ENVIRONMENTAL MANAGEMENT PLAN – NASSAU HARBOUR PORT IMPROVEMENT PROJECT

NASSAU HARBOUR & ARAWAK CAY

BKI PROJECT NO: 044.10003

Rev.	Date	Description of Revision	Contractor Prepared	Contractor Approved	Cox & SHAL Approved	MOWT Approved
4	04.21.10	Issued for Approval	D. Inger	F. Thomassen		
4	04.01.10	Issued for completion of Works	A. de Wit	F. Thomassen		
3	08.01.09	BEST Commission comments added	D. Inger	F. Thomassen		
2	06.07.09	For Approval	D. Inger	F. Thomassen	-	-
1	05.27.09	Updated Incorporating Project Manager Comments	D. Inger	F. Thomassen	-	-
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AMENDMENTS AND REVISIONS

Amendment and revision	Date	Page	Description
0	05.14.09	All	Initial draft for internal review
1	05.27.09	All	Updated incorporating Project Manager comments
2	06.07.09	All	For Approval
3	08.01.09	All	BEST Commission comments added
4	04.01.10	31	Underwater Containment & Control plan
5	04.21.10	31	Incorporated BEST comments

CONTRACTOR PROJECT ENVIRONMENTAL MANAGEMENT PLAN APPROVAL

	Boskalis International QA/HSE Manager approval by:	Boskalis International Project Manager approval by:	Boskalis International Regional Manager approval by:
Name:	David Inger	Frans Thomassen	Robert de Vlaming
Function:	Project QA/HSE Manager	Project Manager	Regional Manager
Date:	05.27.2009	05.27.2009	05.27.2009
Signature:			

I hereby declare that I have received a copy of the Project Environmental Management Plan and I am familiar with its contents. I will work in accordance with the rules and guidelines in this plan and commit myself to continual improvement of the Environmental performance.

EMP – Distribution list:

Name:	Function:	Signature:	Date:
R. Garraway	Client – MOWT		
T. Hluchan	Engineer - Cox & SHAL		
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P. Zimmerman	Works Manager / DPM		
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C. Niemeyer	Foreman Marine Operations		
A. De Wit	Foreman Reclamation		
R. Kaasenbrood	Chief Surveyor		
K. Neves	Technical Superintendent		
T.b.a.	Vessel Master Cutting Suction Dredger		
T.b.a.	Vessel Master Multicat		
T.b.a.	Vessel Master Survey/Turbidity Vessel		
H. van Zuthem	Project Manager – American Bridge Bahamas		
R. Both	Works Manager		

1. INTRODUCTION

Worldwide, cruise shipping is currently experiencing a period of substantial growth and the Caribbean has emerged as the world's most popular cruising areas. Within this context, due to its inherent natural beauty and strategic geographic location, The Bahamas is a favored destination. However, Nassau, the cradle of tourism and cruise shipping in The Bahamas, is unable to accommodate the large mega-cruise liners now entering the market owing to its physiographic constraints.

The Government of the Bahamas through the Ministry of Works & Transportation (MOWT) has awarded a contract to Boskalis International BV, a company of the Royal Boskalis Westminster group, for dredging and reclamation works associated with the Nassau Harbour Port Improvement project. The intention of the project is to dredge and expand the existing harbour facilities in order to accommodate these larger cruise ships and simultaneously expand the Arawak Cay Island and stockpile dredged materials for possible future construction usage.

CONTRACTOR Scope of Work comprises following main activities:

- Mobilization of dredging and construction equipment and personnel;
- Deepening the existing harbour basin (dredge area's: 1a, 1b, 2a, 2b, 3, 4 & 5) dredging approximately 2 million cubic yards;
- Installation of beach turbidity barriers (A = 1.600' and B = 525' long), during dredging works;

- Performing turbidity monitoring during dredging activities;
- Temporary installation of a floating pipeline, submerged pipeline, shore pipeline and discharge pipeline;
- Reclamation of the dredged material to expand the existing Arawak Cay Island (Area C) and stock pile excess materials (Area´s A, B and C) for use in the future;
- Supplying and installation of steel sheet piling for extension of the Arawak Cay including tie-rod, concreting works, ladders, bollards and foundations;
- Provision of Mooring Dolphins and associated walkways, bollards, ladders;
- Demobilization of dredging and construction equipment and personnel.

2. PROJECT DEFINITIONS

2.1 CONTRACTUAL DEFINITIONS AND ABBREVIATIONS

The following terms and abbreviations have been used during the development of this plan and have been included for the clarification of the CONTRACT:

PROJECT	Nassau Harbour Port Improvement Project
CLIENT	Government of The Bahamas – Ministry of Works & Transport
ENGINEER	Cox & SHAL - Bahamas
CONTRACTOR	Boskalis International B.V
SUBCONTRACTOR	Company or companies contracted by CONTRACTOR to perform a specific portion of the work

2.2 ABBREVIATIONS

ABB	American Bridge Bahamas Ltd.
ALARP	As Low As Reasonably Practical
BEST	Bahamas Environment, Science & Technology Commission
BKI	Boskalis International BV
BMC	Bahamas Marine Construction Company Ltd.
CSD	Cutting Suction Dredger
CTD	Central Technical Department (Papendrecht, Netherlands)
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
HIRA	Hazard Identification and Risk Assessment
H&S	Occupational Health & Safety
ISM	International Safety Management
JHA	Job Hazard Analysis

KPI	Key Performance Indicator
MARPOL	Marine Pollution
MLWS	Mean Low Water Spring (Chart Datum 0.0)
MOWT	Ministry of Works & Transport
NTU	Nephelometric Turbidity Unit
PMS	Plant Management System
PPE	Personal Protective Equipment
Q-Aid	Boskalis (Corporate) QA/HSE System
SOPEP	Shipboard Oil Pollution Emergency Plan
SOW	Scope of Work
VBKO	Black/Yellow Safety Instruction Booklet
WMP	Waste Management Plan

3. REFERENCE RULES, CODES AND STANDARDS

3.1 CODES AND STANDARDS

BKI will carry out the works according to the following codes and standards.

Ref	Document Number	Title
/1/	**EN ISO 14001:2004**	Environmental Management System requirements
/2/	**OHSAS 18001:1999**	Occupational Health & Safety Management System Specification
/3/	**EN ISO 9001:2000**	Quality Management Systems – Requirements
/4/	**ISM Code**	The International Management Code for the Safe Operation of Ships & for Pollution Prevention
/5/	**SOLAS**	International Convention for the Safety of Life at Sea (consolidated edition 2001)
/6/	**EPA 180.1**	Turbidity Measurement
/7/	**EPA 6010B**	Soil Sample Analysis (Boreholes)
/8/	**Act No 2**	Health & Safety at Work Act, 2002

3.2 CLIENT DOCUMENTS

All parties have copies of these documents. Items 9 to 34 form part of the Contract.

BKI will carry out the works according to these requirements.

Items 35 to 39 are for reference purposes only.

Ref	Document Number	Title
/9/	**Volume 1**	Contract Document
/10/	**Volume 2**	Conditions of Contract
/11/	**Volume 3**	Specifications
/12/	**Volume 4**	Drawings
/13/	**Volume 5**	Geotechnical Reports

/14/	**01005**	General Instructions
/15/	**01340**	Shop Drawings, Product Data & Samples
/16/	**01410**	Testing Laboratory Services
/17/	**01500**	Temporary Facilities
/18/	**01545**	Safety Requirements
/19/	**01560**	Environmental Protection
/20/	**01600**	Material & Equipment
/21/	**01710**	Cleaning
/22/	**01720**	Documents
/23/	**02200**	Excavating & Fill
/24/	**02360**	Pile Installation – General
/25/	**02361**	Bearing Piles
/26/	**02369**	Steel Sheet Piles
/27/	**02847**	Fenders
/28/	**02881**	Dredging
/29/	**03100**	Concrete Framework & False work
/30/	**03200**	Concrete Reinforcement
/31/	**03300**	Cast-in-Place Concrete
/32/	**03306**	Underwater Concrete
/33/	**05120**	Structural Steel
/34/	**05500**	Metal Fabrications
/35/	**-**	Environmental Impact Assessment – Arawak Cay
/36/	**-**	Environmental Impact Assessment – Nassau Harbour
/37/	**Volume 3 – Annex G**	Turbidity Monitoring Plan – FINAL – ELKO Coastal Consulting,

		Inc. by letter 3 November 2008
/38/	**11326.020 – 01.13.09**	Currents in Nassau Harbour, W.F. Baird & Associates Ltd
/39/	**11326.020 – 01.27.09**	Arawak Cay Extension Impacts at Saunders Beach, W.F. Baird & Associates Ltd

3.3 CONTRACTOR MAIN DOCUMENTS

The following documents will be prepared and/ or updated by the Contractor before and during progress of works. All parties will be provided with copies.

Ref	Document Number	Title
/40/	RBW-512 044.10003-EMP-PLN-001	Environmental Management Plan
/41/	RBW-501 044.10003-H&S-PLN-002	Health & Safety Management Plan
/42/	RBW-530 044.10003-QAC-PLN-003	Quality Assurance & Control Plan
/43/	RBW-506 044.10003-ERP-PLN-004	Emergency Response Plan
/44/	RBW-537 044.10003-MDR-005	Master Document Register
/45/	RBW-539 044.10003-MCR-006	Master Correspondence Register

3.4 SUBCONTRACTOR DOCUMENTS

The following documents will be prepared and/ or updated by the Subcontractor before and during progress of works. All parties will be provided with copies.

Ref	Document Number	Title
/46/	-	American Bridge – Safety Program Manual (update 02/06)
/47/	-	American Bridge – Environmental Protection Plan
/48/	-	American Bridge – Quality Management Plan

3.5 CONTRACTOR INTERNAL DOCUMENTS

The following procedures and forms are Contractor procedural QA documents for the preparation, execution and evaluation of the Works on completion. All parties will be provided with copies, if and when required.

Procedures and forms		
Ref	**Document Number**	**Title**
/49/	RBW-002	HSE Policy Statement
/50/	RBW-003	QA Policy Statement
/51/	RBW-104	Preparing
/52/	RBW-303	Project Preparation Operational Summary (PPOS)
/53/	RBW-304	Survey for projects
/54/	RBW-105	Executing
/55/	RBW-525	Hand-over guidelines
/56/	RBW-313	Risk Assessment
/57/	RBW-513	Risk Assessment Matrix
/58/	RBW-518	Job Safety Hazard Analysis
/59/	RBW-505-01	Obligatory Instructions
/60/	RBW-505-02	Additional Instructions
/61/	RBW-301	Document & Data Control
/62/	RBW-535	Project Master File
/63/	RBW-537	Master Document Register
/64/	RBW-539	Correspondence register
/65/	RBW-310	Non-conformances & Corrective actions
/66/	RBW-311	Preventive Actions
/67/	RBW-540	Weekly Narrative Reporting

/68/	RBW-541	Plant Performance Reporting
/69/	RBW-309	Site Administration & Financial Reporting
/70/	RBW-592	Budget Control Report
/71/	RBW-106	Evaluating
/72/	RBW-528	Project Closedown Checklist
/73/	RBW-305	Project End Report
/74/	RBW-510	Incident Reporting (SIRE)
/75/	RBW-550	Survey Method Statement
/76/	RBW-529	Completion Certificate
/77/	BKI-001	Manual Boskalis International
/78/	RBW-523	Management System Description
/79/	RBW-004	Emergency Plan
/80/	RBW-005	Handbook Crisis Team
/81/	RBW-50000	Terms of Reference BKI Area Functions
/82/	RBW-51000	Terms of Reference Fleet & CTD
/83/	P&O-003	Terms of Reference P&O Crewing Department
/84/	RBW-504	QA/HSE Management Checklist
/85/	RBW-502	VBKO - Black/Yellow Safety Instruction Booklet
/86/	P&O-005	Crew Training & Education Procedure
/87/	Q-Aid (2007 07.02)	Corporate QA/HSE System

4. SCOPE AND PURPOSE OF DOCUMENT

This project Environmental Management Plan has been prepared to comply with the contractual requirements for the works described in the contract between the Government of The Bahamas (MWOT) and Boskalis International BV (CONTRACTOR) and is to be read in conjunction with documents: 044.10003-HSE-PLN-002 (Health, & Safety Management Plan) and 044.10003-QA-PLN-003 (Project Quality Assurance & Control Plan).

The CONTRACTOR's works are limited to cover the execution of the works as detailed in the scope of work for the Dredging, Reclamation and associated Structural/Civil works in respect to the Nassau Harbour Port Improvement Project.

This project EMP defines the Environmental Management System measures, work practices and procedures that are present or will be developed and implemented during the execution of the Nassau Harbour Port Improvement project with the specific objective of eliminating or ensuring the minimization of environmental impacts during the CONTRACTOR Dredging and Reclamation works in the port of Nassau.

Furthermore this EMP outlines the specific mitigation measures that will be implemented in order to eliminate or reduce any adverse environmental impacts associated with the CONTRACTOR´s and SUBCONTRACTOR activities. Specifically; the purpose of the EMP is to:

- Ensure CONTRACTOR and SUBCONTRACTOR(s) commitment to minimize environmental effects;
- Document environmental concerns and implement appropriate protection measures;
- Provide guidance to the Project Management Team regarding procedures for protecting the environment and minimizing environmental impacts;
- Provide relevant information and training regarding environmental issues, as and when required;
- Provide a reference to applicable legislative requirements.

The EMP is also an umbrella document in which all other environmental protection documents are evaluated and communicated. These include:

- Environmental Spill Response Plan;
- EIA – Storage / use of dredged materials for Nassau Harbour Port Improvement Project - NASSAU, BAHAMAS (d.d. 16 April 2009) prepared by Blue Engineering ltd.
- EIA – Nassau Harbour Port Improvement Project (d.d. 20 November 2008) prepared by Blue Engineering ltd.

The information contained in this project EMP will be supplemented by that contained in supporting HSE project documents and procedures to address Health, Safety and Environmental specific issues and requirements to be complied with and maintained throughout the development and execution phases of the work. Together, they form a comprehensive system to achieve Government of the Bahamas, Engineer and our own Environmental policy objectives, and project specific targets.

5. LAWS, REGULATIONS AND REQUIREMENTS

CONTRACTOR utilizes accepted regulatory standards as a minimum to protect the environment, the health and safety of all personnel (CONTRACTOR, SUBCONTRACTOR´s and third parties) working on the Nassau Harbour Port Improvement Project and any others who may be affected by the project activities.

Throughout the performance of the activities as stated in section 1, CONTRACTOR will comply and ensure compliance of his SUBCONTRACTOR`s to these requirements as indicated in the following:

- Applicable Environmental Codes and regulations applicable to The Bahamas;
- Registration of CONTRACTOR´s employees according to Immigration laws in order to obtain work permits,
- Applicable International Laws, as relevant;
- CONTRACT Environmental requirements;
- CONTRACTOR internal Environmental requirements;
- Industry Standards and good practices where appropriate.

All Subcontractors, Project Team Members and Masters of Vessels will be required to sign that they have received, understood and will comply with the contents of this Environmental Management Plan (see registration list page 6).

5.1 LOCAL GUIDELINES / REFERENCES

The most important guidelines and references in respect to environmental protection in the Bahamas are as follows:

- BEST. 2002. – Bahamas Environmental Handbook;
- Bahamas Department of Meteorology – Climate of the Bahamas;
- BEST. 1999. – The Bahamas National Biodiversity Strategy & Action Plan;
- BEST 2000. – Marine Conservation & Research Workshop;
- Bahamas National Trust – Endangered Species of The Bahamas;
- Fish in The Bahamas – Bahamas Fishing Laws & Regulations;
- REEF – Geographic Zone report 4201, New Providence;
- BREEF 2006 – Status of Bahamian Fisheries;
- NOAA 2006 – Historical Hurricane Tracks;
- NOAA 2007 – Tides & Currents – National data buoy station 41046 (E. Bahamas);
- Taras Oceanographic Foundation 2009. - Eco-regional Plan for the Bahamian Archipelago.

6. MANAGEMENT FRAMEWORK AND EMP

6.1 INTRODUCTION

The Q-Aid 2007 (version 07.02) forms the basis of the CONTRACTOR QA/HSE system. The Environmental Management System is fully imbedded within this system.

The Quality, Safety, Health and Environment System is implemented at corporate level in CONTRACTOR's organization, in order to ensure amongst others a safe operation of the marine spread and that environment impacts are minimized during execution of the CONTRACTOR´s various work activities.

The corporate QA/HSE System describes:

- The QA/HSE policy and the QA/HSE objectives;
- The organizational responsibilities;
- The means developed to implement this policy and to achieve the company objectives;
- General instructions and procedures for the effective planning and measuring of the QA/HSE performance;
- The Quality, Safety, Health and Environment Management System, established by CONTRACTOR's Board to reach its objectives in general, and the efforts in the field of auditing and reviewing in particular.

6.2 CERTIFICATION

The CONTRACTOR Corporate QA/HSE is certified against the following International standards:

- ISO 14001:2004 (Environmental Management System requirements).
- ISO 9001:2000 (Quality Management Systems – Requirements);
- OHSAS 18001:1999 (Occupational Health & Safety Management System Specification);

Copies of these certificates can be found in Attachments 16.1, 16.2 and 16.3 of this EMP.

6.3 POLICY AND PLANS

Copies of the Corporate HSE policy statement and Project specific Health, Safety & Environmental Policy Statement have been included in document: 044.10003-H&S-PLN-002. Within the framework of these policy statements other supplementary systems are applicable.

The position of the Project EMP Plan within the Corporate QA/HSE structure is shown in paragraph 6.2.1 of document: 044.10003-H&S-PLN-002. The plan addresses, as a minimum, the following project specific items:

- Tasks, Responsibilities and Authorities;
- Risk Assessment (HIRA);
- Emergency preparedness and (spill) response;

- Project QA/HSE Induction training;
- Communication;
- Specific Health & Safety Instructions;
- Contractual & legal requirements.

Specifically for this project a separate EMP has been created and will be distributed to all parties concerned and is a dynamic document and can be revised whenever the need arises.

6.4 PLANT MANAGEMENT SYSTEM

The Plant Management System (PMS) has been implemented in the CONTRACTOR's organization for the marine spread and is based on the International Management Code for the safe operation of vessels and for the prevention of pollution. The PMS is certified according to the ISM-code.

The PMS consists of four handbooks:

- General: incorporating general procedures and instructions for the CONTRACTOR´s organization;
- CTD: incorporating specific procedures and instructions applicable for the Central Technical Department and Plant Management Teams;
- Crewing; incorporating specific procedures and instructions for the departments;
- Plant; incorporating specific procedures and instructions for the use of plant and onboard equipment.

6.5 RESPONSIBILITIES AND AUTHORITIES

The project organization structure, tasks, responsibilities and authorities have been defined and included in document: 044.10003-QAC-PLN-003 – Quality Assurance & Control Plan.

The CONTRACTOR´s Senior Management has the overall responsibility for Health, Safety and Environment on the Nassau Harbour Port Improvement Project. This accountability is transferred to the CONTRACTOR´s Project Manager and his team on the various project sites and marine spreads via subsequent delegation of authority.

The Project Team comprises of qualified and experienced staff that cover the various disciplines required for the successful completion of the project. They have been sourced from within the CONTRACTOR´s organizations.

6.6 MANAGEMENT OF CHANGE (MOC)

This EMP and associated environmental documentation will be maintained and updated throughout the duration of the project. The Project QA/HSE Manager is responsible for incorporating ENGINEER´s comments on this document as well as updating it to reflect new project information. Revisions to this document will be performed if:

- New project design parameters or construction methodologies are introduced that could change the environmental impact or mitigation measures;
- Changing Environmental requirements, commitments or conditions by Local Authorities;
- As a result of incidents, deviations and/or audit findings.

6.7 MONITORING: AUDITS AND CORRECTIVE ACTIONS

Implementation of this EMP will be monitored by the Project Manager and Project QA/HSE Manager through the performance of periodical inspections and HSE meetings.

During CONTRACTOR´s internal HSE meetings, specific items relating to the environment will be discussed and possible improvements reviewed.

Eventual deviations will be evaluated in order to promptly identify corrective actions and further deviance from CLIENT / CONTRACTOR / SUBCONTRACTOR´s objectives, targets, environmental plans and procedures.

A register of environmental actions generated as a result of these activities will be compiled into a project HSE action register, maintained and regularly updated by the Project QA/HSE Manager.

Environmental Monitoring of CONTRACTOR´s SOW work will be performed by CONTRACTOR in line with the “Monitoring Plan” included in section 10 of this EMP.

6.8 PROJECT ENVIRONMENTAL OBJECTIVES & TARGETS

Overall

- Prevent harm, damage and loss to personnel, the environment and assets;
- Involve and commit the Project Management as well as each employee to the Project (HS)E Policy and objectives;
- Ensure Subcontractors/Suppliers/Visitors apply the same or equivalent Environmental practices as those defined by CLIENT and CONTRACTOR.

Environmental

- Preserve the natural environment by preventing/minimizing nuisance and disturbance to the natural ecosystems in the Bahamas;
- Minimize waste production and ensure correct waste management on site;
- Switch-off equipment when not in use to prevent unnecessary air pollution and noise;
- Actively promote an environmentally responsible approach to the Project activities amongst the entire workforce.

6.8.1 Project HSE Targets

In accordance with the aforementioned objectives, CONTRACTOR has developed SMART HSE targets to enable the HSE performance to be monitored throughout the duration of the Nassau Harbour Port Improvement Project. The project specific QA/HSE Key Performance Indicators have been included in section 7.3 of document: 044.10003-QAC-PLN-003 – Quality Assurance & Control Plan.

The ultimate objective of CONTRACTOR is to complete the activities with zero impact to the environment and zero accidents.

These targets and KPIs establish the acceptable levels of QA/HSE outputs and provide the basis for ongoing control and monitoring, as well for HSE performance measurement.

6.8.2 Project Incentive Scheme

Based on CONTRACTOR's Corporate QA/HSE Management System, CONTRACTOR shall for the Nassau Harbour Port Improvement Project apply a project incentive scheme. This scheme is based on two forms of incentives both based around the SHOC (**S**afety, **H**azard **O**bservation **C**ard) system. The incentive scheme is as follows:

- Every month the Project Manager, Project QA/HSE Manager and QA/HSE Manager (Home Office) will select the best Safety, Hazard Observation Card, submitted by CONTRACTOR´s personnel. The winner will receive a reward.
- For each Safety, Hazard Observation Card written and submitted to the Project QA/HSE Manager, CONTRACTOR will reserve an amount of money (to be specified by Site Management) per card. At the end of the project the total amount will be handed over to a local charity or good will organization. The name of the charity or good will organization will be made known to all, prior to the commencement of the work on site.

Note: This SHOC system is also applicable to Environmental related observations and not only to safety related items.

7. HARBOUR DREDGING AND MATERIAL TRANSPORT

7.1 DREDGING OPERATIONS AND METHODOLOGIES

7.1.1 Site preparation

Prior to commencement of the work in Nassau Port, topographical and photographic surveys will be performed by CONTRACTOR to determine the (existing) state of the Arawak Cay, Nassau Harbour, access roads and surrounding beaches etc. This will be performed after the Arawak Cay site clearance activities by Client.
The main purpose of these surveys is to establish records against which the site restoration work will be judged after the dredging, reclamation, piling and civil works have been completed.

7.1.2 Vessels and Equipment

A variety of dredging and support equipment will be utilized to conduct the dredging and reclamation works. CONTRACTOR intends to use the Heavy Duty Rock Cutting Self Propelled Cutter Suction Dredger “URSA” for this project. This dredger will be assisted by a large “Multicat” BKM-104 and tugs for pipeline and anchor handling. Further different types of pipelines will be used, e.g. sinker lines, floating pipelines, shore and discharge pipelines. Specifications of the CSD “URSA” have been enclosed as Attachment 16.4.

7.1.3 Mobilization dredging equipment (Dredger & Auxiliary Equipment incl. pipelines)

Dredging and support equipment will be mobilized by CONTRACTOR from various locations around the world (Australia, Singapore, India, Abu Dhabi, Trinidad and The Netherlands). The dredger “URSA” will sail on own keel from Singapore. The Multicat BKM 104 will be mobilized from The Netherlands. The standby vessel Alma will sail from Trinidad. Pipelines to pump material from the dredger to the reclamation area, as well as various pieces of auxiliary equipment will be mobilized by cargo ship from several locations (Australia, India, Abu Dhabi, Spain, and The Netherlands) or will be provided by the nominated SUBCONTRACTOR´s (American Bridge Bahamas or Bahamas Marine Construction Company).

7.1.4 Surveying

Prior to the commencement of the dredging works CONRACTOR will perform a pre-dredge survey. This will be executed in order to establish/verify the actual depths and the total volumes to be dredged.

During the works intermediate surveys will be performed in order to monitor the production volumes and progress of the dredging works closely.

On completion of the dredging works, a post-dredge survey will be performed in order to establish/verify that the dredging has been executed to the required lines, levels as stipulated in the Contract.

The difference in the pre-dredge and the post-dredge surveys will be used for the calculation of the payable quantities.

Boskalis International utilizes a “state of the art” survey system "DredgeView 2.0".

The basic properties of this in-house developed survey package are:

- Data logging
- Processing
- Presentation
- Volume Calculation
- Positioning of Dredging Units

Technical information explaining the different DredgeView modules is available on Site.

For specific details on the survey methods and equipment to be used, see document number 044.10003-SUR-MS-001 (rev 2) – Survey Method Statement.

7.1.5 CSD Dredging Methodology

The Cutter Suction Dredger (CSD) is a (semi)stationary dredger equipped with a rotating cutter head and centrifugal pumps. The dredging process consists of cutting away the underwater soil with the cutter head and pumping up the mixture of soil and water by the pumps.

Prior to the start of the dredging operations, the CSD will sail to the location to be excavated. The CSD will position its main spud in the soil in the Harbour basin. The side anchors are then placed outside the dredging cut by means of the dedicated Multicat - BKM104 (dredging assistance workboat).
During the dredging activities, the CSD swings around the main spud with the help of its onboard side winches. The forward movement is provided by the spud carrier. The maximum size of the cut is dependent on the cutter head and soil conditions, but the Ursa can cover a cut of about 330 – 400 ft wide depending on soil consistency. The operation of the CSD consists of cutting the soil with the cutter head and then pumping the mixture of water and soil by means of the suction and discharge pumps.

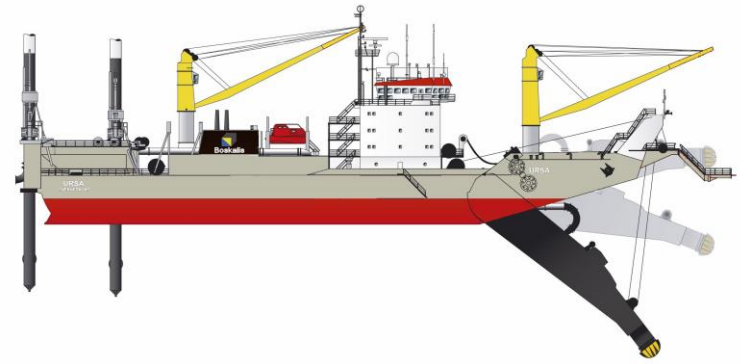


Figure 1 CSD "Ursa"

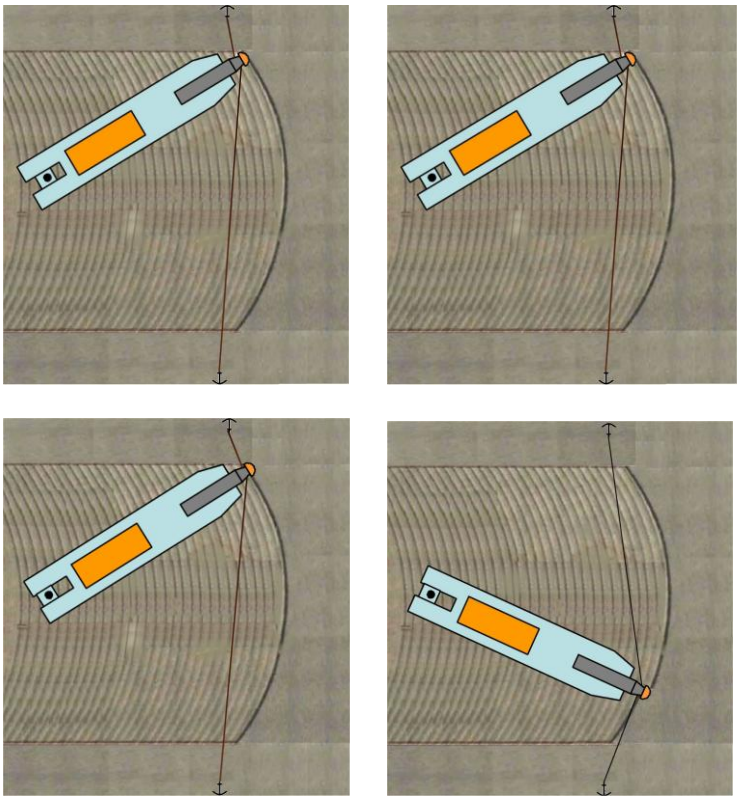


Figure 2 Side ward circular swing movement of the CSD

The dredging process is controlled by means of automated systems. The dredging accuracies are an accumulation of positioning accuracy, soil characteristics, swell, tidal data variances and operator skills. Utilizing automated systems of the dredging process, high accuracies can be achieved. The working accuracy of the CSD is 3 – 10 ft (1.0 m – 3.0 m) in the horizontal plane and 1 – 4 ft (0.25 m – 1.0 m) in the vertical plane, depending on the environmental conditions.

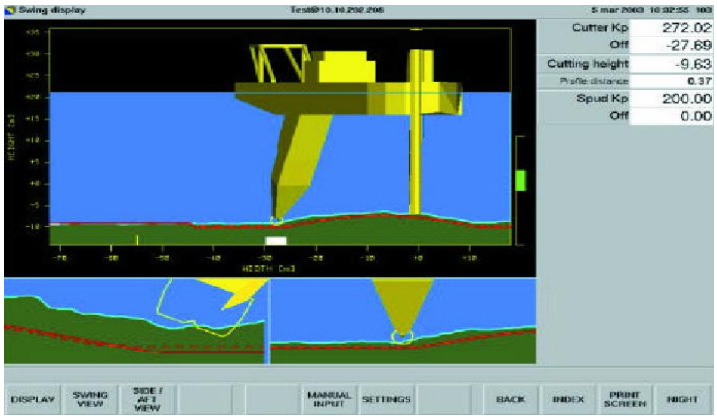


Figure 3 Dredge master - dredging control unit

7.2 VOLUMES AND LIMITS OF DREDGE AREA

Based on the SOW it is estimated that 2 million cubic yards of dredged materials will be produced during the Harbour Improvement works in Nassau.

The limits, volumes and sequence of the dredging activities are as follows:

Dredge Area	Volume (cubic yards)	Proposed Disposal Area	Proposed Sequence
Dredge area 1a (Turning Basin)	289.000	A+B	1 + 2
Dredge area 1b (Turning Basin)	497.000	B+C	3
Dredge area 2a (Turning Basin)	186.000	B	5 + 6
Dredge area 2b (Turning Basin)	397.000	C	7
Dredge area 3 (Channel)	81.500	B	4
Dredge area 3 (Channel)	42.500	Offshore	8
Dredge area 4 (Prince George Wharf)	9.000	B	6 + 5
Dredge area 5 (Prince George Wharf)	281.000	A	2 + 1

Remark: for offshore disposal refer to Section 7.4.5 Underwater Containment & Control Plan.

The final dredge sequence will be subject to availability of dredging areas, length of available pipelines, weather, sea state conditions and physical constraints such as: Cruise and Merchant shipping etc., but all with the aim of a timely project completion and in accordance with the agreed contract SOW, for as far as possible.

See also document number: 044.10003-DRG-MS-002 (Dredging & Reclamation Method Statement).

7.3 MATERIAL TRANSPORT METHODS

7.3.1 Piping and piping Corridor

The choice of (CSD) dredging method optimises the dredging production, thus reducing the dredging time and minimises the effects of turbidity more than other (conventional) dredging methods such as Backhoe Dredging or Trailing Suction Hopper Dredging (TSHD).

The CSD is equipped to remove course materials such as those that can be expected in Nassau Harbour. Removal of sediments shall be done using the centrifugal pumps on the Ursa. The excavated materials will be “sucked-up” and pumped through a floating, sinker and shore pipeline that connects the CSD directly to the Arawak Cay reclamation area. All pipelines will be regularly checked for leakage, thus avoiding fugitive emissions of sediments into the Harbour.

This “closed reclamation system” consists of a floating pipeline, sinker pipeline (across the mouth of the harbour) and shore pipeline which is connected to water boxes and water discharge pipeline thus containing return of fines into the marine environment.

The discharge pipeline will run from the north western corner of the Arawak Cay along the seabed into the ocean, so that discharge will take place at seabed level (- 70 ft.)

7.3.2 Barge / vessel transport

Not applicable.

7.4 DREDGED MATERIAL CONTAINMENT AREA´S

7.4.1 Methodologies

Prior to the start of the dredging activities CONTRACTOR will construct reclamation bunds around the designated reclamation areas at Arawak Cay (Area A and B). Material for these bunds will be excavated from within these reclamation areas. At the same time we will transport material from Arawak Cay to the Arawak Cay extension (from A and B to Area C) where bunds (berms) will be constructed at the inshore side of the steel sheet pile walls.

During the construction of the reclamation bunds CONTRACTOR will install the pipelines from the dredging area to the reclamation area. Another pipeline will be installed from the North-eastern corner of the Arawak Cay extension to a location offshore at approximately – 70 ft. Centrifugal Dewatering Pumps (Van Heck) will be installed in order to pump the residual water from the reclamation area to this offshore location. This method will minimize the turbidity in Nassau harbour and was also successfully used at other projects, e.g. LNG terminal Trinidad and Tobago.

As a contingency measure CONTRACTOR will install a weir box at the Southside of the Arawak Cay extension, which can be used as an additional discharge for the process water.

Once the installation of the pipelines and the bunds is completed the Cutter Suction Dredger "URSA" will be positioned at the dredging area and will be connected to the floating pipeline.

Dredging will proceed at the various dredging areas taking into account the completion requirements and the interfacing with the piling works.

The filling of the reclamation areas will proceed in the sequence A => B => C, from East to West.

The production of the Cutter Suction Dredger is estimated at 140,000 cubic yards per week.

The dredger is equipped with a Global Positioning System and a Dredgeview positioning monitoring system, thus ensuring that accurate dredging will take place to the required lines and levels.

Dredging and Reclamation works will take place 24 hours per day, 7 days per week.

7.4.2 Equipment and materials

For the dredging and reclamation works the following major equipment and materials, or similar, will be used:

- Cutting Suction Dredger – Ursa;
- Multicat work vessel – BKM 104;
- Survey / Support / Turbidity Monitoring vessel – Alma;
- Auxiliary work vessels such as small tugs etc.;
- Floating pipeline approx: 2.460 ft, Ø 31"(750 m Ø 800mm);
- Sinker pipeline approx: 9.185 ft Ø 35" and ball joint (2.800 m Ø 900 mm);

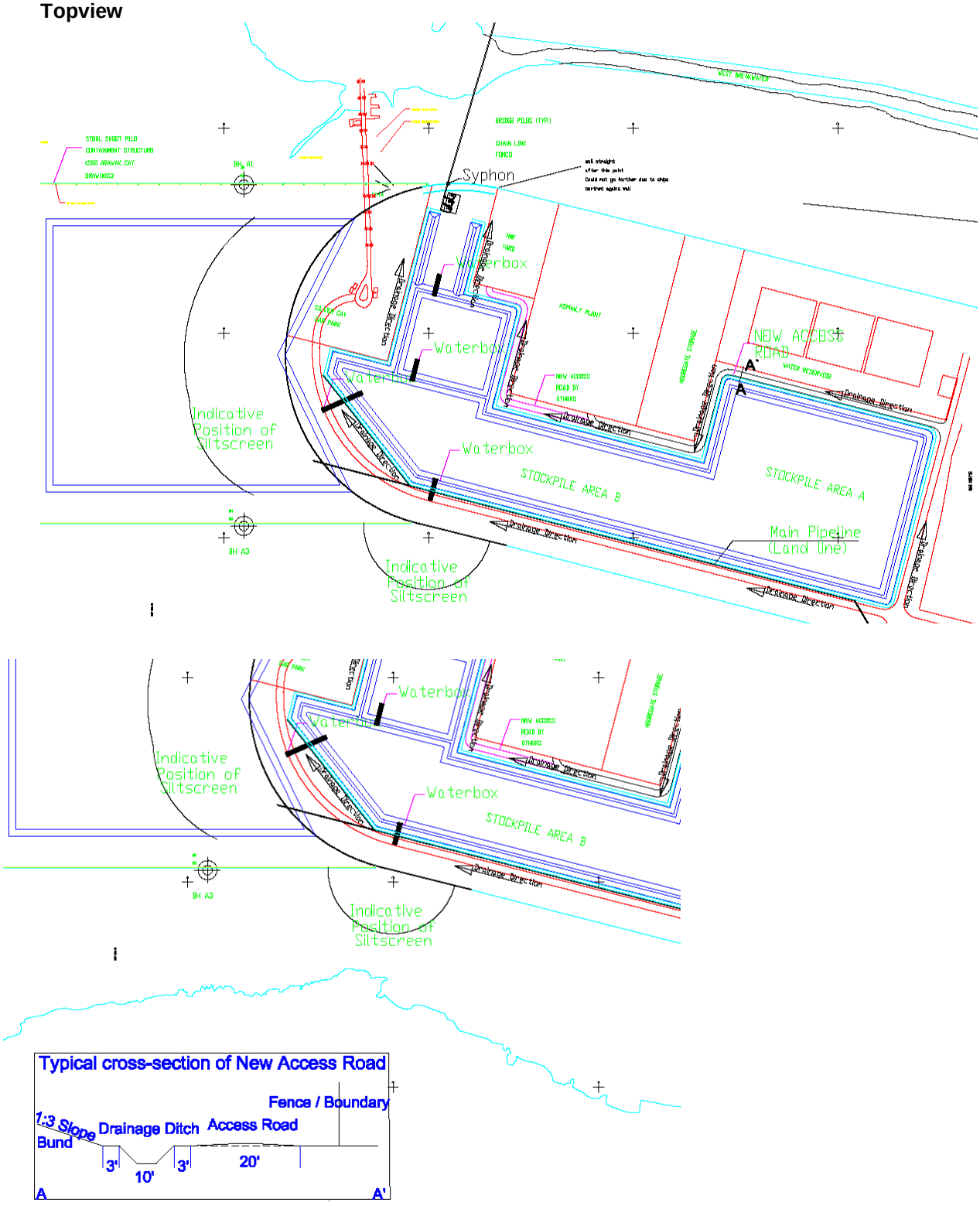
- Shore pipeline approx: 6.890 ft Ø 35" valves, Y-piece and bends (2.100 m Ø 900 mm);
- Discharge pipeline approx: 1.475 ft Ø 43", 80 ft Ø 39"and 1,970 ft Ø 39" (450 m Ø 1100 mm, 24 m Ø 1000mm, 600 m Ø 985 mm);
- 6 no. Water boxes approx: 106'' x 39" x 79" (2.700 mm x 1.000 mm x 2.000 mm);
- 3 no. HK 700 centrifugal water pumps (Van Heck);
- 4.200 ft (1.280 m) Silt Screen (various heights) of which 2.125 ft is in use as beach protective barrier.

7.4.3 Limits of work area's

Below you will find topview plan for Arawak Cay reclamation part of the works with inidicative position of:

- Bunds;
- Roads;
- De-watering pipeline with pump station;
- Water boxes;
- Drainage ditches

Topview



Sketch – 3 no. Indicative waterbox locations & silt screens

7.4.4 Water and Storm water Control plan

The (Process) Water Control Plan has been described in Section 8.1.1. which deals with minimization of turbidity to protect the sensitive aquatic environment. For those events that Hurricane/ Heavy Rain downpours are encountered the following has been designed.

The project area exposed and affected by heavy rain downpours is the Arawak Cay site.

The closed (reclamation) process water system covers up to 80% of the entire Arawak Cay working area and as such any additional “storm water” will be dealt with as if this was process water.

It shall be further noted that BKI have engineered two back-up systems, being

- third standby HK-700 de-watering pump
- extra conventional water box discharging process water from Stockpile Area B to C till Area C sheet piling works are complete, and from Stockpile Area B to the South there after (see also locations as per above sketch under section 7.4.3 Limit’s of work area’s)

With the above back-up systems the capacity for process water discharge can be temporarily increased to suit the demand during bad weather conditions.

As far as the latter 20% Arawak Cay working area is concerned, BKI will excavate ordinary temporary drainage ditches that will be dug under a gradient to drain mainly into the designated settling channel and/or stockpile area C. Thus the 20% working area surrounding the stockpiles A and B will be drained by this temporary ditch system, preventing overflow into the adjacent road and various leased properties.

Where as “very high tides” are concerned, no specific measures can be undertaken except for temporarily rise of the wooden barriers in the water boxes.

7.4.5 Underwater Containment & Control plan

During the project execution, the works had to be interrupted due to bad weather conditions and offshore sea conditions in particular, caused by the predominant North to North-Easterly swell.

Due to this unscheduled interruption 42,500 cyd of the total of 124,000 cyd could not be dredged in the offshore dredge area 3. After 1 month of trials to complete the works it has been agreed to demobilize all equipment and return as soon as the sea conditions are favorable again to dredge this final part of the offshore works.

To limit the time of re-mobilization and installation and thus complete the works as soon as possible without tampering the environmental controls in place, Contractor proposed to solely remobilize CSD URSA, auxiliary vessels BKM104 and ALMA, as well as the winch pontoon WP22259 and A-frame AF-02 with the entire floating pipeline only.

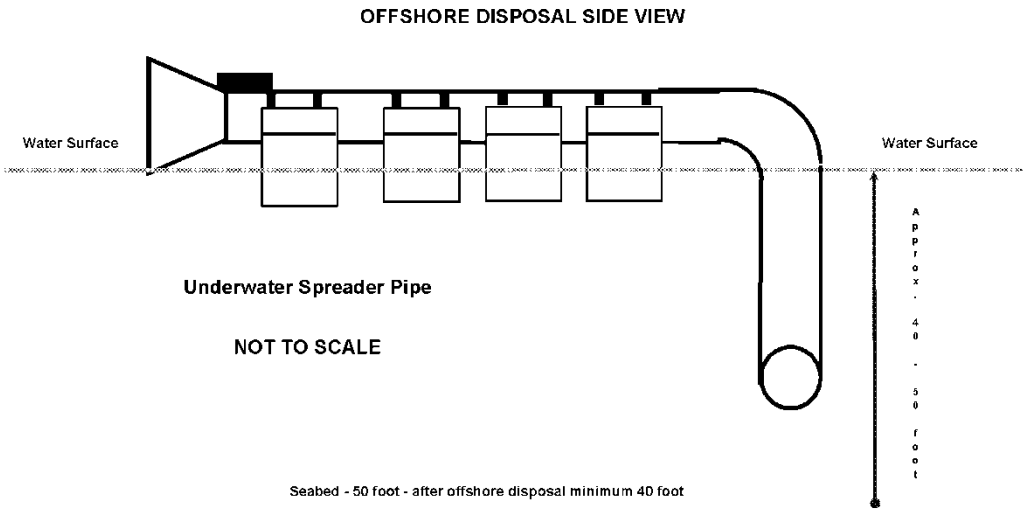
Environmental conditions will still be complied with as the dredging mixing zone is offshore, which no longer requires the beach turbidity barriers, while at the same time the dredged materials will be placed in an underwater containment area.

The works will be executed in a limited period of less then 1 week, at a lower productivity then realized to date, due to the rocky nature of the materials to be dredged in this offshore area no. 3.

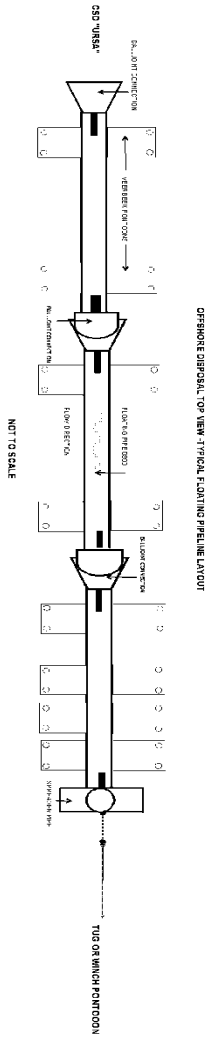
This rocky seabed nature also confirms that the dredged materials are less abrasive and thus the turbidity should be well within the contractual limits. Turbidity will be further controlled by “deep loading”, spraying the dredged materials at approx. 30 foot water depth, and thus creating a density flow for quick deposition at the nearby seabed. The actual realized turbidity will be monitored daily, as executed to date, in accordance with the unchanged Section 10 Environmental Monitoring of this Environmental Management Plan Revision 5.

The underwater containment area will be at the -50 foot depth contour from the edge of the approach channel towards Silver Cay as indicated on the final sketch below. Material will be placed till a maximum depth of -40 foot to prevent any hindrance to navigation. If high spots are detected by hydrographic survey above -40 foot these high spots will be removed. This containment area will be divided into pre-defined boxes to control the underwater placement of dredged materials.

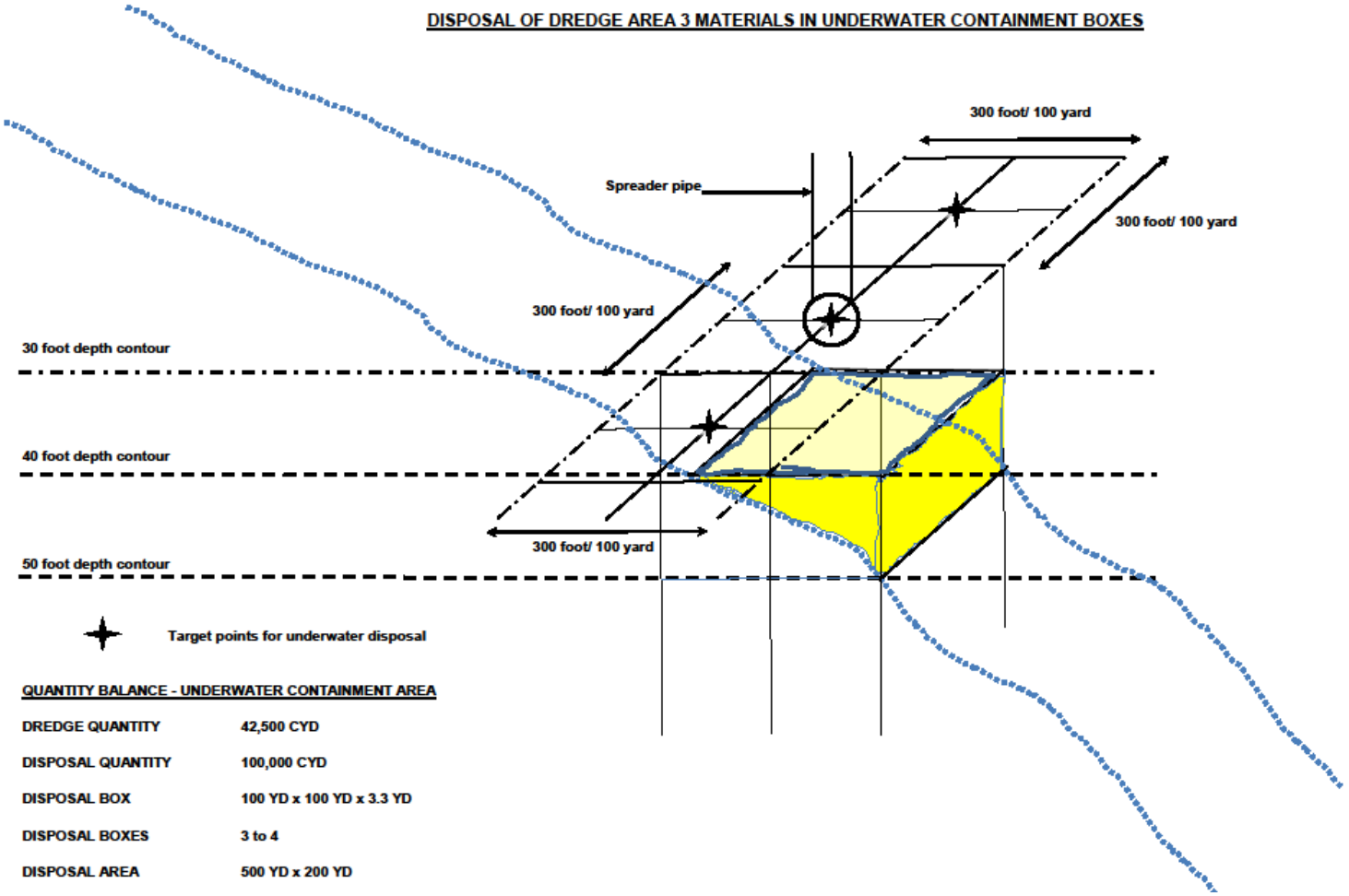
The controlled deposition of materials has been further clarified by the sketch “Disposal of Dredge Area 3 Materials in Underwater Containment Boxes”. Dimensions of those boxes are 100 yard by 100 yard, while for the entire dredge quantity an approx. 500 yard by 200 yard is required.



Dredging will be executed using floating pipeline only, with at the end of that pipeline a spreader pontoon with a vertical pipe protruding under the water surface. This spreader pontoon will be used to place the dredged materials into the pre-defined boxes to control the amount of materials placed at any one box location, and prevent overfilling/ creating high spots.



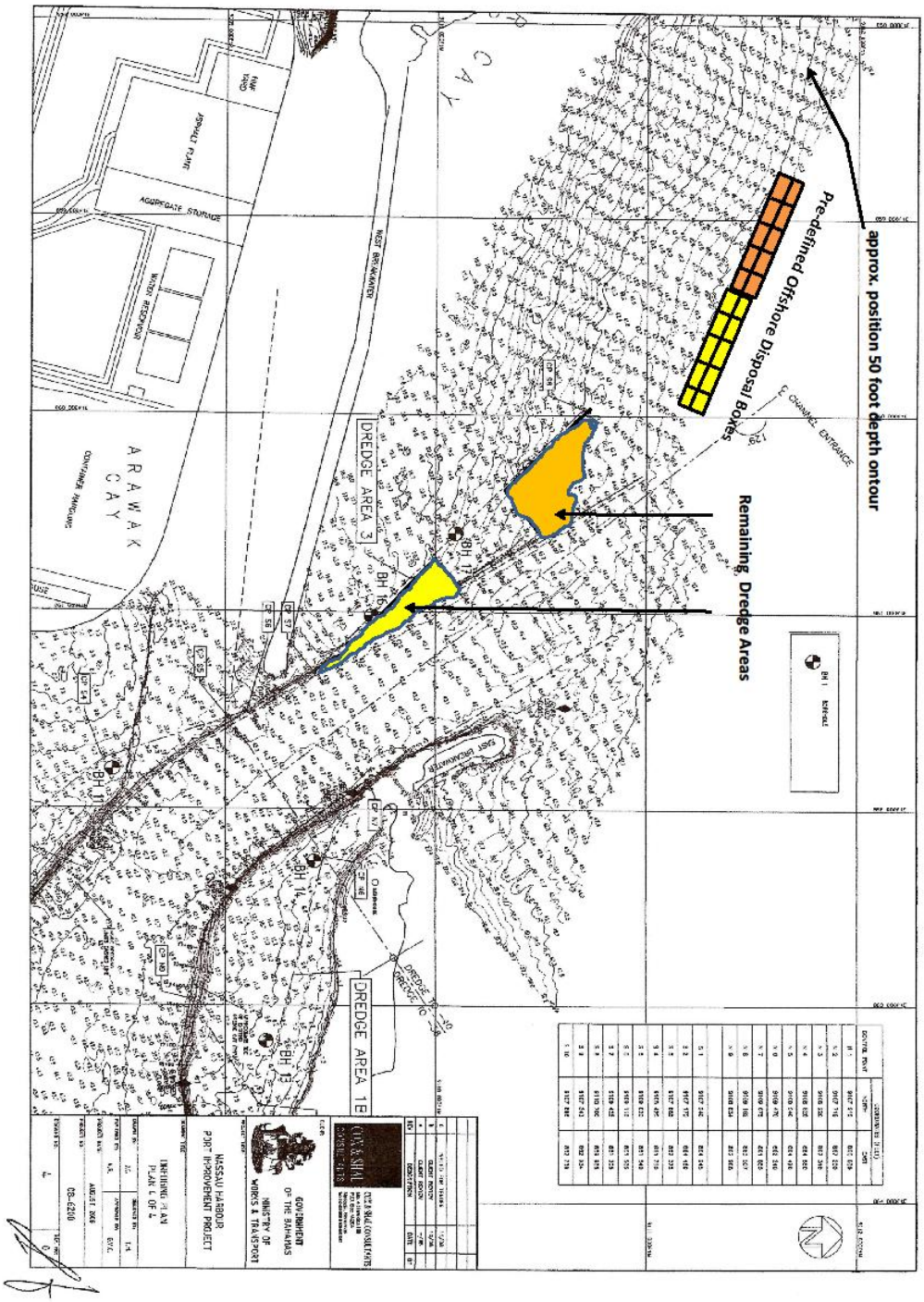
Spreader pontoon will be kept in position with either ALMA or BKM104, and moved from 1 pre-defined box to another box, using the available flexibility in the floating pipeline. When none of the auxiliary vessels is available, the spreader pontoon will be hooked up to the winch pontoon.



During daily 'dredging' progress hydrographic surveys, also the containment or disposal area pre-defined boxes will be surveyed, where the rocky gravel with cobbles is discharged. Any anomaly will be demarcated and corrected upon completion of the dredging works, or in case of hazard to shipping rectified immediately. Both ALMA and BKM104 are equipped with Dredgeview 2 positioning equipment by which the placement of materials is controlled.

In the worst case scenario the URSA will be used to rectify high spots above -40 foot depth contour.

Below you will find top view with dredge locations, dredge material containment area with pre-defined disposal boxes and -50 foot contour depth.



Sketch – Status Completion of Works Dredge Area 3 – demarcating Offshore Containment Area

7.5 LAND RECLAMATION AND DEWATERING

7.5.1 Methodologies

To prevent the outflow of water with fine sediments out of the landfill area into the coastal areas, all water and sediments are collected and contained at the end of the reclamation activities. Transport water with the remaining sediments will first flow into a settling channel. The settling channel will be excavated as wide and as deep as possible. Calm conditions allow for ideal settling conditions for the sediments. Thereafter the transport water will flow into a second basin or pit, where it is collected before being pumped approx. 3000 ft. offshore. A pumping station, consisting of three HK-700 pumps placed parallel, where from two operational, is installed and a submerged pipeline is placed on the sea bed to the -70 feet CD depth contour line.

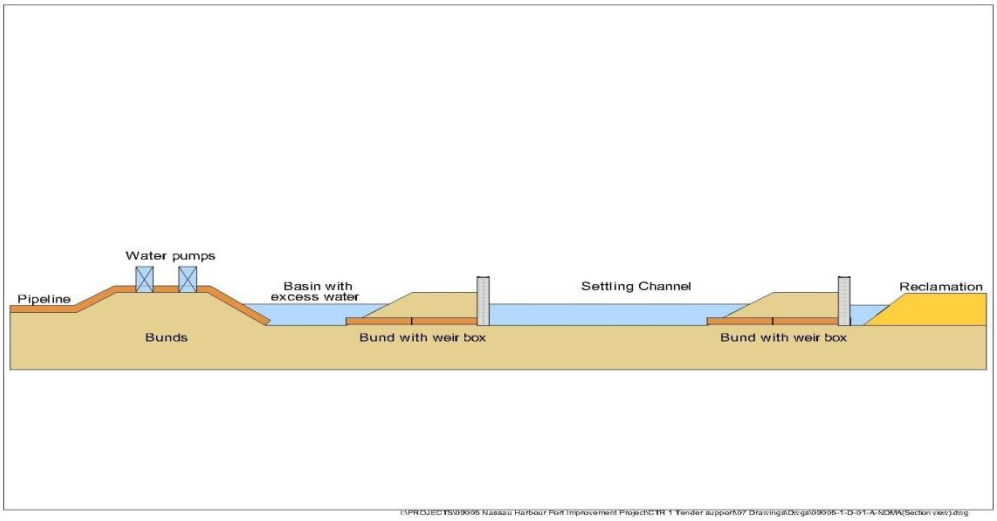


Figure 4 Sectional view of de-watering system – before crossing by pumps to -70 feet CD

The transport water is first contained within the settling channel and subsequently pumped to an offshore disposal area via the submerged pipeline. The whole system is therefore controlled and there is not any outflow from the landfill area into the sensitive shallow coastal areas. The only source of turbidity will be around the cutter head of the CSD on the seabed. A visual plume may be present at some times but will be limited to the direct surrounding of the dredging equipment. Based on previous experiences in Trinidad, this is a highly successful environmental mitigation method creating a closed system in the vicinity of an environmentally sensitive area.

This dewatering discharge pipeline will be placed on the seabed outside the working area of the dredging operations. The outflow of the pipeline is located on the slope near the -70 feet CD depth contour line. A density flow is expected to develop at the outflow depth of -70 feet CD and will transport the material to even deeper areas.

7.5.2 Limits of work area's

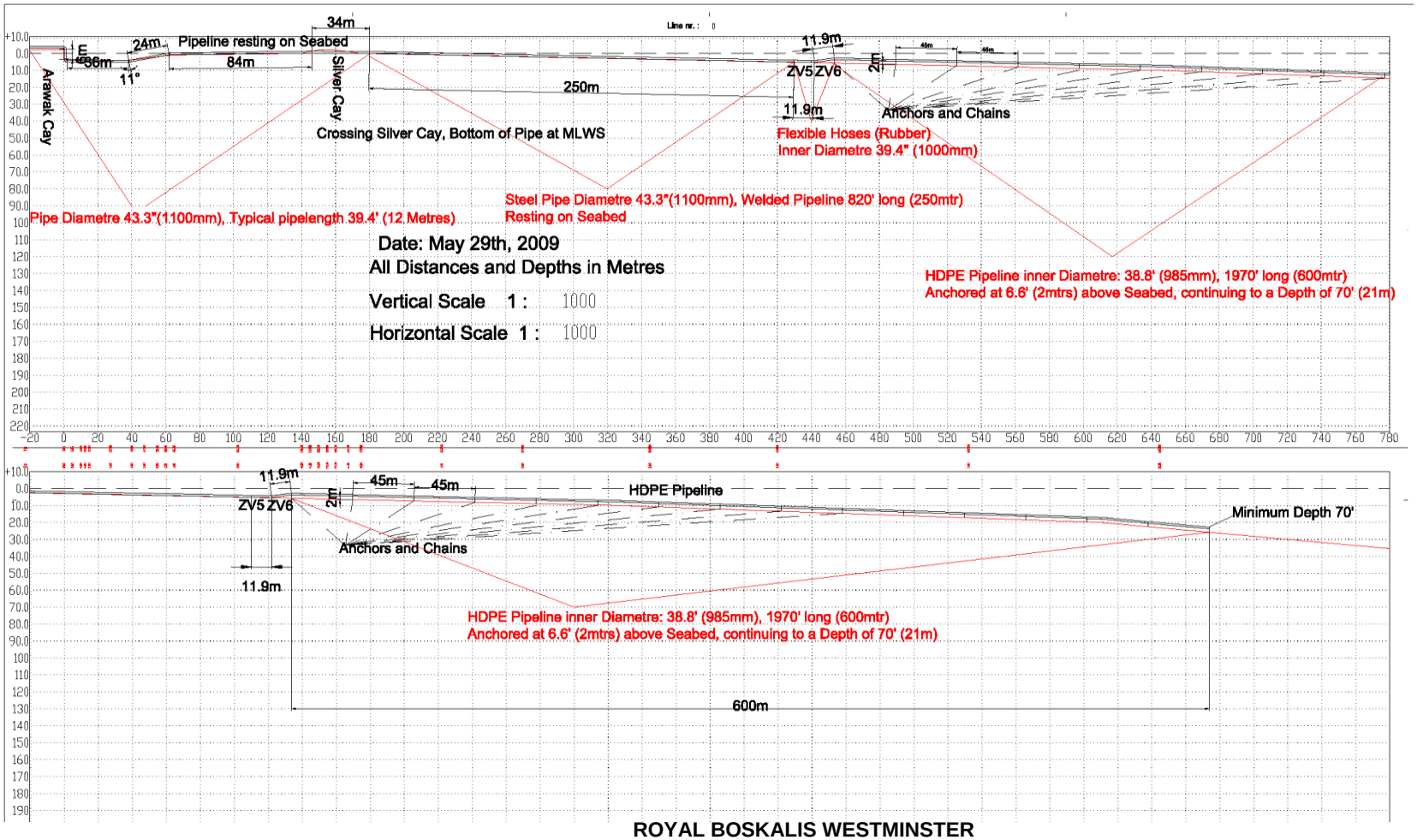
Below you will find a longitudinal view over the de-watering pipeline to be installed.

7.5.3 Demobilization & Reinstatement

After completion of the Dredging, Reclamation and Piling activities all construction equipment will be removed along with any temporary facilities, such as the sinker pipelines, floating pipelines, shore pipelines, piling templates, concrete shuttering etc.

All equipment, tools and surplus materials will be placed in the shipping containers and returned to the Nederland's or shipped to a future project. The various work sites will then be cleaned of any remaining debris and formally handed over to Engineer/Client.

Prior to commencement of the project topographical and photographic surveys were performed of the Arawak Cay and surrounding beaches. In case on any dispute these surveys will form the basis of the reinstatement work.



8. PILING OPERATIONS

8.1.1 Arawak Cay Extension

8.1.1.1 Piling installation method statement

The installation of the steel sheet piles will occur in two operations, one from the land and one from the water. American Bridge Bahamas will start installing sheet piles from the South Setting Point. Installation for the sheet piles from the North Setting Point will commence soon thereafter. At a point during the schedule of the project, American Bridge Bahamas will operate two sheet pile installation operations based on material availability and the project schedule.

The fabricated sheet pile template will allow for a total of ten pairs of sheet pile to be installed per set-up.

Included below is all information pertaining to the installation of the sheet pile extension.

Sheet pile Installation Preparation:

1. Survey control to be installed and verified prior to construction.
2. Verify elevation and location of existing concrete bulkhead.
3. Floating styrofoam buoys to be set out approximately every 300' to provide general reference to the sheet pile extension perimeter.
4. Clear and grub where required.
5. Layout centerline of the sheet pile for the template
6. Layout sheet pile cut-off elevation.

Template and Piling Installation

1. Rig, pick and set two (2) each 24" x 30' steel pipe pile.
2. Set template, verify elevation of template prior to installing anchor sheet pile.
3. Install first anchor steel sheet pile at setting point in pile template. (Sheet pile will be rigged using a self-release shackle)
4. Pick up vibratory hammer and drive anchor sheet pile to proposed grade.
5. Stand and thread nine (9) sheet pile starting at anchor sheet pile in template
6. Set and drive previously stood sheet piles to proposed cut off elevation
7. Remove template.
8. Reset template using one (1) each 24" x 30' steel pipe pile at the leading end and the last previously driven sheet pile. Once template set, verify elevation of template prior to installing additional sheet pile.
9. Stand, thread, and drive ten (10) additional sheet piles to proposed grade.
10. Remove template.
11. Repeat steps one (8) through ten (10) until all sheet piles have been installed.

8.1.1.2 Vessels and equipment

Land Operations

America 5299 Crane – 60 Ton Crane

ICE Model 416 Hydraulic Vibratory Driver / Extractor

Water Operations

America 7260 Crane – 100 Ton Crane

50ft by 150ft Barge

ICE Model 44 Hydraulic Vibratory Driver / Extractor

8.1.1.3 Environmental Considerations

The sheet pile operation will use the same environmental control measures as used for the construction of the earth working berms located within the perimeter of the sheet pile extension.

8.1.2 Mooring Dolphin Installation

8.1.2.1 Sheet piling installation method statement

The installation of the steel pipe piles for the Mooring Dolphin and the bridge Piers will use a floating pile jig and template.

The sequence of the construction for each structure is as follows:

1. Test Piles – North West Mooring Dolphin (total 6 piles)
2. Test Piles – North West Mooring Dolphin Bridge Pier (total 2 piles)
3. Production Piles – North West Mooring Dolphin (total 10 piles)
4. Production Piles - North West Mooring Dolphin Bridge Pier (total 2 piles)
5. Test Piles – South West Mooring Dolphin (total 6 piles)
6. Test Piles – South West Mooring Dolphin Bridge Pier (total 2 piles)
7. Production Piles – South West Mooring Dolphin (total 10 piles)
8. Production Piles - South West Mooring Dolphin Bridge Pier (total 2 piles)
9. Test Piles – North East Mooring Dolphin (total 6 piles)
10. Test Piles – North East Mooring Dolphin Bridge Pier (total 2 piles)
11. Production Piles – North East Mooring Dolphin (total 10 piles)
12. Production Piles - North East Mooring Dolphin Bridge Pier (total 2 piles)

Due to the cut-off and the tip elevation of each of the 36” and 20” pile, each pile has been ordered longer in case of damage to the top of the pile and maximum tip elevation prescribed in the specification. The equipment to be used is described in the section below.

Pipe Pile Installation Preparation:

- Survey control will be installed & verified prior to construction

- Verify elevation and location of existing concrete pier
- Clear and grub where required
- Layout centre line of the pipe for the template
- Layout pipe pile cut-off elevation.

Template and Piling installation:

- Rig, pick and set floating jig
- Set pile template, verify elevation of template prior to standing pipe pile
- Stand first test pile (Pipe pile will be rigged using a self-release shackle)
- Pick-up vibratory hammer and drive test pipe pile as deep as possible
- Attach Pile Driving Analyzer (PDA) sensors to the pipe pile in location determined by the PDA Engineer
- Stand diesel impact hammer and drive test pile
- Repeat steps 3-6 until test pile program for each structure is complete
- Upon completion of the test pile program for each structure, stand, set and drive each production pile for each structure respectively
- Cut off pile to proposed cutt off elevation
- Remove template
- Repeat steps 1-10 for each Moring Dolphin and Bridge Pier.

8.1.2.2 Concrete placement for Mooring Dolphin & Bridge pier

The concrete cap for the mooring dolphin will be placed in 2 stages:

- First stage – lower 2 feet
- Second stage – remaining 4 feet.

The concrete for the bridge pier will be installed in 2 stages:

- First stage – Cap
- Second stage – Walkway Pedestal

The formwork for the mooring dolphin will consist of 20kip friction collars, wood soffit and steel side panel. The anchor bolts for the bollards will be set in the second phase with a steel or wooden template to reduce any movement during concrete placement.

The formwork for the bridge pier will consist of the 20kip anchor brackets with a wooden soffit and steel form side panel.

Concrete will be transported from land on the carpenter barge to the mooring dolphin.

Formwork Installation preparation

1. Survey check to be performed before construction;
2. Layout elevation for friction collar;
3. Layout perimeter of formwork side panels;
4. Clean and fix any irregularities to face of the formwork.

Concrete Placement for Mooring Dolphin Cap (Phase 1)

- Install friction collar/anchor brackets
- Assemble formwork
- Install reinforcing steel
- Perform pre-pour inspection
- Contact field inspector prior to concrete placement for inspection
- Place and consolidate concrete in formwork
- Install curing blankets
- Allow concrete to cure (in accordance with specification)
- Repeat steps for each Mooring Dolphin Cap.

Concrete Placement for Mooring Dolphin Cap (Phase 2)

- Set anchor bolts for bollards
- Perform pre-pour inspection
- Contact field inspector prior to concrete placement for inspection
- Place and consolidate concrete in formwork, apply finish as per specification
- Install curing blankets
- Allow concrete to cure (in accordance with specification)
- Remove formwork for entire cap
- Repeat steps for each Mooring Dolphin Cap.

Concrete Placement for Bridge Pier (Phase 1)

- Install anchor brackets
- Assemble formwork
- Install reinforcing steel for cap and walkway pedestal
- Perform pre-pour inspection

- Contact field inspector prior to concrete placement for inspection
- Place and consolidate concrete in formwork, apply finish to concrete in accordance with specification (do not apply smooth finish in location of walkway pedestal)
- Install curing blankets
- Allow concrete to cure in accordance with specifications
- Repeat steps for each Bridge Pier Cap.

Concrete Placement for Bridge Pier (Phase 2)

- Assemble formwork
- Perform pre-pour inspection
- Contact field inspector prior to concrete placement for inspection
- Place and consolidate concrete in formwork, apply finish to concrete in accordance with specification
- Install curing blankets
- Allow concrete to cure in accordance with specifications
- Repeat steps for each Bridge Pier Cap.

8.1.2.3 Vessels and equipment

America 9299 Crane – 230 ton crane, Boom length -160 ft

Barge 150 x 50 ft.

ICE model 44 Hydraulic Vibratory Driver / Extractor

APE model D46-42 single acting impact hammer with 80 ft. Swing leads.

5 cubic yard Concrete bucket

8.1.2.4 Environmental Considerations

Turbidity devices will surround each pipe pile operation, as and if required.

9. SILT SCREENS (TURBIDITY BARRIERS)

9.1.1 General Principals

The purpose of silt screens is to reduce the area where suspended sediments are visible. This effect is achieved by creating a screen of geo textile that is suspended from floaters at the water surface down to a specific water depth.

The water containing suspended sediments pushes against the screen by ambient (low speed) currents. Once the current reaches the screen, gravity takes over and forces the water mass with sediment particles towards the seabed where settling may take place more rapidly rather than be transported farther afield by the currents (see figure 5). The geotextile used for the screens are so densely woven that they do not allow free passage of water.

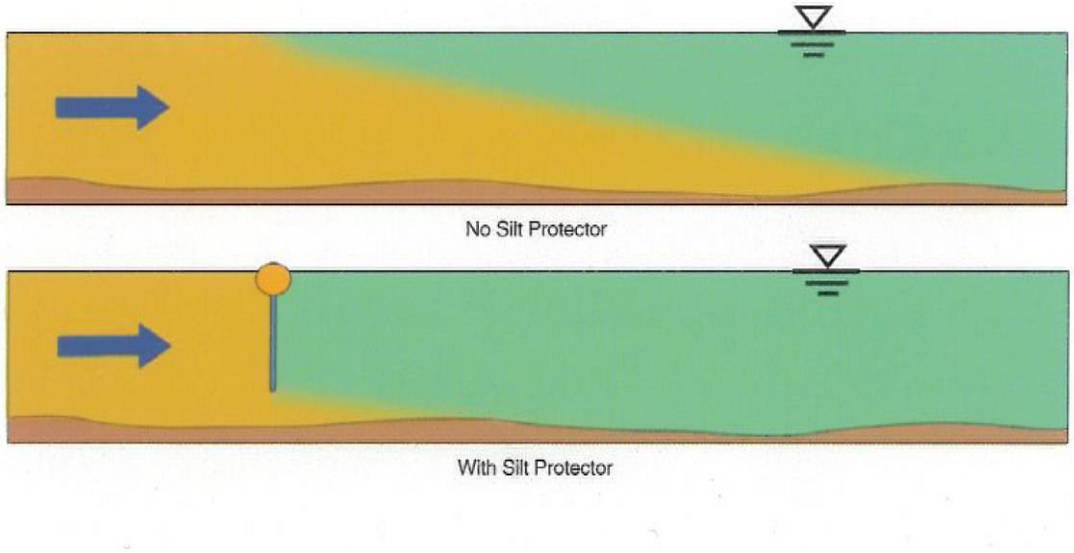


Figure 5 - Principle of operation of silt screens

The silt screen does not indefinitely contain turbid water but instead controls the dispersion of turbid water by diverting the flow under the curtain, thereby minimizing the turbidity in upper layers of the water column outside the silt screen.

For this reason, silt screens cannot be applied in high currents because the screen will be forced up to the surface and silts will easily pass underneath. This may also occur when the screen is installed too close to the bottom.

The floats from which the geotextile curtain is suspended limits the wave conditions under which silt screens can be installed.

9.1.2 Use of silt screen and turbidity sources

The potential turbidity sources thus cover the whole water column from bed level to water surface. However the CSD dredging method has been chosen instead of other dredging techniques due to the fact that the CSD is in principal stationary and therefore causes less turbidity. The turbidity can further be decreased based on the experience of the dredge master and careful maneuvering of cutter head, whereby turbidity sources can be significantly reduced.

The use of the silt screen is dependent on the local authority's requirements as described in the Environmental Impact Assessments (d.d. 20 November 2008 for Nassau Harbour and d.d. 16 April 2009 for the Storage area on Arawak Cay) from Blue Engineering and in conjunction with the monitoring plan, to be approved by the ENGINEER and Governmental Environmental Authorities (BEST).

Based on the recommendations in the project EIA´s, CONTRACTOR will deploy silt screens during the dredging work performed by the CSD "URSA" in the Nassau Harbour zone. A minimum of two silt screens will be deployed as follows:

1. Silt Screen 1 – 1.600' (488 m) long located adjacent to south west side of the Arawak Cay.
2. Silt Screen 2 – 525' (160 m) long located in front of the Colonial Hilton Hotel.

The height of these silt screens will vary to match the water depth at the pre-determined locations.

9.1.3 Silt screen specifications

The screens to be installed in Nassau Harbour exist of a floater, screen and ballast. Silt screen sections have a length of 65.6 ft (20m). Each section consists of a floating bag. The floaters are made of Styrofoam, have a diameter of 11.8 inches (30cm) and a length of 3.3 ft (1m). The floaters are inserted in a bag which is closed by means of a metal strip which is bolted onto the openings.

Figure 6 – "Geolon silt screen" with bolted connection to the Styrofoam float

Under the floater the actual screen is installed. The screen is made of “Geolon” (synthetic textile) sheet and is attached to the floater with bolts for a secure connection.

On the bottom of the slit screen a steel chain is attached for ballast and to keep the screen vertical in the water. This chain has an approximate weight 22–33 lbs/ft (10-15 kg/m). The chain is connected to the screen by means of rubber securing straps.

For mooring the silt screen to its specific location, up to 6.5 ton concrete box anchors approx. 6x3x4 ft (2x1.2x1 m) will be installed every 260–525 ft (80m to 160m) depending on local conditions. A box anchor is a concrete block weighing approximately 6.5 tons. The anchor will be installed at a distance of approximately 165 ft (50m) from the silt screen; the exact distance is dependent on local (wind & wave) conditions. The length of the wires is to ensure there is sufficient stretch in the screen to minimize shock loads from waves in the surf zone, thus damaging the screen.

The silt screen will be provided in sections of 65.6 ft (20 m) long. The height of the silt screen varies depending on the location and has been specially fabricated to suit the (surveyed) water depth. The total length of the silt screen to be used as “beach barrier” in The Bahamas is 2.125 foot.

The exact amount of turbidity caused by the dredging activities and efficiency of the silt screen will be determined by periodical monitoring by CONTRACTOR as part of the Environmental Monitoring Program (section 10 of this EMP) and in line with the requirements set-out in 8.6 of the EIA.

9.1.4 Effectiveness of Silt Screens

The effectiveness of silt screens is limited due to site conditions: small currents v < 0.65 ft/s. (0.2 m/s) and low wave conditions (H < 4.9 ft. (1.5m)) and a maximum depth of 32 ft. (10 m). The sediments require sufficient time to settle, thus the screens have to remain in place until the work is completed. Careless handling of the screen may completely negate the advantage of its use.

In Nassau Harbour, the silt screens will be installed in water depths varying from 3 – 8 ft. (0.9-2.5m), which is very close to the surf zone. The effectiveness of silt screens is therefore expected to be reduced especially when there are strong winds from the northerly direction.

During winds from the northerly direction, the fine material on the surface of the seabed, (in these shallow waters), is stirred-up and sand from the beaches is blown into the sea turning the water very turbid, as can be seen in the photographs (figures 7 and 8), taken during the visit to Nassau in January 2009.


Figure 7 & 8 – Photographs taken from the beach during high winds from Northerly direction, Jan 2009

Summary: Advantages and Disadvantages of using Silt Screens

Advantages

- the silt-screen will have a visual influence on the dispersion of the turbidity;
- the positions of the silt-screens will be visible at all times;
- the silt screen will be independent from the dredging unit and will be anchored by means of concrete blocks
- by choosing to move the dredged material from the dredge to the reclamation area through a pipeline rather than by barge transport, the release of sediments at the dredge is reduced to a minimum.

Disadvantages

- considerable risk of silt-screen being destroyed during Tropical Storms and Hurricanes;
- due to the shallow water-depths ranging from 0 to 8 ft. (0 – 2.5 m) the effect on the reduced spreading of fine sediment, as a result of acceleration of settlement and reduced distance required, will be limited for an area with water-depth of a few meters.

Figure 9 - Photograph of deployment of the Silt Screen on a previous project

10. ENVIRONMENTAL MONITORING

10.1 TURBIDITY MONITORING

Turbidity levels will be monitored near the dredge and near the discharge location. Based on Florida Statutes, a mixing zone has been defined by the Client. This mixing zone is a limited, defined region adjacent to a dredge or point of discharge in which water quality may be temporarily degraded.

Outside this mixing zone, turbidity may not be higher than 29NTU above background levels. Existing background levels will be determined / checked by CONTRACTOR prior to dredging and discharge activities commencing. These background levels will be determined during cruise ship and other vessel movements, normal and adverse weather conditions.

Turbidity measurements will be taken in-situ in real time using an optical backscatter sensor. Therefore no water samples will be collected and stored. Storing turbidity samples and analyzing them at a later date, (especially as long as 2 months later as originally proposed in the EIA), leads to changes in the sediment characteristics and therefore different analysis results. Changes in sediment characteristics are caused by biological and chemical processes, which change the size and shape of sediment aggregates (i.e. flocs). Due to settling (which occurs when the samples are stored), and subsequently consolidation, the properties of flocs further change over time. Both biological and physical processes are irreversible.

These changing properties yield a significantly different behaviour concerning the backscattering of light. This indicates that turbidity levels measured some time after the water sample was collected may be significantly higher or lower than those encountered in-situ in real time.

The CONTRACTOR in-situ turbidity sensor that will be used (YSI 6136 Turbidity sensor) has been verified through the US EPA's Environmental Technology Verification Program, and has shown performance equivalent to the HACH 2100AN, which is an EPA approved laboratory turbidity meter (see attachment 16.6).

10.1.1 Monitoring Locations

For this project, two 3000 ft (1000m) long mixing zones in the vicinity of the dredge and the discharge point have been defined (Figure 10). These mixing zones shift from one side of the operation to the other, depending on the current direction. In figure 10, it is assumed that the current runs from west to east.

Similar to Florida projects, the mixing zone extends no further than 1000 ft (300m) offshore.

Figure 10 - Turbidity Mixing Zones for various dredging and discharge locations. Current runs west to east.

Turbidity measurements will be taken at both the Dredge Mixing Zone and the Discharge Mixing Zone. Near these zones, the following monitoring 'stations' are defined:

- Background 1, at least 2,000ft upstream from the dredge and clearly outside the influence of any turbidity generated by the dredging works or discharge activities
- Background 2, at least 2,000ft upstream from the discharge point and clearly outside the influence of any turbidity generated by the dredging works or discharge activities.
- Compliance 1, no more than 1,000ft offshore from the mouth of the deep-water entrance to the harbour. Compliance 1 will be stationary at this point while dredging is ongoing within the harbour. When dredging proceeds offshore, Compliance 1 will move with the dredging towards the ocean, always staying 1000ft offshore from the dredge.
- Compliance 2, no more than 3,000ft downstream from the dredge. Compliance 2 continuously moves with the dredging activities.
- Compliance 3, no more than 1,000ft offshore from the discharge point.
- Compliance 4, no more than 3,000ft in the direction of the deep-water entrance to the harbour.

At the Compliance stations, turbidity readings will be taken within the densest portion of any visible turbidity plume / 3 ft below the surface.

10.1.2 Limits and response to turbidity events

Turbidity levels outside the mixing zones should stay below existing background levels + 29NTU or daily background levels + 29NTU, whichever is greater.

Existing background levels will be determined by CONTRACTOR's Environmental Engineer before dredging works start, during cruise ship or other vessel movements, during normal and adverse weather conditions. The proposed background level will be the average of the aforementioned values.

Daily background levels are those measured during dredging activities at stations Background 1 and Background 2.

For the purpose of managing the dredging and discharging activities, a warning level will be determined that is lower than the maximum allowable limit (e.g. background levels + 20NTU).

When this warning level is exceeded at any of the Compliance stations, the Project Manager is informed and dredging and discharge activities may be adjusted to prevent exceeding of the maximum allowable limit.

10.1.3 Frequency & Time

The frequency of turbidity monitoring will be as follows at all locations:

- First 10 days of operations: every 6 daytime hours (twice between 7am and 7pm)
- For the remaining duration of the dredging works: in principal once a day
- For ABB piling activities: twice a day

The frequency of the Turbidity Monitoring can be increased should site conditions require this and/or in consultation the Engineer/Client.

For as far as reasonably possible the Turbidity Monitoring will be performed at the same time every day. This will then automatically include changing tides when the most natural disturbance occurs.

10.1.4 Work Method and Equipment

The following work method will be adopted to take in-situ turbidity readings at the 6 turbidity monitoring stations:

1. Obtain GPS coordinates of dredge/discharge point;
2. Sail to 1,000ft or 3,000ft distance from coordinates;
3. Look for visible turbidity plume;
4. Position monitoring vessel in densest portion of any visible plume;
5. Lower turbidity sensor to 3 ft (1m) from water surface;
6. Wait 2 minutes to allow sensor to adjust to water temperature;
7. Start turbidity reading for a minimum of 30 seconds, readings at 1 second interval. The measurements taken at 3 ft (1m) below the water surface are averaged and reported in the daily reports (see attachment 16.7);

8. Stop turbidity reading;
9. Recover turbidity sensor;
10. Move to next location.

To take in-situ turbidity readings, the following equipment will be used (see figure 11):

- Vessel with DGPS positioning
- YSI/D&A direct reading optical backscatter (OBS) turbidity sensor
- Computer for sensor communication.

The YSI 6000 series turbidity sensor (or equivalent) is a direct reading instrument, which will be used to measure turbidity in real time (see attachment 16.6 for specifications). The YSI turbidity sensor measures turbidity (NTU) by measuring the intensity of transmitted light that is being scattered back by particles in the water.

Cleaning and calibration of the YSI turbidity sensor will be performed in accordance with the manufacturer's instructions to ensure accurate performance.

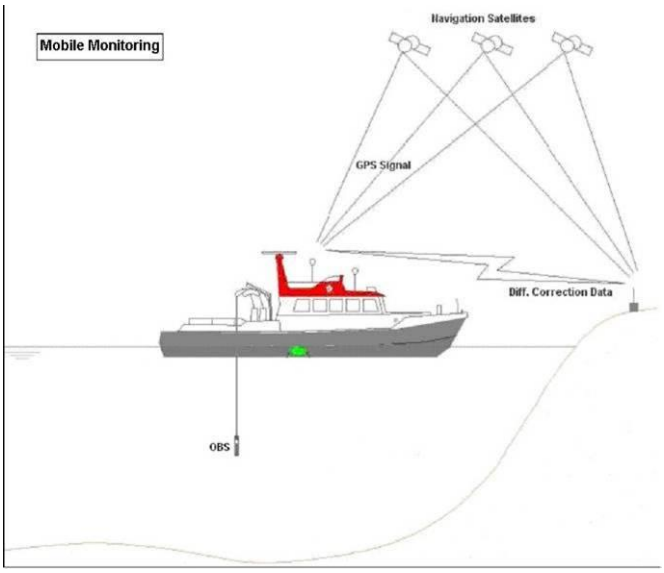


Figure 11 - Schematic layout of monitoring

For Turbidity Monitoring in near shore and shallow waters the "Viper" (American Bridge vessel) will be used. This vessel has a shallow draft and was used during the Trail Turbidity Monitoing by Sanders Beach. This vessel is also equipped with a portable GPS system. The method for monitoring will be the same as detailed above.

10.1.5 Personnel

The manning of the Environmental Monitoring Team will in principle consist of the following technical personnel:

- 1 Environmental Engineer from Hydronamic BV for the first 10 days of operation;
- 1 Skipper for the monitoring vessel;
- 1 Deckhand for the monitoring vessel.

During start-up, an Electronics Engineer will be required to install the equipment on the monitoring vessel.

Environmental Engineer

An Environmental Engineer from Hydronamic BV will execute the Environmental Monitoring during the first 10 days of operation. He/she is responsible for the setting-up and calibration of the turbidity monitoring equipment, data reporting & storage program, performing and agreeing background levels with the ENGINEER for the various monitoring stations, training the Project QA/HSE Manager and Chief Surveyor in the use of the Monitoring equipment.

After the first 10 days of operation, monitoring will be performed by the Project QA/HSE Manager in combination with the Chief Surveyor.

Skipper Monitoring Vessel

The Skipper is responsible for operating the monitoring vessel in a safe and reliable way. He is responsible for the health and safety of all people on board the monitoring vessel. He is also responsible for proper maintenance of the monitoring vessel.

Deckhand Monitoring Vessel

The deckhand assists the Skipper with mooring of the vessel and will be the sole person for handling of the mooring lines and/or anchor. He/she assists the Skipper in ensuring safe (dis)embarkation of all people to and from the vessel. He/she assists the Skipper in maintaining the monitoring vessel in good and tidy condition or where necessary. He/she assists the Environmental Engineer where necessary with the monitoring activities.

10.1.6 Reporting

Daily and weekly monitoring reports will be submitted to the Engineer the day after the measurements are taken. These reports will contain, as a minimum, the following information for each monitoring station:

- Date and time the measurement were taken;
- Coordinates where the measurements were taken;
- Distance from the background station;
- Average turbidity level measured at 3 ft (1m) below water surface during 30-60 seconds, with readings being taken at a 1 second interval;
- Weather conditions;
- Tidal stage and current direction at the time of turbidity measurements;
- Wind direction and velocity.

In addition to this information, the locations of the dredge and the discharge point on that day are given.

On days when turbidity monitoring did not take place, a brief statement will be given in the daily report to explain the reason that no turbidity monitoring was undertaken (i.e. no dredging, or monitoring vessel could not operate due to high waves/tropical storm).

The weekly monitoring report will contain a summary of the daily reports as per Attachment 16.7 and will be submitted to the Engineer.

11. HAZARD IDENTIFICATION AND RISK ASSESSMENT

11.1 GENERAL

Risks are the probability that hazards lead to eventual losses. These losses can be personal injuries, health problems caused directly by the work, damage to assets, environmental spills, damage to reputation, etc. By performing a risk assessment, these risks are identified and categorized in a systematic manner. The execution of a Risk Assessment is obligatory for all BKI projects. The Risk Assessment shall contain the identification of hazards, assessment of hazards and the recommended control measures. For the Nassau Harbour Port Improvement Project the CONTRACTOR will prior to commencement of the work perform a risk assessment.

These assessments shall include the following, as a minimum:

- All routine and non-routine activities;
- Activities relating to the access to the Nassau Port including the transportation of equipment from the CONTRACTOR and his subcontractors, suppliers and visitors;
- All temporary facilities delivered by CONTRACTOR and/or other parties;
- An assessment of the Environmental risks, related to the Dredging and Reclamation operations;
- An assessment of the project specific Health and Safety risks in respect to the various activities performed by CONTRACTOR and integrity of the equipment and marine spread.
- Adverse weather conditions, such as: Hurricane and Tropical storms etc.

11.2 PROJECT RISK ASSESSMENT METHODOLOGY

The methodology used to prepare the Environmental Risk Assessment is identical to that in section 7 of the H&S Management Plan, Document no: 044.1003-H&S-PLN-002

11.3 PROJECT RISK ASSESSMENT REVIEW AND COMMUNICATION

Once prepared and agreed between CONTRACTOR and ENGINEER, the Environmental HIRA will be periodically reviewed by the Project QA/HSE Manager (for the CONTRACTOR´s scope of work) at least every 3 months or whenever new activities commence, legal requirements change or operations are modified. The contents of the risk assessment will be discussed with all employees during the project QA/HSE induction training and/or during toolbox meetings.

11.4 GENERIC ENVIRONMENTAL HAZARD IDENTIFICATION

Based on the aforementioned, CONTRACTOR has prepared a generic Environmental Hazard Identification and Effect Register for the Dredging and Reclamation work. This has been included in document number: 044.10003-HIRA-ENV-006.

During the CONTRACTOR HIRA meeting all environmental effects for each phase of the Nassau Harbour Port Improvement Project for Dredging and Reclamation have been discussed. Specifically for the CONTRACTOR´s works the following critical phases have been determined:

- Mobilization, Site and Office Installation;
- Civil works;
- Port Dredging and Reclamation;
- Sheet Piling works;
- Installation of Mooring Dolphins;
- Site Reinstatement and Demobilization.

See Attachment 16.9 Generic Environmental Hazard Identification for the Environmental Risk Assessment performed for Nassau Harbour Port Improvement Project – Document no. 044-10003-HIRA-ENV-006.

11.5 JOB HAZARD ANALYSIS

Should activities or situations arise during the execution of the SOW that are not covered by the project HIRA, CONTRACTOR will either revise the project HIRA or alternatively develop specific Job Hazard Analysis sheets to effectively manage for these activities.

12. EMERGENCY SPILL RESPONSE PLAN

12.1 ON & OFFSHORE EMERGENCY RESPONSE PLAN

Specifically for the Nassau Harbour Port Improvement Project an Emergency Response Plan has been produced (Document number: 044.10003-ERP-PLN-004) which defines the

communication lines between all parties concerned in the event of emergencies involving CONTRACTOR´s employees and/or plant & equipment and the various interfaces with SUBCONTRACTOR´s, Client and Local Authorities. This ERP is supplemented by the information contained in section 12.2 Spill Response Procedure.

12.2 SPILL RESPONSE PROCEDURE

12.2.1 Scope and Principle

The scope of Spill Response Procedure (SRP) is to minimise the risk of spillages during the execution of CONTRACTOR´s activities in the Port of Nassau in addition to providing information about equipment and materials (contingency equipment) to undertake appropriate immediate remedial actions.
The SRP has been developed in accordance with the relevant Environmental regulations as well as international standards such as MARPOL and other IMO publications.

The specific tasks and responsibilities of the Project Management Team in respect to Emergency and Response Spill are defined in document no: 044.10003-ERP-PLN-004 – Emergency Response Procedure.

12.2.2 Spill Emergencies and field of applicability

This section provides guidance and advice on the duties that are to be performed by onshore and offshore personnel who have been allocated specific roles to perform in the event of a Spill Emergency.

A high degree of preparedness shall be maintained at all times in the Harbour of Nassau and on the Arawak Cay, in order to respond quickly and efficiently to control any Spill emergency situation, this will be ensured through training, Emergency drills, personnel qualifications and job descriptions.

This Spill Response Procedure has been prepared in order to safeguard the Environment and shall be applied to the following operational sites and/or activities:

- All CONTRACTOR and SUBCONTRACTOR activities;
- CONTRACTOR and SUBCONTRACTOR personnel movements to/from the operational sites;
- Port operations in Nassau during mobilization and demobilization of equipment;
- All the vessels/equipment used by CONTRACTOR and SUBCONTRACTOR´s during all operations for dredging, piling, reclamation and installation of Dolphins;
- Interfaces with third parties during CONTRACTOR's activities.

CONTRACTOR recognizes the importance of marine operations and the necessity of implementing all possible reasonable measures to avoid pollution and any contamination. Based on this, CONTRACTOR and SUBCONTRACTOR´s are aiming for zero spills through

environmental safeguarding and performing best practices during their onshore and offshore operations.

The basic philosophy in planning the spill prevention and response measures can be summarized into five levels:

1st Spill prevention;

2nd Minimize the volume of any potential spill;

3rd Minimize the environmental effect of spills;

4th Contingency planning in the event of a spill;

5th Corrective actions.

12.2.3 Categorization of Spill emergencies

According to the scenario, a Spill shall be classified as Major or Minor.

MINOR SPILL: an unplanned event that does not escalate into hazard to life, serious damage to property, without permanent impact on the Environment that can be managed by the onboard Emergency Team and requires no external support.

MAJOR SPILL: an uncontrolled and unplanned event that escalates into hazard to life, damage to property or has an impact on the Environment and does require external assistance.

12.2.4 Spill Response

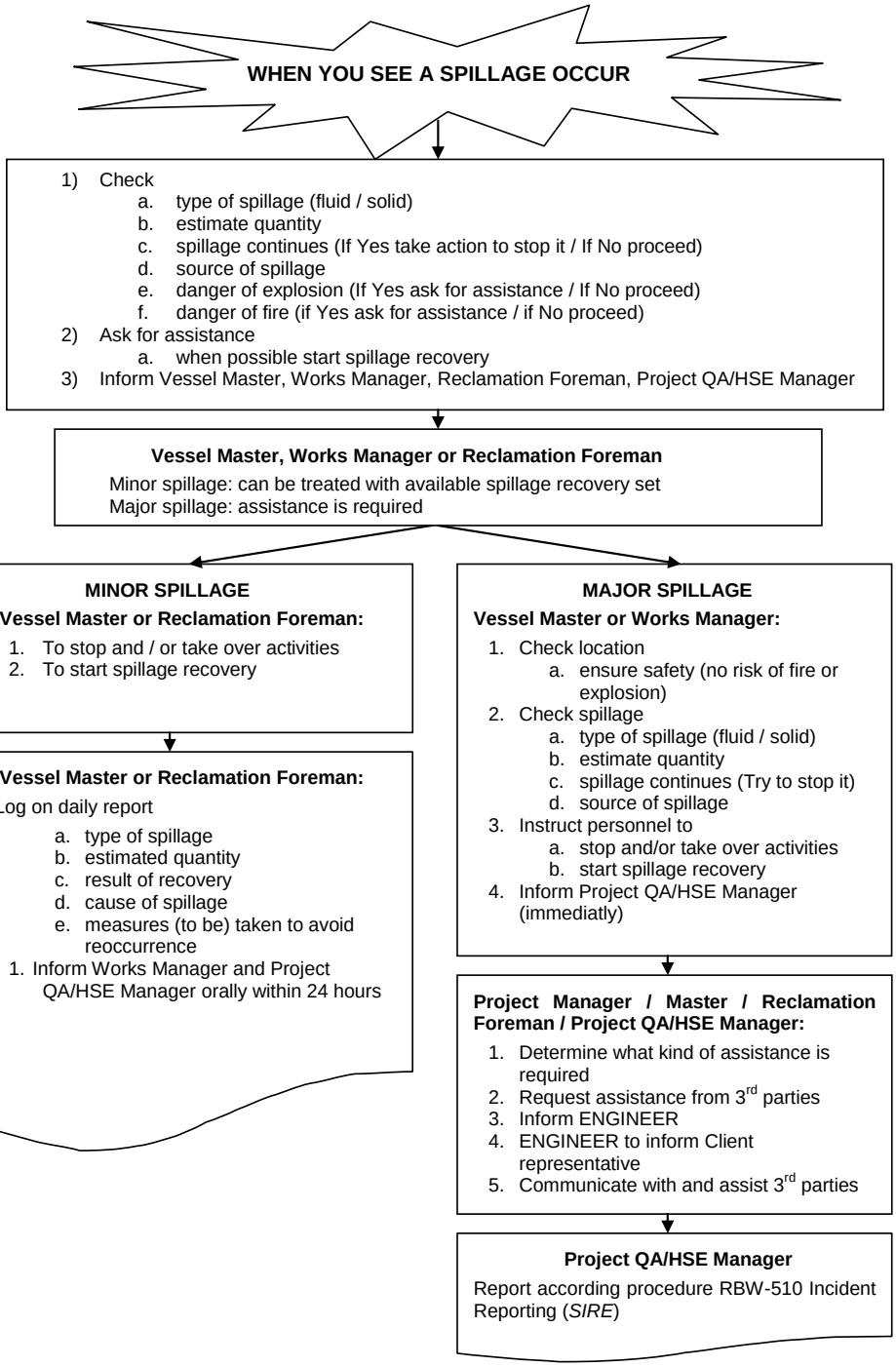
A Spill Response situation occurs whenever one of the following questions is answered with **"**yes**"**:

- Has serious Environmental damage occurred or is it likely to occur?
- Is the situation (potentially) sensitive to the press and/or public opinion?
- Has serious damage to equipment occurred or is it likely to occur?

The following Spill Response measures will be implemented to prevent or mitigate escalation in the event of a possible Spill (SOPEP, MARPOL).

12.2.5 SPILL RESPONSE procedure (Arawak Cay – Nassau Harbour)

The Spill Response Procedure describes what to do when you see a spillage occur.



12.2.6 Communication Onshore and Offshore Emergency Plan

The Onshore and Offshore Emergency Plan (OSEP) Attachment 13.1 in document 044.10003-ERP-PLN-004, defines the communication lines between the parties concerned in the event of an Emergency and/or Spill involving CONTRACTOR´s employees and/or equipment during all of their activities.

The Project Manager is responsible that Emergency arrangements are made and communication lines are established with relevant institutions and authorities, such as:

- Recognized doctor and dentist;
- Local Hospital or Medical Treatment Facility (Doctors Hospital);
- Police;
- Fire-brigade;
- Air Ambulance;
- Other relevant local authorities (i.e. Port Control, Immigration, Expat Consulate etc.);
- SUBCONTRACTOR staff;

The Project Manager is to ensure that employees on the project are aware of the emergency telephone numbers, addresses, and response procedures. Furthermore he ensures, either via the local agent or direct, that the local authorities are made aware of the existence of the project.

A list of important telephone numbers to be contacted in the event of an Emergency or Spill has been provided as Attachment 16.8 of this EMP and will be updated as and when required.

This list will be distributed to all work sites and posted at strategic locations on the project.

12.2.7 Offshore Emergency

A spill caused by the CSD offshore is covered by the Vessels ISM or SMS. The systems and all procedures are available in Q-Aid that are on board of all CONTRACTOR´s marine spread. Q-Aid is the Corporate QA/HSE system of SUBCONTRACTOR. All HSE procedures and documents available in this program can be found under the tab HSE.

12.2.8 Crisis Centre

Should the necessity arise a Crisis Centre will be established in the CONTRACTOR´s office in Nassau. The Project Manager is responsible for coordinating the various activities during a crisis; however he will be supported in this roll by the Project QA/HSE Manager. All resources will be available such as telephone lines, mobile phones, VHF radio, fax, E-mail, radio etc.

12.3 EMERGENCY RESPONSE EQUIPMENT

In the unlikely eventuality there is a spill, on the Arawak Cay and on each vessel in the CONTRACTOR´s marine spread there will be Environmental Emergency Response kits.

These spill kits will consist of the following listed materials (or similar):

- Absorption pads (43 x 48 cm)
- Absorption rolls (96 cm x 40 m)
- Spill drum for contaminated materials
- Absorption socks (7.6 cm x 1.2 m)
- Sack of absorption grit
- Plastic foil

Typical absorption materials in the SUBCONTRACTOR Emergency Spill kit

12.3.1 Disposal of contaminated materials

Once an eventual spill has been cleaned-up all contaminated materials will be packed in plastic sacks and / or foil and placed in the disposal drum. This drum will be transported to an eventual waste recycling / treatment location by a BEST approved waste transportation company, (Bahamas Waste).

13. MAINTENANCE OF VESSELS, PLANT & EQUIPMENT

CONTRACTOR takes the maintenance of equipment very seriously and this forms the basis of the functioning of the preventive maintenance program described in the Plant Management System. The policy is defined in document EQP-202. It is the responsibility of the head of the CTD (Central Technical Department) to ensure that the policy is correclty defined. The Project Managers and Vessels Masters are responsible for the correct implementation of the policy.

Within Boskalis preventive maintenance is defined as: a schedule of planned maintenance activities aimed at the prevention of breakdowns and failures. The primary goal of CONTRACTOR'S preventive maintenance program is to prevent the failure of equipment before it actually occurs, thus avoiding downtime and impacts on the health, safety & environment. It is designed to preserve and enhance equipment reliability by replacing worn components before they actually fail. CONTRACTOR's preventive maintenance activities include equipment checks, partial or complete overhauls at specified periods, oil changes, lubrication and so on. In addition, the CONTRACTOR's onboard engineers and mechanics can record equipment deterioration so they know when to replace or repair worn parts before they cause system failure and contaminate the Environment.

Long-term benefits of preventive maintenance include:

- Improved system reliability;
- Decreased cost of replacement;
- Decreased system downtime;
- Better spares inventory management;
- Protection of the Environment.

All vessels, plant and equipment being utilized on the Nassau Harbour Port Improvement Project have undergone major overhauls/maintenance before arriving on site. The URSA was in Dry Dock in Durban in 2008 and had the cutter gearbox refurbished in Singapore before sailing to the Bahamas. The BKM 104 (Multicat) is a new vessel and was commissioned and had her first service before leaving the Netherlands in July. The ALMA was serviced in Jamaica in April 2009. Specific information regarding the maintenance and overhauls are recorded in the RBK "Maximo System".

All land based equipment (excavators, front end loaders, pumps, bulldozers) were overhauled and had major oil changes before departing from the Netherlands.

Based on the aforementioned the only maintenance work that has to be preformed during the execution of the project is routine oil changes, replacement of filters, etc. and corrective/breakdown maintenance. The aforementioned scheduled maintenance is based on the actual running hours of each individual piece of plant & equipment and is therefore too comprehensive to detail in this document.

In general all land based equipment undergoes minor maintenance every 250 running hours with a major oil change every 1000 -1250 hours.

For the URSA, BKM 104 and ALMA routine maintenance is managed by “Work Orders” created in the “Maximo system”.

For greasing the spud carriage, ladder, side sheaves, cutter head, gear box, engine or any other item that comes into contact with seawater a Bio Grease “TrustLube” is used. This product is anhydrous calcium grease based on biodegradable synthetic esters with additives and is classified as non-hazardous according to dangerous preparation directive (1999/45/EC). The principal constituents are biodegradable.

In order to prevent over lubricating the URSA has a computer controlled lubricating system, injecting only the required quantity of lubricant. Using this system, records show this has reduced the amount of lubricant used by 66%.

Material Safety Data Sheets for all fuel oils and greasing products used are available onboard the vessels and in the maintenance workshop.

For the correct disposal of all waste materials a service contract has been signed with Bahamas Waste (“BEST” approved contractor). All waste oil will be place in drums and transported to a waste oil depot on the island. All other materials will be placed in waste containers provided by Bahamas Waste and disposed of in approved landfill sites. See also section 14 – Waste Management Plan.

14. WASTE MANAGEMENT PLAN

This section of the EMP is designed to ensure that effective waste management is undertaken on the Nassau Harbour Port Improvement Project, which will ensure compliance with all waste management legislation and to introduce project waste minimization objectives, where practical.

CONTRACTOR has the overall responsibility for managing waste on the work sites in the Harbour of Nassau and on the Arawak Cay. CONTRACTOR and SUBCONTRACTOR employees will be responsible for ensuring they minimize the amount of waste produced by their activities and are expected to fully co-operate with CONTRACTOR / Client requirements for waste minimization.

14.1 SCOPE AND PURPOSE

The scope of this waste management plan covers the actions to be taken by all CONTRACTOR´s project personnel for the management and correct / safe disposal of waste materials generated during dredging, reclamation, piling and Dolphin installation activities.
The management of the effluent discharges (e.g. black wastewater, bilge wastewater, separation water etc.) from CONTRACTOR´s marine spread is addressed in the WMP.
Responsible waste management will be accomplished through a hierarchical application of practices. These will include:

- Reduction;
- Reuse and Recycling;
- Treatment;
- Responsible disposal.

The primary purpose of the WMP is to:

- Identify the different types of waste as defined by local regulations;
- Define separation methods;
- Establish the general criteria for avoiding or effectively minimizing, managing, monitoring any possible form of environmental damage or pollution during execution of the scope of work;
- Define recording, monitoring and waste tracking procedures;
- Define responsibility for waste management handling including safe disposal;

14.2 WASTE MINIMIZATION

During the execution of the work CONTRACTOR will evaluate the following:

- Re-use of materials thus reducing the need for the use of primary materials;
- Minimization of road transport where possible;
- Minimization of packaging materials, agreement with manufacturers and suppliers;
- Re-use of excavated soils generated by ground works;
- On-site segregation, recycling and processing of waste materials, where practical;

14.3 WASTE CONTROL MEASURES

During the execution phase of the work CONTRACTOR will implement the following waste control measures:

- At each location (Nassau Harbour and Arawak Cay) a dedicated area will be established for waste management and segregation;
- CONTRACTOR and SUBCONTRACTOR will be required to maximize the opportunities for reuse and recycling of materials, to minimize waste and/or separate as required;
- CONTRACTOR shall ensure that only Local Governmental licensed waste transporters, waste management processing companies and/or landfill sites are used to ensure compliance with legislative requirements, this will be organized through the CONTRACTOR´s local agents;
- CONTRACTOR shall ensure that suitable protection measures and good housekeeping are incorporated in the design of the waste management area to prevent pollution;
- The Works Manager will regularly inspect and manage the area to ensure that stored wastes are covered to prevent accidental spillages and wastes from being blown away;
- CONTRACTOR shall ensure that there are sufficient waste disposal containers are available on site;
- Eventual contaminated soil waste being collected prior to disposal shall be stored wrapped in plastic foil so as to protect local surface water and minimize the potential for leachate formation;
- The site must be left in a clean and tidy condition at the end of each working day.

14.4 WASTE CLASSIFICATIONS

Due to the nature of CONTRACTOR´s SOW all materials used will be of a temporary nature and the amount of waste generated will be minimal. The majority of the materials supplied by SUBCONTRACTOR will be of a permanent nature.

Top soil and where possible vegetation will removed (by Client) and if stored correctly can be replaced or reused on the Arawak Cay or its extension.

Project Waste will be classified in two groups:

14.4.1 Non- Hazardous Waste - Category A

This term is generally used to describe categories of waste for disposal at licensed land fill sites. The term refers to a waste that has no known or immediate hazard connected with handling or disposal, however it may possess certain reactive properties.

Examples of non hazardous waste are:

- Paper (including oiled and tarred paper);

- Cardboard;
- Wood products (hardboard, chipboard, etc);
- Plastics as finished products or manufacturing scrap only (including thermosetting plastics);
- Metals (iron, steel, aluminum) in solid form only;
- Wool, Cotton, Linen, Hemp, Sisal, Hessian, String, Rope and any other natural or man-made fiber;
- Trees, Bushes, Shrubs;
- Cement, brick work.

14.4.2 Hazardous Waste – Category B

This term is widely used but has no defined meaning other than when referred to within EC Legislation to describe wastes listed in EC decision 96/906/EEC.

These are potentially harmful wastes displaying one or more hazardous properties listed in annexes to directive 91/689/EEC on Hazardous Waste.

The term 'Hazardous Waste' is used as a general, often non-technical description of waste that contains a substance in such a quantity liable to cause death, injury or impairment to living beings, pollution of waters, or unacceptable environmental impact if improperly handled, treated or disposed of. It is primarily used to describe categories of waste for disposal at licensed waste disposal sites, if so required by local legislation and the like.

Examples of hazardous waste are:

- Oil based products;
- Diesel oil;
- Petrol;
- Contaminated water from oil/water separators;
- Paints and thinner;
- Contaminated soil;
- Black water from bilges;
- Waste water from chemical toilets;
- Batteries.

14.5 WASTE MATERIAL DOCUMENTATION

- Waste transfer notes and special waste consignment notes must be completed in full and copies are to be retained by CONTRACTOR´s nominated waste transportation and Disposal Company – Bahamas Waste.

- CONTRACTOR will maintain copies of all waste documentation for a minimum period of two years after project completion and be available for inspection upon demand.
- Materials such as waste oil, chemicals and batteries are classed as special waste and will require special handling, storage and disposal. All special wastes must be clearly labeled and stored and disposed of separately to (licensed) waste management sites.
- CONTRACTOR will keep a record of all environmental incidents associated with waste management and remedial action taken in an environmental incident logbook.
- Complaints relating to waste management received will also be recorded and investigated.
- All waste documentation will be made available to the Local Authorities, ENGINEER / Client / BEST upon request.

CONTRACTOR and SUBCONTRACTOR have signed service contracts with Bahamas Waste ltd., (BEST approved contractor) for the collection and disposal of all project waste materials.

15. EQUIPMENT REFUELING

For the onshore dry earth moving equipment, cranes, diesel welding generation sets, compressors etc, piling rigs, refueling will take place on the various work sites in the Bahamas.

To ensure that refueling activities cause no harm to the environment CONTRACTOR will provide two mobile double walled diesel tanks c/w hose and nozzle for the daily refueling activities.

For refueling vessels in the Marine spread reference is made to the compulsory bunkering procedures in attachment 16.5.1 and will be performed by the Port authorized bunkering barge.

Furthermore CONTRACTOR will take the following preventive measures to avoid or be prepared for environmental incidents:

- Only trained and experienced personnel will be allowed to perform refueling activities;
- During refueling activities the machines will be switched off and no open flames allowed;
- A fire extinguisher is to be available at all times;
- During the refueling activities a spill kit is available in order to contain any spillage and prevent contamination.
- An emergency spill kit containing sand or suitable absorbent materials is to be kept readily available in case of spillage in the main fuel storage area;
- All refueling operations must be supervised by trained personnel;
- Valves and taps must not be left open unattended and must be locked when not in use;
- Personnel carrying-out refueling activities are to be made aware of the requirements listed in this EMP and be instructed in the use of spill kits and emergency procedures.

16. ATTACHMENTS

This Environmental Management plan contains the following Attachments which form an integral part of this plan:

16.1 ISO 14001-2004 (Environmental) Management System Certificate;

16.2 OHSAS 18001-1999 Occupational Health & Safety Management System Certificate;

16.3 ISO 9001-2000 Quality Management System Certificate;

16.4 CSD URSA Specifications;

16.5 Compulsory Instructions:

- 16.5.1 Bunkering;
- 16.5.2 Sludge & Garbage disposal;
- 16.5.3 Oil & Chemical Pollution;

16.6 Data Specification Sheet Turbidity Sensor - YSI 6136;

16.7 Environmental Monitoring Report (Daily & Weekly Reporting Format);

16.8 Emergency Response Telephone list;

16.9 Generic Environmental Hazard Identification (Doc. No. 044-10003-HIRA-ENV-006).

16.1 ISO 14001:2004 ENVIRONMENTAL MANAGEMENT CERTIFICATE

BUREAU VERITAS
Certification

BUREAU VERITAS 1828

Certification

Awarded to

Boskalis International bv

Rosmolenweg 20, 3356 LK Papendrecht, The Netherlands

Bureau Veritas Certification Nederland B.V. certify that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the management system standards detailed below

STANDARD

ISO 14001:2004

SCOPE OF SUPPLY

Contracting, designing and executing dredging and dredging related projects.

Original Approval Date : **8 December 2006**

Subject to the continued satisfactory operation of the organisation's Management System, this certificate is valid until : **15 December 2009**

To check the validity of this certificate please call +31 (0)33 4501 600.
Further clarification regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organisation

Certificate Number NL7000047/001 *Date:* 16 January 2007

MGMT. SYS. RvA C 426

SCCM

Managing office: Bureau Veritas Certification Nederland B.V., Terneuzenweg 45, 3821 AJ Amersfoort
Issuing office: Bureau Veritas Certification Nederland B.V., Terneuzenweg 45, 3821 AJ Amersfoort

16.2 OHSAS 18001:1999 HEALTH & SAFETY MANAGEMENT CERTIFICATE

BUREAU VERITAS
Certification

BUREAU VERITAS 1828

Certification

Awarded to

Boskalis International bv

Rosmolenweg 20, 3356 LK Papendrecht, The Netherlands

Bureau Veritas Certification Nederland B.V. certify that the Occupational Health and Safety System of the above organisation has been audited and found to be in accordance with the requirements of the standard detailed below

STANDARD

OHSAS 18001:1999

SCOPE OF SUPPLY

Contracting, designing and executing dredging and dredging related projects.

Original Approval Date : **8 December 2006**

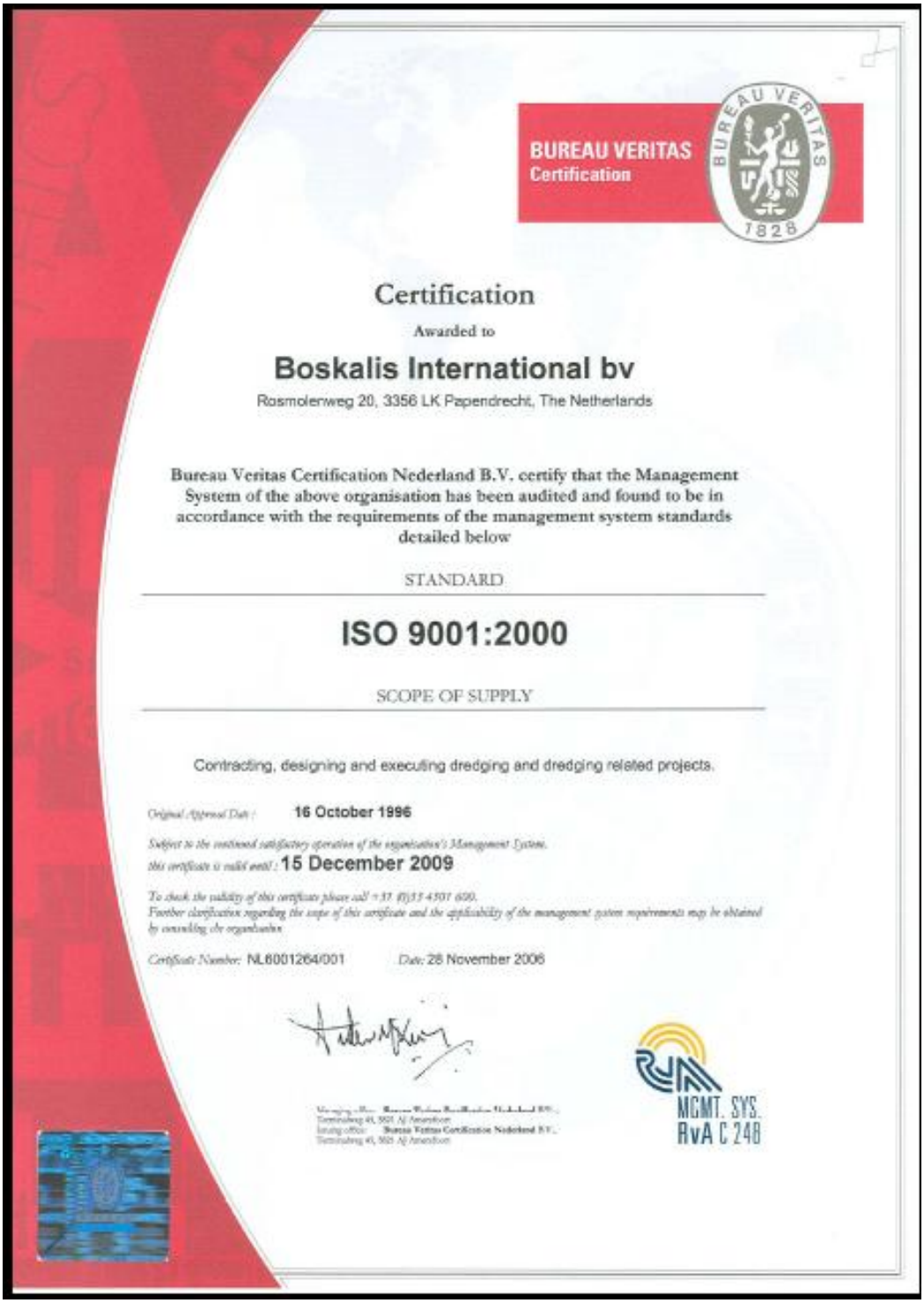
Subject to the continued satisfactory operation of the organisation's Occupational Health and Safety System, this certificate is valid until: **15 December 2009**

To check the validity of this certificate please call +31 (0)33 4501 600.
Further clarification regarding the scope of this certificate and the applicability of the Occupational Health and Safety System requirements may be obtained by consulting the organization

Certificate Number NL7000047/001 *Date:* 16 January 2007

Managing office: Bureau Veritas Certification Nederland B.V.,
Termaalweg 65, 3821 AJ Amersfoort
Issuing office: Bureau Veritas Certification Nederland B.V.,
Termaalweg 65, 3821 AJ Amersfoort

16.3 ISO 9001: 2000 QUALITY MANAGEMENT CERTIFICATE



BUREAU VERITAS Certification

BUREAU VERITAS 1828

Certification

Awarded to

Boskalis International bv

Rosmolenweg 20, 3356 LK Papendrecht, The Netherlands

Bureau Veritas Certification Nederland B.V. certify that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the management system standards detailed below

STANDARD

ISO 9001:2000

SCOPE OF SUPPLY

Contracting, designing and executing dredging and dredging related projects.

Original Approval Date : **16 October 1996**

Subject to the continued satisfactory operation of the organisation's Management System,
this certificate is valid until : **15 December 2009**

To check the validity of this certificate please call +31 (0)33 4501 600.
Further clarification regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organisation

Certificate Number: NL6001264/001 *Date:* 28 November 2006

MGMT. SYS. RvA C 248

16.4 CSD URSA SPECIFICATIONS

Equipment sheet

P.O. Box 43, 3350 AA Papendrecht, The Netherlands
Telephone +31 78 69 69 000, telefax +31 78 69 69 555
e-mail royal@boskalis.nl, Internet www.boskalis.com

Ursa

Self-propelled sea-going cutter suction dredger

Features

- A heavy duty rock cutting sea-going self-propelled dredger designed for operations in sheltered and coastal waters up to 15 miles offshore.
- Equipped for working in hot, tropical climates and isolated locations.
- Fully automated dredging process centrally controlled.

Main data

Built by	Orenstein & Koppel
Year of construction	1986
Classification	B.V. I ✠ HULL ✠ MACH ✠ AUT-MS
	Dredger, Unrestricted navigation, Ice class 1A
Gross tonnage	3,877
Length overall	115.83 m
Length hull	104.10 m
Breadth	20.00 m
Moulded depth	7.80 m
Normal draught	4.90 m
Maximum draught	5.10 m
Suction pipe diameter	0.95 m
Discharge pipe diameter	0.90 m
Maximum dredging depth	25.00 m
Minimum dredging depth	5.80 m
Anchoring system	Spud carriage
Sailing speed	12.0 knots
Total installed power	15,871 kW
Cutter output	3,960 kW
Suction pump output	2,200 kW
Inboard pump output	7,400 kW
Propulsion engines	7,400 kW

16.5 COMPULSORY INSTRUCTIONS

16.5.1 BUNKERING

SCOPE

This instruction 'Bunkering' contains the minimum safety precautions to be observed during bunkering. The purpose of this instruction is to make the Project personnel aware on the risks involved and to ensure safe practice to personnel and the local environment during the fuel supply operation. The Project Manager shall ensure that all personnel involved during the bunkering operations are made aware of the requirements imposed on them by this Project HSE Instruction.

ISM Vessels

ISM Vessels follow the Shipboard Procedures for bunkering. However, the Specific Project Instructions will be supplied to all vessels including ISM vessels.

PROJECT RISK 'STANDARD'

The following table lists the most important risks during the fuel bunkering:

No.	Risks
1	Temperature > 55 ºC
2	Open Fire & Smoking
3	Overflow, spillage and leakage

SPECIFIC PROJECT INSTRUCTIONS

Safety Operating Instructions

General

- The chief engineer is responsible for the bunker operation;
- All Project personnel are responsible to adhere to the instructions given;
- The Captain and Chief Engineer, in co-operation with the project and/ or the supplier, plan the bunker location and timing.
- Local rules and regulations (if any) are to be taken into account.
- The officer on watch on bridge/ deck and a crew member on deck shall stay in close contact with the supplier via VHF or other suitable means during the whole bunker operation. Contact is not to be ceased until the bunker operation is finished.
- Routines for contact between engine room and officer on watch to be agreed, e.g. vhf hand held radio or other means.

Precautions to be taken before Bunker Operations starts

- A crewmember shall inspect if the bunker delivery hose and connection are fit for safe operation;
- Scupper plugs fitted to avoid spillage overboard;
- Absorbent material ready for use at connecting point;
- Fire fighting equipment stand by on hazardous points;

- Bunker flag hoisted;
- Smoking and open fire during fuel bunkering is prohibited and hot work operations in the direct vicinity are to be ceased;

Precautions to be taken during Bunker Operation

- The officer on watch bridge/deck shall ensure that everything and everybody is ready to receive the bunkers, therefore he shall receive a clear order from the engine-room;
- An officer on watch in charge of bunker operations shall only be engaged with bunkering operations;
- During the whole bunker operation a crew member shall stay close to the hose/connection and immediately inform officer on watch and the supplier if anything unusual occurs;
- Deviations, which may result directly in a hazardous situation must be reported by officer on duty to the chief engineer immediately;
- When the bunker operation is finished the chief engineer is responsible for the receipt and entries in engine room log book.

Special References

Special reference is made to the following sections of the black and yellow booklet 'Standard Safety Instructions', being particular relevant (or parts thereof) during bunkering: **§** 8.14 Tanks

16.5.2 SLUDGE and GARBAGE DISPOSAL

SCOPE

This instruction 'Sludge and Garbage Disposal' contains the minimum precautions to be taken for collecting, storage and disposal of waste. The purpose of this instruction is to ensure that the generated waste on the project will be handled in a controlled manner in order to protect the local environment appropriately.

The Project Manager shall ensure that all Project personnel are made aware of the requirements imposed on them by this Project QA/HSE Instruction.

PROJECT RISK 'STANDARD'

The following table lists the most important risks during handling of waste materials:

No.	Risks
1	Spillage
2	Pollution
3	Contamination
4	Harm to human(s), flora and fauna

SPECIFIC PROJECT INSTRUCTIONS

See sample below, select or consolidate the groups where applicable.

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Domestic Waste	Industrial Waste	Chemical Waste	Black Water	Grey Water	Batteries	Separate Disposals
Galley	Wood, Plastics, Glass, Synthetics, Etc.	Paint, Thinners, Coolant, Solvents, Acids,	Bilge water, Dirty oils and other Lubricants	Sewage	Batteries	Metals, others

The following arrangements have been made at the following locations:

Vessel(s) - Bins

Site – Bins and containers

Offices - Bins

Who are authorized waste collectors on the project to collect waste in a controlled manner - TBA

Which vessel(s) use bilge-water separators and or garbage incinerators - TBA

Disposal of Waste

From ISM/SMS vessels to shore

The disposal of waste from the vessels shall be recorded in the relevant Garbage Record Book. Project Management shall inform the vessels on the details of the intended disposal.

If Garbage is collected from the ISM/SMS vessel by using one of the project support vessels, the Project Manager must ensure that the Captain receives the Waste receipt for filing on board; the Captain has to ensure that the receipts are filed on board for with the Garbage Record Book for a period of 2 years.

From shore (Project Site) to relevant disposal centre

When storing and disposing garbage it must be ensured that sufficient measures have been taken to avoid garbage from polluting the environment.

Prior to the disposal of waste from the Project Site, a report/sheet shall be prepared and signed off by both parties (contractor & collector). The report shall state the minimum, as follows:

Project references;

Location / project collection point;

Date and time of disposal;

Composition (group) of wastes;

Amount of wastes (in weight or volume);

Name of the approved waste collector/agent;

Intended location of disposal; and

Disposal unit reference number;

Records of waste disposal shall be handed over to the Project QA/HSE Manager for filing in the Project Master File, when it concerns solely garbage of an ISM vessel the original receipt goes to the vessel, a copy will be filed in the Project Master File.

Special References

Special reference is made to the following sections the black and yellow booklet ‘Standard Safety Instructions’, 4th edition 2007, being particular relevant (or parts thereof) during the handling of waste:

§7.0 Hygiene, Health & the Environment;

§7.3 Environment

16.5.3 OIL AND CHEMICAL POLLUTION

SCOPE

This instruction 'Oil and Chemical Pollution' contains the minimum precautions to be taken for prevention of pollutions by Oil and/or Chemicals. The purpose of this instruction is to ensure that all products used on the project will be handled in a controlled manner in order to protect the local environment appropriately.

The Project Manager shall ensure that all Project personnel are made aware of the requirements imposed on them by this Project QA/HSE Instruction.

PROJECT RISK 'STANDARD'

The following table lists the most important risks during handling of oil and chemicals

No.	Risks
1	Spillage
2	Pollution
3	Contamination
4	Harm to human(s), flora and fauna

SPECIFIC PROJECT INSTRUCTIONS

General

The general Risk Assessment procedure (RBW-313) can assist in identifying such activities and their effects (on air, soil and water quality and flora and fauna). As a minimum the following topics must be taken into consideration:

- Avoidance of nuisance;
- Spillage control;
- Waste disposal.

Activities with unacceptable environmental effects must further be analyzed, in order to examine what next steps could be taken to minimize or eliminate these effects.

Before the works start, the Project Manager must inform all personnel on the project and vessels about environmental requirements and they must be made aware of all risks of environmental damage which have been identified during the "Risk Assessment".

In case environmental incidents occur, they must be reported as soon as possible by means of the incident reporting procedure RBW 510.

Furthermore the incident must be analyzed by the Captain/Senior Dredge Master and/or Project HSE officer and the Project manager, in order to determine the root cause. The result of such analysis must be documented. Consideration will be given to one or more of the following courses of actions:

- Revise or adapt working method;
- Take additional preventive measures;
- Re-instruct and/or re-train persons involved;

- Draft and/or revise procedures/work.

Oil and chemical fluid pollution

If diesel, lubrication oil, chemical fluids or the like are spilled, even small quantities can spread rapidly over quite a large area. On water wave motion and high wind speed can cause the fluids to disperse in a rather short time. For this reason in most countries there are strict statutory requirements in force regarding the (accidentally) discharge of oil and chemicals into the sea or on land.

On no account may oil, oil products, chemical fluids or oil-contaminated bilge water be pumped or otherwise discharged overboard from any vessel!

ISM/SMS vessels of Boskalis have a Shipboard Oil Pollution Emergency Plan. This plan explains what needs to done in case of an (oil) spill and can also be used in case of a chemical fluid spill, depending on the hazard of the particular chemical.

Notwithstanding the presence of such plan or not, if a spill occurs every effort must be made to stem the spillage as soon as possible. The incident must be reported and also the relevant authority must be informed.

Spill Contingency Plan

The most likely spills will result from:

A) PIPELINE LEAKAGES, including hydraulic hoses;

B) (BUNKER) TANK OVERFLOWS;

C) HULL LEAKAGES.

In all cases the Captain, Skipper or barge master, superintendent / shore supervising personnel must inform the Project QA/HSE Manager and/or Project Manager, as soon as circumstances allow.

The Project Manager will inform ENGINEER unless the client requires otherwise.

Reference is made to RBW-510 Incident Reporting.

A) PIPELINE LEAKAGES, including hydraulic hoses;

Measures to be implemented immediately:

- Stop all operations (also bunkering), and close manifold valves.
- Sound the emergency alarm, and initiate emergency response procedure.
- Inform personnel about the incident.
- In case of chemicals check the risks for personnel with the Material Safety Data Sheet

Further measures:

- Consider to stop air intake into accommodation and non-essential air intake to engine-room or work areas below deck.
- Locate source of leakage, and begin clean-up procedures.
- Drain affected section of pipeline into an empty or slack tank (slop tank or another oil tank), or in empty oil drums.

If the spilled fluid is contained on board and can be handled by the crew then:

- Use absorbents and permissible solvents to clean up oil spills.
- Ensure that any residues collected in the clean up operation are stored carefully for disposal.

AFTER DEALING WITH THE CAUSE OF THE SPILL, IT MAY BE NECESSARY TO OBTAIN PERMISSION FROM LOCAL AUTHORITIES TO CONTINUE NORMAL OPERATIONS.

B) (BUNKER) TANK OVERFLOWS;

Measures to be implemented immediately:

- Stop all bunkering/ loading operations, and close manifold valves.
- Sound the emergency alarm, and initiate emergency response procedures.
- Inform supplier personnel about the incident.
- In case of chemicals, check the risks for personnel with the Material Safety Data Sheet (MSDS).

Further measures:

- Consider whether to stop air intake into accommodation and non-essential air intake to engine-room.
- Reduce the tank level by dropping excess into an empty or slack tank or empty drums.
- Prepare pumps for transfer of bunkers to shore if necessary.
- Begin clean up procedures.
- Prepare portable pumps if it is possible to transfer the overflowed oil into a slack or empty tank or empty drums.

If the spilled oil is contained on board and can be handled by the crew then:

- Use absorbents and permissible solvents to clean up oil spills on board.
- Ensure that any residues collected in the clean up operation are stored carefully for disposal.

AFTER DEALING WITH THE CAUSE OF THE SPILL, IT MAY BE NECESSARY TO OBTAIN PERMISSION FROM LOCAL AUTHORITIES TO CONTINUE NORMAL OPERATIONS.

C) HULL LEAKAGES.

If oil is noticed on the water near the vessel during bunkering operations and cannot be accounted for, the possibility of hull leakage should be suspected.

Measures to be implemented immediately:

- Stop all bunkering operations, and close manifold valves.
- Sound the emergency alarm, and initiate emergency response procedures.
- Inform bunkering personnel about the incident.
- In case of chemicals, check the risks for personnel with the Material Safety Data Sheet (MSDS).

Further measures:

- Use crew in a “Pollution Prevention Team” in an attempt to locate the source of leakage.
- Consider whether to stop air intake into accommodation and non-essential air intake to engine-room.

When the source of leakage is identified:

- Reduce the head of bunker oil by dropping or pumping oil into an empty or slack tank
- If the leakage is located below the waterline, call in divers for further investigation.

If it is not possible specifically to identify the tank:

- The level of fluid in the tanks in the vicinity of the suspected area should be reduced. Remember to consider the effect on hull stress and stability of the vessel.

AFTER DEALING WITH THE CAUSE OF THE SPILL IT MAY BE NECESSARY TO OBTAIN PERMISSION FROM LOCAL AUTHORITIES TO CONTINUE NORMAL OPERATIONS.

Spills Resulting from Casualties

In the event of a casualty the master's first priority is to ensure the safety of the vessel's personnel and to initiate action to prevent the incident from getting worse.

If the casualty involves grounding, breaching of the outer hull or other structural damage for which calculations of stability and damaged longitudinal strength are beyond the vessel's resources, assistance must be sought from shore.

Having assessed the damage that the vessel has sustained, and taking into account the effects of hull stress and stability, the master should decide whether or not any action can be taken to avoid further spillage, such as:

- Transfer of bunkers internally. If the damage is limited, for example to one or two tanks, consideration should be given to transfer of oil from damaged to intact tanks.
- Isolate bunker tanks to reduce further loss due to hydrostatic pressure during tidal changes.
- Trimming or lightening the vessel sufficiently to avoid damage to intact tanks, thereby avoiding additional pollution from oil spillage.

16.6 DATA SHEET YSI 6136 TURBIDITY SENSOR

YSI 6136 Turbidity Sensor

Accurate, in situ turbidity measurements

The 6136 is a fouling-resistant, wiped sensor designed to seamlessly integrate – using no external interface hardware – with all YSI sondes that contain an optical port. It provides accurate, *in situ* measurement of turbidity in fresh, brackish, and sea water, and features an improved mechanical self-wiping capability for long-term monitoring, which helps ensure proper turbidity measurements.

YSI 6136 Optical Turbidity Sensor

- *In situ* monitoring
- Self-cleaning sensor for long-term deployment
- Field-replaceable

Take Advantage of YSI's New V2 Sondes

Expand your optical monitoring capability and upgrade your 6820, 6920, or 6600. V2 upgrades increase the number of optical ports on your sonde, allowing for measurement of additional optical sensors including:

- Turbidity
- Blue-Green Algae - Phycocyanin (for freshwater applications)
- Blue-Green Algae - Phycoerythrin (for marine applications)
- ROX™ Optical Dissolved Oxygen
- Chlorophyll
- Rhodamine

Upgrades are available from YSI Authorized Service Centers. Contact YSI for details.

Pure Data for a Healthy Planet.®

Accurate, in situ turbidity measurement

Sensor performance verified*

The performance of the YSI 6136 Turbidity Sensor was verified through the US EPA's Environmental Technology Verification Program (ETV).

To order, or for more info, contact
+1 937 767 7241
800 897 4151 (US)
www.ysi.com

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Fax +1 937 767 9353
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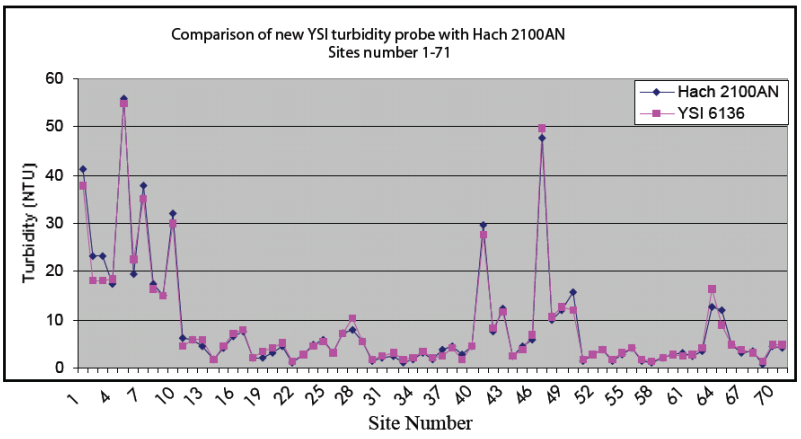
acorbett@ysi.com

ISO 9001
ISO 14001
Yellow Springs, Ohio Facility

Excellent agreement with the industry standard

Extensive empirical field and laboratory tests performed by YSI and independent agencies in Alpha and Beta studies document close agreement between *in situ* measurements made with the YSI 6136 turbidity sensor and data from the Hach® 2100AN, a laboratory instrument recognized as the standard for turbidity measurement.



Comparison of turbidity measurements made with the YSI 6136 Turbidity Sensor and Hach® 2100AN at 70 different riverine and lacustrine sites exhibiting widely varying (lower) turbidity ranges.

YSI 6136 Sensor Specifications

	Range	Resolution	Accuracy
Turbidity* 6136 Sensor* ETV	0 to 1,000 NTU	0.1 NTU	±2% of reading or 0.3 NTU, whichever is greater**

• Maximum depth rating for all standard optical sensors is 200 feet, 61 m. Turbidity is also available in a Deep Depth option (0 to 200 m).

**In YSI AMCO-AEPA Polymer Standards.

Applications include:

- Dredging
- Storm water
- Construction site monitoring
- Vertical profiling
- Long-term studies
- Surface water evaluations
- Circulation in lakes, reservoirs, bays, and estuaries

16.7 ENVIRONMENTAL MONITORING REPORT

WEEKLY TURBIDITY MONITORING REPORT
NASSAU HARBOUR PORT IMPROVEMENT PROJECT

MONITORING BY:

TIME & SEQUENCE	DATE	Antecedent Weather	Temp(◦F)	Tidal Stage	Current Direction	Wind Direction	Wind Velocity (Knts)	COMMENTS
.../1	5-1-2009	Windy	50-78	Incoming 1 hr to high	South	SW	3 to 4	
.../2	5-1-2009	Clear	80-85	High water Slack Tide	Calm	Calm	1 to 3	
.../3	5-1-2009	Cloudy	78-82	Incoming 1/2tide	N	SSE	3 to 5	
.../4	6-1-2009	Fair	78-82	Incoming 1/2tide	N	SSE	3 to 5	
.../5	6-1-2009	Clear	78-80	High water Slack Tide	N	NW	2 to 4	
.../6	6-1-2009	Clear	78-80	Low 40 minute Incoming	S	NW	5 to 8	

WEEKLY TURBIDITY MONITORING REPORT
NASSAU HARBOUR PORT IMPROVEMENT PROJECT

MONITORING BY:
DIRECTREADING
STATION NO:

PRE-DETERMINED LIMIT OF TURBIDITY BASED ON CRUISE SHIP MVMTS: To be agreed NTUs

DIRECT READING			DREDGE LOCATION (STATE PLANE or LAT/LON)		BACKGROUND STATION (STATE PLANE or LAT/LON)			Dist from dredge to background smpl (ft)	Pre-det limit or Bckgrd is greater	COMPLIANCE STATION NO. 1 (STATE PLANE or LAT/LON)			
SEQUENCE	DATE	TIME	X/LON	Y/LAT	X/LON	Y/LAT	NTUs @ 3 ft			X/LON	Y/LAT	NTUs @ 3 ft	**COMMENTS**
…/1													
…/2													
…/3													
…/4													
…/5													
…/6													

16.8 EMERGENCY CONTACT TELEPHONE LIST

External Authorities:

Ambulance: 326-7014 (Accident & Emergency)
Police: 919 / 911 / 322-4444 / 328-477 (crime)
Fire-brigade: 919
Doctors Hospital: 302-4600
BASRA (Bahamas Air Sea Rescue): 325-8864 / 322-7412
Port Control: VHF 16 / 323-3191
BEST Commission: 397-5509 / 397-5526
Crisis Center: 328-0922

Nassau Harbour Port Improvement - Project Team

Boskalis Project Manager: 423-4155
Boskalis QA/HSE Manager: 522-9169
ABB Project Manager: 376-2555
ABB Project Engineer: 376-2079
Client (MOWT): 302-9516
Site Engineer (Cox & SHAL): 323-4012
Bahamas Waste: 357-9730
URSA (Bridge): 552-9162
ALMA (Bridge): 552-9183
BKM-104 (Bridge): 423-3471

16.9 GENERIC ENVIRONMENTAL HAZARD IDENTIFICATION

See Attached Document no. 044.10003-HIRA-ENV-006.