

**THE NATURAL RESOURCES  
CONSERVATION (WASTEWATER  
AND SLUDGE) REGULATIONS,  
2013**

**GUIDELINE FOR REGULATORY  
STAFF**

March 2014

*Note* These guidelines have been prepared by the National Environment and Planning Agency (NEPA) in good faith exercising all due care and attention, but no representation or warranty, expressed or implied, is made as to the relevance, accuracy, completeness or fitness of this document for any other purpose in respect of a particular user's circumstances. Users of this document should satisfy themselves about its application to their situation and, where necessary, seek expert advice.

This document has been prepared for use by Regulatory Staff only. Its use is restricted to the staff of the NEPA, Environmental Health Unit, Agricultural Land Management Division, National Irrigation Commission, Rural Agricultural Development Authority, Water Resources Authority, Jamaica Bauxite Institute and our other regulatory partners. A complimentary Licensee Guide has been prepared for non-regulatory stakeholders.

*The guidelines will be revised periodically following feedback from stakeholders using it, ensuring its on-going relevance and reflecting advances in best practice as the result of regulator and industry experience. Comments are invited and should be sent via email to [pubed@nepa.gov.jm](mailto:pubed@nepa.gov.jm) or by post to the Public Education and Corporate Communication Branch at the address below.*

National Environment and Planning Agency  
10 and 11 Caledonia Avenue  
Kingston 5  
Jamaica W. I.  
Telephone: (876) 754 7540  
Facsimile: (876) 754 7595  
Email: [pubed@nepa.gov.jm](mailto:pubed@nepa.gov.jm)

March 2014

# TABLE OF CONTENTS

<b>TABLE OF CONTENTS .....</b>	<b>iii</b>
<b>ACRONYMS .....</b>	<b>x</b>
<b>1. INTRODUCTION .....</b>	<b>1</b>
<b>1.1 Scope - What is included in this Guideline .....</b>	<b>1</b>
<b>2. OVERVIEW OF THE MAIN FEATURES OF THE WASTEWATER AND SLUDGE REGULATIONS .....</b>	<b>3</b>
<b>2.1 Rationale for Regulations .....</b>	<b>3</b>
<b>2.2 Scope of the Regulations .....</b>	<b>4</b>
2.2.1 Facilities to be Licensed .....	5
2.2.2 Discharge of Trade or Sewage Effluent into a Sewage Collection System or Treatment Plant (Regulations 8, 9 and 10) .....	7
<b>2.3 Regulatory Agencies .....</b>	<b>8</b>
<b>2.4 Structure of the Regulations .....</b>	<b>8</b>
<b>3. REVIEWING LICENCE APPLICATIONS AND REPORTING REQUIREMENTS .....</b>	<b>12</b>
<b>3.1 Introduction to Wastewater and Sludge Licences .....</b>	<b>12</b>
<b>3.2 Information Required From Applicants For the Assessment and Approval of Licence Applications .....</b>	<b>12</b>
<b>3.3 Administrative and Technical Reviews of Licence Application Forms (Schedule I) .....</b>	<b>13</b>
3.3.1 Administrative Review .....	13
3.3.2 Technical Review .....	15
<b>3.3.2.1 General instructions .....</b>	<b>15</b>
<b>3.3.2.2 Review of Licence Application Form.....</b>	<b>15</b>
<b>3.3.2.3 Treatment of Trade Effluent.....</b>	<b>17</b>
<b>3.3.2.4 Treatment of Sewage and Industrial Sludge .....</b>	<b>19</b>
<b>3.4 Discharge of Trade or Sewage Effluent into a Sewage Collection System or Treatment Plant (Regulations 8, 9 and 10) .....</b>	<b>26</b>
<b>3.5 Review of Compliance Plans (Regulation 40).....</b>	<b>26</b>
<b>3.6 Review of Nutrient Management Plans (Regulation 26).....</b>	<b>30</b>
<b>3.7 Review of Waste Water Treatment Plant Operations</b>	

	<b>Manual (Regulation 20) .....</b>	<b>34</b>
<b>3.8</b>	<b>Administrative and Technical Review of Periodic Reports (Regulation 25) .....</b>	<b>37</b>
3.8.1	Review of Sewage Effluent Monthly Reporting Form (Fourth Schedule: Form 1) .....	37
3.8.2	Review of Weekly, Monthly or Quarterly Reports for Trade Effluent (Fourth Schedule: Form 2) .....	38
<b>3.9</b>	<b>Review of Annual Reports.....</b>	<b>39</b>
3.9.1	Review of Annual Sewage Effluent Reporting Form, Fourth Schedule Form 3.....	39
3.9.2	Review of Annual Report – Trade Effluent, Fourth Schedule: Form 4 .....	41
3.9.3	Review of Quarterly and Annual Industrial Sludge Reporting Form (Fourth Schedule Form 6) .....	43
3.9.4	Review of Monthly/Annual Nutrient Management Report .....	46
3.9.5	Review of Form to Report Spills and Pollution Incidents, Fourth Schedule: Form 5 .....	49
<b>3.10</b>	<b>PRTR Facility Reporting (Regulation 46).....</b>	<b>51</b>
<b>3.11</b>	<b>Setting Licence Conditions.....</b>	<b>51</b>
3.11.1	Facility Description.....	52
3.11.2	Monitoring requirements.....	52
3.11.3	Reporting Requirements .....	52
<b>3.11.3.1</b>	<b>Compliance Plan .....</b>	<b>53</b>
<b>3.11.3.2</b>	<b>NMP.....</b>	<b>53</b>
<b>4.</b>	<b>SLUDGE MANAGEMENT .....</b>	<b>54</b>
<b>4.1</b>	<b>Beneficial Use of Sludge .....</b>	<b>54</b>
<b>4.2</b>	<b>Management at WWTP Sites .....</b>	<b>56</b>
<b>4.3</b>	<b>Disposal to Landfill .....</b>	<b>56</b>
<b>4.4</b>	<b>Transportation.....</b>	<b>58</b>
<b>5.</b>	<b>MONITORING.....</b>	<b>58</b>
<b>5.1</b>	<b>Wastewater Monitoring Guidelines .....</b>	<b>58</b>
<b>5.2</b>	<b>Sampling Schedule and Frequency.....</b>	<b>59</b>
5.2.1	Procedure For Missed Samples .....	61
<b>5.3</b>	<b>Sample Collection and Preservation.....</b>	<b>62</b>
<b>5.4</b>	<b>Analytical Methods .....</b>	<b>64</b>

5.4.1	Record Keeping .....	65
<b>5.5</b>	<b>Flow Measurement.....</b>	<b>66</b>
5.5.1	Methods for measuring wastewater flows.....	66
<b>5.5.1.1</b>	<b>Closed Channel Flows .....</b>	<b>66</b>
<b>5.5.1.2</b>	<b>Open Channel Flows .....</b>	<b>67</b>
<b>5.5.1.3</b>	<b>Hydraulic Structures .....</b>	<b>67</b>
<b>5.5.1.4</b>	<b>Weirs .....</b>	<b>68</b>
<b>5.5.1.5</b>	<b>Area Velocity .....</b>	<b>72</b>
<b>5.5.1.6</b>	<b>Slope-Hydraulic Radius .....</b>	<b>73</b>
<b>5.5.1.7</b>	<b>Field Inspection of Flow Measuring Devices .....</b>	<b>74</b>
<b>5.5.1.8</b>	<b>Additional Information Sources .....</b>	<b>76</b>
<b>5.6</b>	<b>Reporting Monitoring Data.....</b>	<b>77</b>
<b>5.7</b>	<b>Guidelines For Monitoring Industrial and Sewage Sludge .....</b>	<b>77</b>
5.7.1	Industrial Sludge .....	77
5.7.2	Sewage Sludge.....	78
<b>6.</b>	<b>ESTIMATING EFFLUENT LOADS AND DISCHARGE FEES .....</b>	<b>81</b>
<b>6.1</b>	<b>General Principles of Measuring Loads .....</b>	<b>81</b>
6.1.1	Using Laboratory Monitoring Results with Flow Rate Measurement .....	81
6.1.2	Components of the Discharge Fee .....	82
6.1.3	Receptor Factor .....	83
<b>6.2</b>	<b>Estimation of Discharge Fees (including incentives).....</b>	<b>85</b>
<b>6.4</b>	<b>Verification and Reconciliation of Discharge Fee Paid.....</b>	<b>89</b>
<b>7.</b>	<b>STAFF REQUIREMENTS FOR IMPLEMENTING THE REGULATIONS .....</b>	<b>90</b>
<b>7.1</b>	<b>Outreach Activities (Regulators, Licensees) .....</b>	<b>90</b>
<b>7.2</b>	<b>Staff Requirements for the Implementing the Wastewater and Sludge Regulations .....</b>	<b>94</b>
7.2.1	Staff Training .....	97
<b>8.</b>	<b>REPORTING REQUIREMENTS .....</b>	<b>99</b>
<b>8.1</b>	<b>Overview of Reporting requirements .....</b>	<b>99</b>
<b>8.2</b>	<b>Annual PRTR Reports.....</b>	<b>99</b>

8.2.1	Information Provided by Applicants .....	99
8.2.2	Information to be Otherwise Obtained by NEPA .....	100
8.2.3	Posting of Licence Information.....	102
<b>8.3</b>	<b>Issue or Regional Specific Assessment Studies .....</b>	<b>102</b>
<b>8.4</b>	<b>Periodic Reviews and Evaluation of the Effectiveness of the Regulations .....</b>	<b>102</b>
<b>9.</b>	<b>APPENDICES.....</b>	<b>107</b>
	<b>Appendix 1: ISIC Codes and Descriptions.....</b>	<b>108</b>
	<b>Appendix 2: Sewage and Trade Effluent Standards .....</b>	<b>115</b>
	<b>Table 9-3 NRCA Trade Effluent Standards .....</b>	<b>115</b>
	<b>Appendix 3: Standards for Sludge .....</b>	<b>117</b>
	<b>Appendix 4: Ambient Water Quality Standards.....</b>	<b>119</b>
	<b>Appendix 5: List of Analytical Methods for the Analysis of Sewage and Trade Effluent .....</b>	<b>121</b>
	<b>Appendix 6: NWC Pre-treatment Standards.....</b>	<b>125</b>
	<b>Appendix 7: Template for Monthly Nutrient Management Report.....</b>	<b>126</b>
	<b>Appendix 8: Template of Overview Format for Pollutant Release and Transfer (PRTR) Facility Report .....</b>	<b>128</b>
	<b>Appendix 9: Template of Detailed Format for Pollutant Release and Transfer Register (PRTR) Facility Report .....</b>	<b>130</b>
	<b>Appendix 10: Summary Table for Load Calculation.....</b>	<b>133</b>
	<b>Appendix 11: Wastewater Treatment Plant Checklist.....</b>	<b>134</b>

## LIST OF TABLES

Table 2-1	ISIC Codes for activities that are required to obtain a Licence .....	6
Table 3-1	Review of the Licence Application Form .....	16
Table 3-2	Requirements for Treatment of Trade Effluent.....	17
Table 3-3	Treatment of Sewage and Industrial Sludge.....	19
Table 3-4	Review of Compliance Plans.....	26
Table 3-5	Criteria used to determine allowed period.....	30
Table 3-6	Requirements for NMPs .....	32
Table 3-7	Requirements for the Review of Wastewater Treatment Plant Operations Manual.....	34
Table 3-8	Review of Annual Sewage Effluent Reporting Form .....	39
Table 3-9	Review of the Quarterly and Annual Industrial Sludge Reporting Form .....	43
Table 3-10	Review of Monthly/Annual Nutrient Management Report.....	46
Table 3-11	Review of Form to Report Spills and Pollution Incidents.....	49
Table 4-1	National Treated Sewage Sludge Standards for Fully Treated Sewage Sludge that can be Applied to Agricultural Land .....	54
Table 4-2	Standards for Soil Waste/Industrial Sludge Suitable for Landfill.....	56
Table 4-3	Standards for Solid Waste/Industrial Sludge Suitable for Landfill (based on Leachate quality test results) .....	57
Table 5-1	Sampling Frequency and Parameters to be Monitored by Sector.....	59
Table 5-2	Procedure For Missed Samples .....	61
Table 5-3	Required containers, preservation techniques, and holding times .....	63
Table 6-1	Parameter Fees (Sixth Schedule of Regulations, Part B) .....	82
Table 6-2	Weighting Criteria .....	84
Table 6-3	Receptor Weight Relationship (Sixth Schedule of Regulations, Part D) .....	85
Table 7-1	Summary of Outreach Activities and Strategies .....	92
Table 7-2	Activity Requirements and Branch Responsibilities for Implementing the Wastewater and Sludge Regulations .....	96

Table 8-1	Measures to give effect to the Wastewater and Sludge Regulations .....	104
Table 9-1	Selected Four Digit ISIC Codes (those likely to be most relevant for these Regulations) .....	110
Table 9-2	NRCA Sewage Effluent Standards for plants built prior to 1997 and plants built after 1997 .....	115
Table 9-3	NRCA Trade Effluent Standards .....	115
Table 9-4	NRCA Effluent Standards for Sewage Effluent to be used for Irrigation.....	116
Table 9-5	NRCA National Treated Sewage Sludge/Biosolids Standards for Fully Treated Sewage Sludge that can be applied to Agricultural Land .....	117
Table 9-6	Standards for Solid Waste/Industrial Sludge Suitable for Landfill Leachate test results not to exceed 100 mg/L .....	118
Table 9-7	Standards for Solid Waste/ Industrial Sludge Suitable for Landfill (based on Leachate quality test results) .....	118
Table 9-8	Jamaican National Ambient Water Quality Standards - Freshwater .....	119
Table 9-9	Jamaican National Ambient Water Quality Standards - Ambient Marine.....	120
Table 9-10	Approved Test Methods (Sewage Effluent).....	121
Table 9-11	Approved Test Methods (Trade Effluent).....	122

**LIST OF FIGURES**

Figure 2-1	Exemptions under the Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013.....	5
Figure 5-1	Three Common Types of Sharp-Crested Weirs (From Appendix G, Supplemental Flow Measurement Information, NPDES Compliance Inspection Manual (1994)).....	69
Figure 5-2	Profile and Nomenclature of Sharp-Crested Weirs (From Appendix G, Supplemental Flow Measurement Information, NPDES Compliance Inspection Manual (1994)).....	70
Figure 5-3	Dimensions and Capacities of Parshall Measuring Flumes for Various Throat Widths (From Appendix O, Supplemental Flow Measurement Information, NPDES Compliance Inspection Manual).....	71
Figure 5-4	Free Flowing Palmer Bowlus Flume From Appendix G, Supplemental Flow Measurement Information, NPDES Compliance Inspection Manual (1994).....	72

Figure 5-5 Manning Formula ..... 74

**LIST OF BOXES**

Box 1 Sample Calculation - Direct Measurement..... 81  
Box 2 Sample Calculation 2 ..... 87  
Box 3 Sample Calculation 3 ..... 88  
Box 4 The Wastewater and Sludge Management Unit..... 95

## ACRONYMS

ASTM	American Society of Testing Materials
BOD	Biological Oxygen Demand
CAS	Chemical Abstracts Service
CEO	Chief Executive Officer
COD	Chemical Oxygen Demand
EA	Environmental Assessment
EHU	Environmental Health Unit
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
F. Coli	Faecal Coliform
HVAC	Heating, ventilation and cooling
ISCO	Instrumentation Specialists Company
ISIC	International Standard Industrial Classification of all Economic Activities
KMR	Kingston Metropolitan Region
JMA	Jamaica Manufacturers Association
MSDS	Material Safety Data Sheet
NEPA	National Environment and Planning Agency
NEPIS	National Environmental Publications Information System
NMP	Nutrient Management Plan
NPDES	National Pollutant Discharge Elimination System
NRCA	Natural Resources Conservation Authority
NTIS	National Technical Information Service
NWC	National Water Commission

P&L	Permits and Licences
PMA	Pollution Monitoring and Assessment
PRTR	Pollutant Release and Transfer Register
PSOJ	Private Sector Organization of Jamaica
QA/QC	Quality Assurance/Quality Control
RADA	Rural Agricultural Development Authority
RPPD	Rural Physical Planning Division
SOE	State of the Environment
STATIN	Statistical Institute of Jamaica
STP	Sewage Treatment Plant
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WRA	Water Resources Authority
WSMU	Wastewater and Sludge Management Unit

# **1. INTRODUCTION**

The purpose of this document is to provide guidance to regulatory staff implementing the Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013, hereafter referred to as "the Regulations". The objective of this Guideline is to enable regulatory staff (from the National Environment and Planning Agency (NEPA) and other agencies with responsibilities under the Regulations) to implement the Regulations by providing step-by-step procedures where appropriate and guidance on various assessment and enforcement activities. Implementation will include processing licence applications (initial and renewals), specifying licence conditions, monitoring compliance with licence conditions and preparing assessment and annual reports. Some aspects of the Guideline (such as sampling, analysis and quality assurance and quality control for effluent and other samples) can also be used by NEPA staff in the review of Environmental Impact Assessments (EIAs) and Environmental Assessments (EAs) and for studies that are used for regulatory or other purposes.

A separate Licensee Guide provides licensees with information that will allow non-regulatory stakeholders in the sector to complete licence applications and to address the ongoing monitoring, reporting and other requirements or conditions specified in their licences.

The ultimate goal of the Regulatory Staff and the Licensee Guidelines is to enable transparent, consistent, efficient and objective enforcement of the Regulations by the use of sampling, analysis, reporting and assessment procedures and the transparent and consistent evaluation and assessment of the information.

The advice and interpretation in this Guideline is not legally binding since any legal interpretation of the Regulations must ultimately be decided by the courts.

## **1.1 Scope - What is included in this Guideline**

The Regulatory Staff Guideline includes:

- (a) information that the NEPA will require from applicants for assessment and approval of applications
- (b) complementary sections to The Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013 Draft Guidelines for Licensees, 2014 (from the perspective of the regulator). These are as follows:

- Guidance for the review of each section of the licence application form (including the review of Compliance Plans and Nutrient Management Plans) (Section 3)
  - Description of the reporting system that includes step by step requirements of the periodic and emergency reporting forms used in the Regulations and record keeping (Section 3)
  - Guidance on the review of Operations and Maintenance Plans<sup>1</sup> (Section 3)
  - Methods for the sampling and analysis of wastewater (trade effluent and sewage effluent, industrial sludge and sewage sludge) for regulatory purposes (Section 5)
  - Guidance in the calculation of the load-based discharge fees and annual reporting (Section 6)
- (c) procedures for the compilation, review (including quality assurance and quality control) and interpretation of the data that are reported (Section 5)
- (d) additional information that NEPA will obtain in order to satisfy reporting requirements (annual internal reports, pollutant loads from point sources to the marine environment and Pollutant Release and Transfer Register reporting) (Section 3 and Appendices)
- (e) suitable templates for reporting (Appendices)
- (f) specify staff requirements for assessment of applications (Section 7)

The provision of guidance in these areas is placed in context by a summary of the rationale for the Regulations, an overview of the underlying principles used to develop the Regulations (Section 2) and a section by section summary of the Regulations.

---

<sup>1</sup> An Operations and Maintenance plan is one of the items that is required to be kept at all times at licensed treatment plants or at a designated location specified by the licensee to the Authority (Regulation 20).

## **2. OVERVIEW OF THE MAIN FEATURES OF THE WASTEWATER AND SLUDGE REGULATIONS**

### **2.1 Rationale for Regulations**

The discharge of polluted water and industrial sludge from human activities, the use of fertilisers, pesticides and agrochemicals and over pumping of coastal aquifers pose threats to Jamaica's surface and underground water quality. The quality of surface and underground water in several areas of Jamaica has been severely affected and is threatened in other areas. Water quality standards have been established for drinking, irrigation, industrial and recreational uses and for ambient freshwater and sea water. Measurements of water quality in selected wells, rivers and springs between 1996 and 1999 exceeded the applicable standards for irrigation, industrial use, recreation and ambient water quality standards. Ambient and recreational water quality standards were exceeded in all river basins except for the Martha Brae basin which met the ambient water quality standards. The discharge of untreated or partially treated sewage, industrial effluent and surface runoff into the sea has also affected near-shore coastal waters especially the Kingston Harbour.

The exceedances of the standards in the various basins are accounted for by one or more of industrial effluents, saline water intrusion or bacterial contamination. Coliform indicates bacterial contamination from faecal pollution from human or animal excreta. High levels of nitrate found in groundwater in the Kingston basin are caused by contamination from soak away pits used for sewage disposal. Some wells in the Rio Cobre, Black River and Martha Brae basins have been abandoned because of pollution from trade effluent from alumina and rum distillery operations. The severe pollution of Kingston Harbour is due in part to discharges of trade effluent and sewage from facilities in the Kingston Metropolitan Region (KMR) and Rio Cobre. Trade effluent accounts for between 24% (during high flow) and 44% (low flow) of the organic pollution in Kingston Harbour while sewage contributes between 29% (high flow) and 53% (low flow). The organic pollution is measured by the biochemical oxygen demand (BOD).

Because of the existing damage and threats to water quality in various basins, it is vital that steps are taken to arrest or reverse the pollution and to remove the threats posed to water quality by human activities. These measures require reduction in the amounts of untreated sewage, trade effluent and industrial sludge that contaminate water basins.

The Regulations address sewage and trade effluent, industrial and sewage sludge, and provide regulatory means to manage wastewater releases from human activities in Jamaica.

## **2.2 Scope of the Regulations**

The regulations, inter alia:

- ✓ Identify facilities that need to obtain licences;
- ✓ Specify monitoring and reporting obligations;
- ✓ Promulgate various standards (trade effluent, sewage effluent and sludge) that the licensees' effluent or sludge must meet; and
- ✓ Specify sampling and analytical methods that are to be used to monitor effluent and sludge quality.

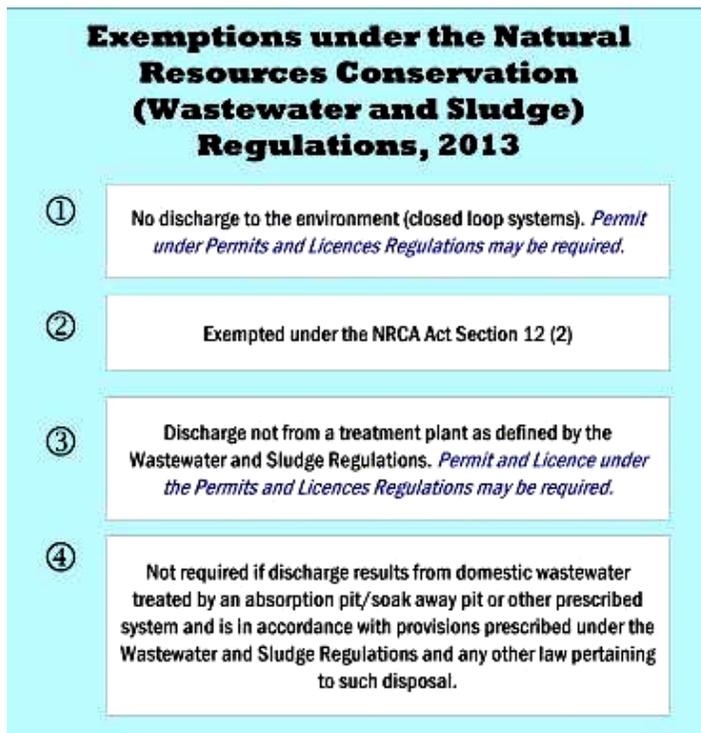
The regulations do not apply to discharges of domestic wastewater from:

- A single family residential property treated by onsite treatment systems.
- Residential developments which are to be connected to an approved central treatment system

In addition, the Regulations do not apply to treatment plants that are designed to discharge treated domestic sewage only in amounts less than 1,500 m<sup>3</sup>/yr. Domestic sewage is waste and wastewater from humans or household operations that is discharged to or otherwise enters a treatment works.

The figure below shows instances in which a licence under the Regulations is not required:

**Figure 2-1 Exemptions under the Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013**



### **2.2.1 Facilities to be Licensed**

A wide range of pollutants are covered by the Regulations because of their potential to cause adverse effects on water quality, ecology and human health. Water quality can be affected by chemical or biological agents or by virtue of the physical properties of the effluent or sludge. These agents or pollutants can influence the natural and human environment whether directly or indirectly by creating conditions that limit or prevent water use for specific purposes or can cause adverse ecological and human health effects.

The discharge of these pollutants from treatment plants into surface or underground waters can limit the use of these waters for agricultural, industrial or recreational use or for drinking water. The treatment plants required to obtain a licence have been categorised using the International Standard Industrial Classification of All Economic Activities (ISIC) Code. The costs for applications and their corresponding ISIC Code and are listed in Table 2-1.<sup>2</sup>

---

<sup>2</sup> All references in the document to ISIC relate to ISIC Rev. 3.1.

Trade effluent, sewage effluent and irrigation standards have been established for most of the pollutants found in trade effluent and discharges from sewage treatment plants. These pollutants include:

- nutrients (nitrogen (e.g., as nitrate and ammonia) and phosphorus in its various forms) that can lead to eutrophication of surface and ground waters
- physical parameters (temperature, colour, conductivity, total suspended solids) that compromise water quality
- oxygen consuming pollutants (BOD and Chemical Oxygen Demand (COD))
- organic pollutants that have adverse ecological and human health effects
- heavy metals that are toxic to plant and animal life as well as human health (Zn, Pb, Cd, As, Cr, Cu, Hg, Ni, Se, Ag, Sn)
- biological agents (Coliform, Escherichia-coli) that have adverse human health effects
- other pollutants that have adverse effects on human health and well-being if they reach waters that are used for recreation – or for drinking water supply (chloride, sulphate, Na, Be, B, Ca, Ba, CN, Fe, Mn, Mg, colour, pH, detergents).

**Table 2-1 ISIC Codes for activities that are required to obtain a Licence**

<b>ISIC<sup>3</sup></b>	<b>Source of Wastewater Discharge</b>	<b>Fee (J\$)</b>
0502	Aquaculture	50,000
1320	Mining of non-ferrous metal ores (includes bauxite, precious metals)	50,000
1410	Quarrying of stone, sand and clay includes limestone, dolomite, gypsum, clay and industrial sand and gravel	50,000
1422	Extraction of salt	50,000
1542	Manufacture of sugar	65,000
1551	Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials	65,000

---

<sup>3</sup> ISIC Rev. 3.1

<b>ISIC<sup>3</sup></b>	<b>Source of Wastewater Discharge</b>	<b>Fee (J\$)</b>
1553	Manufacture of malt liquors and malt (includes manufacture of beer, stout, ale)	65,000
1554	Manufacture of soft drinks; production of mineral waters (includes non-alcoholic beverages, soft drinks, bottled water)	65,000
15xx	Other manufacturing of food products (includes manufacture or processing of fish, meat dairy, grain mill, animal feeds, vegetable and animal oils and fats, bakery products)	65,000
1911	Tanning and dressing of leather	65,000
2320	Manufacture of refined petroleum products	75,000
2411 and 2412	Manufacture of basic chemicals including fertilizers and nitrogen compounds	65,000
242x	Manufacturing of other chemical products (Pharmaceuticals, medicinal chemicals and botanical products, paints varnishes and similar coatings, printing ink and mastics, pesticides and other agro-chemical products, soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations)	65,000
2694	Manufacture of cement, lime plaster (includes cement and lime manufacturing)	65,000
2695	Manufacture of articles of concrete, cement and plaster (includes construction articles made of cement, plaster, wood)	65,000
2720	Manufacture of basic precious and non-ferrous metals (includes alumina plants, manufacture of aluminum foil)	75,000
15** and 2***	All other manufacturing	50,000
4010	Electric power generation	65,000
5141	Wholesale of solid, liquid and gaseous fuels and related products	50,000
9000	Sewage	65,000

### **2.2.2 Discharge of Trade or Sewage Effluent into a Sewage Collection System or Treatment Plant (Regulations 8, 9 and 10)**

Facilities which discharge trade effluent or sewage effluent into a sewage collection system are required to provide the Authority with the written approval of the licensee prior to making the connection to the sewage collection system. In addition to submitting the written

approval, facilities should submit documentation detailing the composition and volume of wastewater generated from the business, industry or manufacturing or trade facility that will be accepted by the licensee. Failure to provide this information constitutes an offence.

Licensees who intend to receive wastewater from a business, industry or manufacturing must obtain written approval from the Authority prior to any agreement to accept such wastewater. The Authority should be informed of any proposed changes to the agreement relating to the composition or volume of the effluent and must give its consent to the amendments or any renewals to the agreement.

## **2.3 Regulatory Agencies**

The NEPA/NRCA has overall responsibility for the implementation of the Regulations, however where appropriate, the NEPA/NRCA will collaborate with the following government agencies:

- Ministry with portfolio responsibility for Health (Environmental Health Unit, Pesticides Control Authority)
- Ministry with portfolio responsibility for Agriculture (Rural Physical Planning Division, National Irrigation Commission and Rural Agricultural Development Authority)
- Water Resources Authority
- National Solid Waste Management Authority
- Jamaica Bauxite Institute

The NRCA/NEPA may consult with any other government agency and department where appropriate.

## **2.4 Structure of the Regulations**

The Regulations consist of fifty-seven (57) numbered paragraphs with six (6) Schedules. An outline of each of the numbered paragraphs is as follows:

### ***Part I. Preliminary***

1. Citation.
2. Interpretation.
3. Natural Resources Conservation Authority (Permits and Licences) Regulations, 1996, not to apply.

### ***Part II. Class I and II Waters***

4. Declaration of waters within the Convention Area as *Class I* or *II* waters.

### ***Part III. Licences***

5. Application for licence to operate a treatment plant.

6. Application for licence to construct sewage wastewater treatment facility.
7. Application for licence for discharge of trade effluent or sewage effluent into the environment.
8. Discharge of trade effluent or sewage effluent into sewage collection system or treatment plant.
9. Licensee to have Authority approval to receive wastewater from business, etc.
10. Licensee shall inform Authority of changes to agreement.
11. The Authority may consult on application.
12. Renewal of licences.
13. Modification of licences.
14. Authority may suspend or revoke a licence.
15. Notice to suspend or revoke a licence.

***Part IV. Specifications of a Treatment Plant***

16. Complete set of drawings and plans.
17. Flow-measuring device.

***Part V. Trade Effluent and Sewage Effluent Standards and Measurements***

18. Effluent standards.
19. Authority may review trade effluent or sewage effluent standards.

***Part VI. Operation and Maintenance of Treatment Plants***

20. Operations and maintenance manual
21. Standby power treatment plant during equipment malfunction.
22. Periods of maintenance and upgrades of treatment plant.

***Part VII. Use of Marine Outfalls and Outfall Pipelines***

23. Use of marine outfalls.
24. Use of outfall pipelines.

***Part VIII. Monitoring and Reporting***

25. Monitoring and reporting requirements.

***Part IX. Reuse for Irrigation Purposes***

26. Irrigation of lawns and agricultural applications.

***Part X. Confirmation Testing of Trade Effluent and Sewage Effluent***

27. Confirmation testing of trade effluent and sewage effluent.

***Part XI. Treatment of Septage***

28. Domestic septage and industrial septage.

***Part XII. Management Practices for Sewage and Industrial Sludge***

29. Sewage sludge.
30. Treatment of sewage sludge.
31. Disposal of sewage sludge.
32. Industrial sludge shall not be released into the environment.
33. Application for hazardous sludge.

34. Industrial sludge shall be harmless and suitable for disposal.
35. Prohibition of unauthorized persons, livestock and other animals.
36. Discharge of sewage sludge or industrial sludge.
37. Monitoring, sampling and analysis.
38. Testing of sludge for use in agriculture.

***Part XIII. Control Order***

39. Control order may be issued.

***Part XIV Compliance Plan***

40. The Authority may request a compliance plan.

***Part XV. Actions by the Authority***

41. Authority shall issue a warning notice.
42. Other actions by Authority.
43. Further actions.

***Part XVI. Fees for Effluent Discharges***

44. Annual effluent discharge fee.
45. Discount on discharge fees.

***Part XVII. Pollutant Release and Transfer Register***

46. Pollutant Release and Transfer Register.

***Part XVIII. Requirement to Report Spills and Leaks***

47. Requirement to report spills and leaks.

***Part XIX. Fees***

48. Fees.

***Part XX. Civil Remedies***

49. Recovery of annual discharge fees.

***Part XXI. Transitional***

50. Licences for construction and operation of treatment plants.
51. Unlicensed effluent discharges.
52. Sewage treatment plant to meet new standards.
53. Sewage effluent standards.
54. Discharging of trade effluent from treatment plant.
55. Waiver of discharge fees.
56. Signs.

***Part XXII. General Penalty***

57. General Penalty.

**Schedules**

**FIRST SCHEDULE**

*Form 1*

**Licence Applications and Notices**

Applications for -

Licence to Operate Treatment Plant for the Discharge of Trade Effluent or Sewage Effluent;

Licence to Construct a Treatment Plant;

	Licence to Reconstruct or Alter a Treatment Plant; and
	Licence to Discharge Trade Effluent or Sewage Effluent into the Environment
<i>Form 2</i>	Application for Renewal of Licence to Operate Treatment Plant and Discharge Effluent
<i>Form 3</i>	Notice of Intention to Suspend Licence
<i>Form 4</i>	Revocation Notice
SECOND SCHEDULE	<b>Signs</b>
THIRD SCHEDULE	<b>Sewage Effluent, Trade Effluent and Sludge Standards</b>
FOURTH SCHEDULE	<b>Reporting Forms</b>
<i>Form 1</i>	Sewage Effluent Monthly Reporting Form
<i>Form 2</i> for Trade	Weekly, Monthly or Quarterly Monitoring Report for Trade
	Effluent
<i>Form 3</i>	Annual Sewage Effluent Reporting Form
<i>Form 4</i>	Annual Trade Effluent Reporting Form
<i>Form 5</i>	Form to Report Spills and Pollution Incidents
<i>Form 6</i> Form	Quarterly and Annual Industrial Sludge Reporting Form
FIFTH SCHEDULE	<b>Approved Test Methods for Sewage and Trade Effluent and Sludge</b>
SIXTH SCHEDULE	<b>Schedule of Fees</b>
<i>Part A</i>	Application Fees
<i>Part B</i>	Discharge Fees per Tonne for Discharges into the Environment
<i>Part C</i>	Assessable Pollutant for each Licensable Discharge
<i>Part D</i>	Method to Calculate Discharge Fees

## **3. REVIEWING LICENCE APPLICATIONS AND REPORTING REQUIREMENTS**

### **3.1 Introduction to Wastewater and Sludge Licences**

The Licence issued under the Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013 is a legal instrument that is enforceable. The licence is granted based on information provided in the licence application form, supporting information requested on the form and any additional information submitted by the Licensee. The information includes specifications of the processes, equipment and pollution control devices that are present at the facility.

The licence specifies operational requirements including a monitoring plan, effluent and sludge discharge limits and monitoring and reporting requirements. Where applicable, such as if trade effluent or sewage effluent standards are exceeded, the licence conditions may include a Compliance Plan (that will specify the requirement for a facility to implement pollution control or other measures to bring the effluent releases into compliance with the standards), a Nutrient Management Plan (NMP) (for cases where application of effluent can be demonstrated to reduce the need for fertiliser and cause no environmental harm) as well as monitoring and reporting requirements. Where a Compliance Plan is required, the licence conditions will include requiring the licensee to complete physical plant improvements and achieve effluent and sludge quality according to a specified schedule and with measurable milestones.

This section of the guide summarises the information required from applicants for the assessment and approval of licences and presents detailed instructions for the administrative and technical review of the applications for Wastewater and Sludge Licences, the review of monthly and annual reports (monthly and annual reporting forms including monitoring plans and emergency response plans) and the processes for the determination of the need for Compliance Plans and NMPs and for their review.

### **3.2 Information Required From Applicants For the Assessment and Approval of Licence Applications**

The Regulations require that owners and operators of existing treatment plants make initial licence applications within 12 months of the commencement date of the Regulations. Applications for Licence renewals are to be made every five years at least six months prior to the anniversary date of the licence.

Applications must be accompanied by the completed licence application forms and the applicable fees in accordance with the checklist provided by the Agency. Where required, plans and drawings should be stamped/sealed by a registered Professional.

***NEPA must not accept the application unless the required fee is paid in full and all outstanding annual discharge fees have been fully paid.***

The requirements for the assessment of applications are provided in subsections 3.3 and 3.4.

## 3.3 Administrative and Technical Reviews of Licence Application Forms (Schedule I)

### 3.3.1 Administrative Review

#### General instructions

- The only additions to the application form that administrative and technical reviewers may make to the application form are in question 1 – the date of receipt and completion date. All other entries must be made by the applicant. Administrative and technical reviewers should indicate **in a separate document** what changes are required.
- As part of the administrative review, list all of the attachments (schedules, drawings, annual reports, receipt for fees, maps and any other material supplied by the applicant or licensee) and verify that all required schedules and fees payable are included and are present.
- Applicants must complete all numbered items. Where information is not applicable the entry should be "N/A" (without the quotation marks). Ensure that the application is signed (last page of the application) and that the person signing the application is the Chief Executive Officer (CEO) or Owner.
- Maps and drawings. Verify that maps and drawings are included. Maps should be metric scale 1:1,250 map if the property is located in a city or town or a metric scale 1:12,500 map. AutoCAD drawings that are referenced to the Jamaica metric grid are acceptable and should be encouraged.

NEPA should maintain a full set of metric scale maps available from the National Land Agency (NLA) for verification and checking.

#### **Old maps in English units should not be accepted.**

The 1:1,250 and 1:12,500 scale metric maps can be obtained from:

National Land Agency  
Surveys and Mapping Division  
23 ½ Charles Street  
Kingston.  
Telephone: 922-6630-5  
Facsimile: 967-1010.

Email: [asknla@nla.gov.jm](mailto:asknla@nla.gov.jm)

- Applicants are required to keep records of all data used to complete the licence application and any supplemental information submitted as part of the application process for a period of at least three years from the date of the application. These records may be requested by NEPA staff if it is deemed necessary to verify or confirm any of the information contained in the application.
- The application form must not be altered in any way by NEPA staff (save and except as stipulated in the first bullet). **Applications that are not in the same format and page numbering sequence must not be processed and must be returned. Questions cannot be deleted or rearranged.**
- Incomplete applications **must** be returned.

The following instructions apply to selected sections of Form 1 of the First Schedule (the licence application form).

### **Specific Instructions**

1. The shaded areas designated for the Application Number, Application Date and Application checked for completion **must** be completed by NEPA staff.
2. **Name and address (Sections 2.1, 2.2 and 2.3):** Verify the legally registered company name, mailing address, telephone and facsimile numbers and electronic mail address for official correspondence. It is important that all address information including parish is entered.
3. **Application Type (Section 2.4):** Verify that the type of application is indicated with a check mark in the appropriate box.
4. **Treatment Facility name and address (Section 3.1):** Verify that the plant name, plant address, and the land title information are included.
5. **List of attached documents** comprising the application (**Section 1.5** and any attachment provided by the applicant): Verify the list provided by the applicant.
6. **Business Activity (Section 3.3):** Make sure that there is a description entered here. This should be the main business. Make sure that the description here is consistent with the description for the ISIC code(s) entered (*see number 7 below and footnote 3*).
7. **International Standard Industrial Classification (ISIC) Codes (Four digit code(s) (Section 3.3) (see footnote 3):** International Standard Industrial Classification (ISIC) codes are numerical identifiers for different types of businesses and industries. ISIC codes are used by Statistical Institute of Jamaica (STATIN) for reporting aggregated information, and for compiling and analysing statistics. Emission inventories for Jamaica will be compiled and will be grouped according to the ISIC codes.

The first two digits of a four-digit ISIC code define a major business sector, while the last two denote a facility's speciality within the major sector.

Verify using Appendix 1 that the ISIC Code is consistent with the type of business. Additional information on the ISIC system is available on the internet at <http://unstats.un.org/unsd/cr/registry/regcia.asp>.

8. Where it is proposed that effluent will be discharged to the marine environment (Regulation 23) the following information should accompany the application:
  - A model of the plume behaviour of the effluent in the coastal and marine environment;
  - The data, studies and calculations that show that the proposed outfall will allow for an effluent quality which is still acceptable and will not affect the marine environment beyond the levels already established for the ambient water quality;

- The data and studies to show the effect of the effluent on the flora and fauna of the marine environment, within the sphere of influence of the plume as described in the first bullet above;
- A drawing of the route of the marine outfall pipe and the construction material and biophysical survey of the route of the pipe, including the method of laying the pipeline on the floor of the sea and stabilization method; and
- Bathymetry of the seafloor along the alignment of the pipeline.

Where outfall pipelines are proposed to be installed for the discharge of sewage effluent on the foreshore and floor of the sea, an application for a licence in accordance with section 5 of the Beach Control Act must be made.

### 3.3.2 Technical Review

#### 3.3.2.1 General instructions

- The only additions to the application form that administrative and technical reviewers may make to the application form are the application date, number and completion information. All other entries must be made by the applicant. Administrative and technical reviewers should indicate **in a separate document** what changes are required.
- As part of the technical review, verify that all of the items listed (by the Administrative Reviewers) and attachments (schedules, annual reports, maps and any other material supplied by the applicant or licensee) are present.
- Applicants must complete all numbered items. Where information is not applicable the entry should be "N/A" (without the quotation marks).
- Applicants are required to keep records of all data used to complete the licence application and any supplemental information submitted as part of the application process for a period of at least three years from the date of the application. These records may be requested by NEPA staff if it is deemed necessary to verify or confirm any of the information contained in the application.
- The application form must not be altered in any way by NEPA staff (save and except as outlined in bullet one above). **Applications that are not in the same format and page numbering sequence must not be processed and must be returned. Questions cannot be deleted or rearranged.**
- **Incomplete applications must be returned.**

#### 3.3.2.2 Review of Licence Application Form

The instructions in Table 3-1 apply to selected sections of Form 1 of the First Schedule (the licence application form) and attachments.

**Table 3-1 Review of the Licence Application Form**

Item	Details required
General and non-confidential description of plant activities	Description entered is consistent with the description for the ISIC code(s) entered.
Description of processes at the plant	<p>This should include a brief narrative description of the general nature of the business and the type of industrial and/or commercial activity at the plant including what specific products are manufactured or produced and/or what services are provided.</p> <p>In contrast to the general description, there must be a detailed description of the processes at the facility which generate wastewater. The description should include information such as any modifications to your process water/storm water handling facilities, the start-up or shutdown of any process or treatment units, any wastewater recycling projects, or any changes in production throughput. Refer to your knowledge of the facility (based on plant visits) and/or to the following examples of reference sources to verify typical and actual processes at the facility (<i>this list is not exhaustive</i>):</p> <p>Green, Don and Perry, Robert. Perry's Chemical Engineers' Handbook, Eight Edition, 2007, McGraw-Hill Book Company</p> <p>Kirk-Othmer Encyclopaedia of Chemical Technology, Fifth Edition.</p> <p>U.S. EPA Industry Sector Notebooks: at <a href="http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/#industry">http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/#industry</a>.</p> <p>Report to Congress on Special Wastes from Mineral Processing at <a href="http://www.epa.gov/compliance/resources/reports/assistance/1990rpttocongress.pdf">http://www.epa.gov/compliance/resources/reports/assistance/1990rpttocongress.pdf</a>.</p> <p>World Bank Pollution Prevention and Abatement Handbook at <a href="http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_handbook_ppah_wci_1319577_543003">http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_handbook_ppah_wci_1319577_543003</a>.</p>
Attachments	<p>The description of the plant process(es) may require attachments such as an emergency response plan (required), compliance plan (if necessary), a monitoring plan (required), sludge management plan (required), nutrient management plan (as required) and pollution prevention programme (optional).</p> <p>These documents must be reviewed for accuracy, completeness and consistency.</p>
Plant capacity data	Plant capacity data should indicate the <b>maximum</b> production rate at which the facility or plant can operate. This includes the maximum amount of water use as well as products and raw materials when the plant operates at its maximum. The licence will allow the (eventual) determination of maximum pollutant loads that may be used to determine the carrying

Item	Details required
	<p>capacity (total daily maximum load) of the water body that receives the trade effluent and the effluent of other facilities.</p> <p>Base the following amounts for water use when the plant operates at maximum capacity.</p> <ol style="list-style-type: none"> <li>a. The maximum annual amounts of water that can be used at the facility;</li> <li>b. The maximum amount of water used at the facility per day;</li> <li>c. Source(s) of water; Make sure the source is specified (e.g., the National Water Commission (NWC), private provider of water services, spring, river, sea water etc.) and the annual amount from each source;</li> <li>d. Ensure that the maximum annual rates of production for all products at the facility and the maximum production capacity for each product are specified. Units must be metric units (tonnes, kg, m<sup>3</sup> etc.); and</li> <li>e. Make sure that the maximum amounts of raw materials, chemicals, substances and energy that will be utilized or consumed at the facility and the maximum rate at which raw materials and chemicals can be used are specified.</li> </ol> <p>Use references to verify that the following lists are complete:</p> <ul style="list-style-type: none"> <li>➤ all raw materials;</li> <li>➤ major intermediates and products handled at the facility that may be reasonably expected to be present in effluent which is discharged in trade effluent or industrial sludge;</li> <li>➤ Corresponding Chemical Abstracts Service (CAS) Registry Numbers;</li> <li>➤ Chemical names (avoid trade names); and</li> <li>➤ Chemicals used on-site which could impact trade effluent quality (for commercial (non-manufacturing) facilities.</li> </ul>

### 3.3.2.3 Treatment of Trade Effluent

Confirm using site diagrams, site visits and consistency with other information supplied that the treatment processes are present. Determine typical treatment efficiency based on design parameters.

**Table 3-2 Requirements for Treatment of Trade Effluent**

Item	Requirements
Wastewater Treatment Units	<p>Verify the following:</p> <p>Physical, chemical, and/or biological treatment processes used at the treatment plant, including each unit in the treatment process and dimensions (e.g. grit removal and handling,</p>

Item	Requirements
	<p>dissolved air floatation, chemical precipitation, equalization, pH control, aeration, sludge management, steam stripping, clarification, anaerobic lagoon) and the associated output stream for each treatment unit and which if any wastewaters are chlorinated prior to discharge.</p> <p>Confirm flow schematics with a water balance showing each treatment unit (including any lagoons, ponds or impoundments) and all sources of wastewater flow into the treatment plant and to each outfall/point of disposal is provided.</p> <p>This schematic should include all process wastewater, cooling water, domestic wastewater, domestic sewage and storm water that enter each treatment unit. The water balance must show average flows at intake, between units, treatment units and discharge points. If a water balance cannot be determined (e.g. for certain mining activities), the applicant may provide instead a pictorial description of the nature and amount of any sources of water and any collection and treatment measures.</p>
Impoundments	<p>For each impoundment (e.g. lagoons or ponds) used for the treatment, disposal, containment, or evaporation of wastewater, make sure the following are specified:</p> <p>Type of liner and the design characteristics of the liner;</p> <p>For impoundments or lagoons or ponds using a synthetic liner: liner permeability, liner thickness, test results on liner compatibility with appropriate wastes, test results from clay borrow source, test results from liner construction, etc.</p> <p>For impoundments using in-situ soils as the liner: soils boring information, the depth of impermeable clay soils, test results on soil permeability, procedures for compaction of top layer of in-situ soil, etc.</p> <p>Dimensions:</p> <p>The dimensions of the impoundments (e.g. length, width, depth from water surface at capacity, depth from natural ground level, and depth of freeboard). Depth from water surface is the depth from the water surface at the impoundment's maximum capacity excluding the freeboard. Depth below the natural ground level should not include bermed or elevated portions of the impoundments. Indicate the freeboard required for existing permits or licences. Provide all dimension units in metric units (metres and cubic metres or litres)</p> <p>For impoundments with irregular shapes, surface area (instead of length and width), the average depth, and the maximum depth below</p>

Item	Requirements
	natural ground level.
Leak detection system present	If there is a leak detection system, make sure there is a description of the type of leak detection system and a reference (manufacturer's specification) for the detailed description of the system.
Groundwater monitoring wells	Where groundwater monitoring is required as a condition of the licence, check that there is a list of groundwater monitoring wells used to check leakage from the impoundment. Verify the location of wells where necessary.
List of references, reports, summaries, studies of groundwater data and/or leak detection system	<p>Ensure that there is a list of references for reports, summaries, studies of groundwater data and/or leak detection system (Note: references only are required). Request copies as needed.</p> <p>Provide a <b>list</b> of the references. Include all hydro-geological reports, data summaries, studies of the monitoring wells or surrounding hydrogeology.</p> <p>The period of time over which well monitoring data are available.</p>

### 3.3.2.4 Treatment of Sewage and Industrial Sludge

Table 3-3 below gives the reviewer an indication of what should be included in the documentation presented detailing the treatment of sewage and industrial sludge.

**Table 3-3 Treatment of Sewage and Industrial Sludge**

Item	Details required
A description of how any sewage sludge or industrial sludge from any treatment process or from any other process or activity at the facility is formed	<p>Comment on definitions:</p> <p>The distinction between domestic and industrial or commercial septage is the type of waste – not the establishment that generates the waste. For example the sanitation waste residues and residues from food and normal dish cleaning from a restaurant, from a motel or nursing home (provided it does not contain grease trap wastes) or from a petroleum-filling or dispensing station are considered domestic septage. Grease trap wastes from a restaurant are not domestic septage, nor are wastes containing petroleum residues; these are classified as non-domestic or trade effluent. Note that restaurants are not included among potential licensees. Dry cleaning waste residues are classified as trade effluent/industrial sludge, while sanitation-only waste from such an establishment would be</p>

Item	Details required
	considered domestic septage.
<p>Any mixture of domestic septage with industrial septage is considered as trade effluent.</p>	<p>Use responses for this section in cases where sludge has minimal quantities of water of liquid trade effluent. Indicate each process or activity that generates industrial sludge that is non-hazardous. [It is expected that separate regulations will manage the disposal of hazardous wastes.] For example, indicate periodic drainage of storage tanks or reaction vessels or cleaning of impoundments of lagoons etc.</p> <p>Until the regulations for the transportation of wastes are in place it will be difficult to verify information for this section. The application should include a description of how industrial sludge is handled from its generation to its disposal whether on- or off-site. This should include descriptions of the sludge dewatering tank or lagoon if one is used, any chemicals used to aid dewatering, the method of pumping the industrial sludge to the hauling vehicle and the hauling vehicle.</p> <p>Ensure the method used to measure sludge volume is stated as well as the kind of records or manifests (of shipments) kept.</p> <p>Ensure that contingency plans have been developed in case of spills or inclement weather. For hazardous materials you should request additional information and consider including requirements for hazardous wastes in licence conditions.</p>
<p>A description of how any industrial sludge from any treatment process or from any other process or activity at the facility is treated</p>	<p>In reviewing this section make sure that there is a description of:</p> <ul style="list-style-type: none"> <li>•Each process used to treat or store industrial sludge at the facility.</li> <li>•The type of liner and the design characteristics of the liner (if liner is used) <ul style="list-style-type: none"> <li>➤ For impoundments or lagoons or ponds using a synthetic liner: liner permeability, liner thickness, test results on liner compatibility with appropriate wastes, test results from clay borrow source, test results from liner construction, etc.</li> <li>➤ For impoundments using</li> </ul> </li> </ul>

Item	Details required
	<p><i>in-situ</i> soils as the liner: soils boring information, the depth of impermeable clay soils, test results on soil permeability, procedures for compaction of top layer of <i>in-situ</i> soil, etc.</p> <p>Dimensions:</p> <p>The dimensions of the impoundments (e.g. length, width, depth from water surface at capacity, depth from natural ground level, and depth of freeboard). Depth from water surface is the depth from the water surface at the impoundment's maximum capacity excluding the freeboard. Depth below the natural ground level should not include bermed or elevated portions of the impoundments. Indicate the freeboard required for existing permits or licences. Provide all dimension units in metric units (metres and cubic metres or litres).</p> <p>For impoundments with irregular shapes, submit surface area (instead of length and width), the average depth, and the maximum depth below natural ground level.</p>
<p>A description of each method or process used to dispose of industrial sludge</p>	<p>The description must indicate how waste is transported off-site and must include the locations and destination both on-site and off-site of the industrial sludge and a list of all persons who transported industrial sludge off-site and the amounts of industrial sludge that is transported off-site.</p> <p>Note: Red mud tailings ponds should be described in this section. Note that in some cases supernatant is reused but the red mud is not re-circulated and hence such tailings ponds, stacking areas and the like are described here. Disposal sites that are no longer in use and which contain red</p>

Item	Details required
	<p>mud should be included. When such sites are <u>fully and formally</u> rehabilitated they should not be included.</p> <p>Verify information provided on the owner, location, handling, storage practices, treatment, if necessary, of facility accepting sludge for additional processing, which should be licensed and application and disposal practices or end-use of the sludge after treatment.</p>
Maps and Drawings	<p>Verify that maps are included. Maps should be metric scale 1:1,250 map if the property is located in a city or town or a metric scale 1:12,500 map. AutoCAD drawings that are referenced to the Jamaica metric grid are acceptable and should be encouraged.</p> <p>NEPA should maintain a full set of metric scale maps available from the NLA for verification and checking.</p> <p>Old maps in English units should not be accepted.</p> <p>The 1:1,250 and 1:12,500 scale metric maps can be obtained from:</p> <p>National Land Agency  Surveys and Mapping Division  23 ½ Charles Street  Kingston.  Telephone: 922-6630-5  Facsimile: 967-1010.  Email: <a href="mailto:asknla@nla.gov.jm">asknla@nla.gov.jm</a></p>
Schematic process drawing	<p>This must show how water and process material, chemicals and substances used in the facility interact with the discharges.</p>
Map showing plant boundary	<p>The map for the facility must show the following:</p> <ul style="list-style-type: none"> <li>a) Plant Boundaries <p>The property boundary, the scale of the map is shown and the direction of true north. If the property is located within a city or town, a planimetric city map(s) 1:1,250 scale metric coordinates map may be used.</p> <p>Determine the JAD 2001 coordinates of at least one reference point on the map (e.g., the southwest corner of the</p> </li> </ul>

Item	Details required
	<p>property boundary).</p> <ul style="list-style-type: none"> <li>b) The location of all storm water drains, all liquid process streams, all trade effluent discharge points, the locations where industrial sludge is formed or stored and all sampling points.</li> <li>c) The location of each point of discharge of trade effluent from the property.</li> <li>d) The location of each point of discharge of storm water. <u>Ensure that the JAD 2001 coordinates and unique ID numbers are assigned to each point.</u></li> <li>e) The location of each sampling point for trade effluent discharge. <u>Ensure the JAD 2001 coordinates and unique ID numbers are assigned to each point. Where there is a control order, compliance plan or other licence conditions that require monitoring, ensure that all points are identified on the map.</u></li> <li>f) The location of each connection to a NWC or other sewer for treatment of domestic (or domestic combined with industrial) waste. <u>Ensure the JAD 2001 coordinates and unique ID numbers are assigned to each point.</u></li> <li>g) The boundaries of any trade effluent treatment ponds or other wastewater treatment facilities on the property (e.g., subsurface drain field, storage ponds for storm water, treatment ponds or vessels etc.).</li> <li>h) all ponds including storage/evaporation/holding ponds on the property.</li> <li>i) the boundary for each storage or disposal site for industrial sludge.</li> </ul> <p>Determine the JAD 2001 coordinates of at least one reference point on the map (e.g., the southwest corner of the</p>

Item	Details required
	property boundary).
Map for area within 5 km of the plant	<p>Surrounding area 5 km in all directions from the plant boundary</p> <ul style="list-style-type: none"> <li>a) The surrounding area within 5 km from the property boundaries. Use more than one map sheet if necessary so that the distances from the property boundary is at least 5 km in all directions.</li> <li>b) Where the discharge is to a gully or watercourse, make sure that the discharge route for a distance of 5 km from the property boundary or until the effluent reaches a stream or river is highlighted. The marking should allow underlying map information to be visible. (e.g., by use of only a yellow or light coloured highlighter). Marking of the discharge route with dark ink is not admissible.</li> <li>c) All springs, public water supply wells, monitor wells, surface water supply intakes, water treatment plants, drinking water storage facilities and sewage treatment facilities within 5 km of the property boundary.</li> </ul>
Map for sewage treatment plants only	<p>This map should be available from the permitting process (where a permit has been issued) or developed in the case of plants that were constructed before 1996 (when the Natural Resources Conservation Permits and Licences) Regulations, 1996 were enacted). For such plants, the design year should be the year when the plant is estimated to just satisfy population served or 30 years in the future (or based on likely remaining lifetime of the plant).</p>
Description (text) of receiving environment/ Receptors	<p>This section must contain a description of the receiving environment (surface waters, groundwater coastal waters, septage treatment plant or sewage treatment plant) into which trade</p>

Item	Details required
	<p>effluent is discharged. The information for the description is as follows:</p> <p>Surface freshwater – name of stream (if appropriate width, depth and typical flow by season), mangrove (describe area of mangrove and seasonal characteristics of water levels, type of vegetation, etc.).</p> <p>Groundwater – depth to water table.</p> <p>Seawater – location, general description e.g., bay, lagoon, harbour.</p>
Monthly Flow rates	<p>Ensure that:</p> <ul style="list-style-type: none"> <li>• all spaces are filled in, including “N/A” where appropriate;</li> <li>• the concentration, mass and flow values accurately characterize the discharge;</li> <li>• the reported values are consistent with historical information i.e. the monthly or other reporting frequency data reported throughout the year.</li> </ul>
Releases for the most recent full calendar year	<ul style="list-style-type: none"> <li>• Self-explanatory</li> </ul>
Estimate of average flow rate of trade effluent in the most recent full calendar year	<p>Average monthly flow rate (litres/month) and annual flow rate of trade effluent (litres/year). If flow rate is not available, use monthly and annual water usage. <i>Section 6 provides details of estimation methods.</i></p> <p>Note that discharges to sewage treatment plants and septage collected for disposal are to be reported as transfers off-site.</p>
Outfall information	Verify the distances and description provided for the outfall.
Information relevant only to sewage treatment plants	<p>Verify the information provided. Use the most recent/current STATIN and census data, maps and site visits as needed.</p> <p>Evaluate the information based on best practices for STPs.</p>
Signature	Ensure that the signature is that for the authorised owner or representative.

### 3.4 Discharge of Trade or Sewage Effluent into a Sewage Collection System or Treatment Plant (Regulations 8, 9 and 10)

Treatment plants that intend to discharge trade effluent or sewage effluent into a collection system should provide the Authority with the following information:

- ✓ the name of facility;
- ✓ type of wastewater;
- ✓ characteristics of wastewater to be treated;
- ✓ layout of pre-treatment facility including geo-referenced sampling point (if applicable);
- ✓ treatment plant capacity;
- ✓ technology of treatment plant; and

agreement between the licensee and the party that will be generating the wastewater.

### 3.5 Review of Compliance Plans (Regulation 40)

**Regulation 40** specifies that a Compliance Plan should include performance targets to be achieved within a specific time, not exceeding a period of two years. The period proposed by the proponent (licensee) must however be as short as is reasonable and should be consistent with the nature and cost of the remedies required.

Existing treatment plants are required to prepare and submit a Compliance Plan when the concentrations of pollutants exceed the Effluent Standards. It is anticipated that Compliance Plans will be required at the initiation of the licensing system. New treatment plants – those constructed after the Regulations come into force should not require a Compliance Plan.

The outcome of the review of the compliance plans should take the form of yes /no answers. In cases where information is incomplete or inaccurate the response must be No. All of the following items in Table 3-4 must be checked yes or no.

**Table 3-4 Review of Compliance Plans**

Compliance Plan Item	YES	NO	What should be included
(a) a description of the current compliance status			<p><b>Item A</b></p> <p>Summary of the aspects which are out of compliance.</p> <p>Suggested text is as follows. Substitute the text in square brackets [] with the facility name, pollutants, dates etc. as is appropriate.</p> <p>The [facility name] is not in compliance with the effluent standards for [pollutants/parameters a, b, c] from the [** process(es)/unit] and with the levels of [pollutants x, y, z] in wastewater/trade/sewage effluent and/or sewage /industrial sludge for the period [** 20** to ** 20**].</p> <p>The [facility name] is not in compliance with</p>

Compliance Plan Item	YES	NO	What should be included
			<p>the [***] reporting requirements as specified in the Wastewater and Sludge Regulations, 2013</p> <p>The [facility name] is not in compliance with the [**] requirements as specified in the Wastewater and Sludge Regulations, 2013</p> <p>A list of all wastewater effluent and sludge sources</p> <p>Description of the location of all discharge points where pollutants exceed the relevant effluent and sludge standards</p> <p>Description of the monitoring locations of the effluent and sludge</p> <p>List other administrative or other requirements that have not been satisfied.</p> <p>Description of the processes used to treat effluent or sludge.</p> <p>A general description of the reasons for exceedance of the relevant standard(s). A statement on each of the following should be included, where applicable:</p> <ul style="list-style-type: none"> <li>• Absence of treatment method</li> <li>• Maintenance (lack of )</li> <li>• Frequent process upsets</li> <li>• Inadequate capacity or size of unit operation/process</li> <li>• Inadequate or inappropriate treatment technology</li> <li>• Inadequacy of chemical inventory</li> <li>• Power supply</li> <li>• Rainfall events</li> </ul>
(b) a list of the pollutants that exceed the effluent standards			<p><b>Item B</b></p> <p>Table provided with dates of samples, monitoring location(s), measured pollutant concentrations/levels for each sample with one or more pollutants exceeding a standard</p>
(c) methods used to determine the facility's compliance status			<p><b>Item C</b></p> <p>All monitoring, record keeping, reporting procedures [monitoring schedule, monitoring protocol (who does sampling, how sampled [grab, continuous, proportional (time or flow) composite. which laboratory does analysis, laboratory certification, if any, what Quality Assurance/Quality Control QA/QC protocols are followed, how many replicate, duplicate and split samples analysed per year, lab QA/QC, Inter-Laboratory studies that the laboratory participates in, number of participating laboratories, exchange frequency, list of</p>

Compliance Plan Item	YES	NO	What should be included
			analytical methods used, how and where records are maintained).
(d) A statement that the facility will continue to comply with each applicable requirement			<p><b>Item D</b></p> <p>For example,</p> <p>I, _____, CEO/Owner of the _____ facility, commit to achieve compliance with the Wastewater and Trade Effluent Regulations by ****, 2xxx,</p>
(e) For pollutants listed in ii, and for each applicable requirement for which compliance is not currently achieved at the facility, the owner shall provide detailed statement of how the facility will achieve compliance			<p><b>Item E</b></p> <p>Description of steps that will be taken to achieve compliance.</p> <p>The description must include as many of the following measures and/or all other measures and associated activities that will be used to achieve compliance such as:</p> <ul style="list-style-type: none"> <li>• Pollution prevention measures (minimization or reduction of waste in waste streams, water management, pre-treatment}</li> <li>• Engineering measures (manufacturing process changes, changes in raw materials, treatment plant process and/or capacity changes,</li> <li>• Maintenance measures</li> <li>• Administrative measures (e.g. reassignment of responsibilities, internal reporting etc.)</li> </ul> <p>Table with a list of all activities, their start and end dates, indicators to determine completion of each activity, indicator(s) to determine progress, monitoring to determine compliance, indicators to show that a report will be submitted to NEPA (and internally if needed)</p>
(f) proposed compliance schedule			<p><b>Item F</b></p> <p>Diagram showing the schedule of activities outlined in Item E. If the facility is subject to a control order, the proposed schedule of remedial measures shall incorporate the order and shall be at least as stringent as the order.</p>
(g) a schedule for submission of progress reports to the Authority at least once in			<p><b>Item G</b></p> <p>List showing the dates on which <b>progress reports</b> are to be submitted to NEPA and the type of information that will be in each report. This must be consistent with the dates and steps in Item E and/or Item F.</p> <p>Note: A progress report would typically not include monitoring data but would indicate the completion of installation of equipment, suitable</p>

<b>Compliance Plan Item</b>	<b>YES</b>	<b>NO</b>	<b>What should be included</b>
every six months or more frequently if so required by the licence; and			milestones in construction, or reorganisation etc.
(h) a schedule for the submission of compliance reports to the Authority, at least once in every six months or more frequently if so required by the licence, indicating what (if any) progress has been made in relation to the schedule and the milestones			<p><b>Item H</b></p> <p>Timetable showing the dates on which <b>compliance reports</b> are to be submitted to NEPA, and indicate what will be in each report. This must be consistent with the dates and steps in Item E and/or Item F.</p> <p>A compliance report must include sampling and monitoring data.</p>
(i) performance targets to be achieved within two years			<p><b>ITEM I</b></p> <p>The period proposed must be as short as is reasonable and must be consistent with the nature and cost of the remedies required.</p>

When evaluating the proposed timelines in the compliance plan the criteria discussed in Table 3-5 should be consulted prior to acceptance of the proposed timelines.

**Table 3-5 Criteria used to determine allowed period**

Nature of requirements	Time Period for completion
Repair	Minor repairs suggest short periods. Bear in mind time to obtain parts and labour.
New construction	Bear in mind the various phases for construction (budgeting cycle, conceptual design, expression of interest, regulatory approvals process, detailed design, procurement process, contracting process, construction, commissioning and testing). Consider costs. Request cost information.
New manufacturing processes	Bear in mind the various phases for construction (budgeting cycle, conceptual design, detailed design, contracting, construction, commissioning and testing). Consider costs. Request cost information.
Change in raw materials	Consider time to obtain different raw materials.
Disposal of sludge	Consider interim storage as option only when no facility is available (e.g., for hazardous wastes). Consider costs. Request cost information.

All communication with the applicant (for additional information or clarification) must be documented and properly dated.

Where a Compliance Plan is refused, the reasons for refusal must be stated in the notification to the owner or operator. This notification should also inform the owner or operator that s/he is entitled to revise and resubmit the compliance plan within sixty days of the date of delivery of the notification. In all cases, the proponent must be required to resubmit the Compliance Plan.

Once the Compliance Plan has been approved, the reviewer must

- summarise the main features of the compliance plan;
- indicate milestones (what should be achieved, how it will be determined to be achieved, when achieved); and
- specify the completion date.

The Legal Services Branch should vet the summary and the milestones so that it can be included among the licence conditions. The Legal Services Branch must also include a reminder that discharge fees will continue to be payable and that prosecution will not take place for exceeding standards unless specified otherwise (e.g., for some pollutants but not others) as part of the milestones.

### **3.6 Review of Nutrient Management Plans (Regulation 26)**

Wastewater effluent contains valuable resources which includes organic matter and nutrients. However, it also can contain concentrations of chemical contaminants, salts and pathogens that are potentially detrimental to soils, plant growth and/or pose a risk to the wider environment or public health.

In an effort to manage the agrochemical loading of the receiving environment, a critical requirement in the licensing arrangements for facilities is the use of effluent and sludge discharges for beneficial use. Reuse of effluent and/or sludge for selected land applications under specific conditions conforms to environmental stewardship principles which are a win-win for the environment and business operations.

The application for the beneficial use of nutrients from the wastewater streams or discharges are subject to the preparation of a NMP which is to be submitted to the NEPA for review and acceptance by the Ministry of Agriculture and Fisheries and the Water Resources Authority.

The end-user of the resource may be either the owner of the facility or third party.

It should be noted that the NRCA and the NEPA will not accept responsibility for any adverse events that result from these activities and will not be party to any contractual arrangements between the discharger and end-user.

The preparation of the NMPs is the responsibility of the end-user. The NMP is required to provide information on the balance between the ferti-irrigation (fertigation) nutrient uptake by the selected plant(s)/crop(s) and residual amount that will be transported to surface and underground water resources that support critical biota.

Transportation of the resource by pipeline or haulage services is to be clearly defined.

In those cases where the treated effluent and/or sludge is approved by the Authority for beneficial purposes, the quantity and quality are to be recorded at each instance. The annual discharge fees payable are associated with the loadings of selected chargeable pollutants (BOD, nitrate, phosphate) present in the wastewater or sludge. Such fees are reimbursable.

Note that the associated fees are based on **actual use** and not on planned use of nutrients and should be reimbursed or used to offset other discharge fees.

A NMP must be submitted and approved in order to obtain reimbursement.

**The main purpose of the NMP is to determine the quantity of the needed nutrients can be provided by wastewater and/or sludge and the amount to be provided by fertilizer(s).** The steps in making the determination are:

- Maintain an up-to-date soil analysis (pH, Nitrogen, Phosphate, Potassium and Magnesium every three to five years), depending on the crop(s) of interest. Use the results to adjust inputs of lime nitrogen, phosphate, potash and magnesium nutrients.
- Assess the total nutrient requirement of the crop using a recognised fertiliser recommendation system.
- Assess the nutrient supply from wastewater, sludge (and organic manures).
- Calculate the need for fertiliser nutrients by deducting the contribution from wastewater, sludge and organic manures from the total crop nutrient requirement.
- Spread wastewater, sludge and organic manures and fertilisers as accurately and uniformly as possible. Equipment must be in good working order and recently calibrated.
- Keep clear field records of cropping, organic manure and fertiliser applications. This will aid future decisions on nutrient management and demonstrate the practical outcome of the NMP.

- Update the NMP at the start of each cropping year.

Indicate in Table 3-6 whether or not the required item is included in the NMP and include any comments.

**Table 3-6 Requirements for NMPs**

Item	Yes	No	Requirements
(a) Sustainability of the activity.			Statement that indicates the sustainable use of the land in the long term based on the avoidance of the build-up of substances in the soil.
(b) General Information.			<p>Verify ownership of trade effluent, wastewater, sewage and/or sludge identified for use and documentation provided where end-user is different from owner of the resource.</p> <p>The availability, quality of the effluent or sludge as well as the presence and concentration of the nutrient(s) of interest, production rate and quantities considered as well as application rates.</p> <p>During the review, changes in the characteristics of the product, effluent and/or sludge, treatment process, sewage or trade effluent being treated,</p> <p>Transportation of waste containing any hazardous materials requires an Environmental Permit.</p>
(c) An aerial photograph or map.			Map must show field(s) that will be fertilized or area where beneficial use will occur.)
(d) Soil map of the field(s).			Verify that the soil map indicates soil types (physical structure and chemical), soil structure (percolation rate, adsorptive capacity, moisture content) that will be used to justify nutrient requirements.
(e) A current and/or planned crop production sequence or crop rotation.			Self-explanatory.
(f) Results of soil, plant, water, manure or organic by-product sample analysis.			Verify that there are analytical data for pH, P, K, and Mg obtained within the past three to five years.
(g) Realistic yield potentials for crops in the rotation.			Verify that the yield for the crop for the area that will be fertilised with wastewater and/or sludge is included.

<p>(h) A quantification (listing) of all nutrient sources.</p>			<p>Verify that there is an estimate of all nutrient sources (commercial fertilisers, manure, wastewater and/sludge sources), and that typical annual rainfall amounts and sources of irrigation water are indicated.</p>
<p>(i) Recommended nutrient rates, timing, form and method of application including incorporation of timing for the time period of the plan.</p>			<p>Verify how and when each of the nutrient sources will be applied.</p>
<p>(j) Location of designated sensitive areas or resources and the associated nutrient management restriction.</p>			<p>Verify that the list and description of any sensitive areas within 1 km of the area(s) that will be fertilized with wastewater, sludge or both is accurate and complete. Sensitive areas should include protected areas, conservation areas, coral reefs, rivers or streams where water quality is compromised and ground water where there are nearby wells used for drinking water. Include also a description of the water table and its depth below surface, how it has been affected by rainfall. Drainage, infiltration, slope of land, potential pollutant loading in the receiving environment as well as potential for runoff to surface waters or percolation to groundwater are to be examined.</p>
<p>(k) Guidance for implementation, operation, maintenance, record keeping, and complete field-by-field nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence.</p>			<p>Verify that there is a description of the plan for the delivery of wastewater and sludge derived nutrients to fields, as well as delivery of nutrients derived from commercial and other (e.g. manure) fertilisers. The plan should indicate which fields (and crops grown) will be fertilized, when, and how. Include a sample table that will indicate how records will be kept. The table should include at least all of the elements in the annual reporting for nutrients (Form 6 of the Fourth Schedule).</p>
<p>(l) A statement that the plan was developed based on current standards and that changes in any of these requirements may necessitate a revision of the plan.</p>			<p>Verify that the statement is present.</p> <p>This NMP was developed based on practices used in the production of [crop x] and took into consideration the soil types present on the [name of</p>

			farm/field where applied] and other agronomic factors. We will continue to monitor the nutrient requirements and make adjustments to the plan as may be needed.
(m) Signature of person who prepared the plan. The plan may also be signed by the CEO of the facility supplying the wastewater and/or sludge and by the owner of the field or farm where nutrients will be applied.			The plan should be signed by the person who prepared the plan, CEO of the facility supplying the wastewater and/or sludge <b>and</b> by the owner of the field or farm where nutrients will be applied.
(n) External Regulatory Approval			The National Irrigation Commission (NIC), Rural Physical Planning Division (RPPD) and the Rural Agricultural Development Authority (RADA) of the Ministry of Agriculture as well as the Water Resources Authority is required to provide a written and signed statement of approval of the aspects of the NMP for which it is competent
(o) Internal Approval			The Environmental Management and Conservation Division through its technical Branches is to provide written and signed comments on the submission based on their areas of technical competence.

### 3.7 Review of Waste Water Treatment Plant Operations Manual (Regulation 20)

Regulation 20 requires sewage treatment plants to prepare and maintain an Operations Manual that must include specific information. These requirements and their review are summarised in Table 3-7 below.

**Table 3-7 Requirements for the Review of Wastewater Treatment Plant Operations Manual**

Item	YES	NO	Requirements (will vary depending on the complexity of the plant). Ensure that these are present in the manual.
(a)a description of the plant;			Plan-view diagrams of the plant and outfalls, influent sewer manholes, pump stations, force mains, and any piped diversions, overflow dams, or bypass weirs. Complete design data in tabular form. The design data may normally be photocopied directly from the approved plans, which should include a complete listing as a reference. A description of how the plant is served with

Item	YES	NO	<b>Requirements (will vary depending on the complexity of the plant). Ensure that these are present in the manual.</b>
			<p>utilities and other auxiliary equipment.</p> <p>Description of the standby power system in detail including explicit procedures to be followed on loss of utility power and conversion to standby power, and vice-versa. Complete list of all non-maintained contacts that will have to be manually re-set on each occurrence. Description of the phasing of any start-ups controlled by time-delay relays. Instructions on which equipment to re-set and start up first. List of equipment items may be considered non-critical, description of which start-ups must be staggered, and provide associated instructions.</p> <p>Drawing showing the locations of utilities (power drops, main breakers, gas meters, land line telephones/ communication equipment, backflow preventers, fuel tanks, chemical storage, and other such auxiliary equipment as may concern firemen responding to an alarm.</p> <p>Drawing /map showing the locations of isolation valves, access points and other pertinent features.</p>
(b) a description of the operating procedures, including details of the process operations;			<p>Description of each unit process and equipment item in detail. Instructions for start up, shutdown, operation under various conditions, and control. Troubleshooting guide or manufacturer's guide for each electrical and mechanical feature of the plant.</p> <p>List of all control and alarm set points and elevations as per schedules in the plans or specifications. Forms for recording start up conditions (developed by the engineer or adapted from the manufacturer's standard forms).</p> <p>Operation and control of other mechanical systems such alarms, telemetry, emergency power and fuel transfer systems, landscaping irrigation, chemical feeders, heating, ventilation and cooling (HVAC), seal water, level controls, flow meters, samplers etc. Description of how these systems work, and their operation and maintenance requirements - including diagrams as necessary.</p>
(c) a list of equipment, including specifications of the equipment;			See item a.
(d) maintenance requirements and			Lists of periodic maintenance requirements, record-keeping forms, equipment suppliers and service reps telephone numbers.

Item	YES	NO	<b>Requirements (will vary depending on the complexity of the plant). Ensure that these are present in the manual.</b>
procedures for the equipment and plant components;			
(e) a schedule of maintenance activities to be carried out by operations staff;			See item b.
(f) an influent and effluent monitoring schedule;			<p>Schedule indicating when and where samples should be taken.  Map showing outfalls and all sampling locations  Summary information on sampling protocols  Refer to NRCA licence as necessary  Include one complete set of all worksheets/reporting forms including period (monthly) and annual.</p> <p><b>Sludge Disposal and Analysis.</b> Reference the information necessary for the operator to insure safe and proper handling and disposal of sludge. Summary of the approved sludge management plan and provision for sludge disposal records.  Operation, maintenance, and control of sludge storage and disposal equipment, tanks, ponds, spreaders, sprayers, and so on. Provide one copy of sludge disposal log forms.  Provide a list of approved sites for disposal or use, contacts, map for such sites, copies of contracts and approvals for transport and disposal if applicable.</p> <p><b>Effluent Reuse.</b> Copy of the NMP or irrigation reuse plan including information the STP operator may require in order to comply with this plan.</p>
(g) an emergency management plan which shall include but is not limited to risks associated with floods, hurricanes or fires.			<p><b>Safety Requirements.</b> The emergency management plan should make reference to occupational hazards and safe practices. There should also be a separate section in the manual on safety. The safety section should include information on specific hazards at the plant, and should refer to the safety training program and standard safety procedures handbook.</p> <p><b>Emergencies.</b> Include a separate section listing emergency phone numbers, including the NEPA and Environmental Health Unit (EHU) staff/office to be called to report any sewage overflow or other problem. Describe or reference procedures for chlorine leaks and neighbourhood evacuation, fires, power and phone outages, etc.</p>
(h) any other information relevant to			See item b.

Item	YES	NO	Requirements (will vary depending on the complexity of the plant). Ensure that these are present in the manual.
the good operation of the plant;			

### 3.8 Administrative and Technical Review of Periodic Reports (Regulation 25)

The Fourth Schedule contains various forms for filing periodic reports (daily, weekly, monthly, quarterly or annual as the case may be) and to report spills and pollution incidents. The annual reports for trade and sewage effluent are the bases for calculating the discharge fees that are payable. The annual report for trade effluent must accompany the initial licence application or renewal. Except for the initial (very first) application, the annual report for trade effluent must be accompanied by the discharge fees for the releases made in the previous calendar year.

FOURTH SCHEDULE (Regulations 18, 25 and 47)

- Form 1 Sewage Effluent Monthly Reporting Form
- Form 2 Weekly, Monthly or Quarterly Monitoring Reports for Trade Effluent
- Form 3 Annual Sewage Effluent Reporting Form
- Form 4 Annual Trade Effluent Reporting Form
- Form 5 Form to Report Spills and Pollution Incidents
- Form 6 Quarterly and Annual Industrial Sludge Reporting Form

#### 3.8.1 Review of Sewage Effluent Monthly Reporting Form (Fourth Schedule: Form 1)

This report is geared exclusively to Sewage Treatment Plants. It presumes monthly sampling. More frequent sampling could be required as a condition of the licence.

Table with values – should have outflow (either instead of, or as well as inflow). Outflow is needed to calculate loads. (Each concentration measurements must be accompanied by a corresponding flow). This table needs to be repeated for each discharge point.

The report should include notification as to whether or not a Compliance Plan or Control Order is in force.

The report should include reporting of the amounts and types (hazardous or biosolids) of sludges generated, stored and removed off-site.

The monthly report form should be used for preparing reports for all sampling intervals required by the Authority up to one month. Collated monthly reports are to be submitted to the agency based on the frequency at which the Authority requires the submission of these reports for e.g. quarterly, twice yearly.

Item	YES	NO	Requirements
Facility			Verify licence number.

Item	YES	NO	Requirements
Dates			Record the date the report was received (hard or electronic).
			Check dates for consistency (reporting period and sampling dates).
Signature			Verify report was signed and signature corresponds with that on accepted identification submitted.
			Was the report received for the previous reporting period?
			If not – verify that notice was sent out requesting overdue report.
Data			Verify that all required data as specified in the licence (frequency of measurement, number of sampling locations, parameters [including sludge], method used,) are reported. Be sure to check the values and units especially for nitrate and phosphate. It is important that the dates and times of collection of samples be checked to ensure that the required amount of samples were collected during the month and that there is sufficient spacing between each sampling event.
			Verify that calibration data for each parameter are included.
Data entry			Enter concentration data and corresponding flow data into database.
Inspection visits			Independently confirm the number of inspection visits.
Violation of standards			Note violations of standards and determine if follow up action is needed.
Average monthly flows			Review the average monthly flows for influent and effluent and compare with design flows. The period (monthly) flow should be reported instead.
Peak Flow			Compare with design flow in licence.
Operation & Maintenance			Review current and previous problems. Determine the need for a control order.

### 3.8.2 Review of Weekly, Monthly or Quarterly Reports for Trade Effluent (Fourth Schedule: Form 2)

Item	Yes	No	Requirement
Dates			Record the date the report was received (paper or electronic)
			Is the report overdue by more than thirty (30) days? If so note for administrative penalty.
			Check dates for consistency (reporting period and sampling dates)
			Was report received for the previous reporting period? If not – verify that notice was sent out requesting overdue report.
Plant Name, ID, Location			Verify that the plant name, location and Licence number are correct.

Item	Yes	No	Requirement
Signature			Verify that the report was signed by both the owner and / or CEO of the facility and by the Laboratory Manager that performed the analyses or the environmental manager or the contact at the facility as designated in the licence. It is important that the dates and times of collection of samples be checked to ensure that the required amount of samples were collected during the month and that there is sufficient spacing between each sampling event.
Data			Verify that all required data as specified in the licence (frequency of measurement, number of sampling locations, parameters [including septage and sludge], method used) are reported.
			Verify that calibration data for each parameter are included.
Data entry			Enter concentration data and corresponding flow data into database.
Inspection visits			Independently confirm the number of inspection visits (number of visits and dates). Dates of visits should be recorded in (Application Management and Data Automation) (AMANDA) and you should call EHU staff to determine visits by them. A system should be set up to provide NEPA with the information on visits by EHU staff to facilities (STPs and trades).
Violation of standards and Compliance Plan			Note violations of standards and determine if follow up action is needed. Check if a Compliance Plan is on file.
Peak Flow			Compare with design flow in licence.
Operation & Maintenance			Review current and previous problems. Determine the need for a control order.

### 3.9 Review of Annual Reports

#### 3.9.1 Review of Annual Sewage Effluent Reporting Form, Fourth Schedule Form 3

The Annual Sewage Effluent Reporting form should be reviewed using the information in Table 3-8 below to access for completeness and accuracy.

**Table 3-8 Review of Annual Sewage Effluent Reporting Form**

Item	Yes	No	Requirement
Facility			Verify permit and licence number. Plant location should state the address [(Address1 -street name, Address2 (other address, Town/Municipality, Parish)].
Dates			Record the date report was received (hard copy or electronic).
			Ensure the date is in the correct format (yyyy/mm/dd).
			Check dates for consistency (reporting period and sampling dates).
Signature			Verify that the report was signed and signature corresponds with that on accepted identification submitted.

<b>Item</b>	<b>Yes</b>	<b>No</b>	<b>Requirement</b>
			Was report received for the previous reporting period?
			If not – verify that the notice was sent out requesting overdue report.
Monthly Data			Verify that all required data (as specified in the licence) are provided. Check that the data reported on the annual form are the same as those on monthly reports.
Annual Load			Verify the calculation of the annual load and the discharge fees (Section 6 refers)
Chlorine Residual			Check the total numbers of exceedances of standards for all parameters. Determine if a Control Order or other measures are needed.
Other Tests			Verify what additional parameters were measured and that the test methods used are consistent with the Fifth Schedule.
Regulatory Inspections/Visits			Verify that the numbers of visits are consistent with monthly reports.
Septage			Ensure that the amount of septage received is indicated and check data against monthly reports.
Sludge			Ensure that the amount of sludge transferred off site is indicated and check data against monthly reports.
Sludge stored on site			This should be the amounts that are stored on-site at end of year. Separate amounts for biosolids (could be applied to agricultural soil) and partially treated sludge.
Repairs, rehabilitation or upgrades.			Check if these are required as part of a compliance plan.
Additional Sewage Inflows			Account for changes in inflows based on new connections to sewer system coming on stream. Ensure that necessary permits were obtained and that design flow is not exceeded.
Changes in Staffing			Summary of staff changes.
Comments			These would include information on public meetings with community groups, newsletters published to describe the facility, tours of facility by groups of (more than 6 persons), sponsorship of community activities.
Laboratory Reports			Ensure that laboratory reports are attached.

### 3.9.2 Review of Annual Report – Trade Effluent, Fourth Schedule: Form 4

The Annual Report should include notification as to whether or not a Compliance Plan or Control Order is in force. For the technical review, verify with the Wastewater and Sludge Management Unit (WSMU) that the information is correct. The WSMU will be aided by the Pollution Monitoring and Assessment and Enforcement Branches. Where necessary the assistance of the relevant engineers/specialists in the Agency will be requested through the WSMU Coordinator or Manager to whom the coordinator reports.

Item	Yes	No	Requirement
Date			This should be the date the Annual Report was submitted to NEPA.
			Ensure that the date is in the correct format (yyyy/mm/dd).
Reporting year			The reporting year must be for the previous calendar year in the date.
Name of Plant			The plant name must be the same as in the Licence.
Location of Plant			This should be the physical address of the plant.
NRCA Permit No. number			Verify if a permit was issued for the facility and check the permit.
NRCA Licence No.			Verify the NEPA Trade Effluent and Sludge licence number.
Estimate of average flow rate of trade effluent			If a monthly or period flow rate is not available, Section 6 provides details of estimation methods.
Annual flow of trade effluent			This must be the total trade effluent flow for the year from this effluent point.

Item	Yes	No	Requirement
Monthly flows			This should be the monthly flows. If the licence required is less frequently (e.g., quarterly), divide the total flow for the period by the number of months in the period and use the result for each of the corresponding months in the period.
Number of reportable incidents			This is the number of incidents that were reported for the year.
Community activities			<p>Community activities should include the following:</p> <ul style="list-style-type: none"> <li>• Public meetings with community groups (specify number of meetings and dates);</li> <li>• Newsletters published to describe the facility (specify number of meetings and dates);</li> <li>• tours of facility by groups (of more than 6 persons), (specify number and dates);</li> <li>• Consultations including the methods used (surveys, focus groups, community panels, etc.) and number of consultations;</li> <li>• Complaint (about environmental issues) handling procedure in place, number of complaints, number resolved;</li> <li>• Environmental awareness or education programme;</li> <li>• Donations/grants to local communities for environmental issues;</li> <li>• Sponsorship of local and national environmental community</li> </ul>

Item	Yes	No	Requirement
			activities/programmes; and <ul style="list-style-type: none"> <li>• Other (specify).</li> </ul>
Laboratory Reports			Ensure that laboratory reports are attached.
Signature			Verify that the report was signed and signature corresponds with that on accepted identification submitted.
			Was report received for the previous reporting period?
			If not – verify that notice was sent out requesting overdue report.

### 3.9.3 Review of Quarterly and Annual Industrial Sludge Reporting Form (Fourth Schedule Form 6)

The Quarterly and Annual Industrial Sludge Reporting Form is designed to be updated quarterly. The last quarterly report will also be the annual report where the totals for the year are reported. For each type of sludge, one entry per quarter is required.

The quarterly reports are due at the end of the month following the last month in each of the first three quarters and the fourth quarter's report is due on the last day of February.

Table 3-9 below contains information to be used to access the form for completeness and accuracy.

**Table 3-9 Review of the Quarterly and Annual Industrial Sludge Reporting Form**

Item	Yes	No	Requirement
1. Date			Ensure the date is in the correct format (yyyy/mm/dd)
2. Reporting year			The reporting year must be for the previous calendar year. The date should be in the format specified above.

Item	Yes	No	Requirement
3. Date received			Record the date the report was received. This is to be filled in by NEPA staff.
4. Name, location and permit and licence numbers for the facility			Ensure the information provided here is consistent with that in Schedule 1 Form 1 (Application form)
<b>5. Quarterly and Annual Release of Industrial Sludge</b>			
Period			The quarter is the calendar quarter (Q1 is January, February and March, Q2 is April, May June, Q3 is July, August, September and Q4 is October, November, December).
Type of sludge			<p>Reports for each type of sludge are required. They should be described in Item 6 and each type is designated by a letter starting with A. For each type of sludge the next letter in the alphabet should be used.</p> <p>(Include description of types A, B, C etc.).</p>
Amount of sludge generated in period (tonne)			<p>This is the total amount of sludge generated at the facility during the quarter.</p> <p>In the case of red mud, since supernatant is re-circulated, two types should be reported: net amount of supernatant and amount of red mud.</p> <p>Spills to the environment of supernatant liquid must be reported as a trade effluent.</p> <p>The solids content of the red mud that remains in the storage pond and the amount of supernatant that will/can be re-circulated to the plant should be provided (and justified).</p> <p>For dry stacking disposal sites, the amount in the dry stacking area</p>

Item	Ye s	No	Requirement
			<p>assuming nominal moisture content when dry and the amount of supernatant in the holding pond should be reported. Use the same moisture content for the entire year.</p> <p>The value for the moisture content should be updated, if needed, in the last quarter and all data for the entire year revised.</p>
Stored on Site at end of period (tonne)			This is the amount that is stored on-site at the end of the period.
Transferred off-site during period (tonne)			This is the amount that is transferred off-site during the period.
Other (specify)			This area is for comments. The Licensee should indicate if the transfers were for further treatment or for disposal. Details are to be provided in the following table in the report.
6. Description of Sludge Types			Description of sludge types A,B,C etc. (see Type of Sludge in 5 above)
<b>7. Transfers of sludge off-site</b>			
Period			As indicated above.
Type of sludge			As indicated above.
Date transfer			Each of the dates on which transfers off-site took place.
Amount transferred			The total amount of waste transferred off-site.
Recipient			The <b>name</b> of the facility (waste management site, company that will use, further treat or destroy) that received the sludge should be indicated.

Item	Ye s	No	Requirement
Address of Recipient (Destination) of Sludge			The full address (street number and name, additional address if needed, City/Town/Municipality and parish) of the facility that received the sludge should be indicated.

The annual amounts of sludge generated, stored on-site and transferred off-site are required for Pollutant release and transfer register (PRTR) reporting.

### 3.9.4 Review of Monthly/Annual Nutrient Management Report

The nutrient management report provides details of the application of trade effluent and sludge to individual field during the preceding calendar year. The monthly report is designed to allow the entry of application of effluent or sludge in a month and the monthly loads can be calculated for roll up into the annual report.

Table 3-10 below should be used to assess the Monthly/Annual Nutrient Management Report for completeness and accuracy.

**Table 3-10 Review of Monthly/Annual Nutrient Management Report**

Item	Ye s	N o	Requirement
1. Date			Ensure the date is in the correct format (yyyy/mm/dd)
2. Reporting year			The reporting year must be for the previous calendar year in the date in the row (above).
3. Date received			Record the date the schedule was received.
4. Name, location and licence numbers for the facility			Make sure the information provided here is consistent with that in application form.
5. Nutrient Application Report			The data required for this table (see 8 below) are self-evident. The application rates for potassium are included to ensure adequate

Item	Ye s	N o	Requirement
			<p>nutrient application according to the NMP.</p> <p>Field ID as identified on the map that must accompany the report.</p> <p>Area of fields (in hectares) to which nutrients were applied.</p> <p>Crops grown on field(s) to which nutrients were applied.</p> <p>Trade effluent derived nutrients and normal fertilizer Applied (kg).</p> <p>Amount(s) in kg of N and NO<sub>3</sub>, C as BOD and P as PO<sub>4</sub> as well as K as K<sub>2</sub>)</p> <p>Date(s) applied for each type (fertilizer, sludge, etc.)</p>
6. Total Fertiliser Applied (Tonnes)			Self-explanatory
7. Incentive for Using Trade Effluent and/or sludge as Fertilizer - Reconciliation of Discharge Fees			Use load calculation formula as presented in Section 6.
<b>8. Nutrient Application Report</b>			
1. Field ID			<p>Distinguishing identity of field or plot to which nutrient is applied. This ID should be checked against the map supplied in the application for NMP.</p> <p>If the application is to a new previously unidentified field or plot, it should be approved if the information required for the NMP is acceptable (e.g., same soil type and nutrient requirements).</p> <p>Where application occurs to a group of fields or plots consistently for each month, the fields/plots may be combined if the application takes place to all fields/plots for the month. Use a separate sheet for different fields or groups of fields/plots.</p>

Item	Yes	No	Requirement
2. Crop			Name and type of crop. This should have been identified in the NMP.
<b>Effluent Applied</b>			
3. Flow rate			Flow rate in the units specified (m <sup>3</sup> /h).
4. Start date and hour			Be sure the full date and time is noted. The difference between the date/times is used to calculate or check the volume applied.
5. End date and hour			
6. Volume applied			The total volume – either recorded independently or calculated from the flow rate and duration (6-5).
7. BOD			<p>Items 7 , 8, 9, 10, 11, 12, 13, 14 and 15 are the individual results of sampling for each application</p> <p>For the monthly loads of BOD, NO<sub>3</sub> and PO<sub>4</sub>, multiply the volume by the flow in each case and then add loads.</p> <p><b>Note do not average flows or loads individually.</b></p>
8. Nitrate as NO <sub>3</sub>			
9. Phosphate as PO <sub>4</sub>			
10. Faecal Coliform			
11. pH			
12. Temperature			
13. Total Coliform			
14. Total dissolved solids			
15. Total suspended solids			
<b>Biosolids Applied</b>			
16. Start date			Be sure the full date and time is noted. The difference between the date/times is used to calculate or check the volume applied.
17. End date			
18. Volume/Weight applied			Check that the weight or volume of biosolids is correctly recorded.
19. BOD			<p>Items 19, 20, 21, 22, 23, 24 and 25 are the individual results of sampling for each application.</p>
20. Nitrate as NO <sub>3</sub>			
21. Phosphate as PO <sub>4</sub>			
22. Other measurement (specify)			
23. Other			

Item	Yes	No	Requirement
measurement (specify)			
24. Other measurement (specify)			
25. Other measurement (specify)			
<b>Other Fertilizer applied</b>			
26. Start date			Ensure that the full date and time is noted. The difference between the date/times is used to calculate or check the volume applied.
27. End date			
28. Volume/Weight applied			Check that the weight or volume of biosolids is correctly recorded.
29. N			Items 29, 30, 31, 32, 33 and 34 35 are the individual results of additions of fertiliser. Note that these quantities refer to fertiliser that is commercially available and not waste or biosolids materials.
30. P			
31. K			
32. Other (specify)			
33. Other (specify)			
34. Other (specify)			
35. Other (specify)			

### 3.9.5 Review of Form to Report Spills and Pollution Incidents, Fourth Schedule: Form 5

The information in Table 3-11 below should be used to assess the Form to Report Spills and Pollution Incidents.

**Table 3-11 Review of Form to Report Spills and Pollution Incidents**

Item	Yes	No	Requirements
Location where spill or incident occurred.			Location on property and areas off-site (receiving water bodies that are affected or can be affected by the spill) should be indicated
Name and phone number of person			Self-evident. Typically this would be the environmental officer or the person who

Item	Yes	No	Requirements
who reported the spill and address.			is authorised to file the report.
Date and time of spill			Self-evident. Note the spill report must be completed as soon as possible after the spill and no later than 24 hours after the spill occurred.
Material(s) spilled			Self-evident. Describe the chemical name (avoid trade names). If a Trade name is provided, be sure that you have the Material Safety Data Sheets (MSDS) and attach it to the report
Characteristics of material spilled			Chemical properties that pose danger to the environment or human health. Information such as provided on MSDS should be used.
Amount of material spilled (volume in litres or weight in kg)			Self-evident. An estimate of the exact quantity should be provided if it is not known. Metric units (kg or m <sup>3</sup> , litres) should be used.
Duration of spill event			Period of time over which spill occurred.
Work completed and/or still in progress in the mitigation of the spill			A description of the work that has been and will be completed to contain and clean up the spill and to treat any contaminated material.  NEPA will likely issue a Control Order for completion of work and submission of more detailed reports on the incident as may be indicated from the nature and severity of the spill.
Preventative actions being taken to ensure the situation does not occur again			Actions that have been taken to date should be indicated.

### **3.10 PRTR Facility Reporting (Regulation 46)**

Facilities licensed by the Authority to release air pollutants, sewage and trade effluent into the air, water and onto land and/or transfer of any waste streams for transfer off-site for disposal and/or treatment including recycling and reuse locally or for export are required to provide such information to the NEPA.

Annual PRTR Reports provide the total quantities of the parameters such as carbon monoxide, sulphur dioxide, nitrogen dioxide, volatile organic compounds, total suspended particulates or fine particulates, toxic or priority air pollutant releases into the air, water and/or land, wastewater releases such as biochemical oxygen demand, chemical oxygen demand, pH, nitrate, phosphate, bio-accumulative or heavy metals for each facility.

The PRTR is intended to guarantee public access to information on releases and transfers of certain pollutants and contributes transparency and public participation in environmental decision-making.

The templates for PRTR reporting can be found in Appendices 8 and 9.

### **3.11 Setting Licence Conditions**

Licence conditions are an extremely important aspect of the licence. In all cases, the need for specific conditions must be assessed based on a careful review of a variety of factors such as:

- Compliance with effluent and sludge standards;
- History of reporting compliance;
- Community complaints;
- Quality of receiving waters; and
- Load discharged and the potential for adverse effects on quality of receiving water body.

In some cases, the licence conditions are required (e.g., non-compliance with an effluent standard will require a Compliance Plan in all cases of initial application for licences) while in other cases judgement will be required. In such cases, the scientific or technical basis for the condition must be clearly justified and documented.

The following general guidelines should be followed:

### **3.11.1 Facility Description**

Since the licences including all licence conditions will be publicly accessible, all licences must contain a brief description of the facility that includes non-proprietary or confidential information. Much of this information should be provided in the licence application and should be repeated or précised in the licence.

- Facility name;
- Location (full address including parish(es) and Watershed Management Unit);
- Brief description of the business of the facility (ISIC Code, what is produced, annual capacity);
- Unit operations at the facility especially those that can generate wastewater or sludge;
- Description of wastewater treatment processes (unit operations) including capacities, inputs and outputs;
- Ecological assets in a 5 km radius;

### **3.11.2 Monitoring requirements**

All treatment plants will be required to conduct monitoring. The parameters to be monitored and the frequency must be consistent with the Third and Fourth Schedules. Any **additional monitoring required must be clearly indicated by specifying the parameters, frequency and reference to the monitoring methods. IN ALL CASES, ALL OF THE MONITORING LOCATIONS MUST BE CLEARLY SPECIFIED.**

### **3.11.3 Reporting Requirements**

All treatment plants will be required to report periodically (e.g., monthly or quarterly etc.) and annually. The reporting requirements (parameters to be reported, and the frequency must be specified and must be consistent with the Fourth Schedule. **Any additional reporting required must be clearly specified.**

**Additional reporting should be specified in cases where there have been frequent complaints, and where the receiving water body exceeds ambient water quality guidelines.**

### **3.11.3.1 Compliance Plan**

#### ***Initial Applications for Licences***

If any pollutant is reported to exceed the standard, then a Compliance Plan must be required. The Compliance Plan must be formally approved by NEPA.

The requirements of the Compliance Plan are provided in Section 3.5 and must be included in the licence. The activities specified in the approved Compliance Plan including the indicators that will determine completion of the activity and the schedule together with pollutant monitoring requirements must be clearly indicated in the licence.

#### ***Licence Renewals or cases where a facility becomes non-compliant***

Compliance Plans should be required when there is a systemic problem with treatment of effluent – i.e., the treatment processes are not capable of routinely achieving the required level of treatment.

In situations where there is poor maintenance or plant/process upsets that result in exceedance of a standard, the use of warnings or Control Orders is preferred to a Compliance Plan.

### **3.11.3.2 NMP**

Applicants who apply to use wastewater for irrigation or sludge for soil conditioning or for other beneficial uses must submit a NMP. The NMP must be approved and included in the licence. The requirements for the NMP are set out in Section 3.6.

## 4. SLUDGE MANAGEMENT

### 4.1 Beneficial Use of Sludge

For the purposes of these Guidelines, beneficial use of sludge will be taken to mean: application for agricultural use, back-fill material for mined-out pits or soil amelioration. Other uses which may be considered beneficial will be assessed by the Authority on a case by case basis to determine whether or not consideration ought to be given regarding the conformity of the requested use to beneficial use as well as the extent to which discounts are to be applied to the applicable discharge fees. Where the application rate of sludge exceeds the nutrient requirement for organic matter, the application will not be considered beneficial use.

Prior to application, sewage or industrial sludge must be stabilized. Stabilization is a chemical or biological process that stops the natural fermentation of the sludge. Stabilizing the sludge will result in reduced pathogens, vector attraction and offensive odours. Sewage or industrial sludge destined for reuse must meet the standards set out in Table 5 of the Third Schedule of the Regulations which has been reproduced below in Table 4-1.

**Table 4-1 National Treated Sewage Sludge Standards for Fully Treated Sewage Sludge that can be Applied to Agricultural Land**

Pollutant	Maximum Concentration #	Annual Pollutant Loading Rates	Jamaican Cumulative loading rates %
	mg/kg (dry weight) basis		kg/ha
Arsenic	65		
Cadmium	75		
Copper	230		
Lead	90		
Mercury	0.045		
Molybdenum	09		
Nickel	180 <sup>##</sup>		

Pollutant	Maximum Concentration #	Annual Pollutant Loading Rates	Jamaican Cumulative loading rates %
	mg/kg (dry weight) basis		kg/ha
Selenium	14 <sup>##</sup>		
Zinc	400		
Cr	830		165
Pathogens	<1,000 MPN/g of total solids (oven dried mass where <i>Viable Helminth Ova</i> <1 per 4g of Total Solids (Dry Weight) <i>Salmonella</i> <3 MPN/4g <i>Faecal Coliform</i> <1,000 MPN/g		

# Based on the 95<sup>th</sup> percentile (rounded to 5mg/kg) of the level of occurrence in Jamaican soils except as noted

## Based on US EPA limits

% Based on 4,400 kg dry weight compost per ha for 45 years

All personnel involved in the management of sludge including, generators, transporters, spreaders and farmers should ensure that the application of the material on land is carried out in an environmentally friendly manner with beneficial effects for agriculture.

Sewage or industrial sludge should not be applied:

- to slopes in excess of 10 % (6 degrees)
- during rainfall
- waterlogged soil
- slowly permeable soils
- highly permeable soils
- land where depth to bedrock is less than 60 cm
- within 50 m of surface waters (on flat land)
- within 100 m of surface waters (down-slope)

- within 5 m of surface waters (upslope)
- contaminated sites
- to land if it is likely to adversely affect protected, threatened or endangered species

Due consideration should be given to the location of sludge application and storage sites to ensure that the transportation, storage and application of sludge does not cause a public nuisance.

The suitability of the land for the application of sewage or industrial sludge and the crops for the sludge can be applied should be determined in consultation with the Ministry of Agriculture and Fisheries and the NEPA. Maximum application rates as determined in an approved nutrient plan should not be exceeded.

On application sites, sludge should be stored in a dedicated area bunded with compacted earth giving due consideration to drainage and runoff. Storage periods should not exceed thirty (30) days. Drainage from the stockpile area should not be discharged into surface waters. Stockpile areas should be located on maximum slope of 4%. Stockpiling should be of limited duration to reduce vector attraction.

Records should be kept of the quantities of sludge generated, stored, transferred, the dates of transfer, the types of sludge, the recipient and the address of the recipient (as may be required) to facilitate the preparation of the quarterly and annual reports that should be submitted to the Agency.

## 4.2 Management at WWTP Sites

Long-term stockpiling of sludge at WWTP sites is not an appropriate disposal method. Where sludge may cause nuisance odours or have the potential to attract vectors, it should be covered or incorporated into the soil. Stockpile areas should be designed with adequate drainage controls and the provision for an impervious base. Drainage should be managed to prevent the pollution of waters.

## 4.3 Disposal to Landfill

Sludge that will be disposed of at a landfill must be treated to meet the standards in Tables 6 and 7 of the Third Schedule of the Regulations which have been reproduced in Table 4-2 and 4-3 below.

**Table 4-2 Standards for Soil Waste/Industrial Sludge Suitable for Landfill**

<b>Leachate test results not to exceed 100 mg/l</b>	
Parameter	

Ammonia sulphide	Maleic anhydride
Benzidine	Methylamine
Benzyl chloride	Potassium permanganate
Diethylamine	Quinoline
Ethylamine	Strychnine
Ethylenediamine	Tetrachloroethanes

**Table 4-3 Standards for Solid Waste/Industrial Sludge Suitable for Landfill (based on Leachate quality test results)**

<b>Parameter</b>	<b>Concentration (mg/L)</b>
Arsenic	2.5
Barium	100
Cadmium	0.5
Carbon Tetrachloride	0.5
Chromium	5
Cyanide (free)	20
DDT	3
Endrin	0.02
Heptachlor +Heptachlor epoxide	0.3
Lead	5
Lindane	0.4
Mercury	0.1
Methoxychlor	10
Methyl ethyl ketone	200
Metolachlor	5

<b>Parameter</b>	<b>Concentration (mg/L)</b>
PCBs	50
Selenium	1
Silver	5
Tetrachloroethylene	3.0
Toxaphene	0.5
Trihalomethanes	10
2,4,5-TP (Silvex)	1
Zinc	500

## **4.4 Transportation**

Transportation of sludge should not result in spillage, odours, or contamination of the sludge being transported. Loads should be covered and dust control procedures implemented to prevent the loss of fine material. No drainage should escape from the vehicle while in transit, if the sludge is not dry. Vehicles should be cleaned in a location where water from wash-down is prevented from entering the storm water system or surface waters.

Vehicles transporting sludge should carry a manifest stating the vehicle registration number, time, date and location where the sludge was collected and the amount loaded as well as the time, date and location where the sludge is offloaded and the amount offloaded. The signatures of the operator of the facility from which the sludge is collected, the driver and the relevant personnel from the recipient location must be affixed to the manifest. The recipient information must be repeated if the sludge being transported will be offloaded at different sites. Copies of the manifests should be submitted to the NEPA and copies must be kept at the Licensed facility where the sludge is generated.

## **5. MONITORING**

### **5.1 Wastewater Monitoring Guidelines**

Monitoring required under the Regulations entails making measurements of flow and effluent parameters at the locations (monitoring points) and at the times indicated in the Regulations or according to the special conditions specified in the licence. The analytical methods used to quantify the parameters must be made using the methods specified in the Fifth Schedule of the Regulations or using previously approved methods or those listed in this Guideline Document. The documentation of the monitoring (sample locations, dates and times of sampling, persons that conducted the sampling and the analyses and all intermediate analytical data (calibration curves, quality control samples, standards) must be kept by the licensee or the analytical laboratory for a minimum of six (6) years after the sample is taken.

## 5.2 Sampling Schedule and Frequency

The Regulations provide typical sampling regimes (Table 5-1) and the parameters to be monitored by sector. Where licences have attached conditions these may specify different frequency and additional or fewer parameters to be monitored.

**Table 5-1 Sampling Frequency and Parameters to be Monitored by Sector**

<b>Sector</b>	<b>ISIC</b>	<b>Frequency for all activities at the facility</b>	<b>Parameters to be monitored unless otherwise specified in Licence</b>
Aquaculture	0502		
Mining of non-ferrous ores (including bauxite)	1320	Quarterly	TSS, pH
Other Manufacturing of Food products $\leq$ 50,000 m <sup>3</sup> /day	15	Quarterly	BOD, COD, Oil and Grease, TSS, NO <sub>3</sub> , PO <sub>4</sub> , NH <sub>4</sub>
Other Manufacturing >50,000 m <sup>3</sup> /day	15*	Monthly	pH, COD, TSS, Oil and Grease
Other Manufacturing $\leq$ 50,000 m <sup>3</sup> /day	15*	Quarterly	pH, COD, TSS, Oil and Grease
All others >50,000 m <sup>3</sup> /day	15*	Monthly	pH, COD, TSS, Oil and Grease
Manufacture of sugar	1542	Monthly during crop (factory grinding sugar cane)	BOD, COD, TSS, NO <sub>3</sub> , PO <sub>4</sub> , temperature

<b>Sector</b>	<b>ISIC</b>	<b>Frequency for all activities at the facility</b>	<b>Parameters to be monitored unless otherwise specified in Licence</b>
		and/or producing sugar)  Quarterly out of crop (factory <b>not</b> grinding sugar cane and/or producing sugar)	BOD, COD, TSS, NO <sub>3</sub> , PO <sub>4</sub> ,
Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials	1551	Monthly	BOD, COD, TSS, NO <sub>3</sub> , PO <sub>4</sub> , temperature
Manufacture of malt liquors and malt	1553	Monthly	BOD, COD, TSS, NO <sub>3</sub> , PO <sub>4</sub> , pH, Oil and Grease, NH <sub>4</sub> , PO <sub>4</sub> , Temperature increase
Other Manufacturing of Food products >50,000 m <sup>3</sup> /day	15xx not previously listed	Monthly	BOD, COD, Oil and Grease, TSS, NO <sub>3</sub> , PO <sub>4</sub> , NH <sub>4</sub>
Tanning and dressing of leather	1911	Monthly	BOD, TSS, Oil and Grease, Total Chromium, pH, Sulphide
Manufacture of refined petroleum products	2320	Monthly	Temperature, pH, TSS, Ammonia, Total Chromium, hexavalent-Chromium, Sulphide, BOD, COD, Faecal Coliform, Total Coliform, Oil and Grease, Phenols
Manufacture of paints, varnishes and similar coatings, printing ink and mastics	2422	Monthly	pH, Phenols, Oil and Grease, TSS, Pb, Cr, Cu, Ni, Zn, Total Heavy Metals
Manufacture of soap and detergents, cleaning and polishing preparations, perfumes	2424	Monthly	BOD, COD, TSS, Surfactants, Oil and Grease, pH

<b>Sector</b>	<b>ISIC</b>	<b>Frequency for all activities at the facility</b>	<b>Parameters to be monitored unless otherwise specified in Licence</b>
and toilet preparations			
Manufacture of cement, lime, plaster	2694	Quarterly  Annual	TSS, Oil and Grease, pH, Temperature, BOD, COD, Faecal Coliform, Total Coliform, Cl, Fe, Mg, Mn, PO <sub>4</sub> , TDS, Zn, Pb, Cd, As, Cr, Cu, Hg, Ni, Se, Ag, Sn
Manufacture of basic precious and non-ferrous metals (includes alumina plants)	2720	Monthly  Every 6 months	Na, SO <sub>4</sub> , pH, Conductivity, COD, Cal, NO <sub>3</sub> , TDS, Fluoride, Oxalate, Fe, Mg, Ca, PO <sub>4</sub> , Zn, Cd, Hg, Pb, As, Cr, Cu, Ni, Se, Ag, Sn
Production, transmission and distribution of electricity	4010	Quarterly	TSS, Cr, Cu, Ni, Zn, Fe, Oil and Grease, NH <sub>4</sub> , Sulphite; Temperature; Oil and grease, NO <sub>3</sub> , PO <sub>4</sub> , Free Available Chlorine.

### 5.2.1 Procedure For Missed Samples

In the event that a sample is missed, i.e., the required sampling frequency is less than that specified in the licence, the procedures indicated in Table 5-2 must be used. If scheduled samples are missed, they may be taken later only within the allowable period (i.e. the minimum time between sample collections must be maintained). The minimum time between sample collections is indicated in Table 5-2.

**Table 5-2 Procedure For Missed Samples**

Sampling Frequency (Minimum Time Between Samples)					Procedure for Missed Samples
Quarterly	Monthly	Fortnightly	Weekly	Daily or continuous	
(2 months)	(18 days)	(8 days)	(4 days)	(15 hours)	
Not applicable	Not applicable	Miss 1 sample	Miss 1 or 2 samples	Miss up to 2.5% of samples or, for continuous	Action ' A ' : Replace missing data with the

				monitoring, miss up to 15% of monitoring time	arithmetic mean of data obtained over the previous 12 months.
Not applicable	Miss 1 or 2 samples	Miss 2 or 3 samples	Miss 3 or 4 samples	Miss between 2.5% and 5% of samples or, for continuous monitoring, miss 15-20% of monitoring time	Action ' B' : Replace missing data with the arithmetic mean of data obtained over the previous 12 months + 20%.
Miss any sample	Miss > 2 samples	Miss > 3 samples	Miss > 4 samples	Miss > 5% of samples or, for continuous monitoring, miss > 20% of monitoring time	Action ' C' : Report failure to collect required samples to the Manager of the Pollution Monitoring and Assessment Branch NEPA within 7 days of failure. Use data from the same time period for the data obtained over the current year + 30%, or the arithmetic mean of the previous 12 months + 30%.

### 5.3 Sample Collection and Preservation

Once a sample is taken, the constituents of the sample should be kept in the same condition as when it was collected. Samples must be properly preserved when it is not possible to analyse collected samples immediately. Preservation will prevent biological activity such as microbial respiration, chemical activity such as precipitation or pH change and physical activity such as aeration.

Methods of preservation include cooling, pH control and adding chemicals to stabilize the sample. Freezing is usually not recommended. The length of time that a constituent in wastewater will remain stable is related to the character of the constituent and the preservation method used. The Handbook for Sampling and Sample Preservation of Water and Wastewater (Environmental Protection Agency, 1982) provides detailed guidelines on this topic. These are summarized in Table 5-3. Standard Methods for the Examination of Water and Wastewater (Published by the American Public Health Association, American Water Works Association, Water Environment

Federation) also provide information on the sample collection and preservation.

**Table 5-3 Required containers, preservation techniques, and holding times**

<b>Parameter</b>	<b>Container<sup>b</sup></b>	<b>Preservative</b>	<b>Maximum Holding Time</b>
<b>Bacterial Test</b>			
Coliform, faecal and total	P,G	Cool, 4°C; 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	6 hours
Faecal streptococci	P,G	Cool, 4°C; 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	6 hours
<b>Inorganic Tests</b>			
Acidity	P,G	Cool, 4°C	14 days
Alkalinity	P,G	Cool, 4°C	14 days
Ammonia	P,G	Cool, 4°C; H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 days
Biochemical oxygen demand	P,G	Cool, 4°C	48 hours
Biochemical oxygen demand, carbonaceous	P,G	Cool, 4°C	48 hours
Bromide	P,G	None required	28 days
Chemical oxygen demand	P,G	Cool, 4°C; H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 days
Chloride	P,G	None required	28 days
Chlorine, total residual	P,G	None required	Analyse immediately
Colour	P,G	Cool, 4°C	48 hours
Cyanide, total and amenable to chlorination	P,G	Cool, 4°C; NaOH to pH > 12	14 days
Fluoride	P	None required	28 days
Hardness	P,G	HNO <sub>3</sub> to pH < 2	6 months
Hydrogen ion (pH)	P,G	None required	Analyse immediately
Kjeldahl and organic nitrogen	P,G	Cool, 4°C; H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 day
<b>Metals</b>			
Chromium (VI)	P,G	Cool, 4°C	24 hours
Mercury	P,G	HNO <sub>3</sub> to pH < 2	28 days
Metals, except above	P,G	HNO <sub>3</sub> to pH < 2	6 months
Nitrate	P,G	Cool, 4°C	48 hours
Nitrate-nitrite	P,G	Cool, 4°C; H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 days

Parameter	Container <sup>b</sup>	Preservative	Maximum Holding Time
Nitrite	P,G	Cool, 4°C	48 hours
Oil and grease	G	Cool, 4°C; H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 days
Organic carbon	P,G	Cool, 4°C; HCl or H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 days
Orthophosphate	P,G	Filter immediately Cool, 4°C	48 hours
Oxygen, dissolved probe	G	None required	Analyse immediately
Phenols	G	Cool, 4°C; H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 days
Phosphorus (elemental)	G	Cool, 4°C	48 hours
Phosphorus, total	P,G	Cool, 4°C; H <sub>2</sub> SO <sub>4</sub> to pH < 2	28 days
Residue, total	P,G	Cool, 4°C	7 days
Residue, filterable	P,G	Cool, 4°C	7 days
Residue, non-filterable (TSS)	P,G	Cool, 4°C	7 days
Residue, settleable	P,G	Cool, 4°C	48 hours
Residue, volatile	P,G	Cool, 4°C	7 days

<sup>b</sup> P = Plastic, G = Glass

## 5.4 Analytical Methods

The Regulations specify the analytical methods (Fifth Schedule Part II) that are to be used to measure the concentrations and other parameters in trade effluent. Details of the methods are provided in the references and will not be repeated here.

Alternate methods may be used provided they are approved by NEPA. Laboratories or licensees that wish to use alternate methods should contact NEPA. References for some of the additional methods that may be appropriate are as follows.

### Analytical Methods

#### [40CFRPart136](#)

([http://www.access.gpo.gov/nara/cfr/waisidx\\_05/40cfr136\\_05.html](http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr136_05.html));

Appendix A to 40CFR Part 136--Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater;

Appendix B to Part 136--Definition and Procedure for the Determination of the Method Detection Limit--Revision 1.11;

Appendix C to Part 136--Inductively Coupled Plasma--Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes Method 200.7 ;

Appendix D to Part 136--Precision and Recovery Statements for Methods for Measuring Metals;

EPA 600/4-79-020. Methods for Chemical Analysis of Water and Wastes. Revised March 1983 (NTIS / PB84-128677; CD ROM or NEPIS / <http://www.epa.gov/clariton/clhtml/pubtitleORD.html>);

EPA 600/8-80-038. Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples. June 1980. (NTIS / PB82-208752);

EPA 821/B-96-005. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. December 1996. (NTIS / PB97-125298 or NEPIS / <http://www.access.gpo.gov/cgi-bin/cfrassemble.cgi?title=199640http://www.epa.gov/clariton/clhtml/pubtitleOW.html>); and

Standard Methods for the Examination of Water and Wastewater (Published by the American Public Health Association, American Water Works Association, and Water Environment Federation)

#### **5.4.1 Record Keeping**

Laboratories that undertake analyses are required to maintain records that must include the following:

- Monitoring ID/name and sufficient information to accurately identify the monitoring location.
- Sample-handling procedures used to ensure the integrity of the sample, e.g., sample date, chain of custody information;
- Results including units of measurement;
- Method(s) used, including sampling and analysis procedure, sample preservation and storage before transfer to the laboratory for analysis;
- Name of officer collecting and handling the samples;
- Name of laboratory;
- Laboratory sample number;
- Calibration of equipment;
- Quality control and quality assurance procedures
- Control charts for standards, analytical balances, sample storage refrigerators, incubators, etc.

## **5.5 Flow Measurement**

The range of instrumentation for flow measurement is large and only some of the most common types are mentioned here. Furthermore, this Guideline will only provide a description of the most common methods and the principles for inspecting the devices to ensure their proper functioning.

The measurement of wastewater flow is a requirement (Regulation 17) of licensees since together with concentration measurements; it is the basis for estimating the load discharged. Flow measurements also provide data to determine operating and performance data for the wastewater treatment plant.

The purpose of this section is to:

- Summarise the methods used to measure flows;
- Indicate acceptable methods for measuring flows;
- Indicate how flows can be verified in field inspections and in the review of licence applications and renewals; and
- Provide references for more detailed information.

### **5.5.1 Methods for measuring wastewater flows**

Wastewater flows occur either in closed channels or open channels.

#### **5.5.1.1 Closed Channel Flows**

Closed channel flows are defined as those that occur in conduits that are entirely filled with liquid under pressure. Examples are flows between treatment units in a wastewater treatment plant, where liquids and/or sludges are pumped under pressure. There will be relatively few licensees with cases or situations where closed channel flow measurements are applicable for wastewater flow measurement. Such cases will typically occur in those cases where wastewater is pumped under pressure immediately prior to discharge from the facility.

Flows in closed channels are measured by inserting a device into the conduit. Examples of closed channel flow measuring devices are the Venturi meter, the Pitot tube, the paddle wheel, the electromagnetic flow meter, Doppler, and the transit-time flow meter. For example, Venturi meters and Pitot tubes relate differential pressure to flow while electromagnetic flow meters relate the induced electric voltage to flow.

### **5.5.1.2 Open Channel Flows**

Open channel flow is defined as flow in any channel in which the liquid flows with a free surface.<sup>4</sup> Examples include rivers and irrigation channels. Open channels are used in most sewer systems, sewage treatment plants and industrial waste applications. Note that sewers and underground drains and pipes when flowing partially full and not under pressure, are also classified as open channels. Most if not all of the wastewater (sewage and trade effluent) flows encountered in licensees' facilities occur in open channels.

Flows in open channels are measured by primary or secondary devices. Primary devices are standard hydraulic structures, such as flumes and weirs, that are inserted in the open channel and accurate flow can be determined from measurements of the depth of liquid (head) at the specific point in the primary device and the (predetermined) geometry of the device.

Secondary devices in conjunction with primary devices can be used to automate the flow measurement. Secondary devices use sensors to measure some property of the wastewater in the primary device and convert the measurement to a corresponding depth or flow using established mathematical relationships. Examples of secondary devices are floats, ultrasonic transducers, bubblers, and transit-time flow meters. A recorder generally measures the output of the secondary device transmitted to a recorder and/or totaliser to provide instantaneous and historical flow data. Sensor outputs may also be transmitted to sampling systems to facilitate flow proportioning.

There are three methods for automatically measuring open channel flow. These are:

- Hydraulic Structures;
- Area Velocity; and
- Slope-Hydraulic Radius.

### **5.5.1.3 Hydraulic Structures**

Weirs and flumes are the two most common methods for measuring flows in open channels. These devices are calibrated restrictions that are inserted into the channel to control the shape and velocity of the flow. The flow rate is then determined by measuring the liquid level in

---

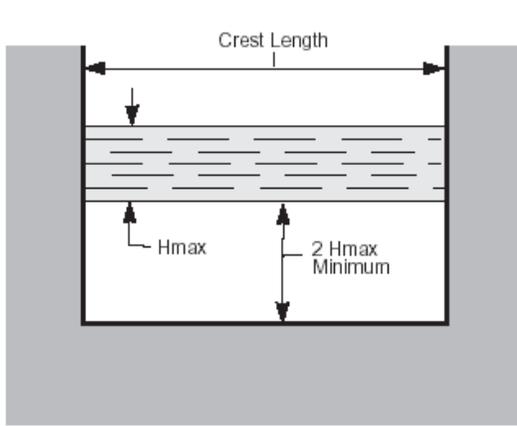
<sup>4</sup> [http://www.isco.com/WebProductFiles/Applications/202/Papers\\_and\\_Article\\_Reprints/OpenChannelFlowMeters\\_Article.pdf](http://www.isco.com/WebProductFiles/Applications/202/Papers_and_Article_Reprints/OpenChannelFlowMeters_Article.pdf)

or near the restriction and using the mathematical relationship that relates the flow to the liquid level and the geometry and type of weir.

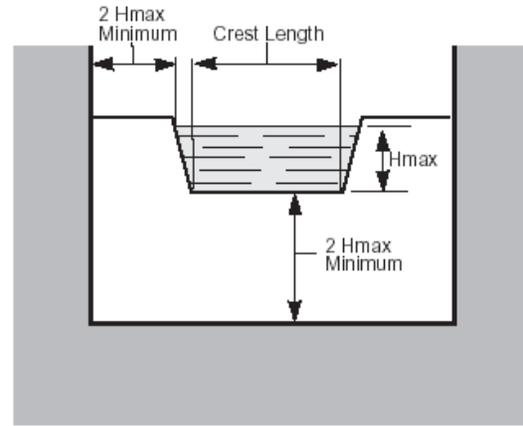
#### **5.5.1.4 Weirs**

The most common types of weirs are the triangular (or V-notch) weir, the rectangular weir, and the trapezoidal (or Cipolletti) weir (Figures 5-1 and 5-2). Weirs are generally not suitable for flows with solids that may cling to the weir or are deposited upstream of the device (thereby changing the flow characteristics). Weirs that are constructed with thin plates with a sharp edge over which the water flows are termed sharp-crested weirs. The broad-crested weirs are typically constructed of timber or concrete and the broad edge is typically across the entire width of the stream. Broad-crested weirs need to be calibrated in order to meet accuracy requirements. In contrast, flow rates determined from sharp-crested weirs are accurately given by equations based on the known geometry of the weir and the level of the liquid.

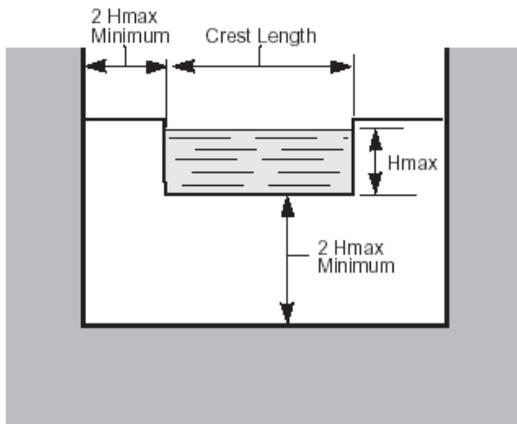
**Figure 5-1 Three Common Types of Sharp-Crested Weirs (From Appendix G, Supplemental Flow Measurement Information, NPDES Compliance Inspection Manual (1994))**



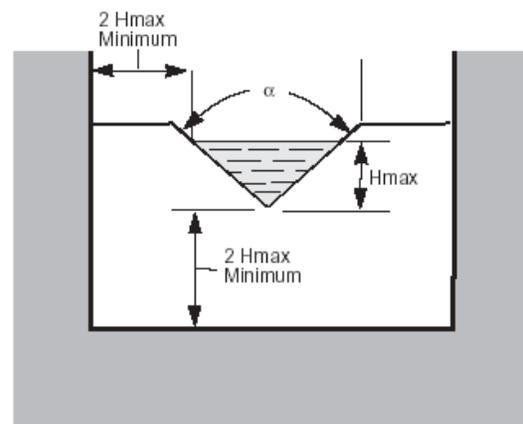
**Suppressed (Without End Contractions) Rectangular Weir**



**Trapezoidal (Cipolletti) Sharp-Crested Weir**



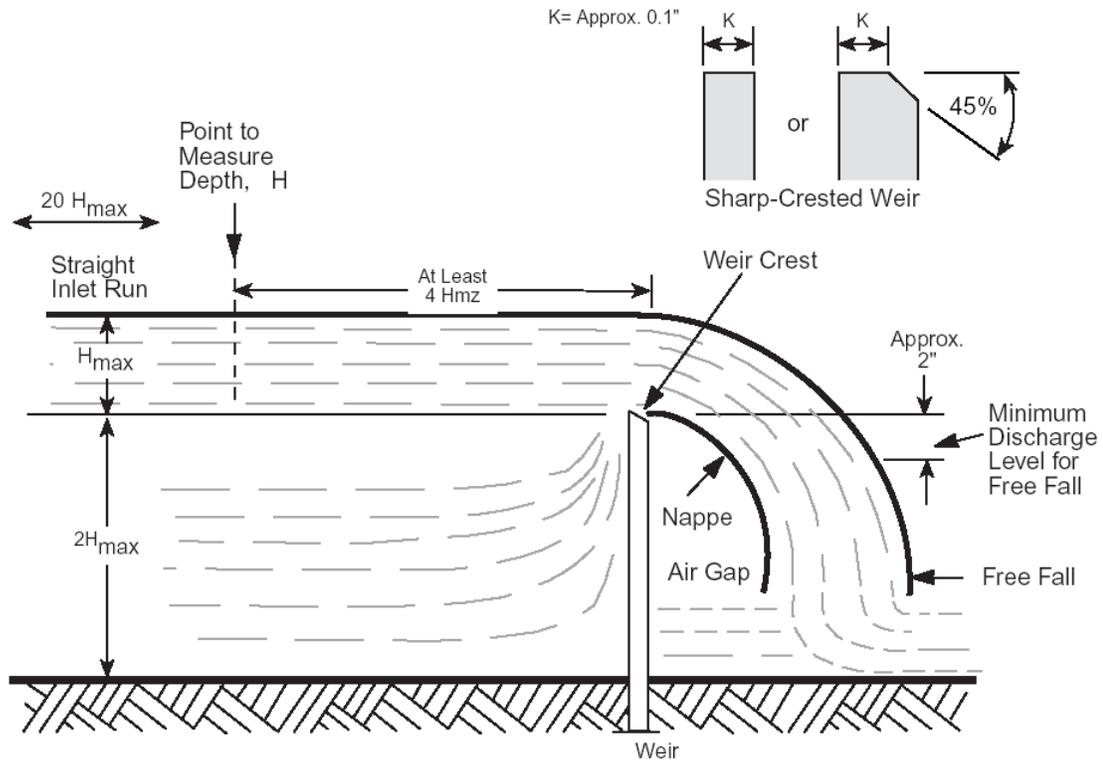
**Contracted (With End Contractions) Rectangular Weir**



**V-Notch (Triangular) Sharp-Crested Weir**

4643-00

**Figure 5-2 Profile and Nomenclature of Sharp-Crested Weirs (From Appendix G, Supplemental Flow Measurement Information, NPDES Compliance Inspection Manual (1994))**



### 5.5.1.5 Flumes

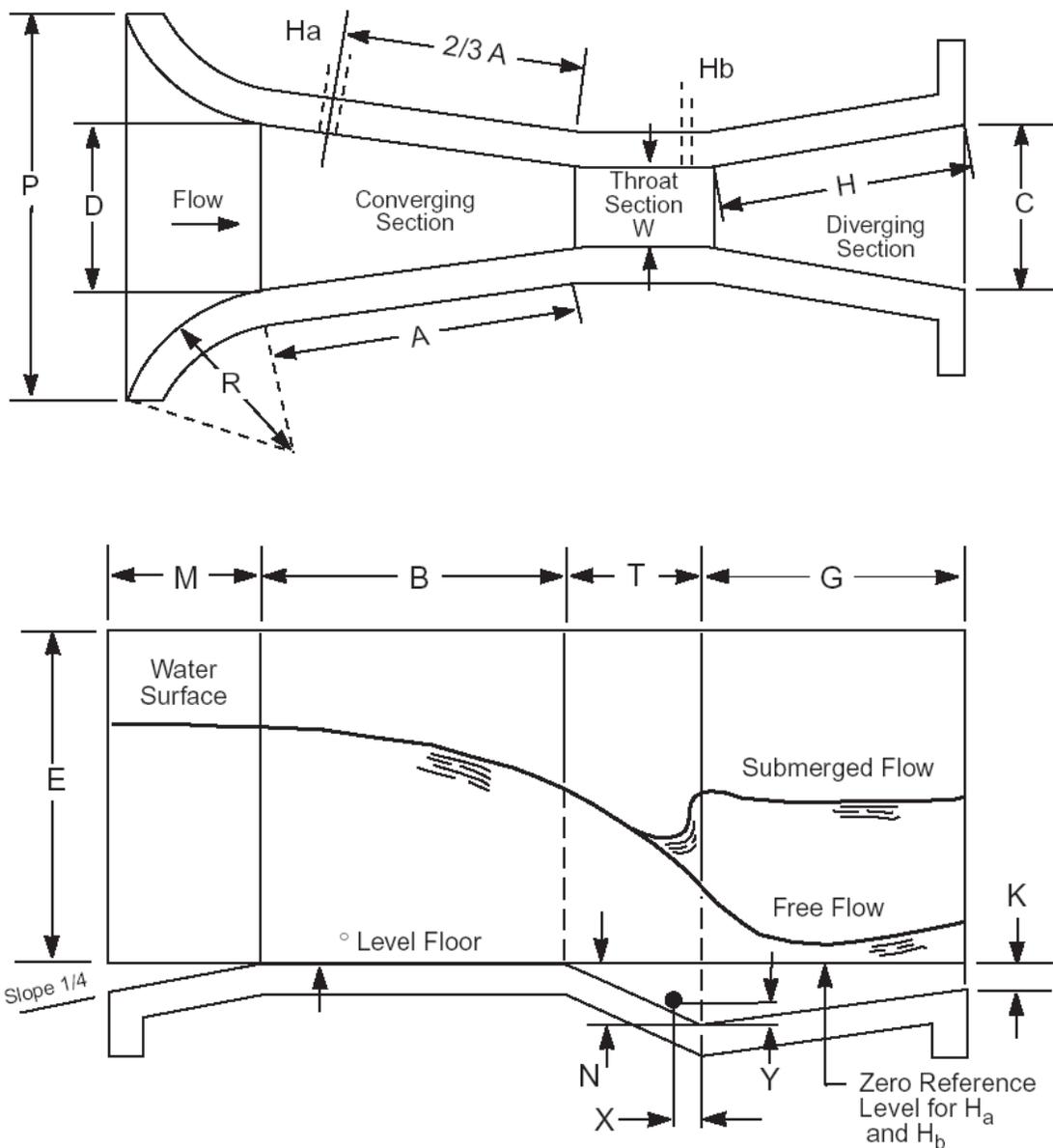
A flume is a specially shaped open channel flow section providing a restriction in channel area and/or a change in channel slope. The flow rate in the channel is determined by measuring the liquid depth at a specified point in the flume. The most common flume is the Parshall flume (Figure 5-3). The flow rate through a Parshall flume is determined by measuring the liquid level one third of the way into the converging section. Parshall flumes are designated by the width of the throat, which ranges from 2.54 cm to 15.24 m (1 inch to 50 feet). The throat width and all other dimensions must be strictly followed so that standard discharge tables can be used. Also, note the drop in the floor of the flume, which makes it difficult to install a Parshall flume in an existing channel.

The Palmer-Bowlus flume (Figure 5-4) is designed to be installed in an existing channel with minimal effort. The flow rate through a Palmer-Bowlus flume is determined by measuring the liquid depth at a point one-half pipe diameter upstream from the flume throat. Palmer-Bowlus flumes are designated by the size of the pipe into which they fit. Standard sizes range from 10.16 cm to 106.68 cm (4 to 42 inches).

The dimensional configuration is not rigidly established for each flume size. However, a Palmer-Bowlus flume with a trapezoidal throat with a flat bottom has emerged as the standard design for circular pipes.

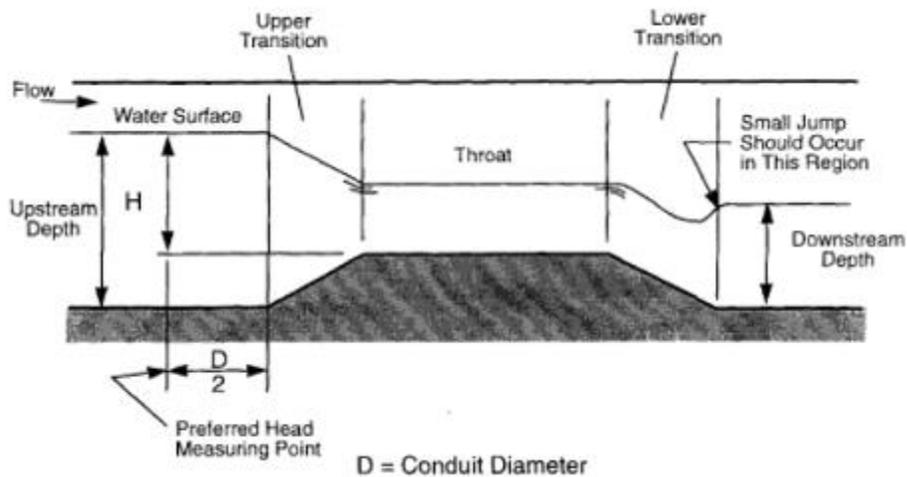
Flumes are more expensive and more difficult to install than weirs. Common materials of construction include fiberglass, concrete and metal. However, flumes result in a lower head loss and are self-cleaning, requiring less maintenance than a weir.

**Figure 5-3 Dimensions and Capacities of Parshall Measuring Flumes for Various Throat Widths (From Appendix O, Supplemental Flow Measurement Information, NPDES Compliance Inspection Manual)**



- W Width of flume throat.
- A Length of side wall of converging section.
- 2/3A Distance back from end of crest to gauge point
- B Axial length of converging section.
- C Width of downstream end of flume.
- D Width of upstream end of flume.
- E Depth of flume.
- T Length of flume throat.
- G Axial length of diverging section.
- H Length of side wall of the diverging section.
- K Difference in elevation between lower end of flume and crest.
- M Length of approach floor.
- N Depth of depression in throat below crest.
- P Width between ends of curved wing walls.
- R Radius of curved wing wall.
- X Horizontal distance to Hb gauge point from low point in throat.
- Y Vertical distance to Hb gauge point from low point in throat.

**Figure 5-4 Free Flowing Palmer Bowlus Flume From Appendix G, Supplemental Flow Measurement Information, NPDES Compliance Inspection Manual (1994)**



### 5.5.1.5 Area Velocity

The area velocity method calculates flow rate  $Q$ , by multiplying the area,  $A$ , of the flow by its average velocity,  $V$ .

$$Q = A \times V$$

Most area velocity flow meters use a single sensor to measure flow rate. Doppler ultrasonics is used to measure average flow velocity, while an integral pressure transducer measures the level in the channel. The flow meter converts this level into the area of the flow based on the size and shape of the channel.

The area velocity method can be used to measure flows in open channel, surcharged, full pipe and submerged flows and does not require the installation of a weir or flume.

### **5.5.1.6 Slope-Hydraulic Radius**

Various resistance equations are used to estimate flow rate based on measurements of the water surface slope, cross sectional area, and wetted perimeter over a length of uniform channel. The most popular of these equations is the Manning formula (Figure 5-5) which uses a coefficient to correct for the type of channel in use. The cross-sectional area of the flow, the wetted perimeter of the flow and the slope ratio must be calculated. The results are more accurate if the flow cross-section, velocity, depth and slope are constant (steady flow).

$$Q = \frac{K}{n} A R^{2/3} S^{1/2}$$

where:

Q = flow rate

A = cross sectional area of flow

R = hydraulic radius (cross sectional area divided by wetted perimeter)

S = slope of the hydraulic gradient

n = a dimensionless number or roughness coefficient based on channel material and condition that defines the flow resistance of a unit of bed surface and is a function of particle size, bed shape, and constructional bed forms (e.g., ripples)

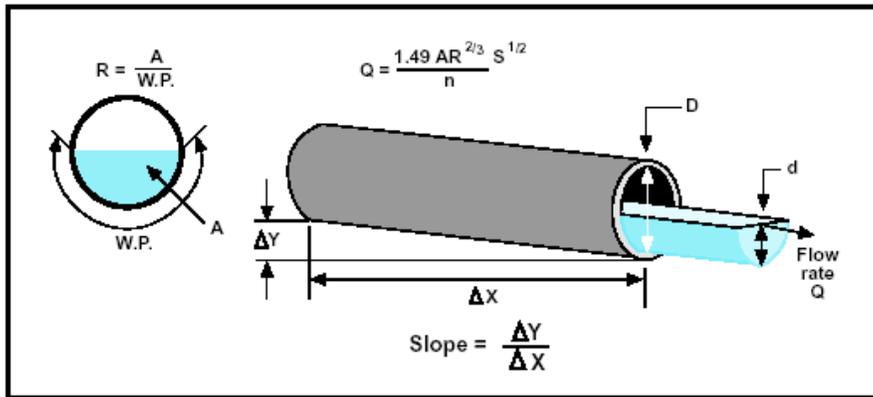
K = constant dependent upon units

The cross-sectional area A and the hydraulic radius R are calculated based on the liquid depth, and the size and shape of the channel. The slope S is often estimated based on installation drawings of the channel. The roughness coefficient n is selected from standard references based on the material of construction of the channel, and its condition.

Given the size, shape, slope and roughness of the channel, an open channel flow meter can calculate flow rate using the Manning formula based on a measurement of the liquid depth.

The Manning formula is not as accurate as the hydraulic structures and area velocity methods, but it can provide sufficient accuracy in some applications. In addition, no weir or flume is required.

**Figure 5-5 Manning Formula**



### 5.5.1.7 Field Inspection of Flow Measuring Devices

Before visiting a treatment plant, inspectors must familiarise themselves with the facility's licence (plant unit operations, type of wastewater treatment, Compliance Plans, monitoring requirements). Nearly all licensees will be required to measure flow. Exceptions will be for treatment plants that can use metered NWC water consumption data less verifiable uses.

When evaluating a facility's flow measuring devices, the inspector should:

- Determine the locations of all flows from the facility and verify that they are consistent with the licence
- Ensure that the flow measurement system or technique being used measures the entire wastewater discharge as required by the licence.
- Inspect carefully the piping to determine whether there are any wastewater diversions, return lines, or bypasses around the system.
- Verify that the site chosen for flow measurement by the facility is appropriate and is in accordance with licence requirements (suitable for type of discharge, flow range, suspended solids concentration, and other relevant factors, such as instantaneous or continuous, daily, or other time interval measure). Noted deviations or discrepancies in the inspection report.
- Verify that the facility has installed primary and secondary devices according to manufacturer's manual instructions.
- Observe the flow patterns near the primary device for excessive turbulence or velocity. The flow lines should be straight.

- Inspect the primary device for evidence of corrosion, scale formation, or solids accumulation that may bias the flow measurement.
- Verify that weirs are level, plumb, and perpendicular to the flow direction.
- Verify that flumes are level, the throat walls (narrowed section of flume) are plumb, and the throat width is the standard size intended.
- Inspect historical records (i.e., strip charts and logs) for evidence of continuous flow measurements.
- Compare periods of missing data with maintenance logs for explanations of measuring system problems.
- If the facility has closed channel flow measuring devices verify that the pipe is always full. If these devices are used, then there must be also a means for the licensee and regulatory agencies/inspector to verify the accuracy of these meters. Primary flow measuring devices such as weirs and flumes are ideal for this purpose.
- Verify that the facility uses appropriate tables, curves, and formulas to calculate flow rates.
- Review and evaluate calibration and maintenance programmes for the discharger's flow measurement system. The licence normally requires the facility to check the calibration regularly by the licensee. The facility must ensure that their flow measurement systems are calibrated by a qualified source at least once a year to ensure their accuracy.
- Verify that the facility calibrates flow meters across the full range of expected flow.
- Verify that primary and secondary devices are adequate for normal flow as well as maximum expected flow. Note whether the flow measurement system can measure the expected range of flow.
- Collect accurate flow data during inspection to validate self-monitoring data collected by the licensee.

The facility must install a flow measuring system that has the capability of routine flow verification by the licensee or appropriate regulatory personnel.

### **5.5.1.8 Additional Information Sources**

Associated Water and Air Resource Engineers, Inc. 1973. Handbook for Industrial Wastewater Monitoring. USEPA, Technology Transfer. EPA 625/6-73-002 NTIS: PB-259146

Blaso, L. 1975. "Flow Measurement Under Any Conditions," Instruments and Control Systems, 48(2): 45-50.

Bos, M.G. 1976. Discharge Measurement Structures, Working Group on Small Hydraulic Structures International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands.

Eli, R., and H. Pederson. 1979. Calibration of a 90° V-Notch Weir Using Parameters Other than Upstream Head. EPA-61809A-2B.

Instrumentation Specialists Company (ISCO). 1985. Open Channel Flow Measurement Handbook, Lincoln, Nebraska. (Contains tables of various flow measurement devices.)

King, H.W., and E.F. Brater. 1963. Handbook of Hydraulics. 5th ed. New York: McGraw-Hill Book Co. (contains tables of various flow measurement devices.)

Mauis, F.T. 1949. "How to Calculate Flow Over Submerged Thin-Plate Weirs." Eng. News-Record. p. 65.

Metcalf & Eddy, Inc. 2003. Wastewater Engineering. 4<sup>th</sup> ed. New York: McGraw Hill Book Co.

Robinson, A.R. 1965. Simplified Flow Corrections for Parshall Flumes Under Submerged Conditions, Civil Engineering, ASCE.

Shelley, P.E., and G.A. Kirkpatrick. 1975. Sewer Flow Measurement; A State of the Art Assessment, U.S. Environmental Protection Agency, EPA-600/2-75-027.

Simon, A. 1976. Practical Hydraulics. New York: John Wiley & Sons.

Smoot, G.F. 1974. A Review of Velocity-Measuring Devices. U.S. Department of the Interior (USDI), United States Geological Survey (USGS). Open File Report, Reston, Virginia

Stevens. Water Resources Data Book, Beaverton, Oregon. (Contains tables of various flow measurement devices.)

Thorsen, T., and R. Oden. 1975. "How to Measure Industrial Wastewater Flow," Chemical Engineering, 82(4): 95-100.

U.S. Department of Commerce, National Bureau of Standards. 1975. A Guide to Methods and Standards for the Measurement of Water Flow. COM-75-10683.

U.S. Department of the Interior (USDI), Bureau of Reclamation. 1967. Water Measurement Manual, 2nd Ed. (Contains tables of various flow measurement devices.)

U.S. Environmental Protection Agency, Office of Water Enforcement and Permits Enforcement Division. September 1981. NPDES Compliance Flow Measurement Manual.

## **5.6 Reporting Monitoring Data**

Monitoring data is reported using the forms in the Fourth Schedule. Note that the table for reporting monitoring data must be repeated for each discharge point. For each parameter that the licensee is required to measure as stated in the licence, copies of laboratory reports should be attached.

## **5.7 Guidelines For Monitoring Industrial and Sewage Sludge**

### **5.7.1 Industrial Sludge**

#### **Representative Sampling Methods**

The methods and equipment used for sampling waste materials will vary with the form and consistency of the waste materials to be sampled. Samples collected using the sampling protocols listed below, for sampling waste with properties similar to the indicated materials, will be considered to be representative of the waste.

Extremely viscous liquid -- ASTM Standard D140-70 Crushed or powdered material -- ASTM Standard D346-75 Soil or rock-like material -- ASTM Standard D420-69 Soil-like material -- ASTM Standard D1452-65

Containerised liquid wastes -- "COLIWASA" described in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods," \* U.S. Environmental Protection Agency, Office of Solid Waste, Washington, DC 20460. [Copies may be obtained from Solid Waste Information, U.S. Environmental Protection Agency, 26 W. St. Clair St., Cincinnati, Ohio 45268]<sup>5</sup>

---

<sup>5</sup> These methods are also described in "Samplers and Sampling Procedures for Hazardous Waste Streams," EPA 600/2-80-018, January 1980.

Liquid waste in pits, ponds, lagoons, and similar reservoirs. -- "Pond Sampler" described in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods."<sup>6</sup>

Appendix II to Part 261 -- Method 1311 Toxicity Characteristic Leaching Procedure (TCLP)<sup>7</sup>

## 5.7.2 Sewage Sludge

Sampling and analysis methods for sewage sludge are needed to determine nutrient levels, trace elements and most importantly to determine pathogen and vector attraction levels. The analyses must include all of the parameters specified in the biosolids standards (Arsenic, Cadmium, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Zinc, Chromium and Pathogens – Appendix 3).

(a) *Sampling*. Representative samples of sewage sludge that is applied to the land, placed on a surface disposal site must be collected and analysed.

Assessment of sampling methods can be achieved only by witnessing the sampling process during site visits. Inspectors should ensure that sampling is witnessed at least one visit per year for each plant that produces sludge.

To date, STPs use air drying and/or composting methods for sludge to reduce pathogens.

Air drying requires sludge to be dried on sand beds or on paved or unpaved basins for a minimum of three (3) months. During two of the three months, the ambient average daily temperature must be above 15 °C.

Composting entails use of either: within-vessel, static aerated pile, or windrow composting methods. The temperature of the sewage sludge is raised to 40 °C or higher and remains at 40 °C or higher for five days. For four hours during the five days, the temperature in the compost pile exceeds 55 °C.

---

<sup>6</sup> This manual also contains additional information on application of these protocols.

<sup>7</sup> Note: The TCLP (Method 1311) is published in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846.

The composting method is capable of achieving lower pathogen levels to meet the biosolids standards (so that sludge is suitable for application to agricultural land).

(b) *Analysis Methods*. Methods in the materials listed below shall be used to analyse samples of sewage sludge.

(1) *Enteric viruses*. ASTM Designation: D 4994-89, "Standard Practice for Recovery of Viruses From Wastewater Sledges", 1992 Annual Book of ASTM Standards: Section 11-Water and Environmental Technology, ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

(2) *Faecal coliform*. Part 9221 E. or Part 9222 D., "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

(3) *Helminth ova*. Yanko, W.A., "Occurrence of Pathogens in Distribution and Marketing Municipal Sludges", EPA 600/1-87-014, 1987. National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (PB 88-154273/AS).

(4) *Inorganic pollutants*. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW-846, Second Edition (1982) with Updates I (April 1984) and II (April 1985) and Third Edition (November 1986) with Revision I (December 1987). (*Available online at <http://www.epa.gov/waste/hazard/testmethods/sw846/online/index.htm>*)

(5) *Salmonella sp. bacteria*. Part 9260 D., "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005; or

Kenner, B.A. and H.P. Clark, "Detection and enumeration of *Salmonella* and *Pseudomonas aeruginosa*", Journal of the Water Pollution Control Federation, Vol. 46, no. 9, September 1974, pp. 2163-2171. Water Environment Federation, 601 Wythe Street, Alexandria, Virginia 22314.

(6) *Specific oxygen uptake rate*. Part 2710 B., "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992,

American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

(7) *Total, fixed, and volatile solids*. Part 2540 G., "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

## 6. ESTIMATING EFFLUENT LOADS AND DISCHARGE FEES

### 6.1 General Principles of Measuring Loads

#### 6.1.1 Using Laboratory Monitoring Results with Flow Rate Measurement

The method requires continuous or semi continuous measurements of the volume of the effluent discharged over a period of time. This measurement is then used to determine the average daily flow rate. Laboratory testing of the effluent concentration for the parameters in the discharge Licence and at the frequency required in the discharge licence is also required. It can therefore be seen, that the more rigorous the sampling regime is for effluent quality and quantity, the more accurate the effluent loads can be reported.

#### Box 1 Sample Calculation - Direct Measurement

Sample Calculation – Direct measurement

Calculating the COD Load

The average COD in the trade effluent from a facility is 37 mg/L in the trade effluent.

The facility has an average daily flow of 25,000 m<sup>3</sup>/day.

1 cubic metre = 1,000 L

25,000 m<sup>3</sup>/day x 1000

=25,000,000 L/day

The release of COD is 37 mg/L x 25,000,000 L/day

=925,000,000 mg/day x 365 day/year

=337,625,000,000 mg/year

1 tonne = 10<sup>9</sup> mg

=337.625 tonnes/y

## Discharge Fees

### 6.1.2 Components of the Discharge Fee

The discharge fee comprises three (3) different elements which may include a discount for beneficial use.

#### ***Monitoring and Inspection (Administration) Fee (Sixth Schedule Part D)***

This fee, which will be determined by NEPA, includes cost for direct labour hours and materials that involve site visits over a five year period, travelling costs among others. One fifth of this cost would be applied to the annual discharge fee.

#### ***Pollutant Load and Volume***

The waste strength in sewage and/or trade effluent discharges based on the concentration level of the licensed pollutants will be used in calculating the fee as well as the volume of the sewage and/or trade effluent.

Measurements of daily flow rates along with laboratory monitoring results for each pollutant would be used to determine the annual pollutant load. Each pollutant has a dollar value attached to it as shown in the Table 6-1.

**Table 6-1 Parameter Fees (Sixth Schedule of Regulations, Part B)**

<b>Pollutant</b>	<b>Fee J\$/tonne</b>
BOD <sub>5</sub>	300
COD <sup>#</sup>	150
Total N	500
Total P	500
Oil and grease	500
TSS	150
Total heavy metals (As, Cd, Cr, Cu, Pb, Hg, Se, Zn)	3,000
As	300
Cd	7500
Cr	500
Cu	200
Pb	700
Hg	20,000
Se	1500
Zn	100
Faecal Coliform	
(a) 200 to 5 000 organisms per 100 ml	1,000
(b) 5 000 to 20 000 organisms per 100 ml	2,000
(c) more than 20 000 organisms per 100 ml	3,000

\* For Faecal Coliform the fee rate is in \$/1,000,000 litres

# Use only if no BOD measurement is available

The parameters to be used in calculating discharge fees for Sewage effluent are *BOD, Total Phosphorous, Phosphate, Total Nitrogen, TSS and Faecal Coliform*.

The parameters to be used for Trade effluent are: *COD, Phosphate, Faecal Coliform, Oil and Grease, Total Suspended Solids, Heavy Metals & Total Heavy Metals*.

For combined sewage and trade effluent the parameters to be used are *BOD, COD, TSS, Oil and Grease, Faecal Coliform, Total Heavy Metals, Total Nitrogen, Phosphate and Total Phosphorus*.

### **6.1.3 Receptor Factor**

The receptor is the receiving environment in which the wastewater is being discharged. Five (5) classes have been assigned based on the receiving environment and are as follows:

Class	I	Ground Water
	II	Surface water
	III	Sensitive Marine Systems
	IV	Enclosed and semi-enclosed water bodies
	V	Open Sea

Specific 'weighting criteria' were used to assess the relative levels of risk and impacts to these receptors (see Table 6-2). The open sea receptor with a zero weighting factor, due to the capacity for complete mixing and therefore dissipation of treated effluent, was used as a baseline.

**Table 6-2 Weighting Criteria**

<b>CRITERIA<sup>8</sup></b>	Surface Water	Groundwater	Sensitive Marine Waters	Enclosed (& semi-enclosed) water bodies
Persistency	0	2	2	4
Potential for causing eutrophication	2	1	4	4
Impact on, and risks to, health	2	1	1	2
Potential for migration to other receptors	3	2	2	1
Risks of undesirable changes in the marine ecosystem, irreversibility or durability of effects	3	1	4	4
Negative impacts on marine life and the sustainable development of living resources or on other legitimate uses of the sea	3	1	4	4
<b>Weighting factor (receptor value / total)</b>	0.5	0.3	0.7	0.8

**Risk Based Weighting of Criteria:**

- None        0**
- Low         1**
- Medium     2**
- High        3**
- Very High  4**

---

<sup>8</sup> Source: Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, UNEP CEP 2002

The resulting receptor weightings, as shown in Table 6-3, reflect the relative harmfulness of the pollutant to the receiving environment and incorporate costs to society/environment to be paid by licensee based on where the outfall is located.

**Table 6-3 Receptor Weight Relationship (Sixth Schedule of Regulations, Part D)**

<b>Receptor</b>	<b>Weighting Factor, f</b>	<b>Comment</b>
Ground water	0.3	
Surface water (including dry gully)	0.5	Streams, rivers, Wetlands, watercourses, gullies
Sensitive marine waters	0.7	Coastal waters inside reefs
Enclosed (and semi-enclosed) water bodies	0.8	Harbours, ponds
Open Sea	0	Areas outside reefs with depths of at least 50m and 100m from the shore or reef

***Discount for the beneficial use of the discharge and/ or sludge generated***

In order to promote the beneficial use of effluent and treated sludge, the regulations include allowances for discounts for the use of effluent or sludge that meets specified standards to be used for irrigation or soil amelioration (Third Schedule Tables 4 and 5). Other beneficial uses will be considered on a case by case basis.

The discount which applies to nutrients (nitrate, phosphate as well as BOD<sub>5</sub> as a surrogate for organic material carbon) will be made provided the facility has an approved NMP and the effluent is demonstrated not to pose any risk to the environment.

**6.2 Estimation of Discharge Fees (including incentives)**

The method for calculating the annual load is specified in the Sixth Schedule.

The key requirements for calculating the load are that:

- for every sampling exercise there should be a concentration measurement,  $C_i$ , for each parameter
- flow rates  $F_i$ , and hence volumes  $V_i$  calculations should be carried out for each calendar year or part thereof

Calculation of load

For each pollutant,  $p$ , the load (in kilograms) for the calendar year is calculated by averaging the concentrations and multiplying this by the total volume that is discharged for the year (or part thereof) Pollutant

$$\text{Load} = [C_{i1} + C_{i2} + \dots + C_{ix}] / x \times \text{Total Volume Discharged (for the year or part thereof)} \dots \text{Equation 1}$$

**Calculation of discharge fee**

The load for each pollutant is multiplied by the per kilogram discharge fee rate and summed to give the base discharge fee,  $B$  (see equation 2).

$$B = \sum_1^p L_p R_p \dots \text{Equation 1}$$

The per tonne pollutant discharge fees are shown in Table 5.2.

The regulations make provisions for amending the discharge fee based on the nature of the receiving environment or receptor,  $x$ , into which the discharge occurs. The weighting factor,  $f$ , is such that discharges to receptors where impacts are of greater concern attract higher fees (see Table 5-4).

Incorporating the fee for monitoring and inspection (M.I), the receptor weighting factor ( $f$ ) and the discount for beneficial use of the effluent and /or sludge ( $U$ ), **equation 3** is derived:

$$DF = \frac{M.I. + B(1+f)}{U} \dots \text{Equation 3}$$

The complete formula is given as:

**Monitoring & Inspection Fee (M.I.) (\$) + {Pollutant load (tonne/yr) x Parameter fee (\$/tonne) [1+ Environmental receptor weighting factor (f)]} - Beneficial Use (U)**

Where U= **Load used** (tonne/yr) x **Parameter fee** (\$/tonne)

Sample calculations using the above equation are shown in Boxes 2 and 3 below.

## Box 2 Sample Calculation 2

### Sample Calculation 2

Sewage treatment plant discharging 9,463.53 m<sup>3</sup> effluent per day discharging into a surface water body. The parameters in its licence and their concentrations after treatment (i.e. at outfall) are as follows

BOD - 15 mg/L  
TSS - 15 mg/L  
Total Nitrogen - 10 mg /L  
Total Phosphates - 4 mg/L  
Chemical Oxygen Demand (COD) - 100 mg/L  
Oil & Grease - 10 mg/L  
Faecal Coliform - 12 MPN/100 ml

The monitoring and inspection fee (M.I.) is \$20,000. 20 per cent of the effluent is re-used for irrigation

**First calculate the effluent discharged per year and convert to litres**

$$9,463.53 \times 365 \times 10^3 = 3,454,188,450 \text{ L}$$

**Then calculate and convert loads to tonnes per year**

$$\text{BOD} = (15 \times 3,454,188,450) \times 10^{-9} = 51.8 \text{ tonne/year}$$

$$\text{TSS} = (15 \times 3,454,188,450) \times 10^{-9} = 51.8 \text{ tonne/year}$$

$$\text{Total Nitrogen} = (10 \times 3,454,188,450) \times 10^{-9} = 30.5$$

$$\text{Total Phosphates} = (4 \times 3,454,188,450) \times 10^{-9} = 13.8$$

**Identify weighting factor and add 1**

$$0.5 + 1 = 1.5$$

**Calculate and convert loads to tonnes per year for beneficial use**

$$\text{BOD} = [15 \times (3454188540 \times 0.2)] \times 10^{-9} = 10.4$$

$$\text{Total Nitrogen} = [(10 \times 3454188450) \times 0.2] \times 10^{-9} = 6.9$$

$$\text{Total Phosphates} = [(4 \times 3454188450) \times 0.2] \times 10^{-9} = 2.76$$

$$\text{DF} = \$20,000 + \{[(51.8 \times 300 \text{ BOD}) + (51.8 \times 150 \text{ TSS}) + (30.5 \times 500 \text{ N}) + (13.8 \times 500 \text{ P}) + (\$0 \text{ Faecal Coliform})] \times 1.5\} - [(10.4 \times 300) + (6.9 \times 500) + (2.76 \times 500)]$$

$$= (\$20,000 + \$68,190) - \$7950$$

$$= \mathbf{\$80,240/yr}$$

### Box 3 Sample Calculation 3

#### Sample Calculation 3

A wastewater treatment plant discharging 290,880 L effluent per day into a surface water body. The parameters in its licence and their concentrations after treatment (i.e. at outfall) are as follows:

BOD - 19mg/L

Ammonia - 1 mg/L

Iron - 2 mg/L

Oil and Grease - 8 mg/L

TSS - 50 mg/L

Total Heavy metals - 2 mg/L

The monitoring and inspection fee (M.I.) is \$27950. There is no beneficial use therefore  $U = 0$

**First calculate total volume discharged per year**

$$290,880 \times 365 = 106,171,200 \text{ L/yr}$$

**Then calculate and convert loads to tonne/yr**

$$\text{Oil and Grease} = (8 \times 106171200) \times 10^{-9} = 0.85 \text{ tonne/year}$$

$$\text{TSS} = (50 \times 106171200) \times 10^{-9} = 5.31 \text{ tonne/year}$$

$$\text{Total Heavy Metals} = (2 \times 106171200) \times 10^{-9} = 0.21 \text{ tonne/year}$$

**Identify weighting factor and add 1**

$$0.5 + 1 = 1.5$$

Complete calculation using formula  $\text{DF} = \text{M.I.} + \{(\text{Pollutant load (tonne/yr)} \times \text{Parameter fee (\$/tonne)}) [1 + \text{Environmental receptor weighting factor (f)}]\} - \text{Beneficial Use (U)}$

$$\text{DF} = 27950 + \{[(0.85 \times 500 \text{ Oil and Grease}) + (5.31 \times 150 \text{ TSS}) + (0.21 \times 3000 \text{ Total Heavy Metals})] (1.5)\} - 0 = \mathbf{\$29,801.50}$$

Note that there is no discharge fee for Ammonia and Iron.

## **6.4 Verification and Reconciliation of Discharge Fee Paid**

The Discharge Fees will be paid to the Finance and Accounts Branch (FAB). After payment is received the Finance and Accounts Branch will submit to the Pollution Monitoring and Assessment Branch a listing of the amounts of the fees that are paid. The Pollution Monitoring and Assessment Branch will determine if the correct fees have been paid and advise the FAB where this is not the case so that the relevant follow up actions can be taken.

## **7. STAFF REQUIREMENTS FOR IMPLEMENTING THE REGULATIONS**

Implementation of the regulations will entail preparing regulatory agencies (human and physical resources), the regulated community and the general public to enable them to fulfil their respective roles. The preparation will entail the following:

Outreach activities - to ensure that all regulatory agencies and the regulatory community are aware of the regulations and their respective roles

Training - for regulatory staff and the regulated community

Public education -to sensitise stakeholder organisations (NGOs, community groups) and through them as well as by other means inform the general public about the regulations

### **Outreach Activities (Regulators, Licensees)**

Outreach activities are directed at the regulators (public sector agencies directly and indirectly involved in implementing the Wastewater and Sludge Regulations) and the regulated community (licensees and others that generate trade effluent and industrial sludge). The purpose of the outreach activities is to sensitise and inform the entire regulated and regulating community about the regulations in advance of the implementation of the regulations. The outreach activities are essentially an extension of the consultation process but will be based on the regulations as they are/will be gazetted.

The regulations identify NEPA as the agency with primary responsibility to implement and enforce the regulations with support from the EHU and the WRA. There are several other agencies and institutions that have key roles in other aspects of the regulations (such as providing information for licensing and assessment) or which may have general interest on the information generated by the regulations.

The nature of the outreach activities will depend on the role of the agencies. These are summarised in Table 7-1.

The Wastewater and Sludge Management Unit/PMA Branch should take the lead in carrying out the outreach activities since the activities are essentially extensions of the consultation process used to develop the

Regulations. Assistance and support from the Public Education and Corporate Communication Branch may be necessary.

**Table 7-1 Summary of Outreach Activities and Strategies**

<b>Stakeholder</b>	<b>Outreach Activities and Strategies</b>
<p>Regulated community                      Industry associations (Private Sector Organization of Jamaica (PSOJ), Jamaica Manufacturers' Association (JMA), Spirits Pool Association, Rum and Sugar Industry, Bauxite/Alumina Technical Environmental Committee, ...)                      Individual licensees (Identified from KMA lists, previous Section 17 notices, Kingston Harbour Project Task B2, permits and licences issues under the Permits &amp; Licences Regulations, NWC sewage treatment plants)</p>	<p>Update the list of stakeholders (ongoing)                      Extension of the consultation process used in developing the regulations                      Communication (print, direct mailing using electronic media) on the implementation schedule and summarising the main features of the regulations. Notification of workshops and training courses for industry.                      Printed material (bookmarks with pointers to information sources).                      Reproduce all information and communication on the NEPA web site</p>
<p>Public sector ministries and agencies                      NEPA, EHU, WRA, Ministry of Agriculture and Fisheries                       Ministries with responsibility for the Environment, Water and Local Government portfolios,                      JBI, National Meteorological Service                      Ministry of Water &amp; Housing,                      Ministry of Local Government &amp; Community Development &amp; Sport,                      National Solid Waste Management Authority, Ministry of Justice &amp; the Attorney General's Department,                      Police, Judiciary</p>	<p>Sensitisation workshops. Awareness Workshops (provide information). Notification of available training courses                       Communication (print, direct mailing using electronic media) on the implementation schedule and summarising the main features of the regulations. Notification of workshops and training courses for public sector staff.</p>
<p>STATIN</p>	<p>Continue and enhance collaboration re SOE reports.                      Sensitisation workshops                      Communication (print, direct mailing using electronic media) on the implementation schedule and summarising the main features of the regulations. Notification of workshops and training courses for public sector staff.</p>
<p>Education and Training Institutions                      Ministry of Education</p>	<p>Identify existing environmental related</p>

<b>Stakeholder</b>	<b>Outreach Activities and Strategies</b>
University of Technology (UTECH), University of the West Indies (UWI)	material in curricula and influence curricula Identify relevant existing courses and promote the development of new courses
Management Institute for National Development (MIND)	Development of a MIND course/modules
Ministry of Information Jamaica Information Service	Influence public education policy to include NEPA material

## **7.2 Staff Requirements for the Implementing the Wastewater and Sludge Regulations**

The purpose of this section is to delineate the roles and responsibilities of the various branches and committees in carrying out the activities that are necessary to implement the regulations.

The required tasks/activities to implement the regulations (outreach, processing and approval of applications, ongoing enforcement, pollution prevention, monitoring, reporting and assessment) together with the branches or committees with responsibility to carry them out are listed in Table 7-2. The responsibility for each activity must be clear and unequivocal. The lead branch will often require information and support from other branches and in some cases from agencies outside of NEPA. [It should be noted that logistical support from the Information Technology (IT) Branch will be required for all activities and the IT Branch is not listed in each activity.]

In the case of new treatment plants, interaction and inputs that relate to planning and broad development issues should take place at the EIA and the permit application stages. In the case of existing treatment plants which may not have gone through an EIA and/or a permit application process, it is recommended that development and planning issues should be examined by exception, namely only in cases where Compliance Plans are required.

We recommend the continuation of the current overview, review and recommendation for approval processes for licences that take place at the Internal Review Committee (IRC), followed by the Technical Review Committee (TRC). In exceptional cases (where there is need for policy direction in order to make a decision) should be referred to the Authority.

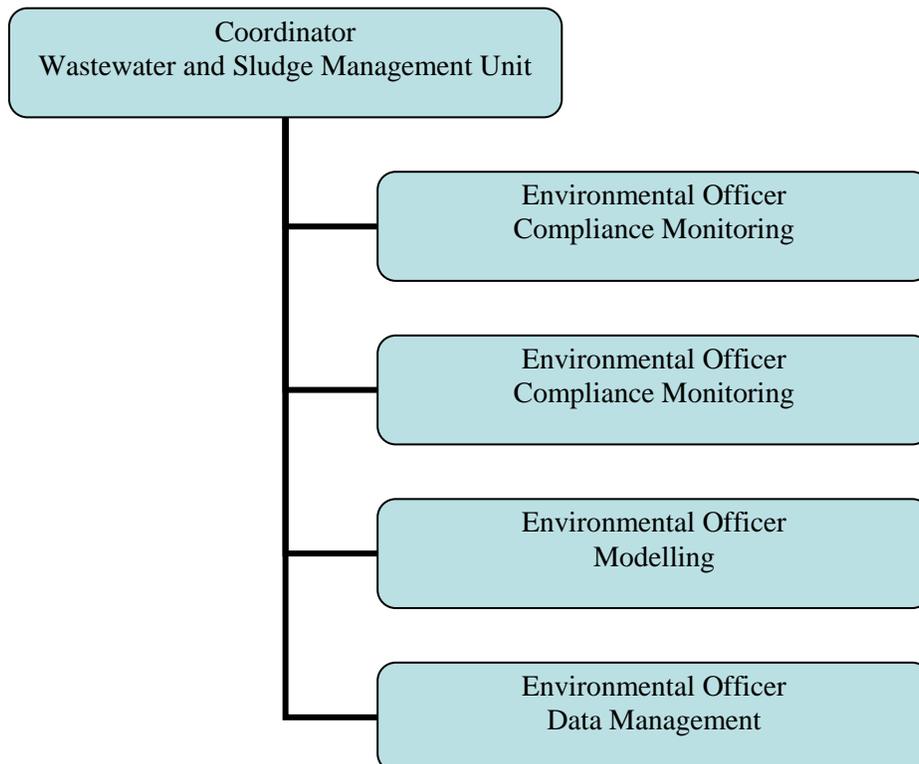
The qualifications, experience and number of staff needed to conduct the outreach, review and assess the licence applications as well as staff to enforce the regulations and assist licensees are described in a separate report.

## Box 4 The Wastewater and Sludge Management Unit

### Wastewater and Sludge Management Unit

In the framework of the Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013, the Unit will be responsible for the management of effluent and sludge discharges, compliance assistance initiatives and the regulatory compliance framework. Some of the activities include:

- 1 The development, review and update of the national wastewater inventory based on the design capacities of treatment systems, watershed management units, receptors and monitoring data.
- 2 Development of minimum design standards for on-site and municipal sewage and industrial waste treatment solutions using appropriate technologies for application in Jamaica.
- 3 Continuous review of the application of the Polluter Pays Principle to dischargers of effluent and sludge and make recommendations for amendments.
- 4 Review of environmental impact assessments and environmental audits of wastewater systems



**Table 7-2 Activity Requirements and Branch Responsibilities for Implementing the Wastewater and Sludge Regulations**

<b>Activity</b>	<b>Responsible Branch</b>	<b>Lead</b>
<b>Outreach</b>		
1. Awareness building with supporting public sector agencies	EMSD, CEO's Office	
2. Communication with potential licensees (Mailings, meetings and workshops with industry groups, etc.)	PECC	
<b>Sensitization and training</b>		
3. Sensitization sessions (for the regulated) in Kingston, Ocho Rios, Montego Bay, Clarendon and Portland	PECC & LSB	
4. Host one sensitization session for umbrella groups such as the JMA, PSOJ, JIEP, JIE.	PECC & LSB	
5. Host Internal training and sensitization sessions with staff of relevant branches (EB/LSB/AMD/PMA)	LSB/EMSB	
<b>Processing and Review of Licence Applications</b>		
6. Prepare Forms and post on website	ASB	
7. Administrative processing (receive, log and check licence applications and renewals for completeness)	ASB	
8. Processing of the applications for licence and renewals	APB	
<b>Monitoring and Enforcement of Licence Conditions</b>		
9. Receive, compile and analyse monthly and other periodic reports	WW&S Point/PMA	Focal
10. Receive, compile and analyse public complaint reports	PMA/EB	
11. Receive, review and assess compliance plans	WW&S Point/PMA	Focal
12. Enforcement of Compliance Plans	EB	
13. Receive, respond to incident reports	PMA	
14. Enforcement visits	EB	
15. Selected monitoring and assessment visits	WW&S Point/PMA	Focal
<b>Support to Licensees</b>		
16. Pollution prevention visits and other initiatives (e.g., EMS promotion, facilitating development of Codes of Practice.)	WW&S Focal Point/PPB	
17. Analyse incident reports, compile annual reports and trend reports for PRTR and other purposes e.g., SOE reporting	WW&S Point/PMA	Focal

### 7.2.1 Staff Training

Most of the activities required to implement the regulations are similar to those required for the Natural Resources Conservation (Permits and Licences) Regulations, 1996. Some of the similar activities (e.g., outreach and review and processing of licence applications) will require few changes. In the cases of **Monitoring and Enforcement of Licence Conditions** and the **Support to Licensees**, there will be several factors that are different when compared with the requirements of the Permits & Licences Regulations and which will require greater skill, experience and effort by staff as well as additional infrastructure (AMANDA fully implemented to track applications, monitor compliance with all licence requirements (incident, periodic and annual reports, track Compliance Plans etc. and laboratory capabilities to measure all parameters with standards). These include:

- An increase in the number of licensed treatment plants
- Additional information will be required when reviewing and processing applications (e.g., maps, ISIC Codes, compliance plans)
- Increased reporting requirements [periodic (e.g., daily, weekly, monthly etc.) and annual reports, estimation of discharge fees, incident reporting, milestone reports for Compliance Plans etc.]
- Greater need for a well-designed plan for post licence monitoring (i.e., using a risk based approach in order to select which treatment plants will be monitored since NEPA will not be able to monitor all treatment plants)
- Increased capability to electronically track compliance

The experience and skills of the staff required in order to perform these activities will therefore be somewhat more demanding than currently exist. The needs can be met by training current staff and, where new staff are hired, to seek persons with skills so that training can be minimised. It should be noted that a separate report identifies the training needs and recommends suitable courses for regulatory staff.

The additional skills that are required are as follows:

- Use of the AMANDA system
- Database management skills
- Enhanced laboratory skills

EHU staff requirements re: STPs

The current EHU inspectors are assigned on a parish basis and have been conducting inspections of STPs (and other facilities) and are adequately trained to do so.

#### Available Courses

The followed undergraduate courses in wastewater engineering are offered:

- UTECH's Bachelor of Engineering degree programme
- UWI

These courses will be suitable for staff employed by licensees. NEPA is also planning a series of training courses that are designed specifically for regulatory staff. These courses will use this manual as the basis for the course modules.

Estimates of the regulatory staff complement needed to implement the regulations are provided in a separate report (included in the training and staff needs assessment report).

## **8. REPORTING REQUIREMENTS**

### **8.1 Overview of Reporting requirements**

This section outlines the external (to the public) reporting by NEPA. External reports are publicly available electronically (posted on the NEPA's website and freely available) or for sale on electronic or print media. Sale prices should reflect near full cost recovery (cost of electronic media plus a mark-up). In addition to the external reports a range of internal reports for NEPA staff will be generated to facilitate the processing and review of licence applications and for enforcement purposes. The internal reports are beyond the scope of this project.

The main external reports are:

- annual PRTR reports
- posting of licences and related information on the NEPA's website
- issue or regional specific assessment studies
- periodic reviews and evaluation of the efficacy of the Regulations

### **8.2 Annual PRTR Reports**

One of the main uses of the annual reports required to be submitted by licensees is for the preparation of annual PRTR reports. (The annual reports are also used to determine discharge fees that are payable and to provide some of the information for the assessment of local, national and regional environmental quality (e.g., stream and watershed quality, coastal zone and marine water quality etc.).

The annual reports will be prepared by NEPA and will include the following:

- Facility reports
- Substance specific reports by media (air, water, land, transfers) aggregated industrial grouping (ISIC Code), geographic region (watershed, parish, nationally)

#### **8.2.1 Information Provided by Applicants**

The annual reports submitted by licensees contains all of the information on releases to water and transfers off-site that is required to prepare the facility PRTR reports. [Information on releases to air will be provided in annual reports submitted by air pollutant discharge licensees in accordance with the Natural Resources Conservation Authority (Air Quality) Regulations, 2006.]

Details of the content and format of facility PRTR reports are provided in Appendix 4 of the report to NEPA<sup>9</sup> titled "Jamaica's Pilot Pollution Release and Transfer Register Project". The facility reports consist of an Overview Report (Appendix 8) and a detailed report (Appendix 9). The overview report includes general facility information, a summary of the number of pollutants that were not in compliance with applicable standards, targets or guidelines, emission control and reduction measures, pollution prevention and energy conservation activities, community activities, ecological assets and source within 5 km or urban area on site and off site (within 5 km), most significant environmental aspects and a description of the facility's environmental setting.

The detailed report contains similar information except that instead of the summary compliance information there is for each pollutant the quantity released to each medium or transferred amount, compliance status.

### **8.2.2 Information to be Otherwise Obtained by NEPA**

The information provided by licensed treatment plants invariably will not reflect all of the emissions for particular pollutants. This is because some treatment plants will release pollutants below the reporting threshold. The reporting thresholds were selected to strike a balance between complete reporting which would require many more licensed treatment plants and achieving a reasonable, high (typically at least 90%) percentage of reported emissions. In the case of air emissions for example, the vast majority of SO<sub>2</sub> emissions (95% or more) will be captured from licensed facilities. In contrast, for NO<sub>x</sub> the percentage reported by licensed facilities will be much lower since it would not be practical to license individual motor vehicles which collectively are a major source of NO<sub>x</sub>. Similarly, it may not be practical to license sewage effluent discharges from individual householders or from very small treatment plants. Sources that are too small to be licensed are termed area sources (even though individually they may be physical point sources). The large number of such sources would require additional resources that would pose an unbearable burden on NEPA's already strained resources – and achieve only marginal gains.

---

<sup>9</sup> Jamaica's Pilot Pollution Release and Transfer Register Project, Report Submitted to Coastal Water Quality Improvement Project and National Environment And Planning Agency Prepared By Claude Davis & Associates, 2002.

It is therefore much more cost effective to estimate the releases from such area sources. In such cases, NEPA will seek to estimate the releases from such area sources so that the contributions from licensed treatment plants can be placed in context. The main area sources to be addressed in the context of sewage and trade effluent releases and guidance on how they may be estimated are as follows:

- Residential sewage effluent releases (those that are not connected to sewerage systems)
  - The Parish Reports of the Jamaica Survey of Living Conditions provides tabulations of the types of toilet facilities by parish from which the number with pit latrines can be estimated. Per capita releases and loadings of domestic sewage can be used to estimate the release to ground water (through percolation from pit latrines).
- Sewage treatment plants below the threshold
  - Information can be obtained in house since NEPA is supposed to license such facilities
- Nutrient run off from agricultural and urban areas (so called non-point sources)
- Point sources that are below the licensing threshold and sectors that are not licensed (e.g., some commercial activities, some government facilities (e.g., hospitals, health centres, clinics, educational institutions, schools, that may have releases other than discharged to sewerage systems)
  - A variety of sources should be used to estimate the numbers of treatment plants that are below the threshold. These include memberships in trade organizations [e.g., Jamaica Manufacturers Association (JMA), Private Sector Organization of Jamaica (PSOJ)] and various lists of institutions. It is recommended that these facilities be prioritised based on water consumption. Water consumption data for non-residential customers (i.e., commercial and industrial consumers) can be obtained from the NWC. These data will only exclude facilities with their own wells (which require approval from the WRA). The facilities should be assigned ISIC Codes, grouped accordingly. Emission factors by ISIC code can be used as a preliminary estimate. Care must be exercised to avoid double counting.

### **8.2.3 Posting of Licence Information**

The main purpose of the PRTR is to provide pollution information to the public. All non-confidential information such as licences, warnings, control orders, prosecutions and convictions should be posted on the web site in a timely manner.

### **8.3 Issue or Regional Specific Assessment Studies**

From time to time NEPA has conducted and will continue to conduct studies or projects that are of interest to the general public. These include for example SOE Reports, regulation development projects, regulatory impact assessments, etc. Many of these reports have been published on the NEPA's website and future reports should be similarly publicised.

### **8.4 Periodic Reviews and Evaluation of the Effectiveness of the Regulations**

In addition to periodic issue- or region-specific assessment studies it is critical that there is periodic review and assessment of the regulations. Such reviews and assessments will determine how well the regulations are working with a view to amendments for improvements. It is recommended that such reviews and assessments take place every four or five years and be reported to the Authority.

Regulatory reviews can take the form of independent, retrospective Regulatory Impact Assessments or a less formal and in-house assessment. Methods to evaluate the long-term effectiveness of the Regulations should address both the environmental performance as well as how well the administrative processes of the Regulations have worked.

The primary (environmental) goal of the regulations is to ensure that water quality levels in surface and underground freshwater and in near shore marine waters in Jamaica are protective of human health and welfare. In cases where the water quality has already been compromised, the regulations seek to reverse the conditions and where water quality is good, to maintain the quality. The Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013 provide some but not all of the means to achieve this goal. Agencies such as WRA, Forestry Department, Ministry of Agriculture and Fisheries and their associated legislation provide support in achieving the goal of maintaining and/or enhancing water quality in Jamaica.

The environmental aspects of the review and assessment of the WW&S Regulations will require the use of environmental indicators or surrogates that must be in place at the outset together with data that can be collected through the use of surveys and questionnaires during or at the end of the period in question. The regulations can also be assessed by analysis of each paragraph in the regulation by defining the purpose and means to measure or assess its effectiveness.

The “big picture” assessment of the regulations will entail integration of information collected under the regulations together with data and information from supporting programs (especially the surface water quality monitoring and watershed and coastal zone programmes) and agencies (WRA, Forestry Department). The goals, objectives, measures, performance measures or indicators and schedule for assessment of the Wastewater and Sludge Regulations are given in Table 8-1.

The regulations require various reports that will provide much of the data needed for performance measures or indicators. There are however, several instances where additional measures will need to be implemented to provide the data needed for assessments.

**Table 8-1**

**Measures to give effect to the Wastewater and Sludge Regulations**

<b>GOALS/ OUTCOMES</b>	<b>OBJECTIVE</b>	<b>MEASURES</b>	<b>PERFORMANCE MEASURES</b>	<b>TIME PERIOD</b>
Achieve ambient water quality objectives throughout all areas of Jamaica	Manage wastewater and sludge releases from all licensed sources	Track progress in achievement of Compliance Plans for facilities in violation of effluent standards	Degree of compliance by facilities with standards Reduction in loadings discharged by facility and by WMUs	2014 - onwards
		Track NMP	Quantity of fertiliser avoided through use of wastewater and sludge for irrigation/soil conditioning	2014 - onwards
	Characterise ambient water quality in all watershed management units to establish baseline conditions  Identify critical pollutants (those that impair water quality) and their sources	Continue ambient water quality surveillance programme Respond to complaints about poor ambient water quality/pollution incidents due to spills at or near licensed and other sources Contribute to management of WMUs.	Numbers samples taken and analysed relative to planned schedule Improvement in water quality/Trends in ambient freshwater and near shore marine water quality on individual water body and watershed bases Number of responses to complaints and incidents	2015
Estimate wastewater releases from point sources below the	Develop methodology for estimating loadings in WMU's and	Baseline and Annual reports on loading to WMUs Integrate with	2015	

<b>GOALS/ OUTCOMES</b>	<b>OBJECTIVE</b>	<b>MEASURES</b>	<b>PERFORMANCE MEASURES</b>	<b>TIME PERIOD</b>
	threshold for licensing and from non-point sources Identify other stressors (land use, development, ) to ecological assets	establish baseline conditions Plan and conduct watershed management programmes	ambient water quality trends	
	Establish target release reductions and devise means to achieve them	Track loadings and transfers annually	Track loadings and transfers annually	2015
		Track progress through bi-annual (every 6 months) reporting or more frequently as may be required.	Track progress through bi-annual (every 6 months) reporting or more frequently as may be required.	2015
	Develop socio-economic indicators to complement assess water quality indicators for assessing effectiveness of regulations and other programmes	Integration with other WMUs activities (land, water and vegetation resources)	Additional indicators developed	2015
	Secure adequate levels of staffing to implement regulations	Identify needs, train staff	Staff secured or outsourcing	2014 - 2015
Implement an efficient and fully cost recoverable system for the WW&S	Near full cost recovery	Establish means to track time spent in processing applications and for all aspects of enforcement	Time and expenses	2014 - 2015

<b>GOALS/ OUTCOMES</b>	<b>OBJECTIVE</b>	<b>MEASURES</b>	<b>PERFORMANCE MEASURES</b>	<b>TIME PERIOD</b>
Regulations by 2012		and tracking		
Maintain Satisfactory stakeholder Relationship	High use of data by public and by government for policy development Effective outreach and public education	Establish targets for public access and use Conduct periodic surveys	Analyses survey results	2014 - 2015

## **9. APPENDICES**

### **List of Appendices:**

Appendix 1: ISIC Codes and Descriptions

Appendix 2: Sewage and Trade Effluent Standards

Appendix 3: Standards for Sludge

Appendix 4: Ambient Water Quality Standards

Appendix 5: List of Analytical Methods for the Analysis of Sewage and Trade Effluent

Appendix 6: NWC Pre-treatment Standards

Appendix 7: Template for Monthly Nutrient Management Report

Appendix 8: Template of Overview Format for Pollutant Release and Transfer (PRTR) Facility Report

Appendix 9: Template of Detailed Format for Pollutant Release and Transfer Register (PRTR) Facility Report

Appendix 10: Summary Table for Load Calculation

Appendix 11: Wastewater Treatment Plant Checklist

## Appendix 1: ISIC Codes and Descriptions

The complete list of two digit ISIC codes is provided below. Four digit ISIC Codes are required. A partial list of ISIC codes that includes those most likely to be relevant to these regulations is given in Table 9-1. The full listing (see the link provided) should be consulted if the activity is not included in the four digit list. Note that a facility may be carrying out activities that require more than one ISIC code and in such cases all such codes should be listed starting with the activity that accounts for the greatest potential for environmental releases.

### [ISIC Rev.3.1](#)

(<http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=17>)

- \* A - Agriculture, hunting and forestry
  - 01 - Agriculture, hunting and related service activities
  - 02 - Forestry, logging and related service activities
- \* B - Fishing
  - 05 - Fishing, aquaculture and service activities incidental to fishing
- \* C - Mining and quarrying
  - 10 - Mining of coal and lignite; extraction of peat
  - 11 - Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying
  - 12 - Mining of uranium and thorium ores
  - 13 - Mining of metal ores
  - 14 - Other mining and quarrying
- \* D - Manufacturing
  - 15 - Manufacture of food products and beverages
  - 16 - Manufacture of tobacco products
  - 17 - Manufacture of textiles
  - 18 - Manufacture of wearing apparel; dressing and dyeing of fur
  - 19 - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
  - 20 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
  - 21 - Manufacture of paper and paper products
  - 22 - Publishing, printing and reproduction of recorded media
  - 23 - Manufacture of coke, refined petroleum products and nuclear fuel
  - 24 - Manufacture of chemicals and chemical products
  - 25 - Manufacture of rubber and plastics products
  - 26 - Manufacture of other non-metallic mineral products
  - 27 - Manufacture of basic metals
  - 28 - Manufacture of fabricated metal products, except machinery and equipment
  - 29 - Manufacture of machinery and equipment n.e.c.
  - 30 - Manufacture of office, accounting and computing machinery
  - 31 - Manufacture of electrical machinery and apparatus n.e.c.
  - 32 - Manufacture of radio, television and communication equipment and apparatus
  - 33 - Manufacture of medical, precision and optical instruments, watches and clocks
  - 34 - Manufacture of motor vehicles, trailers and semi-trailers

- 35 - Manufacture of other transport equipment
- 36 - Manufacture of furniture; manufacturing n.e.c.
- 37 - Recycling
- \* E - Electricity, gas and water supply
  - 40 - Electricity, gas, steam and hot water supply
  - 41 - Collection, purification and distribution of water
- \* F - Construction
  - 45 - Construction
- \* G - Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
  - 50 - Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
  - 51 - Wholesale trade and commission trade, except of motor vehicles and motorcycles
  - 52 - Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods
- \* H - Hotels and restaurants
  - 55 - Hotels and restaurants
- \* I - Transport, storage and communications
  - 60 - Land transport; transport via pipelines
  - 61 - Water transport
  - 62 - Air transport
  - 63 - Supporting and auxiliary transport activities; activities of travel agencies
  - 64 - Post and telecommunications
- \* J - Financial intermediation
  - 65 - Financial intermediation, except insurance and pension funding
  - 66 - Insurance and pension funding, except compulsory social security
  - 67 - Activities auxiliary to financial intermediation
- \* K - Real estate, renting and business activities
  - 70 - Real estate activities
  - 71 - Renting of machinery and equipment without operator and of personal and household goods
  - 72 - Computer and related activities
  - 73 - Research and development
  - 74 - Other business activities
- \* L - Public administration and defence; compulsory social security
  - 75 - Public administration and defence; compulsory social security
- \* M - Education
  - 80 - Education
- \* N - Health and social work
  - 85 - Health and social work
- \* O - Other community, social and personal service activities
  - 90 - Sewage and refuse disposal, sanitation and similar activities
  - 91 - Activities of membership organizations n.e.c.
  - 92 - Recreational, cultural and sporting activities
  - 93 - Other service activities
- \* P - Activities of private households as employers and undifferentiated production activities of private households
  - 95 - Activities of private households as employers of domestic staff
  - 96 - Undifferentiated goods-producing activities of private households for own use

- 97 - Undifferentiated service-producing activities of private households for own use
- \* Q - Extraterritorial organizations and bodies
- 99 - Extraterritorial organizations and bodies

**Table 9-1 Selected Four Digit ISIC Codes (those likely to be most relevant for these Regulations)**

<b>Code</b>	<b>Description</b>
1010	Mining and agglomeration of hard coal
1020	Mining and agglomeration of lignite
1030	Extraction and agglomeration of peat
1110	Extraction of crude petroleum and natural gas
1120	Service activities incidental to oil and gas extraction excluding surveying
1200	Mining of uranium and thorium ores
1310	Mining of iron ores
1320	Mining of non-ferrous metal ores, except uranium and thorium ores
1410	Quarrying of stone, sand and clay
1421	Mining of chemical and fertilizer minerals
1422	Extraction of salt
1429	Other mining and quarrying n.e.c.
1511	Production, processing and preserving of meat and meat products
1512	Processing and preserving of fish and fish products
1513	Processing and preserving of fruit and vegetables
1514	Manufacture of vegetable and animal oils and fats
1520	Manufacture of dairy products
1531	Manufacture of grain mill products
1532	Manufacture of starches and starch products
1533	Manufacture of prepared animal feeds
1541	Manufacture of bakery products
1542	Manufacture of sugar
1543	Manufacture of cocoa, chocolate and sugar confectionery
1544	Manufacture of macaroni, noodles, couscous and similar farinaceous products
1549	Manufacture of other food products n.e.c.
1551	Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials
1552	Manufacture of wines
1553	Manufacture of malt liquors and malt
1554	Manufacture of soft drinks; production of mineral waters
1600	Manufacture of tobacco products
1711	Preparation and spinning of textile fibres; weaving of textiles
1712	Finishing of textiles
1721	Manufacture of made-up textile articles, except apparel
1722	Manufacture of carpets and rugs
1723	Manufacture of cordage, rope, twine and netting

<b>Code</b>	<b>Description</b>
1729	Manufacture of other textiles n.e.c.
1730	Manufacture of knitted and crocheted fabrics and articles
1810	Manufacture of wearing apparel, except fur apparel
1820	Dressing and dyeing of fur; manufacture of articles of fur
1911	Tanning and dressing of leather
1912	Manufacture of luggage, handbags and the like, saddlery and harness
1920	Manufacture of footwear
2010	Sawmilling and planing of wood
2021	Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board and other panels and boards
2022	Manufacture of builders' carpentry and joinery
2023	Manufacture of wooden containers
2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
2101	Manufacture of pulp, paper and paperboard
2102	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
2109	Manufacture of other articles of paper and paperboard
2211	Publishing of books, brochures and other publications
2212	Publishing of newspapers, journals and periodicals
2213	Publishing of music
2219	Other publishing
2221	Printing
2222	Service activities related to printing
2230	Reproduction of recorded media
2310	Manufacture of coke oven products
2320	Manufacture of refined petroleum products
2330	Processing of nuclear fuel
2411	Manufacture of basic chemicals, except fertilizers and nitrogen compounds
2412	Manufacture of fertilizers and nitrogen compounds
2413	Manufacture of plastics in primary forms and of synthetic rubber
2421	Manufacture of pesticides and other agrochemical products
2422	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
2423	Manufacture of pharmaceuticals, medicinal chemicals and botanical products
2424	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
2429	Manufacture of other chemical products n.e.c.
2430	Manufacture of man-made fibres
2511	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
2519	Manufacture of other rubber products
2520	Manufacture of plastics products

<b>Code</b>	<b>Description</b>
2610	Manufacture of glass and glass products
2691	Manufacture of non-structural non-refractory ceramic ware
2692	Manufacture of refractory ceramic products
2693	Manufacture of structural non-refractory clay and ceramic products
2694	Manufacture of cement, lime and plaster
2695	Manufacture of articles of concrete, cement and plaster
2696	Cutting, shaping and finishing of stone
2699	Manufacture of other non-metallic mineral products n.e.c.
2710	Manufacture of basic iron and steel
2720	Manufacture of basic precious and non-ferrous metals
2731	Casting of iron and steel
2732	Casting of non-ferrous metals
2811	Manufacture of structural metal products
2812	Manufacture of tanks, reservoirs and containers of metal
2813	Manufacture of steam generators, except central heating hot water boilers
2891	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
2892	Treatment and coating of metals; general mechanical engineering on a fee or contract basis
2893	Manufacture of cutlery, hand tools and general hardware
2899	Manufacture of other fabricated metal products n.e.c.
2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
2912	Manufacture of pumps, compressors, taps and valves
2913	Manufacture of bearings, gears, gearing and driving elements
2914	Manufacture of ovens, furnaces and furnace burners
2915	Manufacture of lifting and handling equipment
2919	Manufacture of other general-purpose machinery
2921	Manufacture of agricultural and forestry machinery
2922	Manufacture of machine tools
2923	Manufacture of machinery for metallurgy
2924	Manufacture of machinery for mining, quarrying and construction
2925	Manufacture of machinery for food, beverage and tobacco processing
2926	Manufacture of machinery for textile, apparel and leather production
2927	Manufacture of weapons and ammunition
2929	Manufacture of other special-purpose machinery
2930	Manufacture of domestic appliances n.e.c.
3000	Manufacture of office, accounting and computing machinery
3110	Manufacture of electric motors, generators and transformers
3120	Manufacture of electricity distribution and control apparatus
3130	Manufacture of insulated wire and cable
3140	Manufacture of accumulators, primary cells and primary batteries
3150	Manufacture of electric lamps and lighting equipment

<b>Code</b>	<b>Description</b>
3190	Manufacture of other electrical equipment n.e.c.
3210	Manufacture of electronic valves and tubes and other electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
3311	Manufacture of medical and surgical equipment and orthopaedic appliances
3312	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
3313	Manufacture of industrial process control equipment
3320	Manufacture of optical instruments and photographic equipment
3330	Manufacture of watches and clocks
3410	Manufacture of motor vehicles
3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
3430	Manufacture of parts and accessories for motor vehicles and their engines
3511	Building and repairing of ships
3512	Building and repairing of pleasure and sporting boats
3520	Manufacture of railway and tramway locomotives and rolling stock
3530	Manufacture of aircraft and spacecraft
3591	Manufacture of motorcycles
3592	Manufacture of bicycles and invalid carriages
3599	Manufacture of other transport equipment n.e.c.
3610	Manufacture of furniture
3691	Manufacture of jewellery and related articles
3692	Manufacture of musical instruments
3693	Manufacture of sports goods
3694	Manufacture of games and toys
3699	Other manufacturing n.e.c.
3710	Recycling of metal waste and scrap
3720	Recycling of non-metal waste and scrap
4010	Production, transmission and distribution of electricity
4020	Manufacture of gas; distribution of gaseous fuels through mains
4030	Steam and hot water supply
4100	Collection, purification and distribution of water
4510	Site preparation
4520	Building of complete constructions or parts thereof; civil engineering
4530	Building installation
4540	Building completion
4550	Renting of construction or demolition equipment with operator
5010	Sale of motor vehicles

<b>Code</b>	<b>Description</b>
5020	Maintenance and repair of motor vehicles
5030	Sale of motor vehicle parts and accessories
5040	Sale, maintenance and repair of motorcycles and related parts and accessories
5050	Retail sale of automotive fuel
5260	Repair of personal and household goods
5510	Hotels; camping sites and other provision of short-stay accommodation
5520	Restaurants, bars and canteens
6010	Transport via railways
6021	Other scheduled passenger land transport
6022	Other non-scheduled passenger land transport
6023	Freight transport by road
6030	Transport via pipelines
6110	Sea and coastal water transport
6120	Inland water transport
6210	Scheduled air transport
6220	Non-scheduled air transport
6301	Cargo handling
6302	Storage and warehousing
6303	Other supporting transport activities
6304	Activities of travel agencies and tour operators; tourist assistance activities n.e.c.
6309	Activities of other transport agencies
6411	National post activities
6412	Courier activities other than national post activities
6420	Telecommunications
9000	Sewage and refuse disposal, sanitation and similar activities

## Appendix 2: Sewage and Trade Effluent Standards

**Table 9-2 NRCA Sewage Effluent Standards for plants built prior to 1997 and plants built after 1997**

PARAMETER	EFFLUENT LIMIT Plants built prior to 1997	EFFLUENT LIMIT Plants built after 1997
BOD <sub>5</sub>	20 mg/L	20 mg/L
TSS	30 mg/L	20 mg/L
Nitrates (as Nitrogen)	30 mg/L	10 mg/L
Phosphates	10 mg/L	4 mg/L
COD	100 mg/L	100 mg/L
pH	6 – 9 pH units	6 – 9 pH units
Faecal Coliform	1000 MPN/100	200 MPN/100
Residual Chlorine	ml	ml
Floatables	1.5 mg/L	1.5 mg/L Not visible

**Table 9-3 NRCA Trade Effluent Standards**

PARAMETER	TRADE EFFLUENT LIMIT
Ammonia/ammonium measured as NH <sub>4</sub>	1.0 mg/L
Barium (Ba)	5.0 mg/L
Beryllium (Be)	0.5 mg/L
Biological oxygen demand (BOD <sub>5</sub> )	<30 mg/L
Boron (B)	5.0
Calcium (Ca)	No standard
Chemical Oxygen Demand (COD)	100 mg/L or 0.1 kg/1000 kg product
Chloride (Cl)	300 mg/L
Colour	100 TCU
Cyanide (free)	0.1 mg/L
Cyanide (Total as CN)	0.2 mg/L
Detergent	15 mg/L
Dissolved Oxygen (DO)	>4 mg/L
Faecal Coliform	<100 MPN/100 ml
Fluoride(F)	3.0 mg/L
Iron (Fe)	3.0 mg/L
Magnesium (Mg)	No standard
Manganese (Mn)	1.0 mg/L
Nitrate as NO <sub>3</sub>	10 mg/L
Oil & Grease	10mg/L or < 0.01 kg/1000 kg product
pH	6.5 – 8.5

<b>PARAMETER</b>	<b>TRADE EFFLUENT LIMIT</b>
Phenols	5.0 mg/L
Phosphate as PO <sub>4</sub>	5 mg/L
Sodium (Na)	100 mg/L
Sulphate(SO <sub>4</sub> )	250 mg/L
Sulphide	0.2 mg/L
Temperature	±2° of ambient
Total Coliform	<500 MPN/100 ml
Total Dissolved Solids (TDS)	1000 mg/L
Total Organic Carbon (TOC)	100 mg/L
Total Suspended Solids (TSS) (maximum monthly average)	50 mg/L
Total Suspended Solids (TSS) maximum daily average	<150 mg/LL
Trace Metals:	
Zinc (Zn)	1.5 mg/L
Lead (Pb)	0.1 mg/L
Cadmium (Cd)	0.1 mg/L
Arsenic (As)	0.5 mg/L
Chromium (Cr)	1.0 mg/L
Copper (Cu)	0.1 mg/L
Mercury (Hg)	0.02 mg/L
Nickel (Ni)	1.0 mg/L
Selenium (Se)	0.5 mg/L
Silver (Ag)	0.1 mg/L
Tin (Sn)	No standard
Total Heavy Metals	2.0 mg/L

**Table 9-4 NRCA Effluent Standards for Sewage Effluent to be used for Irrigation**

<b>Parameter</b>	<b>Standard Limit</b>
Oil & Grease	10 mg/L
Total Suspended Solids (TSS)	15 mg/L
Residual Chlorine	0.5 mg/L
Biochemical Oxygen Demand (BOD <sub>5</sub> )	15 mg/L
Chemical Oxygen Demand (COD)	<100 mg/L
Faecal Coliform	12 MPN / 100ml

## Appendix 3: Standards for Sludge

**Table 9-5 NRCA National Treated Sewage Sludge/Biosolids Standards for Fully Treated Sewage Sludge that can be applied to Agricultural Land**

<b>Pollutant</b>	<b>Maximum Concentration # mg/kg (dry weight basis)</b>	<b>Annual Pollutant Loading Rates (kg/ha/year)</b>	<b>Jamaican Cumulative loading rates% kg/ha</b>
Arsenic	65		
Cadmium	75		
Copper	230		
Lead	90		
Mercury	0.045		
Molybdenum	09		
Nickel	180##		
Selenium	14##		
Zinc	400		
Cr	830		165
Pathogens	< 1,000 MPN/g of total solids (oven dried mass) where viable Helminth Ova >1 per 4g of Total Solids (Dry Wright) Salmonella <3 MPN/4g Faecal Coliform <1000 MPN/g		

# Based on the 95<sup>th</sup> percentile (rounded to 5 mg/kg) of the level of occurrence in Jamaican soils except as noted

## Based on US EPA limits

% Based on 4,400 kg dry weight compost per ha for 45 years

**Table 9-6 Standards for Solid Waste/Industrial Sludge Suitable for Landfill Leachate test results not to exceed 100 mg/L**

<b>Parameter</b>	<b>Parameter</b>
Ammonia sulphide	Maleic anhydride
Benzidine	Methylamine
Benzyl chloride	Potassium permanganate
Diethylamine	Quinoline
Ethylamine	Strychnine
Ethylenediamine	Tetrachloroethanes

**Table 9-7 Standards for Solid Waste/ Industrial Sludge Suitable for Landfill (based on Leachate quality test results)**

<b>Parameter</b>	<b>Concentration (mg/L)</b>
Arsenic	2.5
Barium	100
Cadmium	0.5
Carbon Tetrachloride	0.5
Chromium	5
Cyanide(free)	20
DDT	3
Endrin	0.02
Heptachlor + Heptachlor epoxide	0.3
Lead	5
Lindane	0.4
Mercury	0.1
Methoxychlor	10
Methyl ethyl ketone	200
Metolachlor	5
PCBs	50
Selenium	1
Silver	5
Tetrachloroethylene	3.0
Toxaphene	0.5
Trihalomethanes	10
2,4,5-TP (Silvex)	1
Zinc	500

## Appendix 4: Ambient Water Quality Standards

Jamaican ambient water quality and irrigation standards are included here for information.

**Table 9-8 Jamaican National Ambient Water Quality Standards - Freshwater**

Parameter	Measured as	Standard Range	Unit
Calcium	(Ca)	40.00-101.0	mg/L
Chloride	(Cl <sup>-</sup> )	5.00- 20.0	mg/L
Magnesium	(Mg <sup>2+</sup> )	3.60- 27.0	mg/L
Nitrate	(NO <sub>3</sub> <sup>-</sup> )	0.10- 7.5	mg/L
Phosphate	(PO <sub>4</sub> <sup>3-</sup> )	0.01 - 0.8	mg/L
Ph		7.00- 8.4	-
Potassium	(K <sup>+</sup> )	0.74- 5.0	mg/L
Silica	(SiO <sub>4</sub> or Si <sup>2+</sup> )	5.00- 39.0	mg/L
Sodium	(Na <sup>+</sup> )	4.50- 12.0	mg/L
Sulphate	(SO <sub>4</sub> <sup>2-</sup> )	3.00- 10.0	mg/L
Hardness	(CaCO <sub>3</sub> )	127.00-381.0	mg/L (as CaCO <sub>3</sub> )
Biochemical Oxygen Demand		0.80- 1.7	mg/L
Conductivity		150.00-600	µS/cm
Total Dissolved Solids		120.00-300	mg/L
Total Coliform		< 2400	MPN/100 ml

Parameter	Measured as	Standard Range	Unit
(recreation waters)			
Hardness (industrial use)		< 300	mg/l
Conductivity (irrigation)		< 3,000	µs/CM

**Table 9-9 Jamaican National Ambient Water Quality Standards – Ambient Marine**

Parameter	Measured as	Standard Range	Unit
Phosphate	PO <sub>4</sub>	0.001 - 0.055	mg/l
Nitrate	N	0.001 - 0.081	mg/l
Total alkalinity	CaCO <sub>3</sub>	131 - 168	mg/l
pH		8.0 - 8.44	mg/l
BOD		0.57 - 1.16	mg/l
Total Coliform		48 - 256	MPN/100mL
Faecal Coliform		<2 13	MPN/100mL

## Appendix 5: List of Analytical Methods for the Analysis of Sewage and Trade Effluent

Analytical Test methods for chemical and biological parameters are given in the Fifth Schedule, Tables 9-9 and 9-10.

**Table 9-10 Approved Test Methods (Sewage Effluent)**

Whereas the Test Methods listed in Appendix 2 of the National Sewage Effluent Standards, 1997 are internationally accepted methods of analysis; the proposed specific tests for NRCA compliance purposes are listed below. However, other test methods can be used if evidence is provided to prove compatibility with the test methods proposed by NRCA.

Parameter	Standard Methods for the Examination of Water and Wastewater Method(s)	ISO Test Method(s)	HACH Method
Biochemical Oxygen Demand (BOD <sub>5</sub> )	5210 B, 5-day BOD test	ISO 5815:1989, Dilution and seeding	
Total Suspended Solids	2450 D, Total Suspended Solids dried at 103 - 105 °C		
Nitrate as nitrogen	4500-NO <sub>3</sub> E, Cadmium Reduction		8039, 8171 and 10020
Total Nitrogen	4500-N, Persulphate Method	ISO 10048:1991	10071 and 10072
Phosphate as Phosphorus	4500-P E Colorimetric or 4500-P F	ISO 6878-1:1986, Colorimetric	8048
Total Phosphorous	4500-P I, Persulphate		8190
Chemical Oxygen Demand	5220 D, Closed reflux, Colorimetric		
pH	4500-H <sup>+</sup> B, Electrometric		
Faecal Coliform	9221 C, Multiple (5) tube fermentation 9222 D, Membrane Filtration	ISO 9308-2:1990	
Residual	4500-Cl, DPD Colorimetric	ISO 7393-2:1985,	

<b>Parameter</b>	<b>Standard Methods for the Examination of Water and Wastewater Method(s)</b>	<b>ISO Test Method(s)</b>	<b>HACH Method</b>
Chlorine		DPD Colorimetric	
Oil and Grease	5520 B, Partition Gravimetric 5520 C, Partition Infrared 5520 D, Soxhlet Extraction	U.S. EPA Method 1664: Guidelines Establishing Test Procedures for the Analysis of Oil and Grease and Non-Polar Materials under the Clean Water and Resource Conservation and Recovery Act	

Recommended test methods for analytical analyses of effluent samples used to assess for compliance with Natural Resources Conservation Authority Sewage and Trade Effluent Standards.

The test methods are as illustrated in the following references;

1. Clesceri, L; Greenberg, Arnold and Trussel, R. (Editors). 1989. Standard Methods for the Examination of Water and Wastewater, 17th Edition. APHA-AWWA-WPCF. Publication Office: APHA, 1015 Fifteenth Street NW, Washington, DC 2005.  
(APHA = American Public Health Association. AWWA = American Wastewater Association. WPCF = Water Pollution Control Federation)
2. ISO. 1994. ISO Standards Compendium, Environment, Water Quality, Vol. 2 - Chemical methods, 1st Edition.  
ISO, Case Postale 56, CH-1211 Geneva, Switzerland. (ISO = International Organization for Standardization)
3. ISO.1994. ISO Standards Compendium, Environment, Water Quality, Vol. 3 - Physical, biological and microbiological methods, 1st Edition. ISO, Case Postale 56, CH-1211 Geneva, Switzerland.

**Table 9-11 Approved Test Methods (Trade Effluent)**

For the Trade Effluent, The proposed Analytical methods for NRCA compliance purposes are listed below. However, other test methods can be used if evidence is provided to prove compatibility with the test methods proposed by NRCA.

<b>PARAMETER</b>	<b>Standard Methods for Examination of Water &amp; Wastewater Test Methods</b>	<b>ISO or U.S EPA Method</b>
Ammonia/ammonium measured as NH <sub>4</sub>	4500-NH <sub>3</sub>	
Barium	3500-Ba	
Beryllium	3500-Be	
Biological oxygen demand (BOD)	5210	ISO 5815:1989, Dilution and seeding
Boron	4500-B	
Calcium	3500-Ca	
Chemical Oxygen Demand (COD)	5220	
Chloride	4500-Cl-	
Colour	2120	
Cyanide (free) Cyanide (Total as CN)	4500-CN-	
Detergent	5540	
Dissolved oxygen (DO)	4500-O	
Faecal Coliform	9221	ISO 9308-2:1990
Fluoride	4500-F-	
Iron	3500-Fe	
Magnesium	3500-Mg	
Manganese	3500-Mn	
Nitrate as NO <sub>3</sub>	4500-NO <sub>3</sub> <sup>-</sup>	
Oil & Grease	5520	U.S. EPA Method 1664: Guidelines Establishing Test Procedures for the Analysis of Oil and Grease and Non-Polar Material
pH	4500-H <sup>+</sup> B, Electrometric	

<b>PARAMETER</b>	<b>Standard Methods for Examination of Water &amp; Wastewater Test Methods</b>	<b>ISO or U.S EPA Method</b>
Phenols	5530	
Phosphate as PO <sub>4</sub>	4500-P	ISO 6878-1:1986, Colourmetric
Sodium	3500-Na	
Sulphate	4500-SO <sub>4</sub> <sup>2-</sup>	
Sulphide	4500-S <sup>2-</sup>	
Temperature	2550	
Total Coliform	9221	
Total dissolved solids (TDS)	2540C	
Total organic carbon (TOC)	5310	
Total suspended solids (TSS) (maximum monthly average)	2540D	
Total suspended solids (TSS) maximum daily average	2540D	
Trace Metals: Zinc Lead Cadmium Arsenic Chromium Copper Mercury Nickel Selenium Silver Tin Total Heavy Metals	3500-metal	

## Appendix 6: NWC Pre-treatment Standards

Parameter	Measured as	Limit	Units
Settleable solids		250	mg/l
Biological oxygen demand		215	mg/l
Sulphide	S	0.25	mg/l
Oil and grease		15	mg/l
Cyanide	CN	0.9	mg/l
Nitrogen	N	9	mg/l
Sulphate	SO <sub>4</sub>	250	mg/l
Available chlorine	Cl <sub>2</sub>	4	mg/l
Sulphur dioxide	SO <sub>2</sub>	0.8	mg/l
Phenolics		1	mg/l
Phosphate	PO <sub>4</sub>	6	mg/l
Individual heavy metal			
Total heavy metals		2.5	mg/l
Chemical oxygen demand		350	mg/l
Temperature		<45	Degrees centigrade
pH		6 to 11	pH units

## Appendix 7: Template for Monthly Nutrient Management Report

Plant Name	The name of the facility (same as in Licence)
Plant ID	This is the plant ID on the licence
Location of Plant	Indicate the address of the plant
Report date	Enter the date on which you submitted the report
Reporting period	Indicate the period (month/year) for which data are provided. Note: Be sure to provide a continuous (i.e., without any gaps in dates) period for the entire year.
NRCA Wastewater & Sludge Licence	Indicate the NRCA Licence Number (under these regulations or the P&L Regulations if applicable)
Total Fertilizer Applied (tonnes)	
Incentive for using trade effluent as fertilizer supplement (reconciliation of discharge fees)	

### Nutrient Application Report

Add as many columns as needed for each application (applicn) of nutrient to fields

PARAMETER	Units	Applicn 1	Applicn 2	Applicn 3	Applicn 4	Applicn 5	Monthly Load (kg)
1. Field ID							
2. Crop							
<b>Effluent Applied</b>							
3. Flow rate	m <sup>3</sup> /h						
4. Start date							
5. End date							
6. Volume applied	m <sup>3</sup>						
7. BOD	mg/L						
8. Nitrate as NO <sub>3</sub>	mg/L						
9. Phosphate as PO <sub>4</sub>	mg/L						
10. Faecal Coliform	MPN/100 ml						
11. pH							
12. Temperature	°C						
13. Total Coliform	MPN/100 ml						
14. Total dissolved solids	mg/L						
15. Total	mg/L						

<b>PARAMETER</b>	<b>Units</b>	<b>Applicn 1</b>	<b>Applicn 2</b>	<b>Applicn 3</b>	<b>Applicn 4</b>	<b>Applicn 5</b>	<b>Monthly Load (kg)</b>
suspended solids							
<b>Biosolids Applied</b>							
16. Start date & hour							
17. End date & hour							
18. Volume/Weight applied	(specify kg or m <sup>3</sup> )						
19. BOD	mg/L						
20. Nitrate as NO <sub>3</sub>	mg/L						
21. Phosphate as PO <sub>4</sub>	mg/L						
22. Other measurement (specify)							
23. Other measurement (specify)							
24. Other measurement (specify)							
25. Other (specify)							
<b>Other Fertilizer applied</b>							
26. Start date & hour							
27. End date & hour							
28. Volume/Weight applied							
29. N							
30. P							
31. K							
32. Other (specify)							
33. Other							
34. Other							
35. Other							

## Appendix 8: Template of Overview Format for Pollutant Release and Transfer (PRTR) Facility Report

NATIONAL ENVIRONMENT AND PLANNING AGENCY (NEPA) POLLUTANT REGISTER				
FACILITY POLLUTION PREVENTION AND RELEASE INFORMATION				
	<b>Reporting Year</b>	<b>20xx</b>		
<b>Overview Report</b>				
Facility Name:	<b>Company XYZ</b>			
Address				
Address1				
Address2				
Parish				
Location	Latitude(dd mm ss.xx):		JAD 2001	
Location	Longitude (dd mm ss.xx):		JAD 2001	
Public Contact:				
Public Contact (Phone):			Fax:	
Public Contact Email:				
Web Address:				
Number of Employees:				
Main Activities:				
North American Industrial Source Classification (ISIC) Code(s)				
<b>OVERVIEW OF POLLUTANT RELEASES</b>				
<b>Reporting Year</b>	<b>20xx</b>			
<b>Medium to which pollutants are released</b>	<b>Compliance with applicable standards, targets or guidelines</b>			
<b>Air</b>	X of the Y regulated air pollutants released from the facility were below the regulation limits. Regulated air pollutants are those with emission standards or emission targets or whose emissions must not cause ambient guideline concentrations to be exceeded.			
<b>Water</b>	N of M pollutants released to water met trade or sewage effluent standards			
<b>Land</b>	There are no applicable emission standards for releases to land			
<b>EMISSION CONTROL AND REDUCTION MEASURES IN 2000</b>				
<b>POLLUTION PREVENTION AND ENERGY CONSERVATION ACTIVITIES</b>				

<b>NATIONAL ENVIRONMENT AND PLANNING AGENCY (NEPA) POLLUTANT REGISTER</b>		
<b>FACILITY POLLUTION PREVENTION AND RELEASE INFORMATION</b>		
	<b>Reporting Year</b>	<b>20xx</b>
<b>Overview Report</b>		
<b>COMMUNITY ACTIVITIES</b>		
<b>ECOLOGICAL ASSETS AND SOURCE WITHIN 5 km or URBAN AREA</b>		
<b>ON SITE</b>		
<b>OFF SITE (WITHIN 5 km)</b>		
<b>MOST SIGNIFICANT ENVIRONMENTAL ASPECTS</b>		
<b>ENVIRONMENTAL SETTING</b>		

## Appendix 9: Template of Detailed Format for Pollutant Release and Transfer Register (PRTR) Facility Report

NATIONAL ENVIRONMENT AND PLANNING AGENCY (NEPA) POLLUTION REGISTER						
FACILITY POLLUTION PREVENTION AND RELEASE INFORMATION						
Reporting Year		20xx				
Summary Report						
Facility Name:		<b>Company XYZ</b>				
Address						
Address1						
Address2						
Parish						
Location	Latitude		JAD200 1			
Location	Longitude		JAD200 1			
Public Contact:						
Public Contact (Phone):			Fax:			
Public Contact Email:						
Web Address:						
Number of Employees:						
Main Activities:						
International System for Industrial Classification (ISIC) Code(s)						
Reporting Year		20XX				
Pollutant/Material	POLLUTANT RELEASES (tonnes)*#			% Compliance with applicable emission or effluent standard or guideline		
	Air	Water*	Land	Air	Water*	Land
Ammonia						
Carbon dioxide						
Carbon monoxide						
Chrysene						
Copper						
Formaldehyde						
Methane						
Nitrogen oxides (NO <sub>x</sub> )						
Nitrous oxide (N <sub>2</sub> O)						
NM VOC						
Particulate Matter						

<b>NATIONAL ENVIRONMENT AND PLANNING AGENCY (NEPA) POLLUTION REGISTER</b>						
<b>FACILITY POLLUTION PREVENTION AND RELEASE INFORMATION</b>						
<b>Reporting Year</b>	<b>20xx</b>					
Particulate Matter (2.5 µm diameter, filterable)						
Sulphur dioxide						
Toluene						
Total non-methane organic compounds (TNMOC)						
<b>Company XYZ</b> Reporting Year 20XX						
<b>Pollutant/Material</b>	<b>POLLUTANT RELEASES (tonnes)*#</b>			<b>% Compliance with applicable emission or effluent standard or guideline</b>		
	Air	Water*	Land	Air	Water*	Land
Treated Sewage and Trade Effluent						
Biological Oxygen Demand (BOD)						
Chemical Oxygen Demand (COD)						
Faecal Coliform						
Nitrate						
Oil & Grease						
Phosphate						
Solid Waste (Filter Mud)						
Sulphate						
Total suspended solids (TSS)						
Waste Oil						
*Values are preliminary estimates based on estimated flows. Analytical data may not represent loadings at point of discharge.						
# Values in tonnes except for faecal and total coliform in MPN/100 mL. Values for water include liquid releases to surface, salt and underground water bodies, to land and transfers off site. Releases to land include amounts stored on site and off site. A blank value means that no release estimate is required for that medium (air, water or land) and so the % compliance is shown as NA for that medium. There are no standards or guidelines for the following: greenhouse gases (carbon dioxide, nitrous oxide and methane) released to air and the flows of trade effluent and sewage effluent released to water.						
Each facility is required to make a certain number of measurements each year. The percentage of compliance with emission standards/guidelines or effluent standards is based on the number of measurements that are below the standard and the number						

<b>NATIONAL ENVIRONMENT AND PLANNING AGENCY (NEPA) POLLUTION REGISTER</b>	
<b>FACILITY POLLUTION PREVENTION AND RELEASE INFORMATION</b>	
<b>Reporting Year</b>	<b>20xx</b>
of measurements required.	
Note: The PRTR Register consists of substances that have a wide range of toxicities and environmental impacts. A small number may not necessarily imply an insignificant impact, for example, a small emission of a highly toxic substance may be of more concern than a larger emission of a substance of relatively lower toxicity.	
<b>EMISSION CONTROL AND REDUCTION MEASURES IN 20XX</b>	
<b>POLLUTION PREVENTION AND ENERGY CONSERVATION ACTIVITIES</b>	
<b>COMMUNITY ACTIVITIES</b>	
<b>ECOLOGICAL ASSETS AND SOURCE WITHIN 5 km or URBAN AREA</b>	
ON SITE	
OFF SITE (WITHIN 5 km)	
<b>MOST SIGNIFICANT ENVIRONMENTAL ASPECTS</b>	
<b>ENVIRONMENTAL SETTING</b>	
Company XYX	Reporting Year 20

# Appendix 10: Summary Table for Load Calculation

All Load Values are in kg

		A Load Discharged										B Beneficial Use Load			C Net Load Subtract each of Column B from corresponding column in A									
Month	Total Monthly Flow m <sup>3</sup>	BOD <sub>5</sub>	TSS	N	P	COD	F. coli.	Oil & Grease	Heavy Metals	Total Heavy Metals	BOD <sub>5</sub>	N	P	BOD <sub>5</sub>	TSS	N	P	COD	F. coli.	Oil & Grease	Heavy Metals	Total Heavy Metals		
JAN																								
FEB																								
MAR																								
APR																								
MAY																								
JUN																								
JUL																								
AUG																								
SEP																								
OCT																								
NOV																								
DEC																								

# Appendix 11: Wastewater Treatment Plant Checklist



## NATIONAL ENVIRONMENT & PLANNING AGENCY WASTEWATER TREATMENT PLANT CHECKLIST

### PART A – ADMINISTRATIVE DATA

1. Facility Name	2. Facility Address	3. Facility Contact Personnel & Number
4. Inspection Officer	5. Inspection Date	6. Inspection Time
7. Type of Inspection <input type="checkbox"/> Post Permit/Licence # _____ <input type="checkbox"/> Routine <input type="checkbox"/> Other _____		
8. Type of Facility <input type="checkbox"/> Domestic <input type="checkbox"/> Industrial	9. Type of Treatment <input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> Tertiary	
10. Name / Description of Treatment Option		

### PART B

#### GENERAL DATA

Requirements	Yes	No	N/A	Remarks / Details
Treatment process as described in permit				
Records of monthly water quality analyses				
Water quality meet regulatory standards				
Parameters assessed correspond with permit / licence				
Facility fenced & protected from unauthorized access				
Aesthetics of site maintained (vegetation trimmed to give professional appearance)				
All tanks free of algae				

All tanks free of accumulated grease				
Plant is free of malodour or offensive odour				
Operational standby power available				
Signage (plant's ID, sampling and discharge point)				

### PLANT INFLUENT

Requirements	Yes	No	N/A	Remarks / Details
Operational flow meter / Flow monitoring device				
Operational Grease traps (clean and odour free)				
Grease disposal (recycling) in environmentally acceptable manner				
Operational screens				
Removal and disposal of screenings in environmentally acceptable manner				

### FLOW EQUALISATION

Requirements	Yes	No	N/A	Remarks / Details
High water alarm system operational				
Pumps / blowers operational & cycling properly				
Controls / weirs operational to equalize flow				

### AERATION SYSTEM

Requirements	Yes	No	N/A	Remarks / Details
All blowers operational and cycling properly				
All diffusers open and no dead spots (air flow balanced)				

'Mixed liquor' looks and smells satisfactory				
Unusual amount of foam on the surface				

### CLARIFIER

Requirements	Yes	No	N/A	Remarks / Details
Weirs level & free of debris and algae				
Surface free of floatables or sludge clumps				
Skimmers operating properly				
Sludge blanket sufficiently deep				
Sludge return pumps operational				
Effluent free of excess / suspended solids				

### SLUDGE DIGESTOR (AEROBIC/ANAEROBIC)

Requirements	Yes	No	N/A	Remarks / Details
Operational aeration and/or mixing mechanism				
Operational biogas collection/treatment (anaerobic)				
Methane flaring or utilization for power (anaerobic)				
Overwhelming scent of hydrogen sulphide (similar to that of rotten eggs)				
Sludge disposal according to approved disposal plan				

### DISINFECTION CHAMBER and/or STORAGE TANK

Requirements	Yes	No	N/A	Remarks / Details
Operational disinfecting equipment / mechanism				
Unsafe chlorine odours				
Floatables on the water surface in chlorine contact / disinfecting chamber				

Electrical power functioning				
Lamps operational				
Operational high water alarm				

**FILTERS (Sand/Gravel/Tricking/ etc.)**

Requirements	Yes	No	N/A	Remarks / Details
Operational filters (unclogged and without solids backup)				
Operational backwash pumps				
Operational air scour blowers				
Clean screen on micro strainer				

**PONDS/LAGOON**

Requirements	Yes	No	N/A	Remarks / Details
Scum on pond surface and discharge outlet boxes				
Anaerobic conditions observed (malodour & black colour)				
Water grown weeds				

**SUB-SURFACE TREATMENT (Pit/Tile Field/Reed Bed/Evapotranspiration Bed)**

Requirements	Yes	No	N/A	Remarks / Details
At least 30m from any wetland, shoreline, stream bed or drinking water well				
System down-hill from well				
Presence of structure or vehicles on the site				
Presence of deep rooted trees and roots				
Wet / waterlogged surface and malodour				
Clogging within media				
Heavy / dense vegetation within				



- Warning Notice was issued.
  
- The assessment conducted was found to be inconclusive and further investigation is recommended.
  
- No evidence of contamination or other environmental breaches were observed

All information as stated by the Operator (or Representative) and/or observed by the Inspecting Officer was recorded.

---

Name(s) of Assessing Officers  
Date

---

Signature