



# ENVIRONMENTAL PROTECTION DEPARTMENT ANNUAL REPORT

2018



ENVIRONMENTAL PROTECTION DEPARTMENT



## Executive Summary

In 2018, amidst many challenges, the Environmental Protection Department embarked on activities aimed at protecting human health and the environment. The most notable areas were in chemicals management and the work the Department has started with the International Atomic Energy Agency (IAEA).

With respect to building development, one thousand six hundred and twenty-four (1,624) applications were received by Department during 2018. The majority of applications received were residential applications (83%). Two thousand six hundred and twenty-six (2,626) applications were pending as of January 1, 2018. During the year, one thousand and fifty-two applications were processed with the majority being approved or approved with conditions.

Twenty (20) consultation files were received by the Department in 2018. Eleven (11) of these were processed by the Building Development Section while three were outstanding at the end of the year. The remaining six files were classified under the category development-related documents as documents had accompanied the files. A further seven development-related documents were received in 2018 for a total of thirteen (13) development-related documents which consisted of environmental impact assessments, monitoring reports and scoping studies among others with comments for eight (8) forwarded to the requesting agencies.

In relation to complaints, there were twenty-three (23) air quality complaints, four (4) noise complaints, three (3) water quality and seven (7) complaints related to marine pollution. Most of the air quality complaints were related to vehicle maintenance facilities and nuisances. Seventy-two (72) air quality, sixteen (16) noise and five (5) marine investigations were carried out in response to the complaints submitted. It should be noted that some of the complaints investigated were received before 2018.

Two noise characterization studies were conducted: one in Holetown and the other in Speightstown with three (3) and five (5) sites being used respectively. The reports for both studies will be completed in 2019. Information collected during the studies included sound level data, meteorological data, traffic counts and activity surveillance data.

The Ambient Air Quality Passive Monitoring report of Bridgetown, Oistins/Speightstown and Holetown and Two Rural Areas commenced in 2018 and will be completed in 2019.

In 2018, two (2) regulatory inspection reports (HIPAC Ltd. and Harris Paints Ltd) were completed. Regulatory inspections were carried out at Portvale Sugar Factory and Arawak Cement Plant Company Ltd.

During 2018, the Global Environmental Facility Project 4881 “Continuing Regional Support for the POPs Global Monitoring Plan under the Stockholm Convention in the Latin American and Caribbean Region” continued with the passive air sampling aspect of the project along with the collection of national samples ( fish, sediment, soil, water, egg yolks and pork) and training of laboratory personnel

The Solid Waste and Hazardous Materials Section received twenty-two (22) requests for disposal advice, fifty (50) applications for the importation of radioactive materials and eleven (11) applications for the importation of pesticides. Majority of the requests were addressed throughout the year.

The Issue 18 EnviroFocus Newsletter was distributed during the year. The Summer Internship programme was also carried out with two (2) interns from Barbados Community College participating.

In 2018, staff participated several training courses most notably Community Noise Enforcement and Environmental Monitoring of Heavy Metals.

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## 1 Overview

The Environmental Protection Department of the Ministry of Environment and Drainage, which in the latter part of 2018 became the Ministry of Environment and National Beautification, has been in existence since 1971 and is responsible for the regulation, management and control of practices which may harm the environment and human health.

There are several areas for which the Department has responsibility:

- Air and Noise pollution
- Marine pollution
- Solid waste and hazardous materials
- Water quality (inclusive of groundwater and nearshore)
- Building development
- Multilateral environmental agreements.

These different areas are reflected in the makeup of the Department with each responsibility being assigned to a particular section. It should be noted that derelict vehicles and houses, as well as asbestos abatement, fall under Solid Waste and Hazardous Materials.

Three persons retired during 2018 and the administration staff was also reduced by a number of persons, which led to the reorganization of tasks within the Department.



## 2 Air and Noise Pollution Control

Ambient air quality management and control of noise pollution is the responsibility of the Air and Noise Pollution Control Section. The Section, in 2018, consisted of a Senior Environmental Technician and two Environmental Technicians. One of the Environmental Technician posts being vacant. The specific functions of the Air and Noise Pollution Section include, but not limited to, the monitoring and regulation, investigation of complaints, research and the development of policies and programmes.

### 2.1 Complaints and Investigations

The ANPC Section received a total of twenty-seven (27) complaints during 2018. The majority of complaints were for vehicle maintenance facilities and air quality-related nuisances (Figure 1). Nuisances may include emissions from construction and odours. There were no complaints from industrial stacks. All of the complaints were classified as new and there were no recurring complaints.

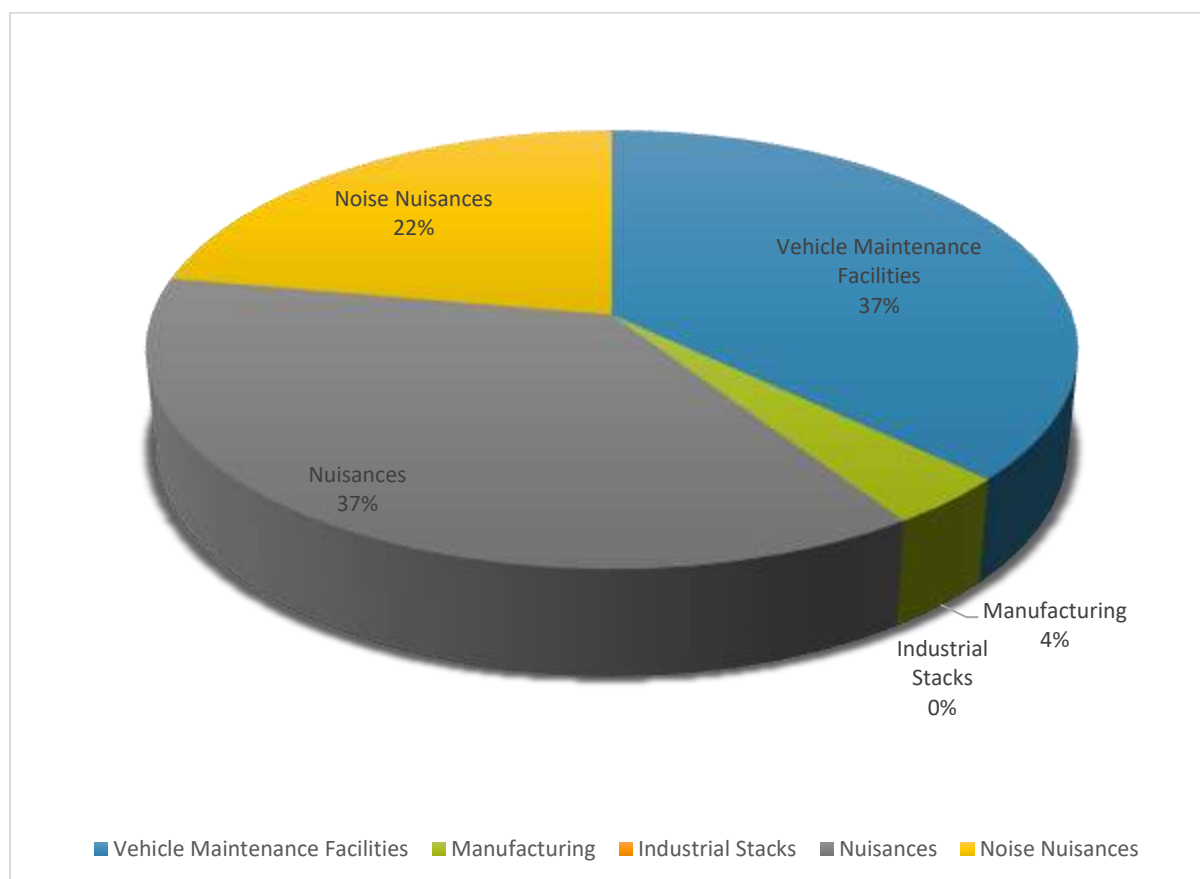


Figure 1: Complaints received by the Department in 2018

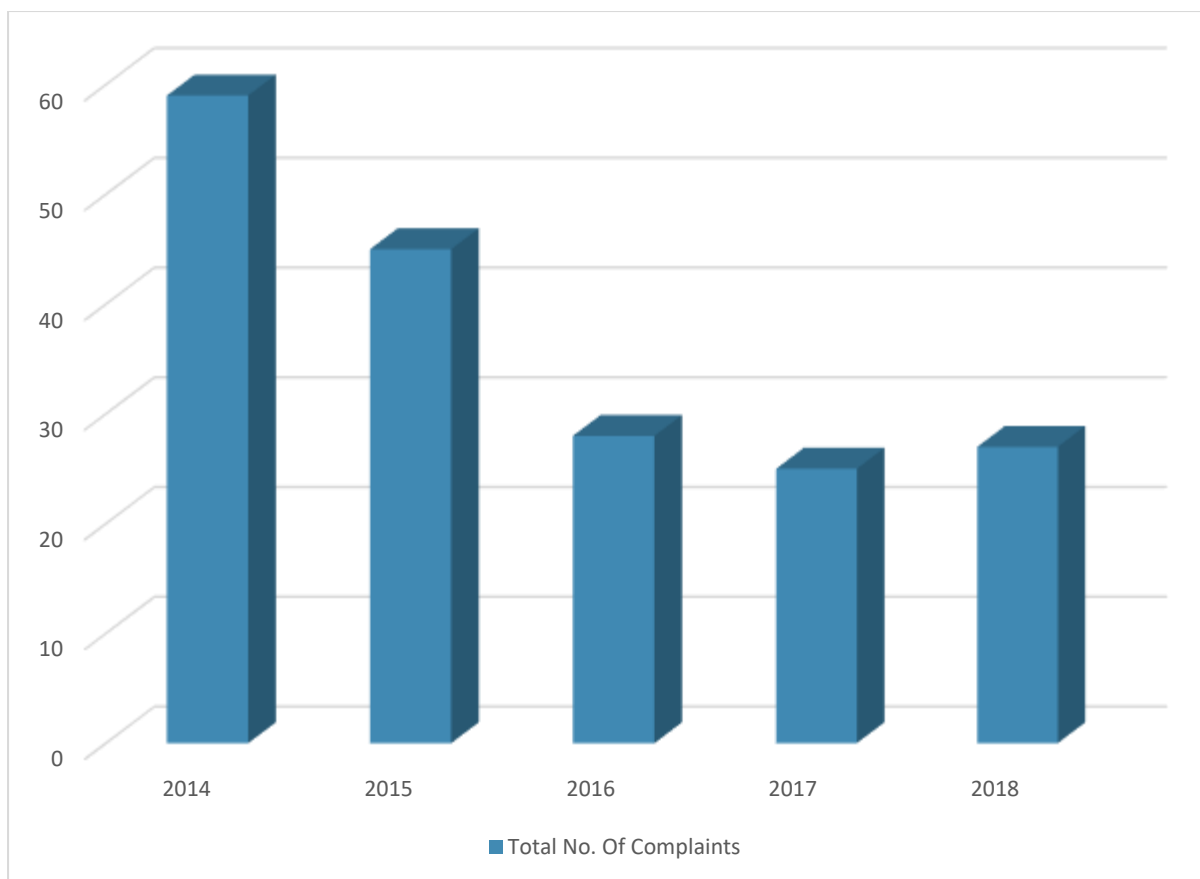


Figure 2: Total Number of complaints submitted to the ANPC Section

Figure 2 shows that there was an initial downward trend (i.e. from 2014 to 2017) with respect to the total number of complaints about both ambient air and noise complaints and in the latter part there is levelling off of complaints. A contributing factor would have been the proclamation of the Safety and Health at Work Act (SHAW) in 2013. After the proclamation of the SHAW Act some categories of complaints, mainly indoor air quality complaints, were directed to the Labour Department.

There were seventy-two (72) investigations undertaken during 2018 related to ambient air quality. Sixteen (16) investigations were undertaken concerning noise. Thirty-seven (37) regulatory notices were sent out with the majority relating to ambient air quality.

## 2.2 Noise Characterization Studies

The Air and Noise Pollution Control Section commenced noise characterization studies in Speightstown and Hometown during 2018.

In Speightstown, six sites were monitored from February 7 to April 12, 2018. The sites were the District E Police Station, Eddies Trading Co. Ltd., Speightstown Fish Market, Northern Business Centre, Pizza Man Doc Restaurant and Port St. Charles.

In Holetown, three sites were monitored from June 26 to September 19, 2018. The monitoring sites were Royal Bank of Canada, Grendon Holdings Inc. and The Beach House.

The data collected during both studies included sound level data, meteorological data, traffic counts and activity surveillance data.

### 2.3 Ambient Air Quality Passive Monitoring Compilation Report

Air and Noise Pollution Section commenced the development of the Ambient Air Quality Passive Compilation Report, which is a comparison of the results from the three ambient air quality monitoring projects conducted between 2012 and 2015. The three ambient air quality projects were Bridgetown, Oistins/Speightstown and Holetown and Two Rural Areas. The projected completion date is March 2019.

### 2.4 Air Quality Monitor AQT 420

The Air and Noise Pollution Section procured an air quality monitor, the AQT 420, in 2018. The monitor can undertake measurements of gaseous pollutants such as oxides of nitrogen, sulphur and carbon, ozone, particulates and weather data e.g. temperature, relative humidity and barometric pressure.

### 2.5 Looking Forward

The Air and Noise Pollution Control Section will be developing a Volatile Organic Compounds (VOCs) management policy and a minimum design and operation criteria/guidelines for Vehicle Maintenance Facilities. The Section will also be looking to improve public awareness of ambient air quality through the development of a proposal for an air quality index and an ambient air quality information dissemination plan.

### 3 Building Development Control

The Building Development Control Section (BDCS) is responsible for assessing development application for conformance to the Health Services Act CAP. 44 and the Health Services Regulations. The section in 2018 consisted of fourteen persons which included the Chief Buildings Development Officer, two Senior Buildings Development Officer, eight Building Development Officer, two Building Inspectors and a draftsman technician.

The main activities of the Section are as follows:

- Reviews all applications for residential, commercial and industrial developments;
- Evaluates primary wastewater treatment systems;
- Offer technical advice to the Chief Town Planner through the Director on applications submitted to the department;
- Provides technical advice with respect to the investigation of building-related complaints; and
- Educate the public about varying aspects of building development.

#### 3.1 Processing Applications

The BDCS received one thousand six hundred and twenty-four (1,624) applications during 2018. Fifty-nine (59) of these applications were made to the EPD directly while the remaining was submitted through the Town and Country Planning Development Office. The majority of the applications were classified as residential as seen in Figure 3 below.

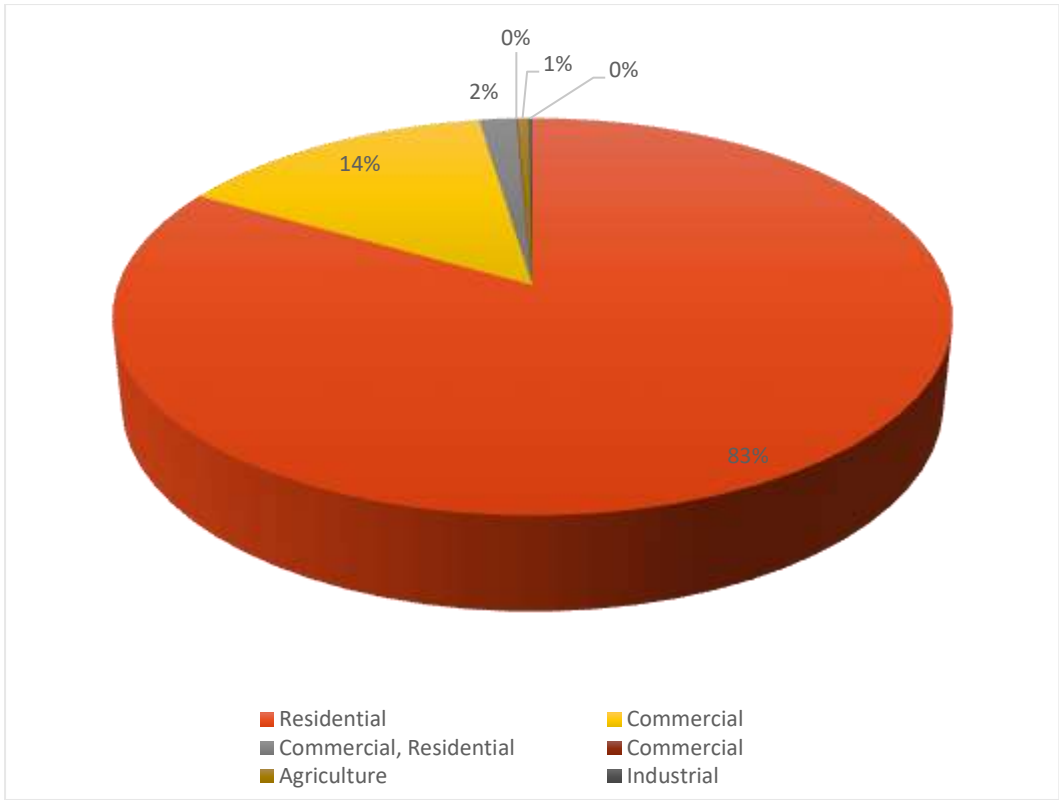


Figure 3: Applications received by the Department during 2018

Two thousand six hundred and twenty-six (2626) applications were pending as of January 1, 2018. One thousand and fifty-two (1,052) applications were processed in 2018 (Table 1). The majority of applications were approved and a minority were withdrawn. There were no industrial applications processed during the period under review.

Table 1: Building Applications processed in 2018

<b>Decision/Classification</b>	<b>Approved</b>	<b>Approved with conditions</b>	<b>Refused</b>	<b>Acknowledged<sup>1</sup></b>	<b>Withdrawn</b>	<b>Total</b>
<b>Residential</b>	<b>618</b>	<b>190</b>	<b>58</b>	<b>6</b>	<b>7</b>	<b>879</b>
<b>Commercial</b>	<b>33</b>	<b>64</b>	<b>23</b>	<b>26</b>	<b>4</b>	<b>150</b>
<b>Residential/Commercial</b>	<b>8</b>	<b>4</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>17</b>
<b>Agriculture</b>	<b>2</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5</b>
<b>Industrial</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Commercial/Industrial</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>
<b>Total</b>	<b>661</b>	<b>262</b>	<b>85</b>	<b>32</b>	<b>12</b>	<b>1052</b>

### 3.2 Inspection of septic tanks and filter beds

The BDCS undertakes inspections of primary wastewater systems, that is, septic tanks and filter beds to determine if they have been constructed and designed appropriately. Thirty (30) septic tanks were inspected during 2018. No filter beds were assessed during the same time frame.

### 3.3 Looking Forward

In 2019, the Building Development Section will continue with its primary task of processing building applications and related activities such as reviewing consultation files and inspecting waste disposal methods.

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<sup>1</sup> Acknowledged applications are those applications which the Health Services Building Regulations do not apply.

## 4 Environmental Planning and Assessment

The Environmental Protection Department reviews development-related documents such as environmental impact assessment as a member of the Environmental Impact Assessment Review Panel. Other development related documents include terms of references (TORs), scoping studies and monitoring reports. The Department also review consultation files sent to the Department from the Town and Country Development Offices as part of the review process. These documents and files are reviewed by the different sections of the Department including, but not limited to, the Environmental Planning, Education and Research Section, ANPCS and BDCS.

The Environmental Planning, Education and Research Section consisted of a Senior Environmental Technical Officer, an Environmental Technical Officer and a Technical Officer. The Senior Environmental Technical Officer post became vacant during the latter part of 2018.

### 4.1 Consultation Files

Twenty (20) consultation files were received by the EPD in 2018. Fourteen (14) were assigned to the BDCS with eleven (11) completed and three (3) were outstanding at the end of 2018.

The six (6) remaining six consultation files were categorized as development-related documents e.g. environmental impact assessments.

The consultation files dealt with matters related to hotels, animal husbandry, renewable energy and an electrical generating station

### 4.2 Development related documents reviewed in 2018

*Table 2: List of development-related documents reviewed*

<b>Types of document</b>	<b>No. of documents</b>
<b>Environmental Impact Assessment</b>	1
<b>Terms of Reference</b>	3
<b>Monitoring Reports</b>	3
<b>Environmental Scoping Studies</b>	3
<b>Other</b>	3

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<b>Total</b>	13
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As shown in Table 2 above thirteen (13) documents were submitted to the Department for review and comments regarding eight (8) of the documents were completed and sent to the agencies that requested the information. The other category including a grievance handling procedure, an environmental social management plan and environmental and social management report. The documents reviewed related mostly to renewable energy applications.

### 4.3 Looking Forward

Activities to be completed in 2019 are the continued review of development-related documents and submission of comments to the appropriate parties.



## 5 Marine Pollution Control

The Marine Pollution Control Section (MPCS) of the Environmental Protection Department is responsible for activities which may affect the marine environment. The functions of the MPCS are as follows:

- Responding to complaints or pollution incidents related to the marine environment;
- Monitoring and control of marine pollution;
- Conducting inspections of various sources to determine potential releases of pollutants;
- Oil spill contingency planning and response;
- Researching marine pollution issues and
- Preparing guidelines for various sectors and or activities aimed at reducing marine pollution.

The Marine Pollution Control Act CAP. 392A is used by the Department to manage activities related to marine pollution.

The MPCS in 2018 consisted of a Senior Marine Pollution Officer and a Marine Pollution Officer. The other two Marine Pollution Officer posts were vacant.

### 5.1 Complaints

Table 3 below shows that a total of seven (7) complaints were received which were almost evenly split between those related to oil pollution and wastewater discharge.

Table 3: Complaints handled by the Marine Pollution Control Section

Type/Activity	Complaints Received	Investigations	Compliance visits	Regulatory Notices	Other Correspondence
Oil Pollution	4	3	1	1	1
Wastewater Discharge	3	2			
<b>Total</b>	<b>7</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>1</b>

Along with the initial investigations, a compliance visit was also conducted and a regulatory notice submitted to the offending operation.

## 5.2 Regulatory Inspections

Regulatory inspections are undertaken by the Department to determine the impacts of various activities on the environment. These activities are carried out by the MPCS ANPCS, Solid and Hazardous Materials Section and the Water Quality Section.

The MPCS completed two regulatory inspection reports in 2018 which were for HIPAC Ltd. and Harris Paints Ltd.

A regulatory inspection was carried out at Portvale Sugar Factory and Arawak Cement Plant Company Ltd by the ANPCS. A new survey instrument was designed and approved for the collection of information as part of the regulatory inspection process. It was piloted during the visit to Portvale Sugar Factory. The report of the inspection of the Portvale Sugar Factory was drafted and submitted for review and approval.

## 5.3 National Oil Spill Contingency Plan

The EPD conducts activities related to the management of oil pollution in Barbados. One of those activities was about emergency response planning in the event of a large release of oil to the environment. The National Oil Spill Contingency Plan is maintained by the EPD to ensure that measures are in place to deal with any eventuality.

Activities conducted in 2018 for the National Oil Spill Contingency Plan (NOSCP) included the updating of the oil spill response equipment inventory (Appendix C) and the Directory of the members of the National Oil Spill Response Committee (Appendix A).

## 5.4 Looking Forward

The Marine Pollution Control Section in 2019, will conduct a review of the regulatory and compliance inspection process and undertake compliance inspections for operations for which regulatory inspections were completed. The section will also update the Oil Spill Contingency Plan with its various components such as the oil spill response equipment inventory and the directory of members of The National Oil Spill Response Committee among other appendices.

## 6 Multilateral Environmental Agreements

The EPD is responsible for the implementation of several multilateral environmental agreements (MEAs) and international policies which include the Strategic Approach to International Chemical Management (SAICM). The MEAs to which EPD are accountable include:

- Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) including the Oil Spill and Land-Based Sources of Marine Pollution Protocols,
- Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal,
- The Stockholm Convention on Persistent Organic Pollutants (POPs) and
- Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons/Chemicals Weapons Convention (CWC).

The Environmental Protection Department is responsible along with the Ministry of Health for the implementation of programs arising out of the membership to the International Atomic Energy Agency (IAEA).

Several sections of the Department contribute to the management of the activities associated with the MEAs. These include the Environmental Planning, Education and Research Section, ANPCS, Water Quality, Marine Pollution Control and Solid Waste and Hazardous Materials Section.

### 6.1 Basel Convention

Environmental Protection Department is the focal point for the Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal in Barbados. The Convention has an annual reporting requirement as stated in Article 13: Transmission of Information. As such, the Annual Report for 2017 was completed and forwarded to the Permanent Secretary for approval before submission.

### 6.2 Stockholm Convention

With respect to the implementation of the Stockholm Convention in Barbados, two projects funded by the Global Environment Facility (GEF) were undertaken in 2018 which should further facilitate progress towards full implementation of the Convention. These projects were the GEF 5558: Development and Implementation of a Sustainable Management Mechanism for POPs in the Caribbean and the GEF 4881: Continuing Regional Support for the POPs Global Monitoring Plan under the Stockholm Convention in the Latin American and Caribbean Region.

Other activities included a review of the proposed amendments to the Stockholm Convention, which will be considered at the 9th meeting of the Conference of Parties

#### 6.2.1 Continuing Regional Support for the POPs Global Monitoring Plan under Stockholm Convention in the Latin America and Caribbean Region (GEF 4881)

GEF 4881 is a regional 12 country project with an overall objective to “strengthen capacity for implementation of the revised POPs Global Monitoring Plan in the Latin America and Caribbean region, and create the conditions for sustainability of the networks”. It has six components which include training, analysis of national GMP samples such as mother’s milk and air and enhancement of the quality of laboratory analysis for the presence of POPs.

##### **Passive Monitoring**

A part of the project was the collection of air samples from 11 samplers using polyurethane. This aspect of the project commenced in December 2016 and continued until January 2019. Samples were collected and deployed quarterly and sent to the local laboratory (University of the West Indies) as well as Spain and Sweden for analysis.

##### **Human Milk**

One aspect of the project is the determination of the level of exposure of women of childbearing age to POPs by quantifying the concentration of these substances in mother’s milk. Samples were taken from a number of participants and the samples were then pooled into one. The pooled sample of breast milk was shipped to Germany for analysis. In 2018, retired nurses were contracted to distribute tokens of appreciation to the mothers who donated milk samples. Upon completion of this aspect of the project, the Ethics Board at the UWI was informed of the closure of the research into the presence of POPs in breast milk.

## **National Samples**

During 2018, national samples consisting of fish, sediment, soil, water, egg yolks and pork were collected, prepared and shipped to Sweden and the Netherlands for analysis.

## **Training**

The University of West Indies (UWI) hosted experts from an international laboratory who conducted training on various POPs analyses. Participants from the Forensic Sciences Centre and the Government Analytical Services were invited to participate in the training.

## **Meetings and Reports**

Expenditure and progress reports were prepared for the periods July to December 2017 and January to June 2018. Both reports were submitted to the coordinators of the project. Dr Smith, from the University of the West Indies, represented Barbados at a meeting in Colombia to discuss progress made on the project and any actions that need to be taken.

### 6.2.2 Development and Implementation of a Sustainable Mechanism for Persistent Organic Pollutants

Under the five-year regional project *Development and Implementation of a Sustainable Management Mechanism for Persistent Organic Pollutants in the Caribbean* funded by the Global Environment Facility (GEF), several activities were undertaken during 2018.

One activity was a series of project meetings were held from May 28 – 31, 2018. These meetings include the Training of Trainers: Inventory and Environmentally Sound Management of Persistent Organic Pollutants in the Caribbean Workshop was held on May 28, 2018. The workshop provided participants with guidelines for handling, storage, labelling, storage, packaging, collection and use of personal protective equipment related to the management of hazardous chemicals and POPs.

Another meeting was The Third Annual Project Steering Committee Meeting, which was held on May 29, 2018. It provided an update on the various consultancies associated with the project and the upcoming activities and country visits for consultants. The outcome of the Validation Workshop for the update of National Implementation Plans was the recommendation that the consultant's work plan be revised to facilitate the completion of the consultancy.

Additionally, the workshop on May 31, 2018, allowed for the presentation of the country status reports by the legal consultant, Christine Toppin-Allahar, and discussion of the way forward for drafting model chemicals management legislation.

Representatives of the communications consultant, Arthur Lok Jack School of Business visited Barbados during the period, August 20 -21, 2018. A meeting was convened with the consultants and the project oversight committee to discuss the findings of the needs assessment surveys and recommendations for a communications strategy for POPs for Barbados. Site visits were conducted on August 21, 2018.

A meeting was convened with the legal consultant, Christine Toppin-Allahar, a representative of BCRC-Caribbean and the project oversight committee on September 20, 2018, to discuss the draft model chemicals management legislation and comments were subsequently submitted.

The upgrade of the BCRC-Caribbean's information technology infrastructure, necessary for support the POPs Regional Information System commenced in 2018 and was undertaken by Business Tech Research Institute.

A stakeholder consultation was coordinated and convened as part of the process to update the National Implementation Plan for the Management of Persistent Organic Pollutants and was held on March 6, 2018.

### 6.3 Strategic Approach to Chemicals Management

The Strategic Approach to Chemicals Management (SAICM) is a policy framework which is used to promote chemical safety around the world. It was adopted on February 6, 2006, by the First International Conference on Chemical Management. Barbados has had four projects funded by the Quick Start Programme (QSP). These were:

- Updating a national chemicals management profile, developing a national SAICM capacity assessment, and holding a national SAICM priority setting workshop
- Capacity Building for POPs analysis to support the Global Monitoring Plan of POPs for effectiveness evaluation under the Stockholm Convention
- Strengthening capacities for SAICM implementation and supporting capacity building for the Globally Harmonized System of Classification and Labelling of Chemicals in Barbados
- and includes the final one which is "Building Capacities to Strengthen the Management of Heavy Metals."

The full and final closure of the QuickStart Trust Fund and the end of the QSP will be December 31, 2019.

### 6.3.1 Building Capacities to Strengthen the Management of Heavy Metals

The project “Building Capacities to Strengthen the Management of Heavy Metals” commenced on April 28, 2018, with the signing of the agreement by the Permanent Secretary, Ministry of Environment and Drainage, and the representative of the SAICM Trust Fund. The one-year project involves the development of inventories of cadmium, lead and mercury (CLM) using the mercury toolkit for mercury and using the toolkit as a guide to carry out the lead and cadmium inventories. The other components were training and environmental monitoring of cadmium, lead and mercury.

A media launch for the project occurred on July 16, 2018, and was held at the conference room in the Warrens Tower II, Warrens, St. Michael in the now renamed Ministry of Environmental and National Beautification. The Honourable Trevor Prescod, J.P., M.P. Minister of Environment and National Beautification addressed the media and informed them about the project.

To facilitate the development of the inventory of the cadmium, lead and mercury, two project assistants were contracted from September 2018 to February 28, 2019.

A workshop in inventory development, which was facilitated by a representative from UNITAR, was undertaken by the Department to train staff in how to use the mercury toolkit and to undertake inventories of CLM.

The Department also hosted a workshop on environmental monitoring of heavy metals, which was facilitated by a representative from IHE-Delft, and attended by members of staff.

Samples of air, soil, sediment, marine water and groundwater from across the island were collected to be analysed for cadmium, lead and mercury. The samples of groundwater, marine water, soil and sediment were stored at Government Analytical Services temporarily before being shipped to Advanced Environmental Laboratories (AEL) in Florida, USA. The air monitoring equipment and filters were obtained from ROSE Environmental Inc in Trinidad and the samples were also sent to ROSE Environmental Inc for analysis.

The preparation of inventories for cadmium, mercury and lead in Barbados commenced in 2018.



## 6.4 Chemical Weapons Convention

Barbados participated in several activities associated with Chemicals Weapon Convention (CWC). One of these was the hosting of the Planning and Coordination Meeting for the Caribbean Region Project from August 28-30, 2018. In attendance at this meeting were representatives from Barbados Defence Force (BDF), EPD, Department of Emergency Management and the Royal Barbados Police Force (RBPF).

The EPD has initiated the process for the development of a National Multi-Agency Training Course for Chemical and Radiological Emergencies. A meeting of stakeholders was held on June 27, 2018, and the preparation of the Cabinet Paper was started.

Barbados was represented at the Regional Meeting of States Parties in Latin America and the Caribbean from July 9-11, 2018 and at the Annual National Authorities meeting from November 6-9, 2019.

The department continued with the facilitation of training of emergency response personnel for chemical emergencies: personnel from the EPD, BDF, Barbados Fire Service (BFS), Ministry of Labour and RBPF all received training during the period.

Barbados submitted its annual report required under Article X of the CWC on National Programmes for the Protection against Chemical Weapons by the deadline of March 31.

## 6.5 International Atomic Energy Agency

At the 59<sup>th</sup> International Atomic Energy Agency (IAEA) General Conference in September 2015, Barbados' application for membership to the IAEA was approved by the Plenary. As part of the membership to IAEA, Barbados has undertaken several activities.

A National Inventory of Radiation Sources commenced in 2018 and a database of radioactive sources and radiation devices is being populated for importation into the Regulatory Authority Information System (RAIS) when it is received. The RAIS is an information management system for radioactive sources and radiation devices developed by the IAEA. It is a database for use by the regulatory authority to centralise all of the information related to radioactive sources and radiation devices.

The preparation of a policy paper for Radiation Protection was started and is nearing completion. This will assist in the development of regulations for the management of radioactive sources in Barbados and also identify areas for capacity building.

Personnel from the department received training in different aspects of the management of radiation.



The department has also received several pieces of equipment from the IAEA to assist with the work of regulation and management. The equipment received included:

- Three (3) Personal dosimeters,
- One (1) Portable Radionuclide Identifier with Radioactive Source,
- One (1) Portable Radiation detector, and
- Two (2) DoseRAE electronic personal dosimeters.

## 7 Solid Waste and Hazardous Materials Section

The Solid Waste and Hazardous Materials Section (SWHMS) is responsible for the management of solid waste and hazardous substances in Barbados. The Derelict Buildings and Vehicles Section (DBVS), which deals with the proper removal of derelict houses and vehicles as well as asbestos abatement, is a part of the SWHM Section.

The SWHM consists of the Senior Environmental Protection Officer and one Environmental Protection Officer post, which was vacant in 2018. While the DBVS consists of the Senior Environmental Inspector and two Environmental Inspectors.

### 7.1 Inspection of Landfill and Disposal Sites

Inspections of the Mangrove Landfill and other disposal sites were undertaken during the year. The other disposal sites included the following:

- Lonesome Hill, St. Peter
- Rock Hall, St. Philip
- Bagatelle, St. James

The areas assessed during the inspection include recordkeeping, waste management and environmental management e.g. control of illegal dumping. Three inspections were carried out in 2018 on January 11, February 22 and July 10.

The SWHMS encountered a number of challenges which impeded their ability to carry out inspections of the various disposal sites. One challenge was limited human resources and competing priorities such as the completion of contracts for the removal of derelict houses. Limited equipment also had an adverse impact on the ability of the SHWMS to conduct monthly inspections which included the vehicle malfunctioning.

### 7.2 Complaints

The SWHMS investigates complaints dealing with the improper disposal of waste and hazardous materials and also the indiscriminate use and handling of hazardous materials. During 2018, there were eight (8) complaints received and addressed by the SHWM Section.

### 7.3 Advice on the disposal of hazardous wastes

The SWHMS received and responded to twenty-two (22) requests for disposal advice during 2018.

## 7.4 Management of Radioactive Materials

Fifty (50) applications for the importation of radioactive materials were received and processed by the SWHMS during 2018. The majority of the applications came from the Queen Elizabeth Hospital and the Nuclear Medicine Barbados Inc.

## 7.5 Review of Pesticide Applications

In 2018, eleven (11) new applications for the importation of pesticides and two (2) applications for reassessment were received by the Department and all applications were addressed. Insecticides accounted for the majority of the applications submitted to the Department for review by the Pesticide Control Board.

## 7.6 Identification and Removal of Derelict Buildings & Vehicles

In 2018, the SHWMS coordinated and oversaw the removal of forty-one (41) houses at costing \$ 129,643.00. Forty-four (44) vehicles were also removed without any cost to the Department during the period under review.

## 7.7 Environmental Sound Disposal of Asbestos

Twenty-six (26) requests for permission to remove asbestos-containing materials were processed, approved and monitored by officers of the Department in 2018.

## 7.8 Looking Forward

The maintenance of the national inventory of radioactive sources and radiation devices on the island and the identification and sourcing of the relevant equipment necessary for the effective management of radioactive materials are two of the activities planned by the SWHM in 2019. The section also plans to educate the public by developing guidelines for the management of hazardous chemicals in industry.

## 8 Public Awareness and Education

The Environmental Protection Department undertakes several environmental awareness-raising and education activities. These include the summer internship programme and the EnviroFocus Newsletter among others.

### 8.1 EnviroFocus Newsletter

Issue #18 of the EnviroFocus Newsletter was developed in 2018 and circulated in February 2019. The Newsletter contained articles dealing with radiation safety, illegal dumping, chemicals management, the value of recycling and chemical weapons. It also possessed an article about the experiences of the 2018 interns.

### 8.2 Internship Programme

Two (2) students from the Barbados Community College participated in the summer internship programme in 2018. The interns spent time with the majority of the sections within the Department and thus was able to experience the different duties of each section. The interns also reviewed an environmental impact assessment and prepared a report with their comments. This was a collaborative effort between the interns.

### 8.3 Booklets

In 2018, the Department started the preparation of four booklets dealing separately with the topics: medical facilities, livestock, daycare centres and food establishments. The purpose of the booklets is to increase public awareness of the legislative and policy requirements needed to make an application to the EPD in the aforementioned areas. The booklets are schedule to finalized in the first quarter of 2019.

### 8.4 Looking Forward

The internship programme will continue in 2019 as well as the preparation of Issue 19 of the Envirofocus Newsletter. Work will also continue on the finalization of the public awareness booklets.

## 9 Water Quality

The Environmental Protection Department is responsible for the management of groundwater and nearshore water quality. This responsibility for sampling is shared between the Water Quality Section (WQS) and MPCS. Water quality monitoring and reporting for both marine and groundwater is normally done by the WQS. The WQS is manned by a Senior Environmental Protection Officer, two Environmental Protection Officers and one Environmental Inspector.

### 9.1 Complaints

The Water Quality Section investigated three (3) complaints of which two related to a wastewater discharge and the other was related to a molasses spill. The two complaints, which related to wastewater discharge, involved the problems with the South Coast Sewage Treatment Plant.

### 9.2 Groundwater Monitoring Programme

The Groundwater Monitoring Programme is used to determine whether there are any pollutants which may be negatively impacting the potable water supply. These pollutants may be microbiological or chemical among others.

*Table 4: Sampling frequency by Catchment*

Area	Frequency/monthly
<b>Belle Catchment</b>	1 <sup>st</sup> Tuesday
<b>Hampton Catchment</b>	2 <sup>nd</sup> Tuesday
<b>West Coast Catchment</b>	3 <sup>rd</sup> Tuesday
<b>Springs</b>	4 <sup>th</sup> Tuesday

Table 4 above, shows the sampling schedule for the groundwater monitoring programme which is carried out in conjunction with the Barbados Water Authority.

Two thousand and eighty-four (2,084) samples were taken during 2018 which consisted of eighty-one (81) samples from the Belle Catchment, eighty-five (85) from Hampton, Springs fifty-nine (59) and fifty-nine (59) as well from the West Coast Catchment.

Samples were analysed for twenty-one (21) microbiological and physicochemical parameters and compared to the World Health Organization (WHO) Guidelines for Drinking-water Quality.

### 9.3 Chlorides

The wells in the west coast catchment had the higher chlorides levels compared to the other catchments (Figure 4) The Whim Public Supply (P.S) had the highest concentration of chlorides for 2018 with a value of 277 mg/L which also exceeded the guideline value of 250 mg/L. It was the only well that surpassed the guideline value for 2018.

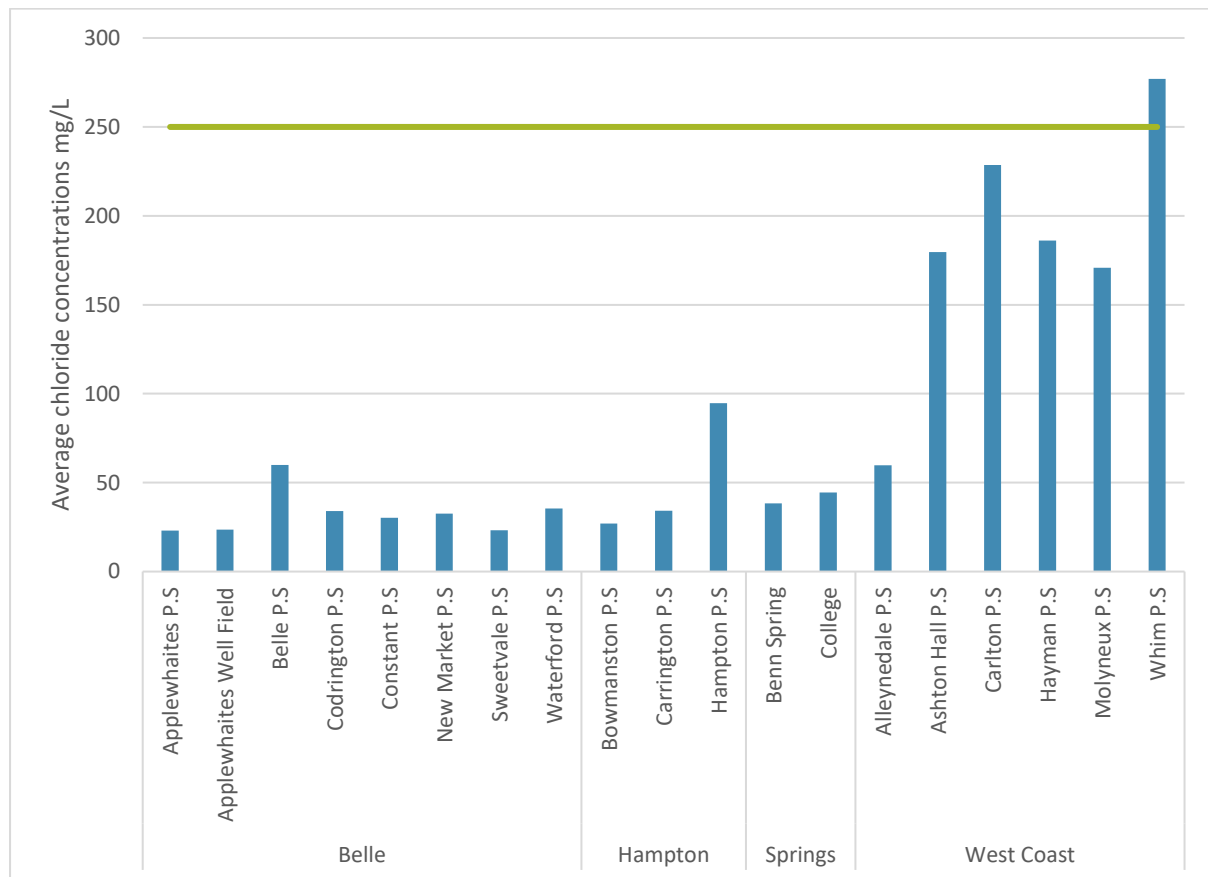


Figure 4: Average chloride concentration for public supply sources in 2018

Figure 5 shows that in 2018 the chloride concentrations for the wells in the west coast catchment are lower than some of the preceding years. However, the values are for the most part, except Alleyndale, still significantly higher than the other sources. Trents P.S and Villa Marie were not operational during 2018.

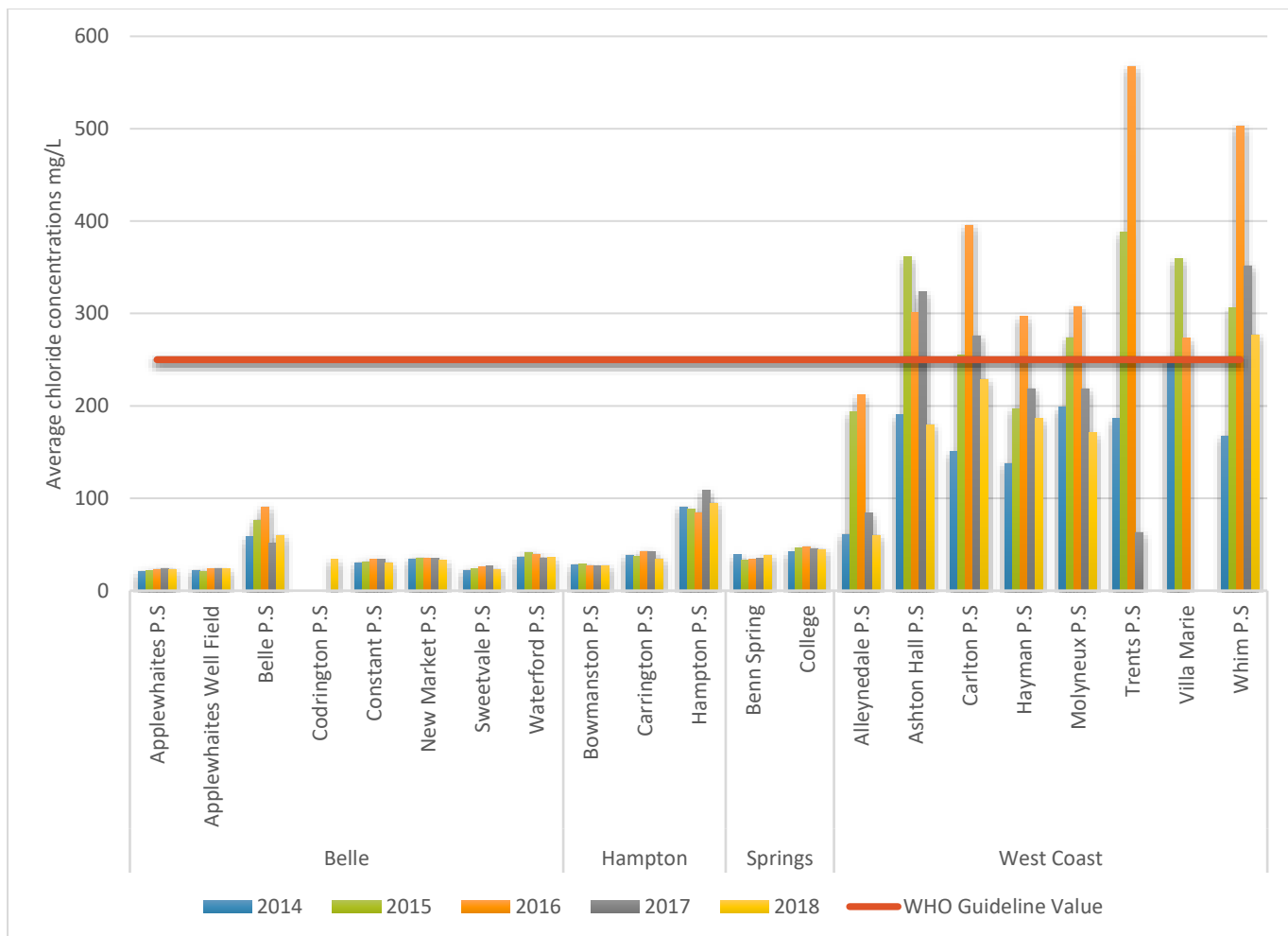


Figure 5: Average chloride concentrations for public supply sources from 2014 to 2018

## 9.4 Nitrate expressed as Nitrogen (Nitrate-N)

All of the potable water sources were below the guideline value of 10.0 mg/L (Figure 6). The highest value was from Ashton Hall P.S which was a value of 8.30 mg/L.

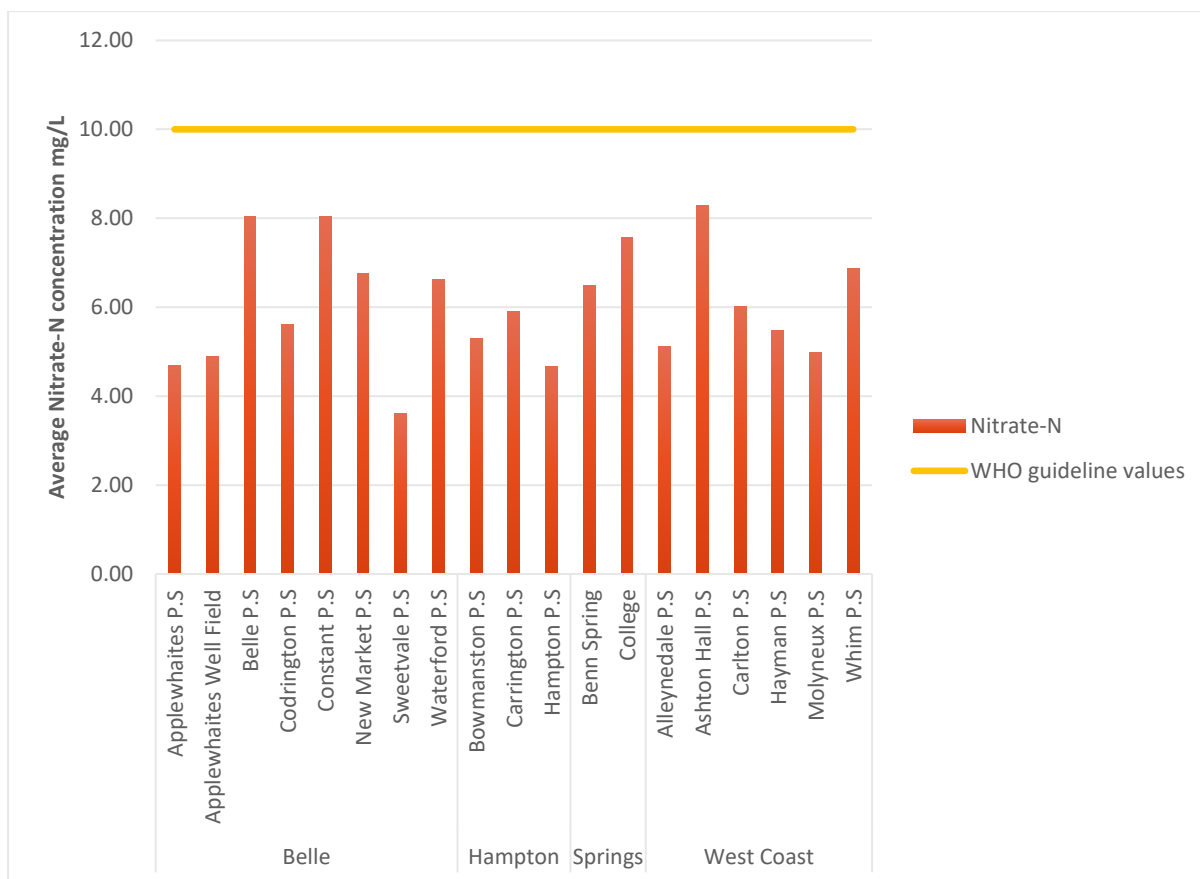


Figure 6: Average Nitrate-N concentration for the public supply sources in 2018

None of the public supply sources has exceeded the guideline of 10 mg/L during the five years (Figure 7). Values peaked during 2016 but a decrease was observed for 2017 and 2018 for some of the wells.



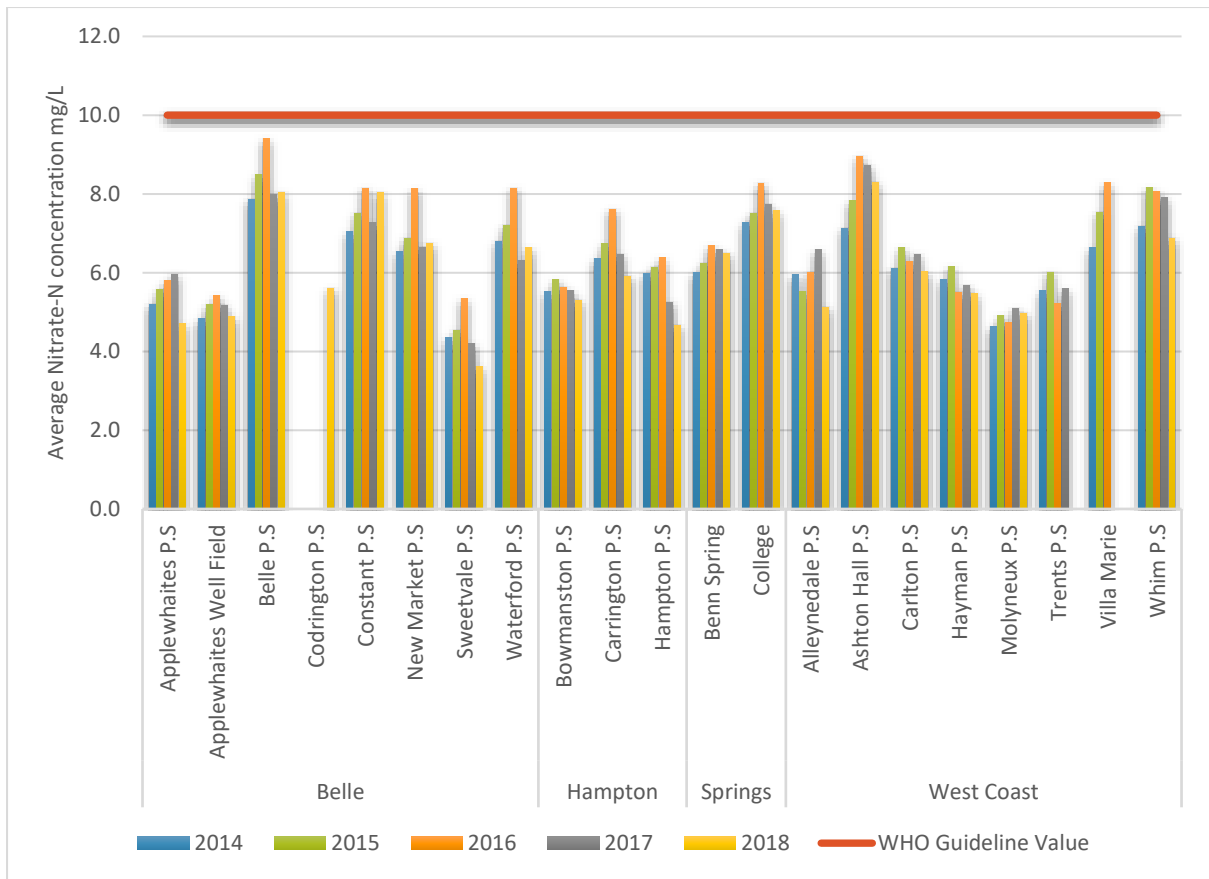


Figure 7: Average Nitrate-N concentrations for the public supply sources from 2014 to 2018

## 9.5 Sulphates

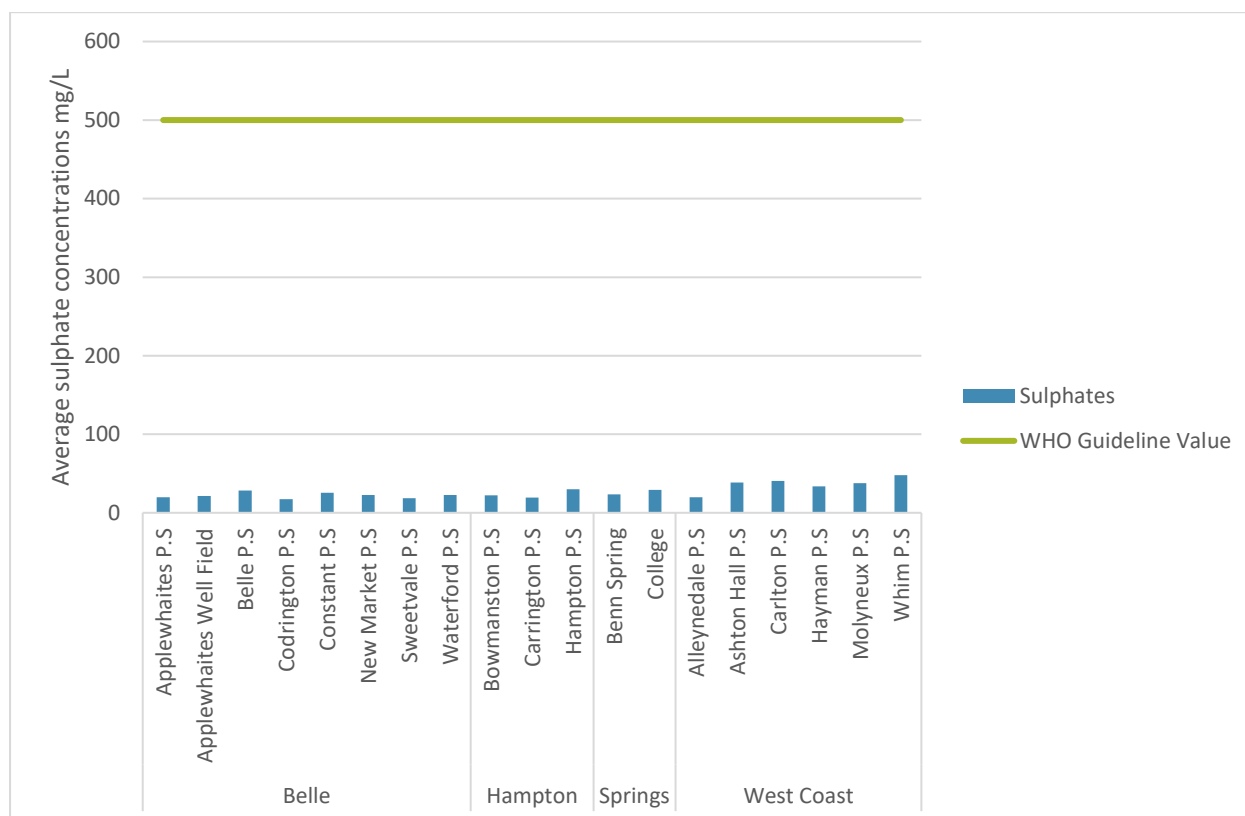


Figure 8: Average sulphate concentrations for public supply sources in 2018

Figure 8 shows that none of the public supply sources has exceeded the guideline value of 500 mg. This also is the case for the five years of 2014 to 2018.

## 9.6 Total Dissolved Solids

Four public supply wells exceeded the guideline value of 600 mg/L for total dissolved solids (TDS) which were Ashton Hall P.S (623 mg/L), Carlton (692 mg/L), Molyneux (619 mg/L) and the Whim P.S with the highest concentration of 776 mg/L (Figure 9). The wells in the west coast catchment generally had higher concentrations of total dissolved solids.

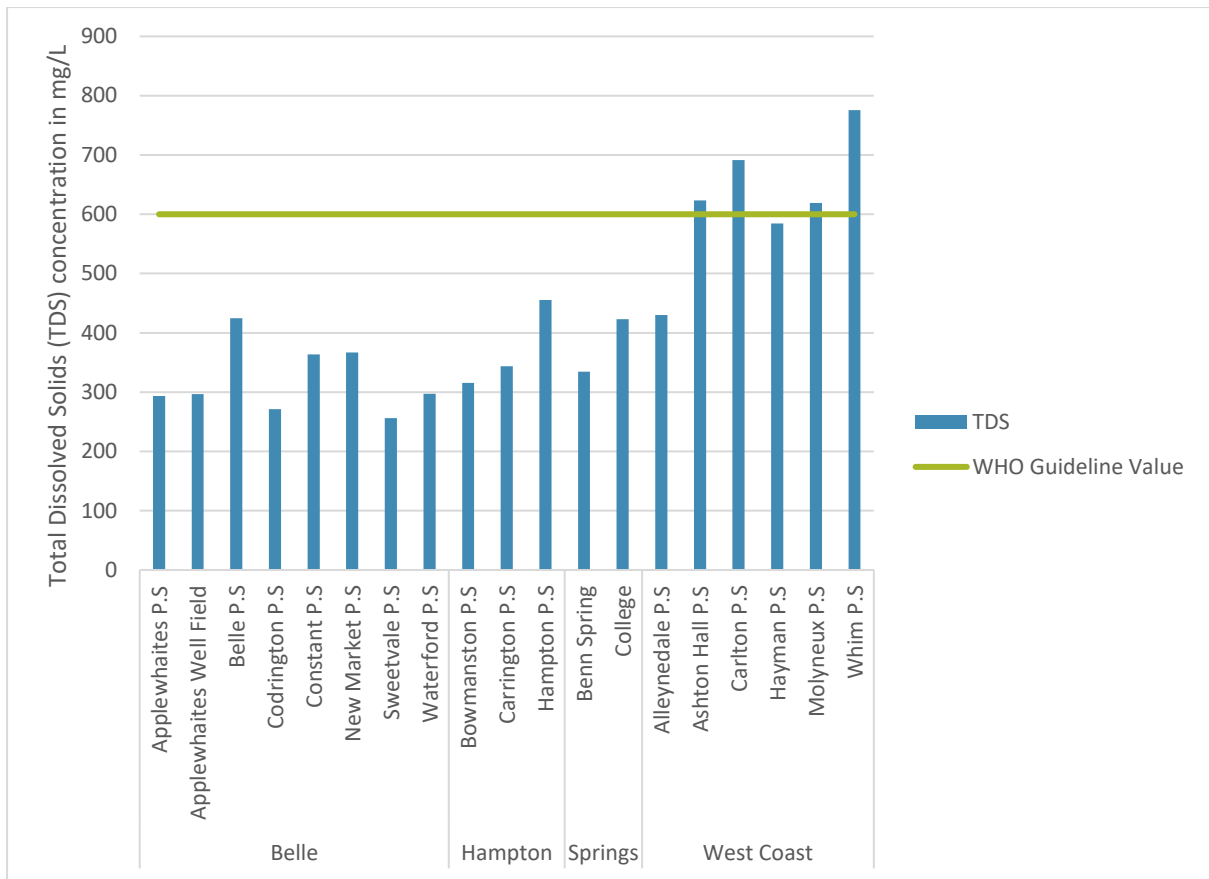


Figure 9: Total Dissolved Solids of public supply sources in 2018

Figure 10 shows that in 2018 the TDS concentrations for the west coast wells dropped compared to the preceding years in the five years of 2014 to 2018. The concentrations of TDS in the other wells were fairly constant.

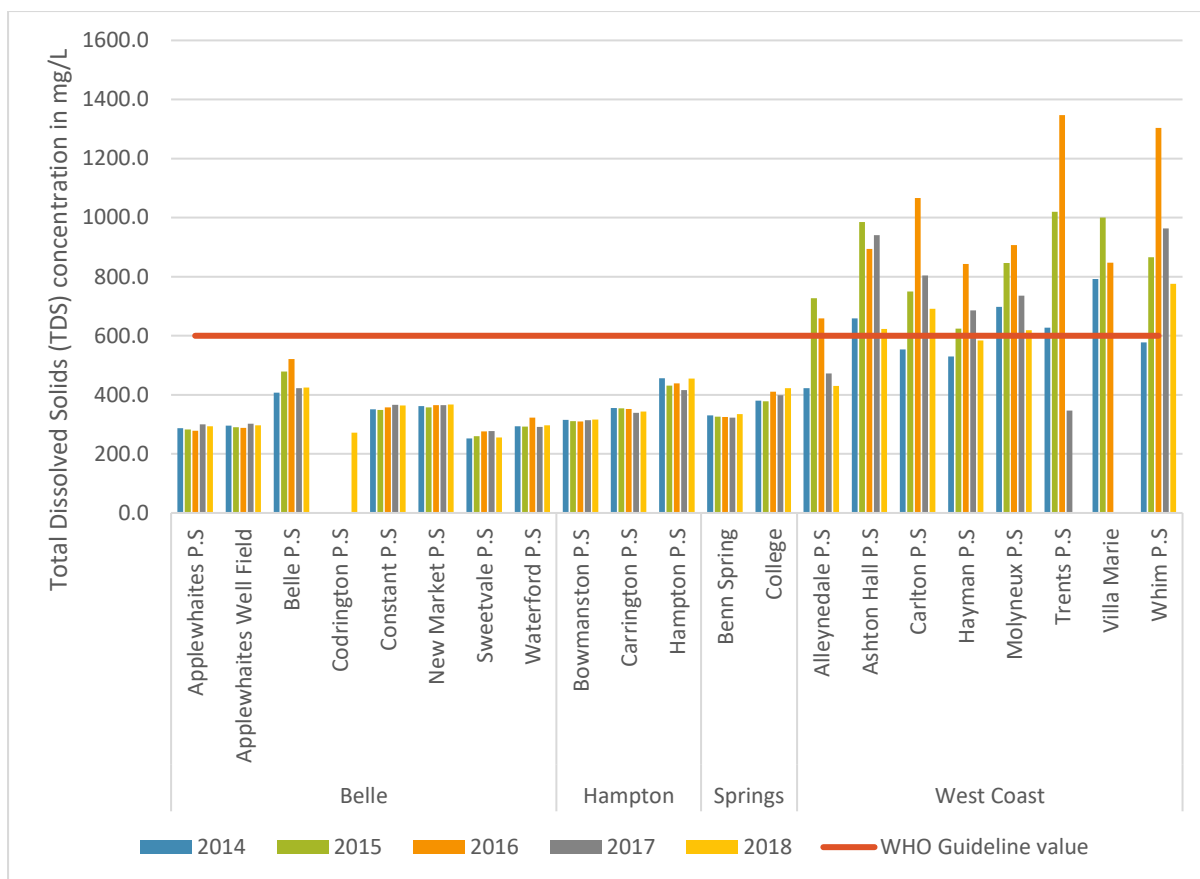


Figure 10: Concentrations of TDS from 2014 to 2018 in potable water sources

## 9.7 Faecal Coliform

Most of the public supply sources did not exceed the guideline value for faecal coliform of 0 CFU/100 ml. The sources that exceeded the guideline value were Applewhaites P.S and Bowmanston P.S with 1 CFU/100 ml.

## 9.8 Monitoring of Natural Springs

### 9.8.1.1 Chlorides

For Chlorides, all of the springs i.e. Fortesque, Porey Springs, Pothouse and Three Houses chloride concentrations were below the WHO guideline values of 250 mg/L.

### 9.8.1.2 Nitrate expressed as Nitrogen (Nitrate-N)

Most of the springs did not exceed the guideline value of 10 mg/L. However, the Nitrate-N concentration for Fortesque (10.5 mg/L) exceeded the guideline value.

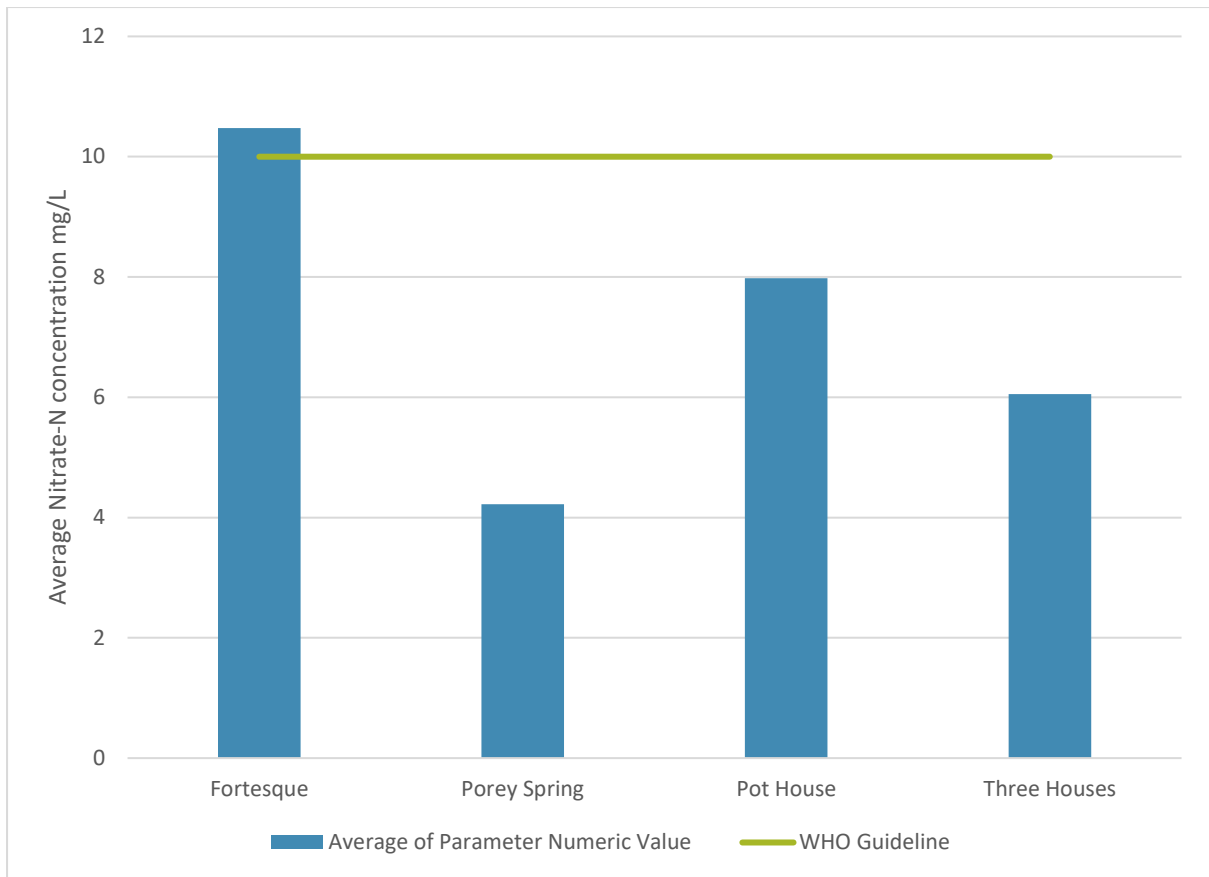


Figure 11: Average Nitrate-N concentration for springs in 2018

## 9.9 Nearshore Water Quality Monitoring

The Environmental Protection Department conducts sampling of marine water to ensure that the quality of water is safe for recreational purposes and also to protect the nearshore environment. Table 5 shows the beaches sampled as part of the nearshore monitoring programme.

Table 5: List of beaches samples by Catchment

<b>West Coast</b>	<b>South Coast</b>
<b>Brandons</b>	<b>Brownes</b>
<b>Brighton</b>	<b>Pebbles</b>
<b>Paradise</b>	<b>Amaryllis</b>
<b>Batts Rock</b>	<b>Accra</b>
<b>Coach House</b>	<b>Worthing</b>
<b>Holetown</b>	<b>Dover</b>
<b>Mullins</b>	<b>Graveyard</b>
	<b>Welches</b>
	<b>Miami</b>
	<b>Silver Sands</b>

In 2018, one thousand seven hundred and three (1,703) nearshore water samples were analysed. One thousand and eight-six (1,086) samples were analysed for South Coast beaches and six hundred and seventeen (617) samples from West Coast beaches. West Coast sampling was suspended due to issues with the South Coast Sewage System and the subsequent need to conduct daily sampling at south coast beaches.

### 9.9.1 Microbiological Analysis

For both catchments, one thousand five hundred and ninety-one samples (1,591) were tested for Enterococci and of these four samples were too numerous to count (TNTC) and two (2) had confluent growth. One thousand five hundred and ninety-one (1,591)

samples were tested for faecal coliform of these thirty-six (36) samples were TNTC and four (4) showed confluent growth.

The South Coast Catchment had one thousand and twenty-one (1,021) samples analysed for both faecal coliform and enterococci and West Coast had five hundred and seventy-one (571) samples analysed for enterococci and five hundred and seventy-two (572) samples for faecal coliform.

Table 6: Marine Quality Parameters and Proposed Ambient Standards

<i>Parameter</i>	<i>Standard</i>
<i>Enterococci</i>	The geometric mean of a minimum of 5 samples should not exceed 35 colonies/100ml in any 30-day period.
<i>Faecal Coliform</i>	The geometric mean of a minimum of 5 samples should not exceed 200 colonies/ 100ml in any 30 days.  AND  No more than 10% of samples exceed 400 colonies/100ml

### ***South Coast***

The standard for enterococci and faecal coliform was exceeded three times in 2018. These instances occurred at Worthing Site 1 (2 times) and Worthing Site 2 (once) during September and October. The cause of these exceedances was due to issues with the South Coast Sewerage System which resulted in contaminated wastewater entering drainage areas leading to Worthing Beach.

### ***West Coast***

There were no instances in which the microbiological standards were exceeded on the West Coast during 2018.

## 9.9.2 Physicochemical and Nutrient Analysis

Table 7 shows the guideline values for the physicochemical parameters sampled and analysed for in the nearshore monitoring programme.

Table 7: Parameters and the standard values

Parameter	Ambient Water Quality Standard
<b>Total Nitrogen</b>	<b>0.1 mg/L</b>
<b>Total Phosphorous</b>	<b>0.015 mg/L</b>
<b>pH</b>	<b>7.0 - 8.7</b>
<b>Total Suspended Solids (TSS)</b>	<b>5 mg/L</b>
<b>Turbidity</b>	<b>1.5 NTU</b>

### *South Coast*

For the South Coast Catchment, the average value for the total nitrogen exceeded the standard value (Table 8). This was also the case for total phosphorus, turbidity and total suspended solids (TSS). pH was within the range of recommended values.

The annual averages for all the beaches for total nitrogen exceeded the standard with Silver Sands Site 1 showing the highest average (0.86 mg/l). This site also had the overall maximum value of 1.67 mg/L.

With respect to TSS, eight out of 11 sites exceeded the standard. These were Dover, Graveyard Site 3, Miami Site 1, Pebbles (Site 1 & 2), Silver Sands Site 1, Welches, Worthing Site 2. The highest average was recorded at Graveyard Site 3 (15.77 mg/L) and also the maximum value (61 mg/L).

Dover Site 3 (1.56 NTU), Silver Sands Site 1 (5.44 NTU) and Worthing Site 2 (1.68 NTU) annual average turbidity values were greater than the standard. Silver Sands Site 1 has posted a maximum value of 14.10 NTU.

Table 8: Average values for physicochemical parameters for the South Catchment for 2018



	<b>Total Phosphorus/ mg/L</b>	<b>TSS/ mg/L</b>	<b>pH</b>	<b>Turbidity/ NTU</b>	<b>Total Nitrogen/ mg/ L</b>
<b>No. of samples</b>	<b>63</b>	<b>63</b>	<b>63</b>	<b>63</b>	<b>60</b>
<b>Average</b>	<b>0.06</b>	<b>6.03</b>	<b>7.72</b>	<b>1.77</b>	<b>0.36</b>
<b>Max</b>	<b>0.31</b>	<b>61</b>	<b>4.07</b>	<b>14.10</b>	<b>1.67</b>
<b>Minimum</b>	<b>0.05</b>	<b>2.00</b>	<b>8.26</b>	<b>0.20</b>	<b>0.06</b>

Table 8 shows that the annual averages for Total Phosphorus, Turbidity and Total Nitrogen for the West Coast Catchment exceeded the standards for those parameters. Total Suspended Solids (TSS) and pH were within the limits for those parameters.

With respect to turbidity, Batt Rock Site 1 (2.78 NTU), Coach House Site 1 (2.96 NTU), Heywoods Site 2 (1.59 NTU) and Holetown Site 2 (1.58 NT) annual average exceeded the turbidity standard of 1.5 NTU.

In relation to total phosphorus, the detection limit is 0.05 mg/L which is higher than the standard. Therefore, the present procedure would be incapable of detecting when the standard is exceeded.

Table 9: Average values for physicochemical parameters for the West Coast Catchment for 2018

Parameters	Total Phosphorus/ mg/L	TSS/ mg/L	pH	Turbidity/NTU	Total Nitrogen/ mg L
No. of samples	44	44	44	44	42
Average	0.05	4.45	7.77	1.65	0.38
Max	0.09	24.00	8.32	9.00	0.88
Minimum	0.05	2.00	6.07	0.11	0.03

## 9.10 Special Sampling

### Nearshore special sampling on the south coast: September 2018 to December 2018

Daily sampling commenced on September 6, 2018, in response to discharges of wastewater to the nearshore at Worthing via the sluice gate-drain. Sampling was conducted at 5 beaches (10 sites) in the area of concern. These beaches were Amaryllis, The Board Walk, Accra, Sandy Beach and Worthing.

The first report for samples collected over the 30-day period September 6, 2018, to 05 October 2018 showed the following:

There were no exceedances of the Faecal Coliform Geometric Mean criterion<sup>2</sup> and one (1) exceedance of the Enterococci Geometric Mean criterion<sup>3</sup>. This occurred at Worthing Beach with a value of 47 CFU/100ml (Table 10).

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<sup>2</sup> Faecal Coliform Criterion – Geometric mean of a minimum of 5 samples should not exceed 200 Colony Units (CFU)/100 ml in any 30-day period.

<sup>3</sup> Enterococci Criterion - Geometric mean of a minimum 5 samples not be greater than 35 CFU/100 ml in any 30-day interval

Table 10: Geometric means at each Beach

<b>Beach</b>	<b>Faecal Coliform Geometric Mean CFU/100ml</b>	<b>Enterococci Geometric Mean CFU/100ml</b>
<b>Amaryllis</b>	5	2
<b>BoardWalk</b>	6	3
<b>Accra (Rockley)</b>	18	4
<b>Sandy Beach</b>	28	7
<b>Worthing</b>	171	47

Results over 30 days were assessed to determine the 95<sup>th</sup> Percentile for Enterococci. This approximates that 95% of the results at a given beach over the period were under a stated value. Conversely, it shows that 5% of the results reported were over this stated value. These results also allowed a comparison with the World Health Organisation (WHO) and the European Commission (EU) standards for recreational and bathing waters. These standards are outlined in Table 11 and Table 12.

Table 11: World Health Organisation (WHO) Enterococci Criterion

<b>World Health Organisation (WHO) Enterococci Criterion (2003) - 95 Percentile /100 ml</b>	<b>Estimated Risk per Exposure (Illness Rate)</b>
<b>'A' standard of ≤ 40</b>	< 1 case of Gastroenteritis (GI) in every 100 exposures or <1% GI illness risk  Negligible or <0.3% Acute Febrile Respiratory Illness (AFRI) risk
<b>'B' standard of 41-200</b>	1 case of GI in 20 exposures or 1-5% GI illness risk  <19 cases of AFRI per 1,000 exposures or 0.3-1.9% AFRI risk
<b>'C' standard of 201-500</b>	1 in 10 or 1 in 20 cases of GI for a single exposure or 5-10% GI illness risk  19-39 cases of AFRI per 1,000 exposures or 1.9-3.9% AFRI risk
<b>'D' standard of &gt;500</b>	>10% chance of GI per single exposure of >10% GI illness risk  19-39 cases of AFRI per 1,000 exposures or >3.9% AFRI risk

Table 12: European Commission (EU) Enterococci Criterion

<b>European Commission (EU) Enterococci Criterion (2006) - 95 Percentile /100 ml</b>	<b>Estimated Risk per Exposure (Illness Rate)</b>
<i>Excellent Quality ≤ 100 CFU/100 ml</i>	-
<i>Good Quality 101-200 CFU/100 ml</i>	-
90 Percentile /100 ml	
<i>Sufficient ≤185 CFU/100 ml</i>	-

The results in Table 13 indicated that, over the 30-day sampling period, Amaryllis and BoardWalk Beaches met the World Health Organisation (WHO) 'A' standard for recreational waters. Accra Beach and Sandy Beach met the WHO 'B' standard, while Worthing Beach fell into the WHO 'D' standard. Additionally, Amaryllis, BoardWalk

and Accra Beach met the EU Standard for ‘Excellent’ bathing water quality and Sandy Beach met the EU standard for ‘Good’ bathing water quality. Worthing beach did not meet any EU standard and was be classified as ‘Poor’.

Table 13: 95<sup>th</sup> Percentile values at each beach.

Beach	Enterococci 95 <sup>th</sup> Percentile CFU/100ml	Assessment against WHO recreational waters <u>Enterococci</u> standard	Assessment against EU recreational waters <u>Enterococci</u> standard
Amaryllis	12	A	Excellent
BoardWalk	37	A	Excellent
Accra (Rockley)	68	B	Excellent
Sandy Beach	139	B	Good
Worthing	100,900	D	Poor

A further assessment of the 90<sup>th</sup> percentile of the Enterococci results was used to determine the Statistical Threshold Value (STV) excursion frequency for all of the enterococci results obtained over the 30-day period. Table 14 below shows that Worthing beach was the only beach that exceeded the US EPA excursion frequency.

Table 14: Assessment of Exceedances of Statistical Threshold Value (STV)

Beach	Enterococci 90 <sup>th</sup> Percentile CFU/100ml	Exceedance of Statistical Threshold Value (STV) magnitude [130 CFU/100 ml] in the same 30-day interval
Amaryllis	6	No
BoardWalk	21	No
Accra (Rockley)	31	No
Sandy Beach	91	No
Worthing	15,780	Yes

Daily sampling, which commenced on September 6, 2018, continued through to the end of 2019. The results over the 4 months are summarised in Table 15 through 18.

Table 15: Number of samples assessed during daily sampling from Sept. 6, 2018, to Jan. 2, 2019

Area of Concern	Number of samples assessed for Faecal Coliform	Number of samples assessed for Enterococci
<b>Amaryllis Beach to Worthing Beach</b>	1,825	1,888

Table 16: Failures of Single Sample Maximum (SSM) criteria during daily sampling from 06 Sep. 2018 to 02 Jan. 2019

Area of Concern	Failures of US EPA (1986) Enterococci SSM standard of 104 CFU/100ml	Failures of Health Canada (2012) Enterococci SSM standard of $\geq 70$ CFU/100ml
<b>Amaryllis Beach to Worthing Beach</b>	139	185

Table 17: Geometric Mean criteria during daily sampling from Sep. 6, 2018, to Jan. 2, 2019

Area of Concern	Incidences of non-compliance with US EPA 1976 Faecal Coliform Geometric Mean Criterion	Non-compliance	Incidences of non-compliance with US EPA 1986 & 2012 Enterococci Geometric Mean Criterion	Non-compliance
<b>Amaryllis</b>	0	0%	0	0%
<b>Board Walk</b>	0	0%	0	0%
<b>Accra (Rockley)</b>	0	0%	0	0%
<b>Sandy Beach</b>	0	0%	0	0%
<b>Worthing</b>	4	33%	6	50%

Table 18: Results from the sampling of surface water in the sluice gate canal between Oct. 16, 2018, to Nov. 30, 2019

Area of Concern	Range of Faecal Coliform Results CFU/100ml	Range of Enterococci Results CFU/100ml
<b>Sluice Gate Canal</b>	53,900 to 33,900,000	32,500 to 35,000,000

On **Monday, February 19, 2018**, the Environmental Protection Department conducted an intensive nearshore sampling program at Worthing Beach and Sandy Beach, between the hours of 7 am and 3 pm. This was done to collect data on the levels of Faecal Coliform and Enterococci bacteria observed after the release of water from the Graeme Hall swamp through the drainage canal/slucice gate at Worthing beach. The release occurred overnight until approximately 5 am. The data collected was used to evaluate temporal and spatial changes in these bacterial levels, and to inform the Department regarding exceedances of recreational water criteria and the potential for a recurrence of exceedance in the future. There were overnight showers during the period of the release and the day was characterised as generally cloudy.

The results indicated that elevated Faecal Coliform levels were observed at most of the beach sites up to 11:30 am. Laboratory results were recorded as Too Numerous To Count (TNTC) for Worthing Sites 2 and 1 and the Slucice gate-drain. This suggests that the counts may have been above the highest previously recorded numerical value of 250 CFU for that particular beach over one year, from November 2016 to November 2017. Enterococci levels at the beach sites were within the single sample maximum criteria set by the USEPA, 1986 (104 CFU/100ml) and Canada Health, (70 CFU/100ml), but the lowest levels were observed at all sites after 10:30 am. Very high Faecal Coliform and Enterococci Levels were observed in the slucice gate-drain.

Another round of intensive sampling was conducted on **Monday, May 07, 2018**, at Accra Beach and Worthing Beach from 6 am to 9 am. The purpose of this sampling was to assess nearshore water quality during the early morning, noting the previous much-publicized release of wastewater from a drain at Accra Beach, and the significant contamination of the slucice gate-drain at Worthing Beach from continuous flows of wastewater in the area of the old Scotia Bank.

The results from this sampling showed variable bacterial levels at most sites. However, Accra Site 2, which is directly opposite the mouth of the affected drain showed some elevated Faecal Coliform levels (TNTC) at 6:00 am and 8:55 am. There was a failure of the USEPA (1986) and Canada Health (2012) Enterococci Single Sample Maximum criteria (SSM) at that same site at 8:55 am. A failure of the Canada Health Enterococci SSM was also observed at 8:26 at Worthing Site 1. All other nearshore samples met the relevant criteria.

Testing of the water in the drain at Worthing and Accra was conducted as part of the intensive sampling on May 07, 2018, and showed very high Faecal Coliform and Enterococci levels. It was also shown that the Enterococci levels in the drain at Accra were about ten times greater than those observed in the slucice gate-drain by Worthing. This may have been due to the direct impact from, and closer proximity of that drain (Accra) to, the source of the wastewater. At that time, it suggested that a discharge of a more deleterious nature was coming from the drain at Accra.

## 9.11 Widescreen Water Quality Monitoring

Biannual monitoring of groundwater potable supply sources was carried out on May 22<sup>nd</sup> 2018 and November 27<sup>th</sup> 2018. On both occasions, sampling was undertaken at 6 sites which were Belle, Hampton, Applewhaithes P.S, Benn Spring, Waterford P.S and Haymans P.S.

Samples were tested for several parameters including but not limited to metals, semi-volatiles, volatiles, persistent organic pollutants and radionuclides.

Haymans P.S (630 mg/L) exceeded the WHO guideline value for total dissolved 600 mg/L during the dry season monitoring session. During the wet season sampling in November Haymans, P.S (570 mg/l) exceeded the US EPA standard of 500 mg/L.



## 10 Training, Conferences, Seminars and Workshops

The staff of the Department participated in the number of local and overseas training activities during 2018 (Appendix Table 19 and Table 20 ). Most notable of these were the Community Noise Enforcement and Environmental Monitoring of Heavy Metals training courses.

The Community Noise Enforcement course was held on July 17 to 20, 2018 at upstairs L.V. Harcourt Lewis Building and was conducted by Mr Eric Zwerling (Rutgers Noise Technical Assistance Center). The course was opened by Minister of Environment and National Beautification, the Hon. Trevor Prescod.

Thirty (30) persons participated in the course from agencies including the Royal Barbados Police Force (RBPF), Labour Department, Town and Country Development Planning Office, Department of Public Prosecution, Chief Parliamentary Council, Ministry of Health and Wellness, the Ministry of Public Works and Maintenance and the majority were from the Environmental Protection Department. The course dealt with applicable legislation and standards provided practical experience in measuring noise levels and explained the requirements for enforcement.

Ten (10) officers attended the Environmental Monitoring of Heavy Metals training course held from October 1 to 5, 2018 and were facilitated by Dr Alissa Zuijdgeest from IHE Delft. Other agencies were also represented at the training course: The Barbados Water Authority, Coastal Zone Management Unit and the Government Analytical Services (Ministry of Agriculture). The course dealt with heavy metals in the environment, comparison with standards, sampling methods and data analysis. This training course was a component of the GEF 4881 project.

Table 21 and Table 22 (Appendix) shows the conferences and meetings which the Department participated in both locally and overseas. Several of the activities involved the Solid Waste and Hazardous Materials Section with topics related to pesticides, radioactivity and chemical weapons.

## 11 Appendix

Table 19: List of training activities EPD staff participated in locally

Name of Course/Activity	Location & Date/Period	Aim/Objectives(s)	Officer(s) in Attendance
Public Service Document Preparation	<p><b>Location:</b> Training Administration Division</p> <p><b>Date:</b> January 15 to 19, 2018</p>	<ul style="list-style-type: none"> <li>• Explain the role that the administrative officer plays in the functioning of the public service.</li> <li>• Apply a systematic approach to the research and writing of public service documents.</li> <li>• Use established formats to prepare a variety of public service documents including minutes, reports, briefs and replies to parliamentary questions.</li> </ul>	<p>Shaina McAllister – Senior Environmental Technician</p> <p>Ann-Marie Eversley – Senior Marine Pollution Officer</p>

<p>Post Graduate Diploma in Public Sector Management</p>	<p><b>Location:</b> Cave Hill School of Business, UWI</p> <p><b>Date:</b> Semester 1 (January 23 to April 12, 2018)</p> <p><b>Location:</b> Training Administration Division</p> <p><b>Date:</b> April 4, 2018</p>		<p>Anthony Headley - Director</p>
<p>CDB Project Management Follow-up Virtual Meeting</p>	<p><b>Date:</b> February 6, 2018</p>		
<p>Barbados VLS Modules 3-9</p>	<p><b>Location:</b> Online</p> <p><b>Date:</b> February 6, 2018</p>		<p>A. Eversley - Senior Marine Pollution Officer</p>

<p>UNESCO-IHE online course on Biological Wastewater Treatment: Principles, Modelling and Design.</p>	<p><b>Location:</b> Online</p> <p><b>Date:</b> September 4, 2017, to February 16, 2018.</p>	<p>To familiarize participants with the latest approaches to the design, operation, modelling and simulation of wastewater treatment processes such as activated sludge, biological nitrogen or phosphorus removal, secondary settling tanks and membrane bioreactors.</p>	<p>A. Reeves – Technical Officer</p> <p>P. Pile – Environmental Technical Officer</p>
<p>IAEA Regional Training Course for First Responders to a Radiological Emergency</p>	<p><b>Location:</b> Radisson Aquatica Hotel</p> <p><b>Date:</b> June 4 -8, 2018</p>	<p>To familiarize participants with the requirements for an effective response to a radiological emergency</p>	<p>T. Armstrong – Senior Environmental Protection Officer</p> <p>N. Cummins – Environmental Inspector</p>
<p>Time Management</p>	<p><b>Location:</b> Training Administration Division, Warrens II, Warrens, St. Michael</p> <p><b>Date:</b> July 11, 2018</p>	<p>To expose participants to current methods and strategies for managing their time, to improve individual and organisational productivity.</p>	<p>Carlos Taylor – Building Development Officer</p>

<p>Community Noise Enforcement</p>	<p><b>Location:</b> Upstairs, L.V. Harcourt Lewis Building, Dalkeith, St. Michael</p> <p><b>Date:</b> July 17 to 20, 2018</p>	<p>To educate attendees about the applicable legislation and standards, provide practical experience in measuring noise levels and explain the requirements for enforcement</p>	<p>S. McAllister - Senior Environmental Technician</p> <p>L. Chapman - Environmental Technician</p> <p>Justin Yearwood - Environmental Technician</p> <p>C. Layne - Building Development Inspector</p> <p>H. Clarke - Building Development Officer</p> <p>S. Chase - Building Development Inspector</p> <p>E. Harper - Building Development Officer</p> <p>G. Clarke - Building Development Officer</p> <p>T. Marshall - Building Development Officer</p> <p>C. Browne - Building Development Officer</p> <p>T. Williams - Marine Pollution Officer</p>
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Communications and Interpersonal Skills	<p><b>Location:</b> Training Administration Division</p> <p><b>Date:</b> July 30 - 31</p>	To enable participants to enhance their interpersonal relations through the use of effective communication techniques.	S. Forde - Buildings Development Officer
On-Scene Commander IMO Level 2 and Incident Command (SCAT Course Training)	<p><b>Location:</b> Barbados National Oil Company Limited,</p> <p>Date(s): September 17 to 21, 2018</p> <p>and</p> <p>September 24 to 28, 2018</p>	<p>On-Scene Commander IMO Level 2 - to provide a comprehensive review of oil spill response and develop individuals to the On-scene Commander level</p> <p>SCAT Training - to implement and be a part of the SCART programme from looking at the character and dynamics of coastal zones, how oil behaves on different shorelines types, managing a shoreline assessment programme and developing the most appropriate endpoints</p>	<p>T. Williams - Marine Pollution Officer</p> <p>A. Deane - Senior Buildings Development Officer</p> <p>A. Eversley - Senior Marine Pollution Officer</p>

<p>UNITAR Mercury, Cadmium and Lead Project</p>	<p><i>Location:</i> Conference Room, EPD</p> <p><i>Date:</i> September 17-20, 2018</p>		<p>T. Armstrong - Senior Environmental Protection Officer</p> <p>P. Pile - Environmental Technical Officer</p> <p>A. Reeves - Technical Officer</p> <p>J. Yearwood - Environmental Technician</p> <p>P. Fergusson - Environmental Protection Officer</p> <p>G. Clarke - Building Development Officer</p>
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<p>Environmental Monitoring of Heavy Metals</p>	<p><b>Location:</b> Environmental Protection Department</p> <p><b>Date:</b> October 1-5, 2018</p>		<p>T. Armstrong - Senior Environmental Protection Officer</p> <p>S. McAllister - Senior Environmental Technician</p> <p>J. Yearwood - Environmental Technician</p> <p>T. Marshall - Building Development Officer</p> <p>H. Clarke - Building Development Officer</p> <p>R. Howell - Computer Operator</p> <p>G. Hinds - Environmental Protection Officer</p> <p>C. Griffith - Environmental Inspector</p> <p>P. Pile - Environmental Technical Officer</p> <p>A. Reeves - Technical Officer</p>
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Effective Presentation Skills	<p><b>Location:</b> Training Administration Division, Warrens II, Warrens, St. Michael</p> <p><b>Date:</b> November 5 to 9, 2018</p>	To give participants the tools to cultivate confidence and competencies required to deliver effective presentations	Justin Yearwood – Environmental Technician
Coastal Risk Information & Planning Platform Software System	<p><b>Location:</b> Data Processing Department</p> <p><b>Date:</b> December 6, 2018</p>		T. Williams – Marine Pollution Officer
New Web Registry Application	<p><b>Location:</b> Data Processing Department</p> <p><b>Date:</b> December 21, 2018</p>	To familiarize the staff with the new application for dealing with correspondence	<p>R. Prescott – Secretary</p> <p>P. Agard – Clerical Officer</p> <p>A. Eversley – Senior Marine Pollution Officer</p> <p>S. McAllister – Senior Environmental Technician</p>

Table 20: List of training activities EPD staff participated in overseas

Name of Course/Activity	Location & Date/Period	Objectives(s)	Officer(s) in Attendance
General Training Course on Chemical Weapons Convention for personnel of national authorities and relevant stakeholders	<p><b>Location:</b> The Hague, The Netherlands</p> <p><b>Date:</b> April 9 to 13, 2018</p>	To familiarize participants with the Chemical Weapons Convention and the role of the National Authorities	N. Cummins - Environmental Inspector
National Ambient Air Monitoring Conference	<p><b>Location:</b> Environmental Protection Agency, USA</p> <p><b>Date:</b> August 13 to August 28, 2018</p>	To provide air monitoring professionals with the skills and information to help prepare for the future challenges of air monitoring.	S. McAllister - Senior Environmental Technician
Regional Training Course- Train the Trainers on Orphan Sources Search and Recovery	<p><b>Location:</b> San Antonio, Texas</p> <p><b>Date:</b> August 27 -31, 2018</p>	To provide training on the recovery of orphan sources	N. Cummins - Environmental Inspector
Green Supply Chain Workshop on Cooling without warming	<p><b>Location:</b> Jakarta, Indonesia</p> <p><b>Date:</b> October 8 to 10, 2018</p>	To promote stakeholder cooperation in the cooling supply chain across countries and industries	S. McAllister - Senior Environmental Technician
Nuclear Radiological Emergency Preparedness and Response	<p><b>Location:</b> School of Radiation Emergency Management, USA</p>	To provide a comprehensive understanding of emergency preparedness and response to nuclear and radiological	T. Armstrong - Senior Environmental Protection Officer

	<b>Date:</b> November 26 to December 7, 2018	emergencies including the international framework	
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Table 21: List of conferences, seminars, workshops and meetings which were attended by staff locally

<b>Name of Course/Activity</b>	<b>Location &amp; Date/Period</b>	<b>Objectives(s)</b>	<b>Officer(s) in Attendance</b>
Sub-Regional Workshop on Ratification of the Rotterdam Convention for Barbados, St. Lucia and Grenada	<b>Location:</b> Hilton Hotel, Needhams Point <b>Date:</b> February 7 & 8, 2018	To support efforts being made by Barbados, St. Lucia and Grenada to become Parties to the Rotterdam Convention	T. Armstrong - Senior Environmental Protection Officer
Weather Ready Nation (WRN)- Barbados Hazard Impact and Response Matrices Workshop	<b>Location:</b> Department of Emergency Management, No. 30, Warrens Industrial Park, St. Michael <b>Date:</b> March 5 to 6, 2018	To introduce the WRN Project to key stakeholders and also to present, discuss and refine the current suite of Response Matrices and associated messaging for agreement	K. Barrow - Chief Building Development Officer (Ag)
Health Disaster Management Plan Workshop	<b>Location:</b> Pan American Health Organization, Dayrells Road, St. Michael <b>Date:</b> March 21, 2018	Review of Hazard Vulnerability Matrix  Presentation of the Draft Plan  Presentation of outline for Individual plans	K. Barrow - Chief Building Development Officer (Ag)

Ozone Steering Committee Meeting	<b>Location:</b> Ministry of Environment and Drainage <b>Date:</b> March 20, 2018	Discussion on the Matter of Air Conditioning Units at the Queen Elizabeth Hospital	S. McAllister - Senior Environmental Technician
1 <sup>st</sup> Strategic Action Plan Workshop for the Coastal Risk Assessment & Management Programme	<b>Location:</b> Savannah Beach Hotel <b>Date:</b> March 22, 2018		I. Lavine - Deputy Director  A. Eversley - Senior Marine Pollution Officer
National Workshop on the Implementation of the IMO Member State Audit Scheme	<b>Location:</b> Sandy Beach Hotel <b>Date:</b> May 7-11, 2018	Preparation and training for the upcoming IMO audit for the implementation of the country IMO instruments	T. Williams - Marine Pollution Officer  A. Eversley - Senior Marine Pollution Officer
Management of Used Engine Oil in Barbados	<b>Location:</b> NUPW, Upstairs EPD <b>Date:</b> May 17, 2018	Discussion with stakeholder on the status and possible steps forward to manage used oil	T. Armstrong - Senior Environmental Protection Officer  J. Yearwood - Environmental Technician  A. Eversley - Senior Marine Pollution Officer

Group of Pesticide Control Boards of the Caribbean Meeting	<b>Location:</b> Courtyard by Marriott <b>Date:</b> June 11-13, 2018	Allowed stakeholders to raise and address concerns regarding the management of pesticides in the region	T. Armstrong - Senior Environmental Protection Officer
Development of a National Multi-Agency Emergency Response Training Programme	<b>Date:</b> June 27, 2018		
IAEA Regional Meeting on Integrated Nuclear Security Support Plans for Central America and the Caribbean	<b>Location:</b> Hilton Resort, Barbados <b>Date:</b> July 2-4, 2018	raising participants' awareness of the significance of nuclear security and the IAEA's nuclear security programme.	T. Armstrong - Senior Environmental Protection Officer
Meeting for Finalization of the INSSP for Barbados	<b>Location:</b> EPD, Barbados <b>Date:</b> July 5-6, 2018		T. Armstrong - Senior Environmental Protection Officer
OPCW Planning and Coordinating Meeting Caribbean Region Project Chemical Emergency Response Planning and Management Meeting	<b>Location:</b> Radisson Aquatica Hotel <b>Date:</b> August 28 -30, 2018	Allowed stakeholders in the region to discuss current capacities for chemical emergency response and identify needs.	T. Armstrong - Senior Environmental Protection Officer A. Headley - Director
National Maintenance Mandate	<b>Location:</b> <b>Date:</b> September 18, 2018		L. Senhouse - Senior Environmental Technical Officer

<p>Opening Ceremony of the Meeting Caribbean Community (CARICOM) Climate Change Negotiators and Ministers</p>	<p><b>Location:</b> Radisson Aquatica Resort</p> <p><b>Date:</b> November 14, 2018</p>		
<p>2<sup>nd</sup> Regional Sargassum Symposium under the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH)</p>	<p><b>Location:</b> 3Ws Pavilion, Cave Hill Campus UWI</p> <p>Date November 21-22, 2018</p>	<p>Various information on sargassum within the Caribbean and South Africa</p>	<p>A. Eversley - Senior Marine Pollution Officer</p>
<p>Preparation for marine sediment sampling for the CLM project</p>	<p><b>Location:</b> EPD</p> <p><b>Date:</b> November 23, 2018</p>	<p>To discuss and plan the assistance of the Barbados Coast Guard in collecting samples for the CLM project</p>	<p>A. Eversley - Senior Marine Pollution Officer</p>

Table 22: List of conferences, meetings, seminars and workshop staff attended overseas

Name of Course/Activity	Location & Date/Period	Objectives(s)	Officer(s) in Attendance
GEF IWEco – Second Regional Project Steering Committee Meeting	<p><i>Location:</i> Cuba</p> <p><i>Date:</i> February 23 to March 2, 2018</p>	<ol style="list-style-type: none"> <li>1) Provide an update on the status of GEF small grants projects (UNDP)</li> <li>2) Identify opportunities for collaboration with other regional programmes, projects and activities</li> </ol>	I. Lavine - Deputy Director (ag.)
6 <sup>th</sup> Annual Steering Committee Meeting of the Basel Convention Regional Centre for the Caribbean, 3 <sup>rd</sup> Annual Meeting of the Regional Project Steering Committee of the GEF#5558 and Project Meetings for GEF#5558	<p><i>Location:</i> St. Johns, Antigua</p>	<p>Training of Trainers: Inventory and Environmentally Sound Management of Persistent Organic Pollutants in the Caribbean – to provide training on the environmentally sound management of persistent organic pollutant (POPs).</p>	L. Senhouse – Senior Environmental Technical Officer



	<p><i>Date:</i> May 28 to 31, 2018</p>	<p>GEF#5558 HIRD Annual Project Steering Committee Meeting (May 29, 2018) - to undertake monitoring and evaluation of the project</p> <p>Validation Workshop on the Update of National Implementation Plans (May 30, 2018) - to endorse and validate the final draft of the NIPs for all participating countries</p> <p>1<sup>st</sup> Regional Stakeholder Workshop: Towards a Model Legal Framework for Chemicals Management (May 31, 2018) - to present the findings of the draft Legal Country reports and to chart the way forward with this component of the project.</p>	
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IMO Regional Workshop on the Anti-Fouling Systems Convention and the Biofouling Guidelines	<i>Location:</i> Trinidad & Tobago  <i>Date:</i> June 20 to 22, 2018	To assist the administrations in the Wider Caribbean Region in preparing for ratification and effective implementation and enforcement of the Anti-Fouling System (AFS) Convention, as well as the effective implementation of the Biofouling Guidelines.	A. Eversley - Senior Marine Pollution Officer
Ocean Power Studies Technical Tour (Public Sector Smart Energy Program Component 2.2)	<i>Location:</i> Scotland  <i>Date:</i> August 27 to 31, 2018	To increase awareness of marine energy across the public sector	A. Headley - Director
OPCW 19 <sup>th</sup> Regional Meeting of National Authorities in Latin America and the Caribbean	<i>Location:</i> Guatemala City, Guatemala  <i>Date:</i> July 9 -11, 2018	Discuss issues affecting the region concerning the implementation of the Chemical Weapons Convention	T. Armstrong - Senior Environmental Protection Officer
OPCW 20 <sup>th</sup> Annual Meeting of National Authorities to the	<i>Location:</i> The Hague	Meeting to discuss the implementation of the Chemical Weapons Conventions and to chart the	T. Armstrong - Senior Environmental Protection Officer

Chemical Convention	Weapons	<i>Date:</i> November 6-9, 2018	way forward for the Convention	
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