go through all the layers and be carried out at 1.0m interval and keep the disturbed samples.

2.5.2. Laboratory Test

a) The undisturbed clayey soil samples should be tested to supply physical and mechanical parameters such as moisture content, natural unit weight, specific gravity, void ratio, degree of saturation, liquid limit, plastic limit, plasticity index, liquidity index, coefficient of compressibility (Test maximum pressure of 800 kPa), modulus of compressibility, unconfined compressive strength and cohesion and internal friction angle of shear box tests (under unconsolidated-undrained and 24 hours consolidated-undrained condition). The disturbed samples should be tested and get the moisture content and the Atterberg limits.

b) Sandy soil should supply dry and wet angle of repose. Test items of silt samples can refer to the contents of clayey soil, in addition, the particle size distribution test (dispersing agent: sodium hexametaphosphate) should be added.

c) For medium weathered rock sample, the saturated and dried uniaxial compressive strength should be supplied with softening coefficient.

3. Technical Specification

3.1. Location and Height Measurement

The actual position of boreholes should be checked to meet the requirements:

a) It should be ensured that the borehole location will avoid damaging the coral and protected plant (mangrove). The borehole location can be adjusted if needed.

b) The allowable error for the height measurement should be less than ±10cm.

In the area with deep and swift water flow, it is required to measure the depth of water repeatedly and use the length of the casing as an additional check.

3.2. Drilling

All boreholes will be full-section cored, and the core recovery is not less than 90% in the clay layers, 70% in the silt and sand layers, 65% in the strongly and completely weathered rock and 80% in the moderately weathered rock. The length per run is less than 2 m.

The core will be placed neatly into the core box, labeled, marked, and noted the round trip and the location and depth of layer's change, and photo to save pictures as an annex to the investigation report.

Every drilling roundtrip, sampling, in-situ tests and other work will be simultaneous with measurement of borehole depth. When confronted with sudden change during drilling, measure the borehole depth to ensure accurate position of layers.

The driller's log will be kept during the execution of the drilling programme and should be returned daily to duly elected representative. And the record should meet the codes and standards.

3.3. Sampling

The soil samples will be taken, identified, described, tagged, stored carefully, and transported to the laboratory timely, meanwhile, the samples will be kept from disturbance, sunshine and shock. The storage time should no more than 1 weeks and the rock samples should be sealed immediately if the nature humidity is requested.

Borehole cleaning before sampling is needed and residual height of spoil soil in the bottom should be less than that of wasteland camber of sampler. Make sure the natural state of soil sample during the operation as far as possible.

Cohesive soil samples will be taken by the sampler at 1.5 m interval, samples are taken by heavy hammer with less blows, the diameter of sampling size is 75 ~ 100mm.

Rock core samples will be taken, and ratio of the core length to diameter is greater than 2.

3.4. SPT

SPT test is used for sand and rock layers in sampling boreholes and all strata in SPT boreholes. Test is carried out using Φ42mm sounding rod, 63.5±0.5kg of hammer, and the free-fall distance of hammer is 76cm along guide rod.

Pre-penetrate 15cm before record the blow count when the depth penetrated is 30cm, and the blow count is the N value, by which the strength, deformation, bearing capacity of foundation and single pile, the liquefaction of silt and sand etc. can be obtained.

Borehole clearing before test should be carried out to ensure there is no waste deposit and cannot disturb the following test. During the test, it should be ensured that the level of the slurry is not lower than that of the groundwater to prevent bore hole from collapsing and sand boil. Check the penetrator before use it to find whether the inner and outer surfaces are properly lubricated or not, and replace it if the reamer shoe is broken or transmigrate. The penetrator should be put into the hole lightly to prevent the collapse or lose of the hole wall stabilization from the pumping effect. And the spoil soil thickness should be less than 5cm. The bottom position of the casing should be higher than the test position when it is used to protect the wall.

For the uneven soil layer, the SPT test should be increased.

3.5. Laboratory Test

Laboratory test is performed to get physical and mechanical parameters for ascertaining bearing capacity of each soil or rock layer, ultimate skin friction and toe resistance of pile (for common pile types), make clear of the type, distribution and properties of soil layers.

The tests and the methods adopted are as follows:

a) Moisture content : oven-drying method

b) Bulk density : specimen-retaining ring method

c) Particle density : pycnometer method

d) Atterberg limits : cone penetrometer test for liquid limits, Roller rolling method for plastic limits

e) Particle size distribution : sieving method, sedimentation by the hydrometer method

f) Incremental loading oedometer test : one dimensional and consolidation test, with maximum load of 800kPa.

g) Direct shear box test : direct shear consolidated sample, direct shear undisturbed nature sample.

h) Unconfined compression test: uniaxial compression test for soil.

i) Uniaxial compression test for rock

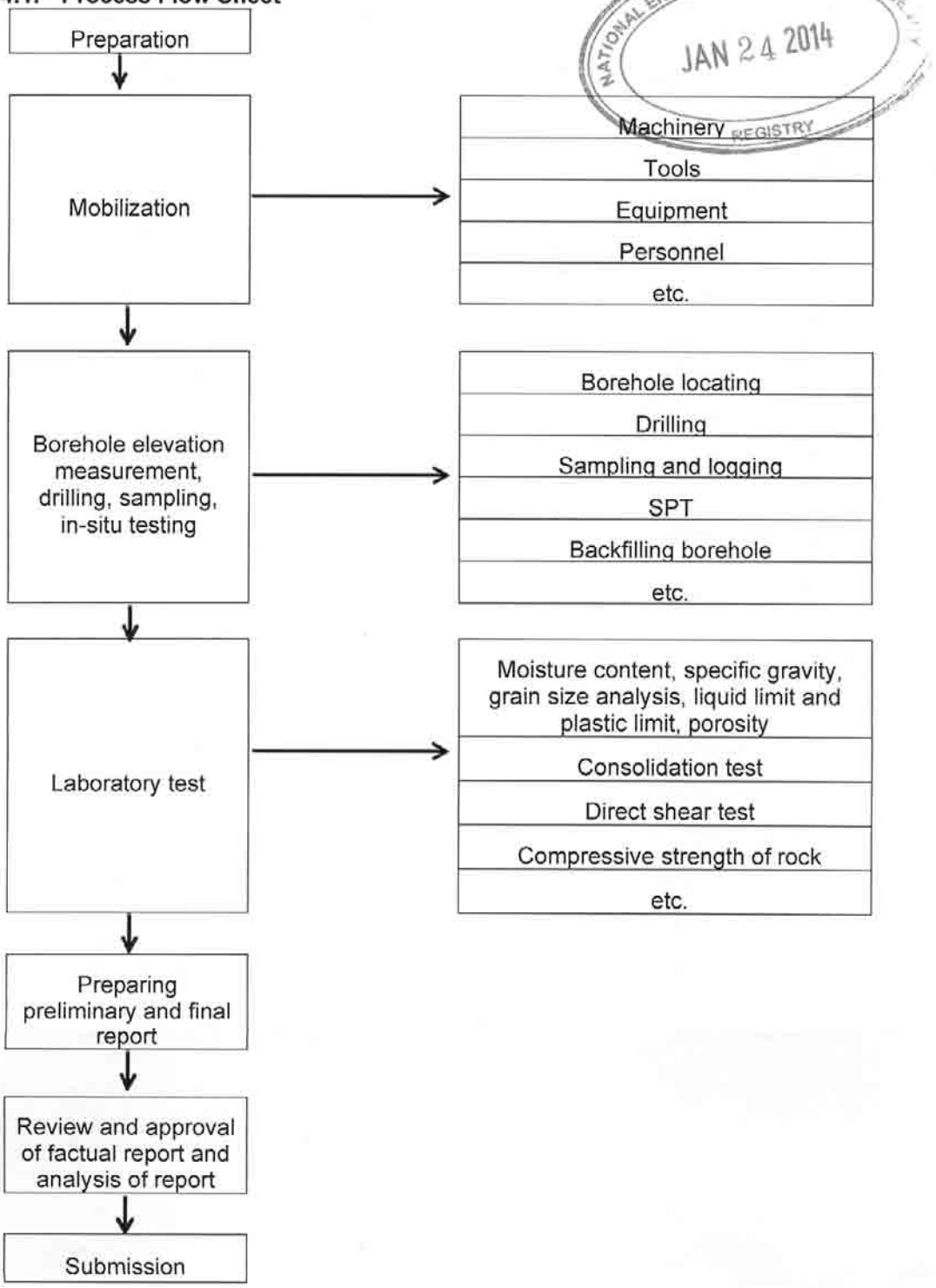
3.6. Reporting

12 copies of reports should be supplied and electronic document in Word\AutoCAD form. The formal investigation report should be attached with site plan of boreholes, table for information of boreholes, the logs of boreholes, geological section, all kinds of figures and tables of lab test results and statistic table of physical and mechanical parameters of each soil or rock layer, and allowed bearing capacity of each soil or rock layer and ultimate resistance of pile

shaft and pile end (for common pile types) should be offered and give advices to the main engineering geological problems.

4. Methodology

4.1. Process Flow Sheet



4.2. Borehole Location and Elevation Measurement of Ground Level

On-land boreholes:

In the work, the device of Total Station with centimeter-level test precision will be used to locate boreholes' position and measure the elevation of orifice, which meet the codes and the standards.

Off-shore boreholes:

The elevation of the orifice should be measured by RTK GPS and depth meter (or lining rope). In general, measurements should be carried out during the slack water period. In the area with large tidal range, the water table should be measured repeatedly and the correct sea surface level in time in order to calculate the drilling depth precisely. In the area with deep and rushing water, the orifice should be determined by the repeated sounding surveys, and checked by the length of casing in water.

4.3. Drilling

For this work, the xy-1 drilling rig shall be used, and the rig has a winch of about 2 ton capacity, which is driven by a diesel engine and a derrick of about 6m in height. The size of borehole casings and core barrels are 146mm and 127mm. this gives a maximum borehole of about 100m in suitable strata.

According to the "Borehole Layout Plan", there are 5 on-land boreholes, 21 offshore boreholes (4 on-island boreholes and 17 overwater boreholes). For on-land boreholes, the drilling rig can be towed by a light vehicle and moved by worker on-site. For Off-shore boreholes, the cantilever platform will be built on exploration boat(about 300 tons boat with about 7m width and 35m length should be adopted with certain amount of load inboard for balance and 4 sets of 150kg anchors for stabilization, and when boring close to the shore in relatively shallow water, a float platform shall be constructed which is similar with that in following picture) for overwater exploration.

(a) low-tide

(b) high-tide

Fig 4.1 the floating platform

The methods of rotary drilling, follow-down drilling and mud flush drilling shall be adopted. In soft soil, the sample should be taken by thin wall sampler under static pressure. In hard soil, thick wall sampler should be taken with blows of heavy punch. In completely weathered and highly weathered rock stratum, double-barreled drilling method will be used. The alloy bit for soil layers and strongly weathered rock, the diamond bit for the medium-slightly weathered rock layers.

4.4. Sampling

The undisturbed soft soil samples will be obtained by thin-wall sampler (stainless steel material , diameter of 75mm and height of 50cm) combining with driving sampling of static thrust, and the quality of soil sample obtained is Class 1.

The hard clay soil samples will be obtained with thick-wall open tube sampler by dynamic impact, and the quality of soil sample obtained is Class 1

The disturbed samples should be obtained from drill tools and split barrel samplers.

The rock sample should be taken by double tube core barrels, and if the broken rock could not be got by drilling, carry out SPT and keep the sample from the split barrel sampler.

4.5. SPT

The boring equipment xy-1 shall be capable of providing a clean hole before insertion of the sampler and shall ensure that the penetration test can be performed in relatively undisturbed soil. When wash boring, a side-discharge bit shall be used. The process of jetting through an open tube sampler and then testing when the desired depth is reached shall not be permitted.

The drive assembly of an overall mass shall comprise the following: a hammer made of steel and weighing 63.5kg, a pick up and release mechanism which shall ensure that the hammer has a free fall of 76cm, a guide arrangement which shall permit the hammer to drop with minimal resistance and to ensure the hammer strikes the anvil squarely.

4.6. Laboratory testing

Laboratory test is performed in the lab which has established in Jamaica. The test shall be carried out according to the codes, standards and technical requirement.

5. Main Equipment List and Specifications

Table 5.1 Measurement Equipment Specifications

No.	Equipment	Specification	Unit	Amount	Role
1	Total station	Topcon GTS332	set	1	Height measurement
2	RTK GPS	S86-7	set	1	Borehole location and height measurement

Table 5.2 Drilling Equipment Specification

No.	Equipment	Specification	Unit	Amount	Role
1	Drilling rig	xy-1	set	1	Drilling
2	SPT equipment	Hammer 63.5kg,drop height 76cm, jack rod φ42mm	set	1	SPT
3	Sampling device	Thin-wall, thick-wall, double tube core barrel	set	4	Sampler
4	Exploring boat	500 ton	set	1	Working platform
5	Traffic boat	100 horsepower	set	1	Weight anchor, cargo transportation
4	Auxiliary equipment	Mud pump, diesel engine,etc.	set	1	Auxiliary equipment

Table 5.3 Office Equipment Specification

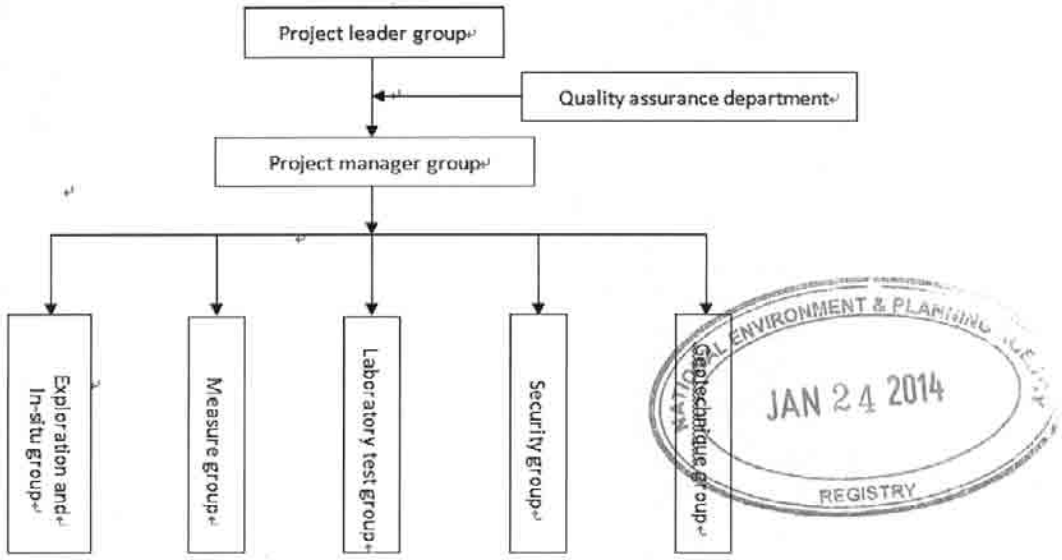
No.	Equipment	Specification	Unit	Amount	Role
1	Computer	Dell/ Lenovo	set	3	Office software
2	Printer	HP Laser jet 5200l	set	1	Office software
3	MS office	Microsoft Office	set	3	Office software
4	OS	Windows xp	set	3	System software
5	CAD	Autodesk2010	set	3	Drawing software
6	Investigation software	GICAD 8.0	set	3	Data processing software

Table 5.4 Main Test Equipment Specifications

No.	Equipment	Specification	Unit	Amount	Role
1	The soil test data processing software	fz-01	set	3	Data collection and processing
2	Drying oven	101-3	set	1	Moisture content
3	Pycnometer	100ml, 50ml	set	6	Specific gravity
4	Test sieves Hydrometer	(75mm~0.075mm) (-4 ~ 50)S°	set	1	Grain size analysis
5	Hand-operated Liquid limit device	76g cone	set	2	Liquid limit
6	Consolidation test machine	WG-3 high pressure consolidation apparatus	set	5	Consolidation test
7	Shear apparatus	DSJ-4	set	2	Direct shear test
8	Unconfined compressive strength equipment	TSZ-1B tri-axial apparatus	set	1	Unconfined compressive strength
9	Compression test machine	WE-600B	set	1	Compression strength of rock
10	Electronic balance	BL-2000F(500g/0.001g) BL-4000F(4000g/0.01g)	set	2	Moisture content, density of grain size analysis, etc.
11	Vacuum suction and boiling equipment	Φ300×200mm	set	1	Water absorption of rock
12	Auxiliary equipment		set	1	Testing auxiliary

6. Project Management Organization

The processes of this exploration are as follows: drilling location, drilling, sampling, in-situ testing, laboratory testing, reporting and so on. The work team organization chart is as the follow:



(1)Project leader group

In charge of the ground investigation, preparing staff, capital and equipment to insure the project proceed smoothly. The members of the Project leader group are as follows:

a) Director: Liu Yongman (Vice president/ Senior engineer)

b) Vice director: Chen Yunjin (Company manager/ Senior engineer)

(2)Quality assurance department

In charge of the quality of the project, supervise and inspect all the work. The member of the group has the veto on the quality.

The members are:

a) Xia Yubin (Vice chief engineer/ Registered geotechnical engineer)

b) Jia Zengchuan (Registered geotechnical engineer)

(3)Project management group

In charging of the organization of the field work, including the arrangement of staff, capital and equipment, insure the implement of the investigation plan to be finish on time.

a) Project manager: Hou Manhong (Geotechnical engineer);

(4)Exploration and In-situ test group

In charge of the exploration and in-situ test works, including boring, sampling, testing, preliminary record, bore logging etc.

a) Director: Hou Manhong (Geotechnical engineer)

b) Reviewer: Jia Zengchuan (Registered geotechnical engineer)

Experienced drillers and other site operatives will be used in carrying out the Works. The drilling crews are experienced.

(5)Measure group

In charge of the locating of boreholes. The precision must meet the specification requirement. Records comprised of the coordinate and elevation of the boreholes must be submitted.

a) Director: Huang Yongqin (Surveying and mapping engineer)

b) Reviewer: Wang Xiaohan (Registered surveying and mapping engineer)

(6)Laboratory test group

In charge of Laboratory test to make sure it meets the Specification. The test results and the report must be submitted in time.

a) Director: Liu Yongsheng

(7)Security group

In charge of Safety in production propaganda and safety check, and the security manager is Hou Manhong (concurrent)

(8)Exploration group

In charge of all the field works, including instruction and supervision during construction and the review and approval of the reports, this should be undertaken by the exploration group.

7. Project Schedule

The investigation is mainly composed of: information collecting, field work, data analysis, report accomplishing, result auditing, authorizing and publishing and follow service and so on.

We shall take full account of requirements for the working time in Jamaica and the surrounding environment, and the daily working time is from 7:00 am-5:00 pm in or near city and community area.

The planed duration is 50 effective working days (not including the time for demobilization and mobilization of personnel and equipment), see the table below, including:

a) Preparing works on site: 3 effective working days.

b) Drilling, in-situ test: 37 effective working days

c) Laboratory test: finish within 5 effective working days after field work.

d) Interim report: the 27th calendar day after starting working.

e) Finished report: submitted 5 days later after the laboratory test is finished.

Table 7.1 Duration Schedule

NO.	Item	Day																	
		3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	50	
1	Preparation																		
2	Drilling																		
3	Laboratory test																		
4	Interim report																		
5	Finished report																		

8. Health Safety and Environment Management

8.1. Objectives

The carrying out the Health, Safety and Environment Management is to:

a) Provide a process that achieves no harm,

b) Outline the actions in carrying out the assessment to ensure acceptable HSE standards and practice,

c) Communicate and implement HSE procedures

d) Ensure relevant standards and requirements of statutory agencies are met.

Ensure documentary evidence is maintained

e) To maintain productivity

8.2. General Safety Rules

8.2.1. On Shore

a) Mobile equipment should only be operated by authorized personnel.

b) Gloves should be worn when handling cable, rods, or any sharp or splintery materials.

c) A safety hat should be worn during all drilling operations.

d) There should be no smoking in the vicinity of a drill rig, especially near flammable material.

e) The work area should be kept free of excess tools and equipment which may cause any obstruction or interruption to the movement of vehicles, plants and personnel on site.

f) Cables should be checked at the end of every work day for excessive wear and tear and should be replaced when necessary.

g) No holes will be left uncovered after job is completed. All borings will be backfilled with appropriate materials.

h) First aid kit is to be maintained on site to treat breaks in the skin or any other minor injuries.

8.2.2. Off Shore

a) Contractor and its subcontractors will ensure that all craft are operated in accordance with maritime law, in particular with regards to proper identification of the vessels and mooring lines during the day and correct lighting of vessels at night.

b) Contractor shall comply with all orders and directions given by the Harbour Master in respect of navigation and shall comply in every way with our requirements in respect of marking, lighting and watching any structure, craft or equipment which may be used in carrying out the works.

c) Any light provided by Contractor shall be so placed or screened as not to interfere with any navigation signal, light, ranging beacon or other markings.

d) Contractor shall liaise generally with the Harbour Master concerning all marine aspect of the work and give all reasonable co-operations as to minimize any potentially adverse effects that could arise in regard to interference with ongoing shipping operations near the site.

e) Drilling and Sampling equipment should only be operated by authorized personnel.

f) Gloves should be worn when handling cable, rods, or any sharp or splintery materials.

g) A safety hat should be worn during all drilling operations.

h) There should be no smoking in the vicinity of a drill rig, especially near flammable material.

i) The work area should be kept free of excess tools and equipment.

j) Drill rods, casings and other equipment not being used should be kept free of dirt and should be stacked in an orderly manner and secured to avoid dislodgement.

k) Cables should be checked at end of every work day for excessive wear and tear and should be replaced when necessary.

l) First aid kit is to be maintained on site to treat breaks in the skin or any other minor injuries.

m) When working on water either in a boat or on a barge, float or platform, a life preserver must always be worn.

n) Adequate anchor and securing lines must always be used and these lines should be checked from time to time to assure proper tension.

o) Crew members should ensure that their bodies are clear of all lines before dropping anchor and anchor lines should never be straddled.

8.2.3. Obey Local Laws and Relevant Rules

The investigating team for the assessment has responsibility for maintaining the requirements of the local legislative and laws of the Jamaica. The clauses in such acts of Jamaica govern the health and safety on site as well as the protection of the environment in executing the works. These acts and regulations impose the duties or actions to carry out and shall not relieve the investigative team from doing so.

8.3. Environmental Management

8.3.1. Table of Environmental Factors Identification

Table 8.1 Environmental Factors Identification

Activity/Equipment/Supply		Environment impact	Mitigation
Set up platform and drill rig, and deliver equipment		Abandoned cotton yarn, gloves and leftover material	Collect and transport to an approved garbage dump
Drilling	Slurry	Water pollution	Limited offshore: build filtering circulating pool to control and keep slurry from into the sea. Limited onshore: build mud tank to collect waste water
Testing	Chemical reagent	Land pollution	If exist, collect and deliver to appointed place
	Rock and soil samples	Solid pollution	Collect and deliver to appointed place
Plastic toilet on site		Human waste	Portable toilet will be

		used on site and the human wastes shall be processed and handled with measures satisfactory to the Ministry of Health. (Sanitation company may be engaged in case necessary.)

8.3.2. Other Environmental Management Rules

a) Working area footprints will be within 6m×6m around boreholes; all the boreholes are either along the seashore or along existing roads, no plant in working area will be cut down.

b) Equipment depot will be placed in Moore pen town which is convenient both access to the road and the sea; the place also will minimize the effect on the surrounding condition.

c) Access to the site: the equipment will be mobilized to the site on shore by the existing roads or through the farmland; and to the site off shore by boat.

d) All temporary and permanent roads will be cleared of any spillage or droppings accrued during the period of the works.

e) No holes will be left uncovered after job is completed. All borings will be backfilled with suitable material.

f) All rubbish, waste material, debris will be systematically cleared off the working areas as it accumulates and removed from the site.

g) Time schedule refer to Chapter 7, no work at night and no interruption to the local residents.

h) Completion : Upon completion of works, crew members must remove and clear away from the site all equipment, surplus materials, rubbish, temporary buildings, erections and works of every kind, and leave the whole of the site clear and in a condition satisfactory to the Engineer.

8.4. Flora, Fauna and Benthos Assessment

c) It should be ensured that the borehole location will avoid damaging the coral and protected plant (mangrove). The borehole location can be adjusted if needed.

a) All boreholes on land are either along existing roads or at the sea shore, so no flora, fauna and benthos will be destroyed when mobilize equipment to the site by roads or by the sea.

8.5. Emergency Action Plan

In the event of any accident or mishap occurring on site, whether or not they are caused by the inadequacy of safety provision or non-compliance with safety regulations, the relevant authorities will be immediately notified. The following emergency information will be observed by all personnel prior to the start of field activities.

(1) Three major categories of emergencies could occur during site operations:

a) Illnesses and physical injuries

b) Catastrophic events (fire, explosion, earthquake)

c) Safety equipment problems

(2) Emergency contacts

Name	Telephone Number
Lu Zhao Project Coordinator	857-7069
Nadine Tarawali HSE Coordinator	582-2035
Mr. Edghill Port Authority of Jamaica	922-0290
Police	119
May Pen Hospital	986-6307
Spanish Town Hospital	984-3031-5
Spanish town Fire station	922-2121-2/110

(3) Information of hospitals and fire stations

a) May Pen Hospital

Address: Muirhead Avenue, May Pen, South Central Clarendon, Jamaica
Telephone: 986-6307

b) Spanish Town Hospital

Address: Burke Road, Spanish Town, St. Catherine,
Telephone: (876) 984-3031-5 Fax: (876) 984-7431

c) Spanish town fire station

Address White Church Street, Spanish Town
Telephone: 984-2251

Fig. 8.1 Location of Hospitals and Fire Stations

IMPLEMENTATION PLAN

OF

ENGINEERING SURVEY

FOR THE

FIRST-STAGE CONTAINER TERMINAL PROJECT

IN

PORTLAND BIGHT PORT, JAMAICA

CCCC WATER TRANSPORTATION CONSULTANTS CO., LTD

JAN. 2014

Content:

1. Summary 1
   1.1. Project Summary 1
   1.2. Scope of Work 2
2. Specification and Methodology 3
   2.1. Codes 3
   2.2. Control Survey 3
   2.3. Topographic Survey 4
   2.4. Bathymetric Survey 4
   2.5. Data Processing 5
   2.6. Inspection and Acceptance 5
   2.7. Submit List 6
3. Main Equipment 6
4. Project Management Organization 7
5. Project Schedule 8
6. Health Safety and Environment Management 8
   6.1. Objectives 8
   6.2. General Safety Rules 9
   6.3. Emergency Action Plan 10

1. Summary

1.1. Project Summary

The first phase of the Portland Bight development requires an engineering survey, which is a component of the feasible study for the project. The proposed development is located in the southeastern coast of the parish of Saint Catherine of Jamaica, with straight-line distance of 7.5km from east-west highway, 17km from Spanish Town and 30km from Kingston. The overall proposed project area consists of both Goat Islands and a section of the main land, just north of – the Goat Islands (Refer to Fig. 1.1). The conceptual proposal is to develop the Goat Islands into container terminals, and the land on the main lands into an industrial zone. The magnitude and phasing of the proposed development will depend on the geotechnical and other feasibility studies that are required to assess its suitability.

The objective of this project is to create a container transshipment terminal, and an international logistics, manufacturing center and cargo distributing centers in the Caribbean and Middle America trading areas. The current concept proposes that the development will commence with the port construction, with a gradual development of the port logistics and near port industries, and ultimately develop into a large scale, modern comprehensive port area and near port industrial zone.

In accordance with the proposed development phases, an initial 830 metres of coastline is needed for the container transshipment zone with an adjacent area behind the coast line for the bonded logistics zone (Refer to Fig. 1.2).

It is conceptualized that the Port Area at the Goat Islands will be connected to the main land area with a bridge and causeway infrastructure, such that there is negligible impact on the existing water circulation.

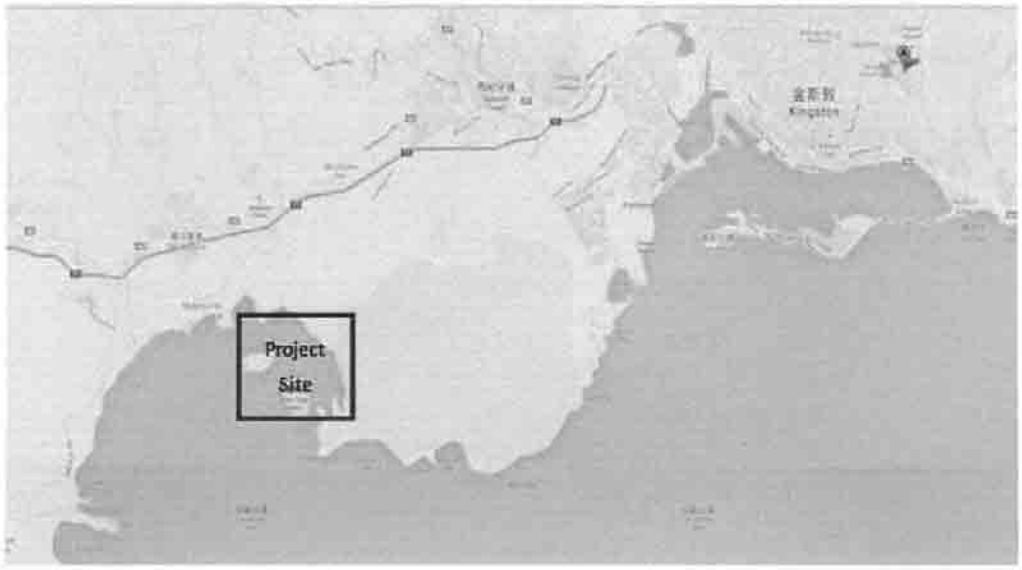


Fig.1.1 Schematic of the Proposed Project Location

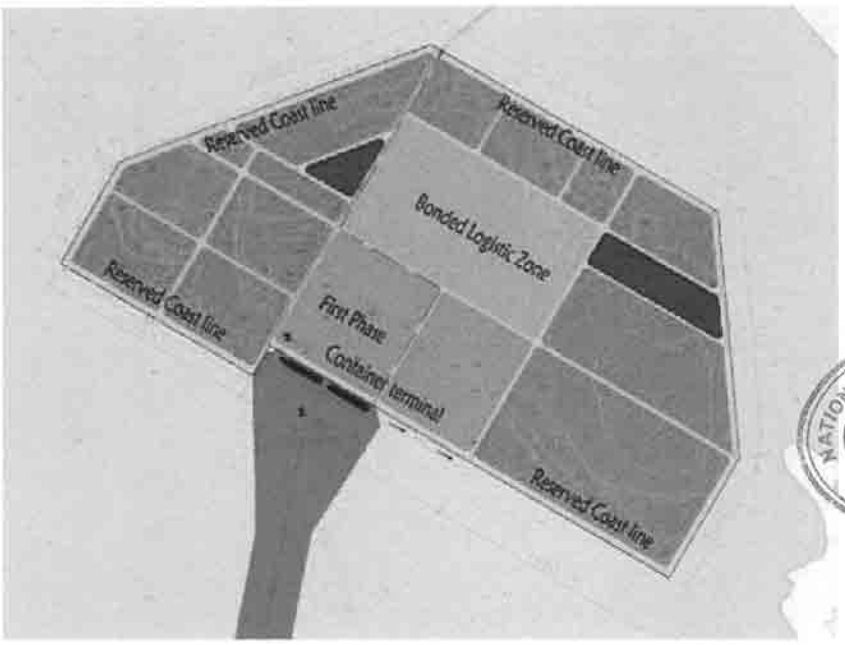


Fig. 1.2 Proposed General Layout of the Project

This document has been prepared by CCCC Water Transportation Consultants Co., Ltd (PDI), the design and survey team of China Harbour Engineering Company (CHEC) and is under direction from CHEC to execute the work according to local laws and regulations.

1.2. Scope of Work

5 GPS control points with E grade will be set up on site. The total topographic and bathymetric survey area is 9.1 km^2.

The survey area is shown in Fig 1.3 as below:

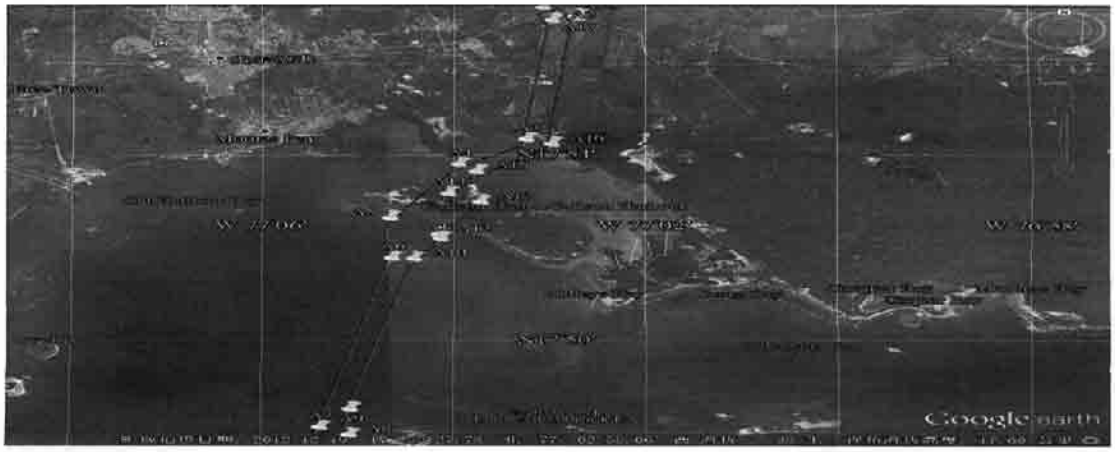


Fig 1.3 Survey Area

Table 1.1 Survey Limit Points

No.	longitude	latitude
A1	77°03'6.8"W	17°57'5.0"N
A2	77°03'1.0"W	17°56'48.2"N
A3	77°03'17.0"W	17°54'12.1"N
A4	77°03'59.6"W	17°53'39.5"N
A5	77°04'42.4"W	17°52'30.0"N
A6	77°04'41.3"W	17°51'38.2"N
A7	77°05'26.0"W	17°47'57.2"N
A8	77°05'7.7"W	17°47'47.2"N
A9	77°05'7.2"W	17°48'20.6"N
A10	77°04'27.4"W	17°51'37.4"N
A11	77°04'10.7"W	17°52'3.6"N
A12	77°04'12.0"W	17°52'8.3"N
A13	77°03'46.0"W	17°52'50.5"N
A14	77°04'6.0"W	17°53'1.6"N
A15	77°03'48.2"W	17°53'30.2"N
A16	77°03'1.4"W	17°54'6.0"N
A17	77°02'46.1"W	17°56'51.3"N
A18	77°02'53.5"W	17°57'13.2"N

Notes: Latitude and longitude coordinates of the limit points are read from an existing chart data. During survey, if find a large deviation between actual location and the given data in the above table, please contact with designer immediately.

2. Specification and Methodology

2.1. Codes

The codes and standards should use ASTM and other international versions.

2.2. Control Survey

2.2.1. Datum System

Coordinate system: WGS84 independence coordinate system or others.

Vertical system: Local Theoretically Lowest Tide Level (LTLTL) or Chart Datum (CD).

Scale: 1:2000.

2.2.2. Collection of Control Points

The surveyors will collect control points as soon as arrival. Control points are very important for survey work, especially the points with high grade within 10Km around

the project site. According to the situation of collecting points, if there are some points with high precision, which are conserved well, then we will use these points as prime control points. Otherwise, WGS84 independent coordinate system will be used.

2.2.3. Horizontal Control Survey

(1) Control network with E grade

Several GPS with E grade control points will be operated, which should consider the situation around the project site. We will setup10 points according to terrain and vegetation. The GPS points should be setup at the place, where hard, solid, reliable and convenient transportation. The GPS monument should be permanent and stability. When the point is determined, the surveyors should dram sketch map.

(2) Sub-control network

In order to meet topographic survey, we will use RTK to setup sub-control network around the project site.

2.2.4. Vertical Control Survey

According to the control point's data, vertical datum will be determined to use LTLTL or CD. If there are some bench marks (BK) with high precision, we must survey GPS control points with these BKS by RTK style.

2.3. Topographic Survey

Topographic survey filed work will be operated by RTK. After transferring the data to computer by cable, the surveyor can perform the data by professional software.

The surveyor must obey the principle that processing the data on time and drawing the map. Then the project manager or the reviewer must check to ensure the production veracity.

2.4. Bathymetric Survey

2.4.1. Water Gauge Observation

The water gauge will be set up at a little dock, where lies in west of the survey scope. The most distance between the water gauge and the survey scope is about 11 km. The offshore is open, so the surveyor want to use one water gauge station to control the throughout the work scope.

During bathymetric survey, surveyor will use tide gauge typed TGR-2050 to observe the change of the tide every 10 minutes, which must be started in 10 minutes before bathymetric surveys begin, and be suspended 10 minutes after the end of bathymetric surveys.

2.4.2. Sounding Line

According to field conditions, all the sounding line are substantially perpendicular to contour, with line spacing 2cm on map and point spacing 1cm on map.

2.4.3. Echo Sounder Fixing and Calibration

The transducer and GPS antenna will be placed at the middle of vessel. GPS antenna shall be placed on the top of sounding equipment, so that the center of location is consistent with the depth sounding center.

Before start bathymetric survey, use HY1200 sound velocity profiler to determine the temperature of the sea water and velocity of sound in the surveys area. The test

depth closes to the maximum water depth. Calculate the average velocity of sound and input the parameter to the sounder to correct the velocity of sound. Adjust the sound velocity in sounder every day to eliminate the water temperature, salinity and other factors to ensure sounding accuracy.

2.4.4. Survey Process

Use DSM232 GPS beacon receiver combined with Haida navigation software to carry out the field work. GPS positioning data and sounder bathymetric data are automatically synchronized acquisition to the computer.

Before bathymetric survey, measure the static draft of the transducer. According to the survey vessel horsepower and the normal speed, measure the action draft and input the parameter to the sounder for correction. During the data collection, surveyor must be attention to whether the sounder works properly, whether sounder data collection is in good condition, whether the echo signals are clear, and whether waterline drifts to ensure sounder stable.

2.5. Data Processing

2.5.1. Control Survey Data Processing

Control survey data processing includes several aspects as following, calculation table for horizontal and vertical control, precision statistic and analysis, checking field observation notes, compiling control survey result table, drawing control points sketch map.

2.5.2. Topographic Survey Data Processing

After finishing field work, the survey group will check by self firstly, and then the audit will check again. After finishing check work, we will combine the topographic & bathymetric map and compile to frame. The map will be framed to 50cm * 50cm.

2.5.3. Bathymetric Survey Data Processing

After finishing survey each day, the surveyor firstly organize various types of data files, including the sounding data, transducer draft, navigation and positioning files, and water level data. And then proofread all the data. Use bathymetric processing software to process the bathymetric data, and use single-station tide to correct the depth data to format the final mapping data, and then transfer the mapping data into CASS2008 sketch.

2.6. Inspection and Acceptance

The project process control is in accordance with the management system documents of CCCC Water Transportation Consultants Co., Ltd and related specifications, which obeys our company system of Two Grade Checks and One Grade Acceptance.

Firstly, the project department will check all the survey results after survey group inspect by themselves. Then quality management will double-check the results.

The survey groups must check and inspect all the results carefully, which must according to the Code. The results, which must meet the requirements of specifications, can be submitted with full signature.

2.7. Submit List

a) Control points result table in Microsoft Excel format

b) Topographic and bathymetric map

c) Survey technique report

All the results mentioned above will be submitted in soft copy and hard copy.

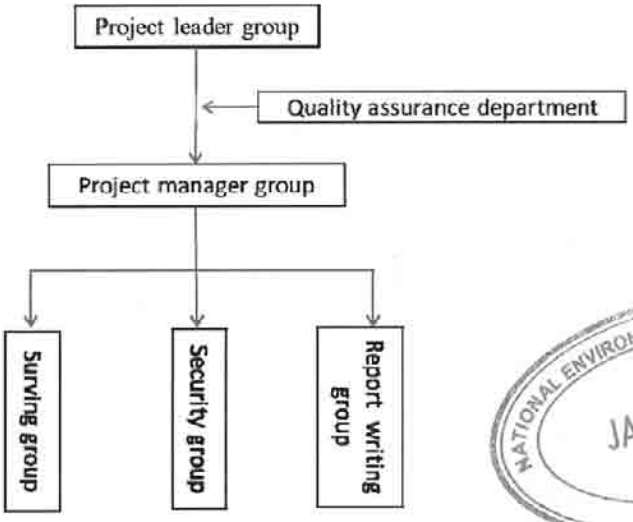
3. Main Equipment

Table 3.1 Survey Equipment

No.	Equipment	Type	Amount
1	GPS	Trimble R5	3
2	Sounder	HY1601	1
3	Total Station	Leica 402	1
4	Level	Leica NA2	1
5	Tide gauge	RBR TGR-2050	1
6	Sound velocity profiler	HY1200B	1
7	Vehicle		1
8	Vessel	100 horsepower	1

4. Project Management Organization

The management organization is as below:



(1)Project leader group

Preparing staff, capital and equipment to insure the project proceed smoothly. The members of the Project leader group are as follows:

Director: Liu Yongman(Vice president/ Senior engineer)

Vice director: Chen Yunjin (Company manager/ Senior engineer)

(2)Quality assurance department

In charge of the quality of the project, supervise and inspect all the work.

Member: Lu Junmin(Vice manager/ Professional senior engineer)

Wang Xiaohan (Registered surveying and mapping engineer)

(3)Project management group

In charge of the organization of the field work, including the arrangement of staff, capital and equipment, insure the implement of the survey plan to be finish on time.

Project manager: Li Jianwei (Surveying and mapping engineer);

(4) Surveying group

In charge of topographic and bathymetric survey. The precision must meet the specification requirement.

Project manager: Li Jianwei (Surveying and mapping engineer);

Reviewer: Wang Xiaohan (Registered surveying and mapping engineer)

Member: Wang Jungang (Surveying and mapping engineer)

Huang Kang (Assistant engineer)

(5)Security group

In charge of safety in production propaganda and safety check, and the security manager is Hou Manhong (concurrent)

(6)Report writing group

In charge of instruction and supervision during construction and the review and approval of the reports.

Compiler: Li Jianwei (Surveying and mapping engineer);

Reviewer: Wang Xiaohan (Registered surveying and mapping engineer)

5. Project Schedule

The planed duration is 50 effective working days (not including the time for demobilization and mobilization of personnel and equipment), please see the table below:

Table 5.1 Duration Schedule

Working day / Work items	2	5	3	5	20	5	7	3
Guide outline writing								
Control points collecting								
Select site								
Control survey								
Bathymetric survey								
Topographic survey								
Result processing								
Check & accept								
Data submitting								

6. Health Safety and Environment Management

6.1. Objectives

The carrying out the Health, Safety and Environment Management is to:

a) Provide a process that achieves no harm,

b) Outline the actions in carrying out the assessment to ensure acceptable HSE standards and practice,

c) Communicate and implement HSE procedures

d) Ensure relevant standards and requirements of statutory agencies are met. Ensure documentary evidence is maintained

e) To maintain productivity

6.2. General Safety Rules

6.2.1. On Shore

a) Mobile equipment should only be operated by authorized personnel.

b) Gloves should be worn when handling cable, rods, or any sharp or splintery materials.

c) A safety hat should be worn during all survey operations.

d) There should be no smoking in the vicinity of a drill rig, especially near flammable material.

e) The work area should be kept free of excess tools and equipment which may cause any obstruction or interruption to the movement of vehicles, plants and personnel on site.

f) Cables should be checked at the end of every work day for excessive wear and tear and should be replaced when necessary.

g) First aid kit is to be maintained on site to treat breaks in the skin or any other minor injuries.

6.2.2. Off Shore

a) Gloves should be worn when handling cable, rods, or any sharp or splintery materials.

b) A safety hat should be worn during all survey operations.

c) The work area should be kept free of excess tools and equipment.

d) First aid kit is to be maintained on site to treat breaks in the skin or any other minor injuries.

e) When working on water either in a boat or on a barge, float or platform, a life preserver must always be worn.

f) Adequate anchor and securing lines must always be used and these lines should be checked from time to time to assure proper tension.

g) Crew members should ensure that their bodies are clear of all lines before dropping anchor and anchor lines should never be straddled.

6.2.3. Completion

Upon completion of works, crew members must remove and clear away from the site all plant, surplus materials, rubbish, temporary buildings, erections and works of every kind, and leave the whole of the site clear and in a condition satisfactory to the Engineer.

6.2.4. Obey Local Laws and Relevant Rules

The survey team for the assessment has responsibility for maintaining the requirements of the local legislative and laws of the Jamaica. The clauses in such

acts of Jamaica govern the health and safety on site as well as the protection of the environment in executing the works. These acts and regulations impose the duties or actions to carry out and shall not relieve the investigative team from doing so.

6.3. Emergency Action Plan

In the event of any accident or mishap occurring on site, whether or not they are caused by the inadequacy of safety provision or non-compliance with safety regulations, this will immediately be notified to the relevant authorities. The following emergency information will be observed by all personnel prior to the start of field activities.

(1) Three major categories of emergencies could occur during site operations:

a) Illnesses and physical injuries

b) Catastrophic events (fire, explosion, earthquake)

c) Safety equipment problems

(2) Emergency contacts

Name	Telephone Number
Lu Zhao Project Coordinator	857-7069
Nadine Tarawali HSE Coordinator	582-2035
Mr. Edghill Port Authority of Jamaica	922-0290
Police	119
May Pen Hospital	986-6307
Spanish Town Hospital	984-3031-5
Spanish town Fire station	922-2121-2/110

(3) Information of hospitals and fire stations

a) May Pen Hospital

Address: Muirhead Avenue, May Pen, South Central Clarendon, Jamaica
Telephone: 986-6307

b) Spanish Town Hospital

Address: Burke Road, Spanish Town, St. Catherine,
Telephone: (876) 984-3031-5 Fax: (876) 984-7431

c) Spanish town fire station

Address White Church Street, Spanish Town
Telephone: 984-2251

Fig.6.1 Location of Hospitals and Fire Stations


PAJ-FCST-01
Mc Cooks Pen
A2
Old Harbour
Lot #7
AMITY HALL
Moores Pen
Lot 11A
GALLEON HARBOUR
THE DEANERY
LITTLE GOAT ISLAND
Lot 11B
GREAT GOAT ISLAND
© 2013 Google
10324 ft
2006
Image © 2014 DigitalGlobe
Imagery Date: 12/18/2012 17°53'55.33" N 77°02'56.03" W elev 0 ft eye alt 48396 ft
Google earth