REPORT FOR TASK B1

IDENTIFICATION AND CHARACTERIZATION OF INDUSTRIES AND A PROGRAMME STRATEGY FOR ENFORCING ENVIRONMENTAL DISCHARGE LIMITS FROM INDUSTRIAL POLLUTERS THAT DISCHARGE INTO KINGSTON HARBOUR

Institutional Strengthening for Enhanced Environmental Management of Kingston Harbour

Component B

IMPROVING THE ENVIRONMENTAL PERFORMANCE OF INDUSTRIES DISCHARGING TO KINGSTON HARBOUR

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY

1 litre	0.2642 U.S. gallons
BCE	Business Council for the Environment
BOD	Biological oxygen demand
COD	Chemical oxygen demand
CWIP	Coastal Water Quality Improvement Program
EAST	Environmental Audits for Sustainable Tourism
EMS	Environmental Management System
GPS	Global Positioning System
IDB	Inter-American Development Bank
ISIC	International System for Industrial Classification
ISO	International Standards Organisation
JEF	Jamaica Employers Federation
JMA	Jamaica Manufacturers' Association
KSA	Kingston and St. Andrew
NEPA	National Environment and Planning Agency
NGO	Non-governmental organisations
NIC	National Irrigation Commission
NSWMA	National Solid Waste Management Authority
NWC	National Water Commission
PRTR	Pollutant release and transfer register
PSOJ	Private Sector Organisation of Jamaica
STP	Sewage treatment plant
UTECH	University of Technology (UTECH)
UWI	University of the West Indies
WRA	Water Resources Authority

EXECUTIVE SUMMARY

This report provides results for the first of four tasks of Component B of an Inter-American Development Bank funded project that addresses the improvement of the environmental performance of industries discharging trade effluent into Kingston Harbour.

The objectives for this task were to:

1. Identify and characterise industrial facilities that discharge trade effluent directly or indirectly into Kingston Harbour; and
2. Develop a programme strategy to assist the National Environment and Planning Agency (NEPA) in enforcing discharge limits from industrial polluters.

Criteria used for the initial selection of facilities were those facilities that a) are potentially licensable under the proposed Trade Effluent and Industrial Sludge regulations, and b) discharge trade effluent that lead directly or indirectly into Kingston Harbour via gullies, sewers, rivers (Rio Cobre, Fresh River/Salt River/Duhaney Rivers) or underground aquifers. The proposed regulations prescribe a limit of 4,000,000 litres/y (1,056,800 U.S. gallons/y) above which facilities are required to obtain a licence. Facilities that discharge toxic pollutants that pose threats to human health or the environment may also be required to obtain a licence even though the discharge may be below the prescribed limit. Since information on the annual volumes of trade effluent discharges was limited but water use information over a recent three month period was readily available, the latter was used as the basis for identifying facilities in the study area.

The number of facilities initially identified was 125 of which 70 were eliminated based on telephone calls, a review of information available at NEPA and our knowledge of industries in the study area. There were 47 facilities that were likely to require a trade effluent licence and 8 with unknown or uncertain water use but which have activities that could trigger a trade effluent licence.

Information was obtained from 39 of the 55 industrial facilities in Kingston, St. Andrew and St. Catherine based on responses to questionnaires and site visits. Figure 1 illustrates the locations of these facilities.

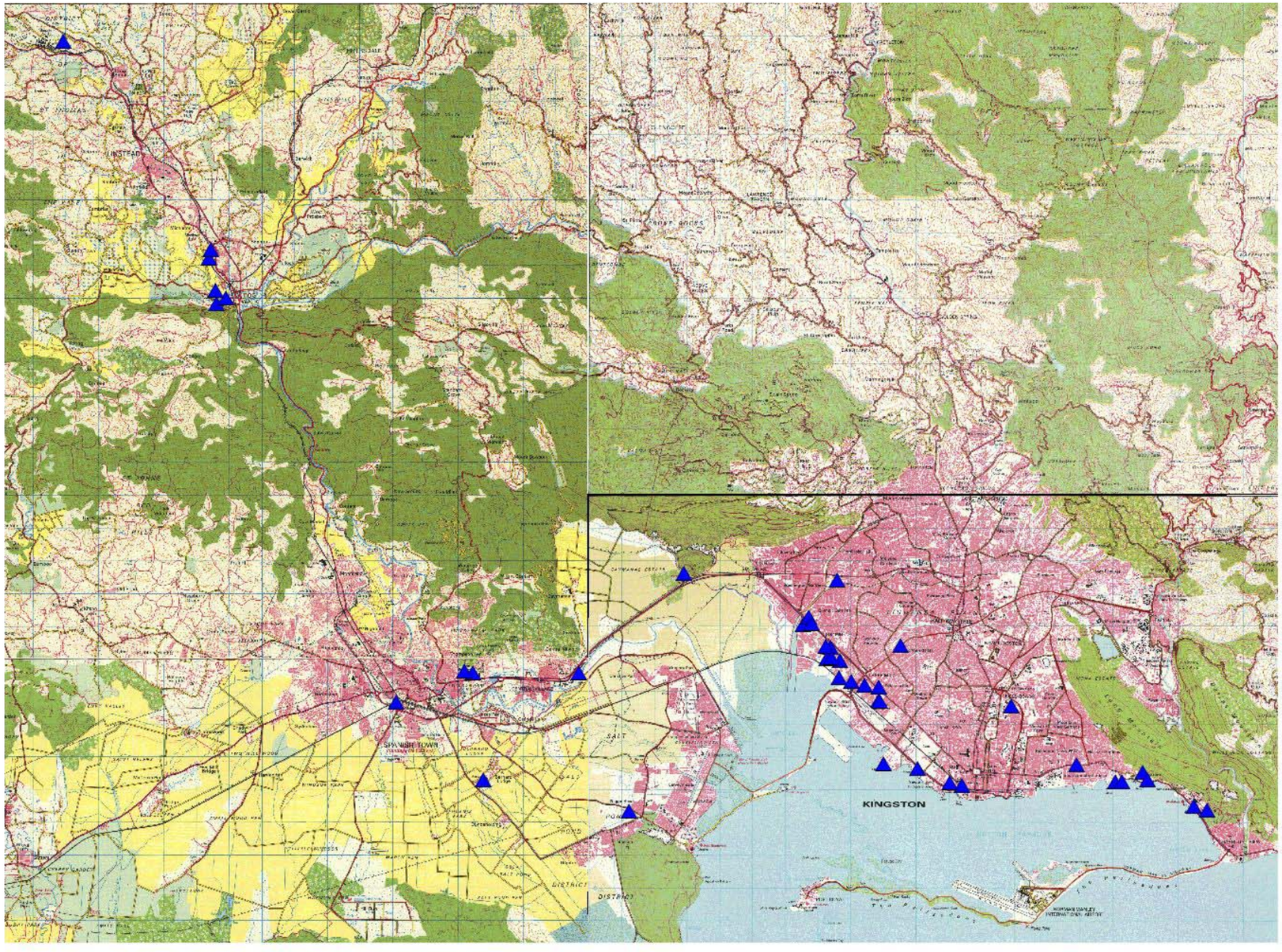
The majority of facilities (31) were located in the western parts of Kingston and St. Andrew (KSA West) which includes the Spanish Town Road and adjacent areas and 7 facilities in the KSA East area (Rockfort and Windward Road areas). There were 11 facilities in the St. Catherine South (Spanish Town, Twickenham Park and surrounding areas) and 6 facilities in St. Catherine North (Bog Walk Walk/Ewarton).

The majority of facilities (30) were engaged in the manufacture of food products and beverages followed by those facilities (13) that manufacture chemicals and chemical products.

Only 4 facilities in the downtown and Bell Road areas discharged into the National Water Commission (NWC) sewer system and the remainder discharged into gullies, roadside drains, streams or the underground that eventually lead to the Harbour. There were 2 facilities in St. Catherine South that discharged some of their effluent into irrigation canals.

There were 25 facilities that had some type of on-site system to treat some or all of their trade effluent of which 13 currently (within the past year) monitored the effectiveness of the treatment system to determine compliance with NEPA Trade effluent standards. At the other 8 facilities with some type of treatment system, monitoring was not current or was done at irregular intervals. There were 15 facilities without any waste water treatment system, of which 5 currently made scheduled measurements of trade effluent. The status of treatment systems at the remaining 19 facilities was unknown.

Figure 1 Map Showing the Locations of Facilities in the Study Area



Trade effluent **flow** was measured at only three facilities. The pollutants that were measured most frequently in trade effluent were nitrate, phosphate, biological oxygen demand (BOD), chemical oxygen demand (COD), oil and grease and coliform. Measurements for BOD and COD were made most frequently and there were fewer data for the remaining pollutants. The concentrations in trade effluent were measured with varying frequencies as follows: daily (3 facilities), fortnightly (1 facility), monthly (4 facilities), quarterly (5 facilities) and every four months (1 facility).

Where trade effluent flow measurements were lacking, they were estimated from water use data corrected for the volumes used in products and for domestic use. The amount of domestic water use was estimated from the number of employees and an assumed average water use per person per shift.

The annual trade effluent flow in 2003 was estimated at 5.229×10^9 L (5,229 million litres) from 37 of the 55 facilities for which estimates were available. The water use for 9 of the remaining 13 facilities was about 8.31×10^7 L (83.1 million litres). This suggests that the facilities for which there were estimates of trade effluent flow accounted for about 98% of the trade effluent volume if we (conservatively) assume that water use for the remaining facilities is similar to the trade effluent flow.

Pollutant Loading

Pollutant loadings, defined as the trade effluent flow multiplied by the concentration, were estimated at 1,903 tonnes/y for BOD (27 facilities) and 6,396 tonnes/y COD (27 facilities). The percentage contributions from the seven (7) facilities with the highest BOD loadings and "All Others" for which there were available data are shown in Figure 2. Similar data for COD are shown in Figure 3. The four largest contributors of trade effluent discharge into the study area account for 90% of the BOD loading and 84% of the COD loading.

These loadings can be compared with the loadings from sewage treatment plants (STPs) that discharge (directly or indirectly) into Kingston Harbour bearing in mind the limited number of data and potential double counting (in those cases where facilities discharge into the sewer system).

Based on the maximum capacity values and the limited biological oxygen demand (BOD) data for STPs, the annual loading from the STPs for which there were available data ranged from 3,600 to 18,000 tonnes BOD and 9,800 to 55,000 tonnes COD.

When available data for the facilities that discharged into the sewer are excluded, industrial facilities considered in this study would account for between 10% and 35% of the BOD loading and 10% to 40% of the COD loading in the harbour.

Strategies to Assist NEPA to Enforce Discharge Limits

The following strategies were proposed to assist in the enforcement of discharge limits in NEPA's proposed Trade Effluent and Industrial Sludge regulations for discharge into the environment and in the National Water Commission's (NWC's) influent standards for the discharge into their sewer system.

The strategies entail direct enforcement (A and C) as well as those that would promote compliance (B) and complement enforcement (C though F).

A. Design of a risk based strategy for investigation, inspection and enforcement

The strategy is based on a risk assessment approach that identifies hazards and understands their likelihood and consequences, offers a systematic method for setting priorities and for allocating scarce resources for investigations, inspections and enforcement of trade effluent (and indeed other pollution) related issues.

Figure 2 Estimates of the Relative BOD Loadings for the Top 8 and Other Facilities That Discharge Trade Effluent Into the Study Area

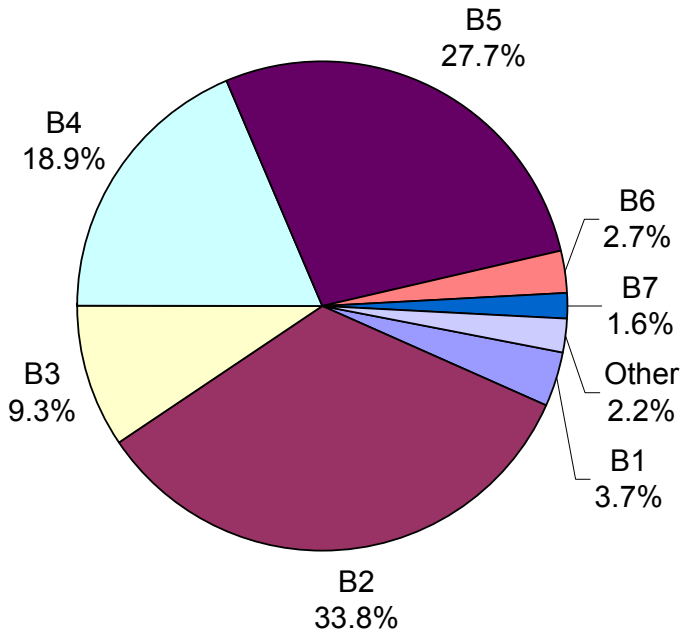
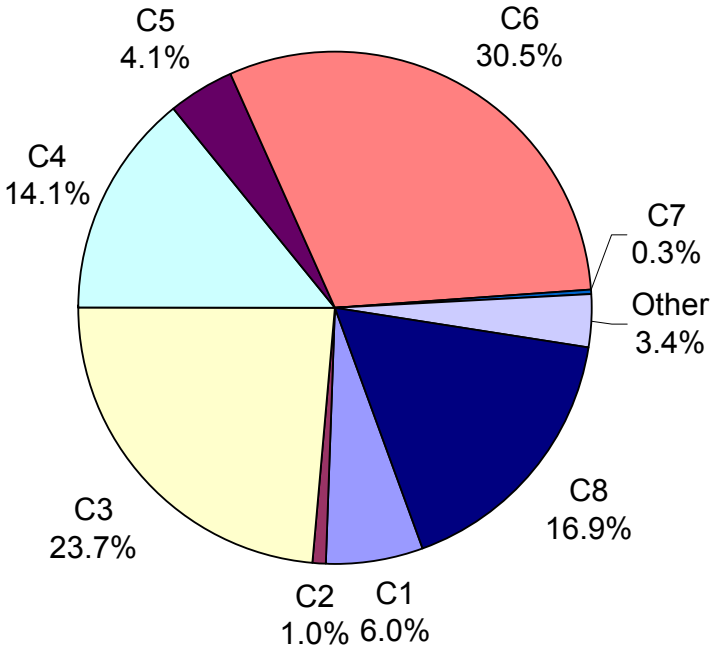


Figure 3 Estimates of the Relative COD Loadings for the Top 8 and Other Facilities That Discharge Trade Effluent Into the Study Area



The assessment of the relative risk posed by facilities to determine potential for human health and environmental impacts could initially be based on the facilities' discharge fees since the per tonne fees in the proposed trade effluent and industrial sludge regulations took into account, in a very simplified manner, the relative impact (toxicity) of pollutants. Over time, more precise pollutant-specific metrics for relative risk can be used if necessary. The relative risk would be weighted based on factors such as compliance history and complementary environmental protection activities. The resulting weighted relative risk would then be ranked and used as the basis for setting priorities for enforcement visits and verification monitoring.

B. Outreach and Sector Based Training

The proposed strategy is geared towards the industrial facilities and builds on previously designed strategies for training NEPA staff and public education and outreach programmes. Additional stakeholders were identified.

The previously identified themes and messages could be complemented and enhanced by clearly articulating and reinforcing the need for the regulations, the principles and strategies that underpin the regulations, complementary activities, emphasising the reduction in discharge fees when loads are reduced and how voluntary actions can complement the regulations.

In view of the long delay in enacting the proposed air quality and sewage regulations and limited follow up actions on Section 17 reports and post permit enforcement, industry has adopted a "wait and see" attitude and indeed question the seriousness and ability of NEPA to enforce regulations. It is therefore vital for NEPA to overcome these views by clearly specifying and abiding by the schedule for implementation of the regulations and by engaging the licensees and others in an effective outreach strategy.

Additional strategies proposed include building deeper and stronger partnerships with private sector organizations, e.g., Jamaica Manufacturers' Association (JMA), Business Council on the Environment (BCE), Private Sector Organisation of Jamaica (PSOJ), as the means to provide outreach and obtain feedback on implementation issues

The need for training of NEPA staff was also anticipated by NEPA and outlines of the content of training modules have been developed based on a gap analysis to identify training needs. A similar detailed exercise was not specifically done for the licensees but it was assumed that similar gaps exist. This is borne out by the level of information that was evident from the site visits and the data available at NEPA. It is recommended that the courses for the licensees could be similar to those provided to NEPA staff – but from the perspective of the licensee.

We proposed training modules that are geared to training licensees in the study area. The modules could address how to comply with the regulations and how to implement cleaner production and pollution prevention activities that would reduce pollutant loads and hence discharge fees.

C. Designing a strategy for a trade effluent and surface water sampling monitoring programme to assess industrial trade effluent impacts

A strategy was proposed for a trade effluent and surface water sampling and monitoring programme to assess discharges from the facilities that discharge into Kingston Harbour. Such a program should be compatible with an overall national program. Current documentation of NEPA's overall monitoring programme was limited to what is the articulated in NEPA's corporate plan. It is recommended that a detailed programme be developed and fully documented.

D. Continued promotion of the adoption of Environmental Management Systems (EMS) by industries

NEPA spearheaded the development of a Draft White Paper that outlined a national policy and strategy for EMS in Jamaica. Strategies to promote EMS, for industry to implement EMS and criteria for acceptability of such systems by NEPA were included in a Draft White Paper and are considered complete. Further promotion of EMS among the facilities that discharge into Kingston Harbour should entail renewed promotion of the establishment of EMS through the JMA and inviting facilities who have been audited and who have EMS to relate their experiences and to publish these experiences.

E. Development of incentives schemes to complement regulatory enforcement

Several jurisdictions now employ a variety of incentives that complement regulations in order to increase awareness for the implementation of sound environmental practices and to promote compliance with environmental regulations. The proposed Trade Effluent and Industrial Sludge regulations include some of these incentives, namely, effluent charges and allowance for future trading within defined watersheds. Additional incentives proposed include:

- Establishment of national awards and/or means to recognise environmental performance for facilities that exceed regulatory requirements. The awardees could be granted greater reporting flexibility, expedited permitting and licensing and access to revolving funds for environmental projects to reduce pollutant discharges.
- Establishment of an Environmental Neighbours Partners scheme which recognises facilities or companies that implement local environmental projects in partnership with the neighbouring communities. The goal would be to promote communication between facilities and the adjacent community.
- Favourable loans (to be developed in Task B4)

F. Development, establishment and publication of a bank of Jamaican case studies for successful pollution prevention, clean technology production and effluent reduction projects.

We proposed that NEPA encourage the documentation of successful application of environmental management systems and pollution prevention and pollution control projects and publish them on a section of the NEPA web site that is devoted to pollution prevention, compliance assurance and enforcement information. The web pages could also include links to similar web sites in other countries. The publication of such activities could also be linked to national recognition and awards initiatives.

1. INTRODUCTION

1.1 Background

The Inter-American Development Bank (IDB) has funded a project for institutional strengthening to support environmental management of Kingston Harbour. Component B of the project addresses the improvement of the environmental performance of industries discharging trade effluent into Kingston Harbour.

The purpose of this component is to support the National Environment and Planning Agency (NEPA) in the development of a strategy focused on industrial dischargers by leading the biggest polluters through stages of improved environmental management. In addition, a fund would be developed, or existing funds leveraged, to help finance process improvements in industries that discharge trade effluent into the harbour.

Component B entails four tasks, namely:

- Development of effective strategies for enforcing effluent quality limits for industrial discharges
- Conduct of Clean Production/EMS audits of two different industries that discharge to the harbour.
- Assistance to the most serious offenders to improve their environmental management practices
- Development of schemes for financing improved environmental performance of industries.

This report provides results for the first of these tasks.

1.2 Objectives - Development of Effective Strategies for Enforcing Effluent Quality Limits for Industrial Discharges

The objectives for this task were to:

a) Identify and characterise industrial facilities that discharge trade effluent directly or indirectly into Kingston Harbour; and

b) Develop a programme strategy to assist NEPA in enforcing discharge limits from industrial polluters

The bases for the selection of the industrial facilities, the strategies employed to collect the required information and a summary of the information collected are described in Section 2. Strategies to assist NEPA in enforcing discharge limits from industrial polluters are described in Section 3.

2. IDENTIFICATION AND CHARACTERIZATION OF INDUSTRIES

2.1 Bases For The Selection Of Facilities

Two types of criteria were used to identify and select facilities that discharge into Kingston Harbour. The first was a geographic criterion which allowed the inclusion of all facilities in Kingston, St. Andrew and St. Catherine that discharge directly or indirectly into the Harbour via gullies, sewers, rivers (Rio Cobre, Fresh River/Salt River/Duhaney Rivers) or the underground aquifers that lead to Kingston Harbour.

Industrial facilities in St. Andrew that discharge into the Hope River and those in St. Catherine that are not connected to the Rio Cobre are excluded. For example, the areas that drain into the Salt Island Creek which drains into the Galleon Harbour or Great Salt Pond are excluded.

The effluent from the Bernard Lodge Sugar Factory is in part used for irrigation and it is unclear whether or not the effluent could drain into the Rio Cobre via a series of gullies.

To be conservative and to avoid a detailed study of ground water flow, the Bernard Lodge Sugar Factory is included. The geographic area covered by this criterion will be referred to as the study area.

The second criterion was based on the loading from industries that are licensable under the proposed Trade Effluent and Industrial Sludge regulations[1]. The drafting instructions for these regulations are in the process of being combined with those for the proposed Sewage Regulations and the Sewage Sludge Regulations.

The threshold for requiring a licence under the proposed Trade Effluent and Industrial Sludge regulations is for the discharge of at least 4,000,000 litres (1,056,800 U.S. gallons) of trade effluent per year or 333,333 L/month (88,067 U.S. gallons/month). The regulations include provisions for regulating facilities that discharge toxic pollutants even though the discharge of trade effluent is less than 4,000,000 L/y. The regulation may take the form of requiring a licence or the development and implementation of sector specific guidelines or codes of practice.

Information on the volume of trade effluent discharged was limited but data for water use were more readily available so the water use data were used as an initial measure for trade effluent discharge volumes. In general, apart from facilities whose products contain significant amounts of water (e.g., manufacturers of beverages and water based paints), this will be a reasonable estimate when account is taken of water used for domestic purposes within each facility. Waste water used for domestic purposes (i.e., in wash basins, toilets, showers) is considered sewage and is not considered here except when such sewage is discharged from industrial facilities along with trade effluent. This approach is consistent with that used in the trade effluent regulations where trade effluent alone or combined with sewage is considered as trade effluent.

Several strategies were used to identify industrial facilities in the study area that would be licensable under the proposed regulations. These included:

- Analysis of water use from NWC, National Irrigation Commission (NIC) and Water Resources Authority (WRA) well data

[1] Drafting Instructions for Trade Effluent and Industrial Sludge Regulations
http://www.nepa.gov.jm/regulations/instructions/DraftingInstructionsNEPACSDMar082004.pdf

- A review of industrial facilities that are members of the Jamaica Manufacturers' Association (JMA)
- A review of "Section 17" reports

Water use data over a recent three month period (March, April and May 2004) were provided by NWC. Although water use over a three month period may not always reflect annual use, these were the only data that were readily available from NWC. As an initial screening method, the average use for the three month period was considered reasonable. In the course of the subsequent survey, facilities were asked to provide **annual** water use data and there were no significant inconsistencies between the two estimates. The NWC water use data were reviewed and sorted to extract industrial customers in Kingston, St. Andrew and St. Catherine whose average monthly water use was greater than 333,333 litres. The names of the facilities in NWC data base frequently did not reflect facility or company names and additional means (see below) were used to indicate water use for a facility.

Since some facilities obtain water other than from NWC (e.g., river water, their own wells or irrigation water from the NIC), a list of facilities known to have such sources was compiled based on data from the WRA and our knowledge of the industries in the Bog Walk, Spanish Town and Spanish Town Road areas.

A listing of JMA members located in Kingston, St. Andrew and St. Catherine was compared with the list of NWC industrial customers. In some cases, JMA members were added to the list of potential facilities even though water use information was not readily identifiable. In other cases, the addresses in the NWC data and the JMA list were used to match the water use for a facility.

Information in NEPA's "Section 17" files was reviewed. Section 17 of the Natural Resources Conservation Authority Act (1991) authorises NRCA to compile information on the discharge of pollutants from various types of facilities. The data in these files reflect facilities that had been sent "Section 17" notices and/or companies that had responded by providing the requested information. NEPA also conducts monitoring at selected facilities and these data were also obtained and reviewed. The Section 17 and other NEPA data included water use data (but not trade effluent volume) as well as concentration data in trade effluent.

A total of 125 facilities were identified by all of the above means for closer examination.

2.2 Strategy For Site Visits

Telephone calls were made to all 125 facilities and based on information provided during these telephone calls, the facilities were sent questionnaires by email or fax. It was indicated that we would complete the questionnaire during one or two site visits. In some cases, the facilities were eliminated from further consideration because they were no longer in business, had drastically changed their operation or had water consumption and/or activities that would not likely trigger a requirement for a trade effluent licence. Examples of these cases included facilities that had changed their manufacturing operation (since Section 17 notices were sent) to exclusive trading activity of the same or similar products.

A second site visit was scheduled to obtain accurate information on the locations of sampling points and the points where trade effluent discharges and combined trade effluent and storm water crossed the facility's property boundary.

The 125 facilities were segregated into three categories A, B and X as follows.

Category A Facilities with water use or trade effluent volumes > 4,000,000 litre/y and with activities that would likely require a trade effluent licence.

Category B Facilities with water use that was less than 4,000,000 litres/year (1,056,800 U.S. gallons/year) or with unknown or uncertain[2] water use but with activities that could trigger the requirement for a trade effluent licence.

Category X Eliminated from further consideration based on water use and/or their known current activities

Appendices 1 (categories A and B) and 2 show the companies considered, the assigned categories and the status of information obtained from telephone calls, visits and questionnaires. There were 47 facilities in category A (will or likely to require a trade effluent licence) 8 in category B (with unknown or uncertain water use but which have activities that could trigger a trade effluent licence) and 70 in category X.

In the majority of cases, the information on the questionnaires was completed during the site visit. In some cases, there were delays in the provision of promised information. In a few instances, the completed questionnaires were returned and a single site visit was needed to obtain Global Positioning System (GPS) information. Despite several attempts, some facilities were not contacted or times for mutually convenient site visits could not be arranged.

2.3 Analysis of Data Obtained from Site Visits and Questionnaires

Of the 55 facilities in categories A and B, completed or partially completed questionnaires were obtained from 39. Estimates of trade effluent flow data were available for 34 facilities while pollutant concentration data were available for only 28 facilities (based on the most frequently measured pollutant namely biological oxygen demand (BOD)). The sampling method used at all but two facilities was grab sampling. Few (14) facilities had current (data for 2003 or more recent) pollutant concentration data. Flow measurements for trade effluent streams (as opposed to estimates) were made at only four facilities.

We identified 13 facilities that are likely to have significant trade effluent flows for which there were no trade effluent pollutant concentration and flow data to estimate pollutant loads. We recommend that NEPA consider including these facilities in their monitoring programme in order to fill the data gaps.

The information obtained from the site visits and questionnaires is summarized by the following parameters:

- Parish
- Type of industry based on the International System for Industrial Classification (ISIC) code
- Nature of the receiving structure or medium (sewer, gully/drain, stream/river, public storm water drain or road, land)
- Type of treatment
- Pollutant loading

2.3.1 Summary by Parish

Four general locations are identified (see Table 2-1). The parishes of Kingston and St. Andrew (KSA) were subdivided into the KSA East (Rockfort/Windward Road area) and KSA West. The general locations of the facilities are illustrated in Figure 2-1 using the best available base maps for the study area. As expected, the majority of facilities (31) in categories A and B were located in the KSA West area

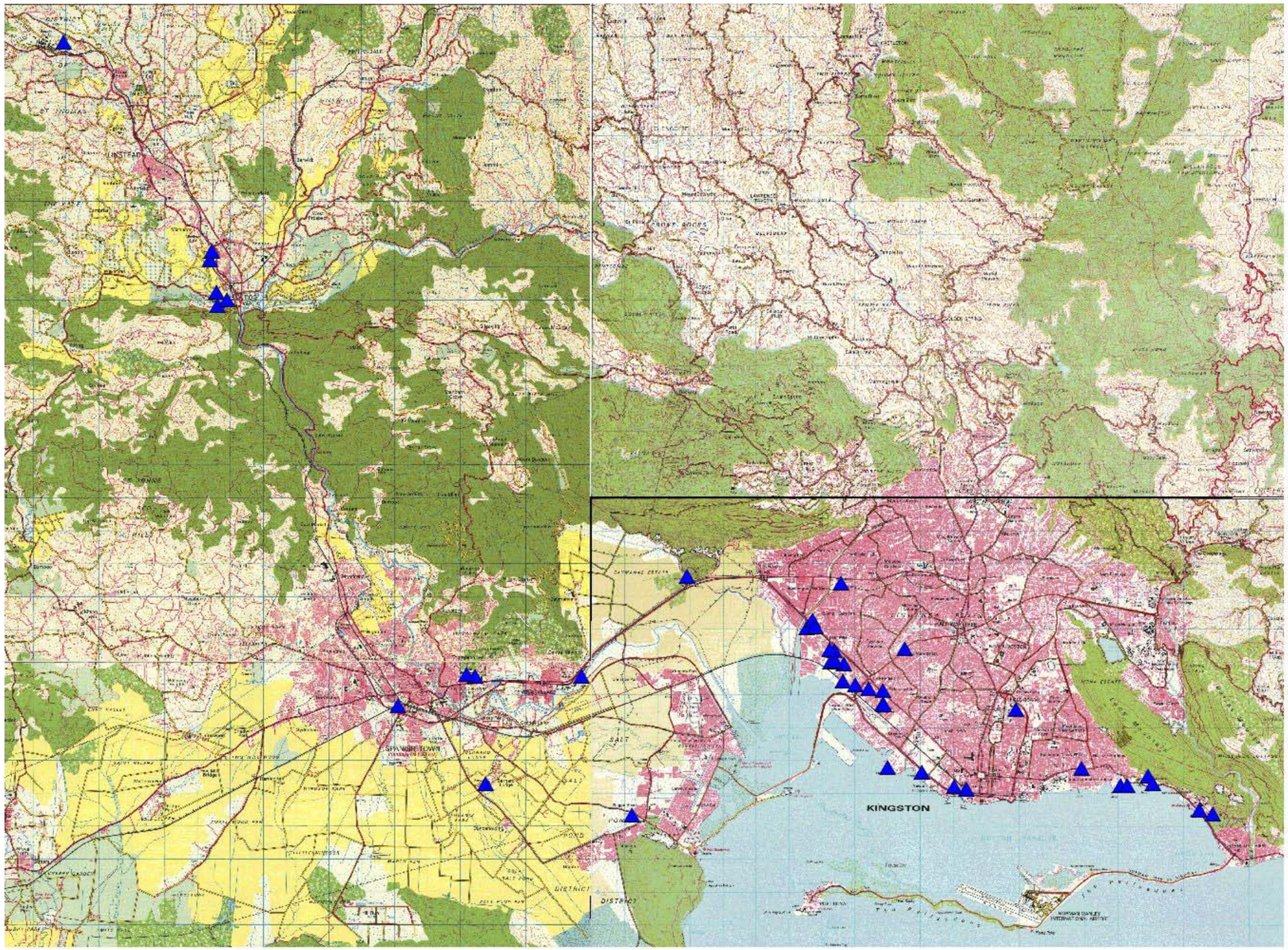
[2] Uncertain water use arises when the NWC water use is indicated as an estimate. Unknown water use arises when the facility obtains water other than from NWC sources (e.g., own well or stream).

which includes the industrial areas along Spanish Town Road, Marcus Garvey Drive, Bell Road, downtown Kingston, Arnold Road and Hagley Park Road. There were 7 facilities in the KSA East area.

Table 2-1 Facilities that Discharge Trade Effluent into Kingston Harbour - Geographic Distribution

Location	Count
Kingston & St. Andrew – West (Spanish Town Rd, Downtown, Washington Blvd, Hagley Park Rd, Arnold Rd)	31
Kingston & St. Andrew – East (Windward Road/Rockfort)	7
St. Catherine - South (Spanish Town & vicinity)	11
St. Catherine – North (Bog Walk/Ewarton)	6
Total	55

Figure 2-1 Map Showing the Locations of Facilities in the Study Area



St. Catherine was divided into two areas – St. Catherine North and St. Catherine South. There were 11 facilities in the St. Catherine South area (Spanish Town and surroundings (White Marl/Ferry/ Naggo Head/Twickenham Park)). There were 6 facilities in St. Catherine North (Bog Walk Walk/Ewarton).

2.3.2 Summary by Type of Industry

Industrial and commercial activities in economies are classified based on the ISIC codes. The numbers of facilities in each of the categories defined by the first two digits of the ISIC codes are summarised in Table 2-2. The majority of facilities (30) were engaged in the manufacture of food products and beverages (ISIC Code 15) followed by those facilities (13) that manufacture chemicals and chemical products (ISIC Code 24). The numbers of facilities in these two groups are broken down further as shown in Table 2-3.

2.3.3 Receiving Structure or Medium

The receiving structure or medium was defined based on the structure or medium at the property boundary. Of the 55 facilities in categories A and B there were only four (4) [in the downtown and Bell Road areas] that discharged into the sewer since they are connected to the NWC sewer system. The remainder of facilities in the Spanish Town Road area discharge into gullies or to roadside drains that eventually lead to the Harbour.

Facilities in the KSA East (Rockfort/Windward Road area) discharge some or all of their effluent into gullies or drains that lead into the Harbour.

Facilities in the St. Catherine South (Spanish Town and surrounding areas) areas discharge effluent onto land either through irrigation canals or directly on to land. The facilities in the Bog Walk area of St. Catherine North are located relatively close to each other and discharge their effluent on to land or into gullies or streams that lead into the Rio Cobre.

2.3.4 Summary by Wastewater Treatment Technology

There were 25 facilities that had some type of on-site system to treat to treat some or all of their trade effluent. A breakdown by the type of the main on-site treatment technology is given in Table 2-4. The treatment systems often employed more than one type of physical, chemical or biological process and the treatment system is characterised by the main type of process.

Of the 21 facilities that had treatment systems to partially or completely treat some or all of the trade effluent, 13 currently (within the past year) monitored the effectiveness of the treatment system to determine compliance with NEPA Trade effluent standards. At the other 8 facilities with some type of treatment system, monitoring was not current or was done at irregular intervals.

Of the 15 facilities without any waste water treatment system, there were only 5 facilities that currently made scheduled measurements of trade effluent.

There were 15 facilities where it is not known if they have a treatment system for trade effluent and for which no current monitoring data were available.

There were only four facilities at which all of the trade effluent is handled by the treatment system and for which there were current routine measurements to determine the effectiveness of their treatment system and compliance with NEPA Trade Effluent Standards. At the other four facilities, a portion of the waste is treated and the remainder is either not treated and discharged or is sent off-site for disposal in a NWC sewage treatment plant.

Table 2-2 Facilities that Discharge Trade Effluent into Kingston Harbour - Distribution by 2-Digit ISIC Code

Main 2 digit ISIC Code	Count	Description
15	30	Manufacture of food products and beverages
16	1	Manufacture of tobacco products
19	1	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
23	1	Manufacture of coke, refined petroleum products and nuclear fuel
24	13	Manufacture of chemicals and chemical products
25	1	Manufacture of rubber and plastics products
26	1	Manufacture of other non-metallic mineral products
27	1	Manufacture of basic metals
28	2	Manufacture of fabricated metal products, except machinery and equipment
29	1	Manufacture of machinery and equipment n.e.c.
40	3	Electricity, gas, steam and hot water supply
Total	55	

n.e.c. Not elsewhere classified

Table 2-3 Facilities in the Study Area that Manufacture Food Products and Beverages (ISIC Code 15) and chemicals and chemical products (ISIC Code 24)

ISIC Code	Count	Description
1511	3	Production, processing and preserving of meat and meat products
1513	5	Processing and preserving of fruit and vegetables
1514	1	Manufacture of vegetable and animal oils and fats
1520	1	Manufacture of dairy products
1531	1	Manufacture of grain mill products
1541	1	Manufacture of bakery products
1542	1	Manufacture of sugar
1544	1	Manufacture of macaroni, noodles, couscous and similar farinaceous products
1549	3	Manufacture of other food products n.e.c.
1551	4	Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials
1553	2	Manufacture of malt liquors and malt
1554	7	Manufacture of soft drinks; production of mineral waters
Subtotal Code 15	30	
2411	3	Manufacture of basic chemicals, except fertilizers and nitrogen compounds
2422	4	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
2423	3	Manufacture of pharmaceuticals, medicinal chemicals and botanical products
2424	3	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
Subtotal Code 24	13	

Table 2-4 Facilities that Discharge Trade Effluent into Kingston Harbour - Distribution by Type of On-Site Treatment Technology

On-Site Treatment Technology	Number of Facilities
Aerobic System	2
Anaerobic treatment	5
Impoundments	1
Screening	
API separator	4
Settling	3
Other	
Custom Chemical treatment/sludge separation	6

2.3.5 Trade Effluent Volume, Pollutants and Pollutant Loading

Trade effluent flow was measured at only three facilities. There were only three (3) facilities where concentrations were measured on a daily basis. Measurements of pollutant concentrations in trade effluent were made fortnightly at one (1) facility, monthly at four (4) facilities, quarterly at five (5) facilities and every four months at one (1) facility. Where flow measurements were lacking, trade effluent flows were estimated from water use data corrected for the volumes used in products and for domestic use. The amount of domestic water use was estimated from the number of employees (or in some cases employees plus contractors that are normally on site) and an assumed average water use of 100 L/person/8 h shift. In one case, a higher value was used based on employees' activities (showering after each shift).

The annual trade effluent flow in 2003 was estimated at 5.228×10^9 L (5,249 billion litres) from 37 of the 55 facilities for which estimates were available. The water use for 16 of the remaining 18 facilities was about 8.31×10^7 L (83.1 million litres). This suggests that the facilities for which there were estimates of trade effluent flow accounted for over 98% of the trade effluent volume if we (conservatively) assume that water use for the remaining facilities is similar to the trade effluent flow.

The facilities with the ten highest annual trade effluent flows ranged from 1,418 million to 105 million litres. The flows of once through cooling water (such as at power generating stations and other industries that use cooling water that is not mixed with any other trade effluent) were not included in the estimates for annual trade effluent flows.

2.3.5.1 Pollutants

The pollutants that were measured most frequently in trade effluent were nitrate, phosphate, biological oxygen demand (BOD), chemical oxygen demand (COD), oil and grease and coliform. Measurements for BOD and COD were made most frequently and there were fewer data for the remaining pollutants. Apart from measurement of chromium at one facility, no measurements of heavy metals or organic compounds were reported. The draft trade effluent regulations include sector based lists of the minimum pollutants that are required to be monitored. It should be noted that where warranted, the regulations may require facilities to monitor additional pollutants. In general, the main gaps in the pollutants required to be monitored are in the paint industry where there are no data for organic solvents (e.g., toluene, xylene, volatile organic compounds) or metals.

2.3.5.2 Pollutant Loading

Pollutant loadings are defined as the trade effluent flow multiplied by the associated concentrations for reach pollutant. Apart from three facilities where flows were measured, flow data were based on estimates derived from water use, water in products and domestic consumption. The majority of the concentration data were based on single measurements instead of (ideally) averages derived from regularly scheduled monitoring. Given the limitations of the flow and concentration data, the estimates of pollutant load must be heavily qualified. Loadings only for BOD and COD were estimated since data for other pollutants were less extensive. Where BOD concentration data were available but COD were not, (8 cases) the COD was assumed to be three times that for BOD.

The estimated annual loadings were 1,903 tonnes/y for BOD (27 facilities) and 6,396 tonnes/y COD (27 facilities). The percentage contributions from the seven (7) facilities with the highest BOD loadings and "All Others" for which there were available data are shown in Figure 2-2. Similar data for COD are shown in Figure 2-3. The four largest contributors of trade effluent discharge into the study area account for 90% of the BOD loading and 84% of the COD loading. The geographic distributions of the BOD and COD loadings (based on the data available) are shown in Figure 2-4.

Figure 2-2 Estimates of the Relative BOD Loadings for the Top 7 and Other Facilities That Discharge Trade Effluent Into the Study Area

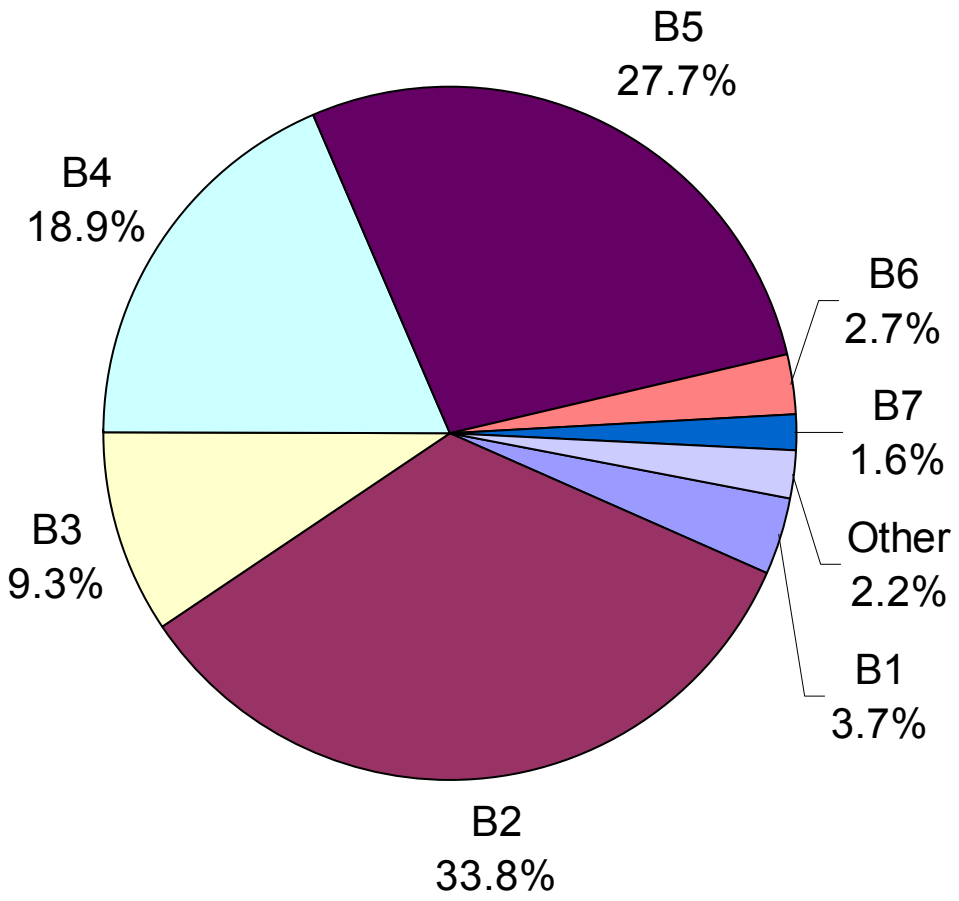
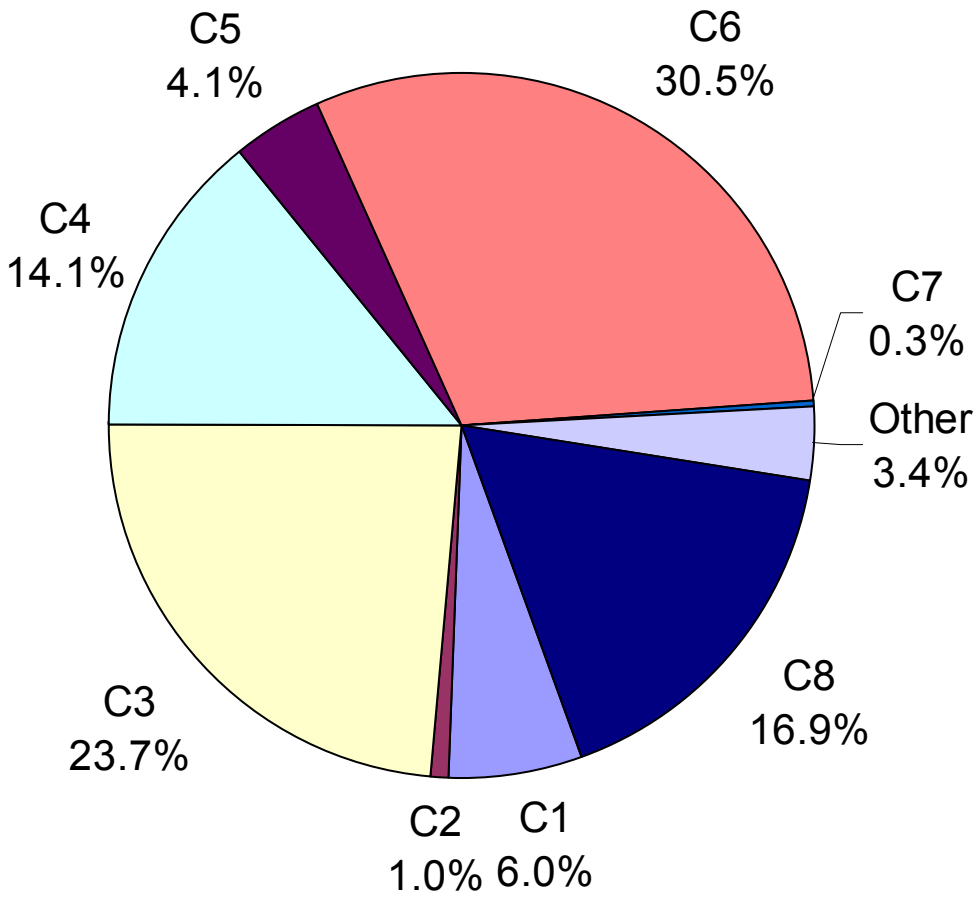


Figure 2-3 Estimates of the Relative COD Loadings for the Top 8 and Other Facilities That Discharge Trade Effluent Into the Study Area



These loadings can be compared with the loadings from sewage treatment plants (STPs) that discharge (directly or indirectly) into Kingston Harbour bearing in mind the limited number of data and double counting. Some double counting will occur since some of the facilities discharge into the sewer and hence would be included in the loading for the STPs. Of the 54 facilities surveyed, four (4) discharged into the sewer and of these only two (2), one of which was the facility with the largest BOD loading, had BOD data that are included in the loading from the industrial facilities. The STPs in Kingston, St. Andrew and St. Catherine (Spanish Town/Independence City/Portmore areas) have a maximum flow capacity of ~124 x 10^6 L/day of which the Greenwich and Western Plants account for 74.8 x 10^6 l/day and the Independence City and Greater Portmore plants account for 26.9 x 10^6 L/day.

There are apparently very limited data on the effluent quality from STPs. The only data found were those in a Coastal Water Quality Improvement Program (CWIP) report "Operation and Maintenance Programme and Strategy for NWC's Wastewater Facilities"[3] report and data supplied by NWC[4] for a sampling programme conducted between 2000 and 2001. In the latter programme, between 3 and 6 samples were taken at 8 of the STPs in Kingston and St. Catherine. The available data are given in Table 2-5.

Based on the maximum capacity values and the limited BOD data for STPs, the annual loading from the STP plants for which there were available data ranged from 3,600 to 18,000 tonnes for BOD and 9,800 to 55,000 tonnes for COD. It must be stressed that these estimates are based on extremely limited data for pollutants and are based on the maximum daily flow.

When available data for the industrial facilities that discharged into the sewer are excluded and the high and low estimates for STPs are taken into account, industrial facilities considered in this study could account for between 10% and 35% of the BOD loading and 10% to 40% of the COD loading in the Harbour.

2.4 Database and Maps of Monitoring and Discharge Locations

The locations where samples are taken for monitoring trade effluent (concentrations and flow) as well as where the effluent streams cross the property boundaries were mapped using a GPS instrument. The trade effluent streams are defined to include streams with trade effluent alone or combined with sewage. A description of all trade effluent sampling and discharge points is given in Appendix 3 and their coordinates in Appendix 4.

Maps showing the locations of the sampling and discharge points are given in Figures 2-4 and 2-5 (KSA East), Figures 2-6 to 2-9 (KSA West), and Figures 2-10 and 2-11 (St. Catherine North and South).

Photographs showing selected sampling and discharge points are provided in the Appendix 7. The photographs indicate the very wide ranges in the nature of wastewater treatment systems (or lack thereof) and the state of trade effluent discharge from industrial facilities in the study area.

[3] Waste Research Management and Training Centre (2002). Operation and Maintenance Programme and Strategy for NWC's Wastewater Facilities, prepared for Government of Jamaica's National Environment and Planning Agency and the United States Agency for International Development.

[4] Cain, S. (2004). Personal communication.

Table 2-5 Estimates of Loadings from Sewage Treatment Plants in the Study Area

Location	Region#	Capacity (10^6 L/d)	Concentration (mg/L)		Loading (Tonnes)	
			BOD*	COD *	BOD*	COD*
Greenwich T/Works	KSA	52.80	76.1	182	1,467	3,508
Greenwich T/Works	KSA	52.80	584	1,751	11,245	33,736
Western T/Works	KSA	22.00	76.1	182	611	1,461
Western T/Works	KSA	22.00	584	1,751	4,686	14,057
Greater Portmore	Portmore	13.60	102	305	505	1,515
Independence City	Portmore	13.26	109.2	368	528	1,781
Bridgeport	Portmore	7.60	96.6	342	268	949
Bridgeport	Portmore	7.60	268	949	743	2,632
Greater Portmore A	Portmore	6.81	12.6	53	31.3	132
Greater Portmore B	Portmore	6.81	18.6	70	46.2	174
Greater Portmore A	Portmore	6.81	31.3	132	77.7	327
Greater Portmore B	Portmore	6.81	46.2	174	115	432
Ensom City Housing	Spanish Town	3.80	35.7	125	49.5	173
Ensom City Housing	Spanish Town	3.80	44.4	133	61.6	185
Eltham Park	Spanish Town	2.30	4.4	10	3.69	8.4
Horizon Park	Spanish Town	1.90	27	38	18.7	26.4
Elletson Flats	KSA	1.10			-	-
Twickenham Park	Spanish Town	0.95	0.1	5	0.03	1.73
Hamilton Gardens	Portmore	0.76	9.4	52	2.61	14.4
Hamilton Gardens	Portmore	0.76	4.44	13.3	1.23	3.69
Angels Estate	Spanish Town	0.68	55	88	13.7	21.9
Dela Vega City	Spanish Town	0.50	34	77	6.21	14.1
Boone Hall	KSA	0.40	9.6	20.7	1.39	2.99
Lime Tree Grove	Spanish Town	0.38	18	31	2.50	4.30
Whitehall Avenue	KSA	0.35	127	478	16.4	61.4
Ebony Vale	Spanish Town	0.27	26.9	91	2.65	8.97
Ebony Vale	Spanish Town	0.27	3.15	9.46	0	0.93
Barbican Mews	KSA	0.26	15	37.7	1.45	3.63
College Green	KSA	0.26	79.7	196	7.68	18.89
Grove Manor	KSA	0.25	12.5	35	1.12	3.15
Acadia	KSA	0.22	112	323	9.01	25.9
Hughenden	KSA	0.15	6.4	15	0.36	0.84
Caymanas Gardens	Portmore	0.10	31.8	136	1.18	5.06
Total (high)		-			18,051	54,887
Total (low)					3,554	9,801

KSA – Kingston and St. Andrew

* The mean COD/BOD ratio for measurements was 3.0 excluding one outlier. Entries in red are based on assumed values: BOD and COD concentration data for Greenwich T/Works were assumed to be the same as that for Western T/Works and missing COD concentrations were assumed to be 3.0 times the BOD values.

Figure 2-4 Map Showing Locations of Monitoring and Discharge Points for Facilities in Kingston & St. Andrew East A

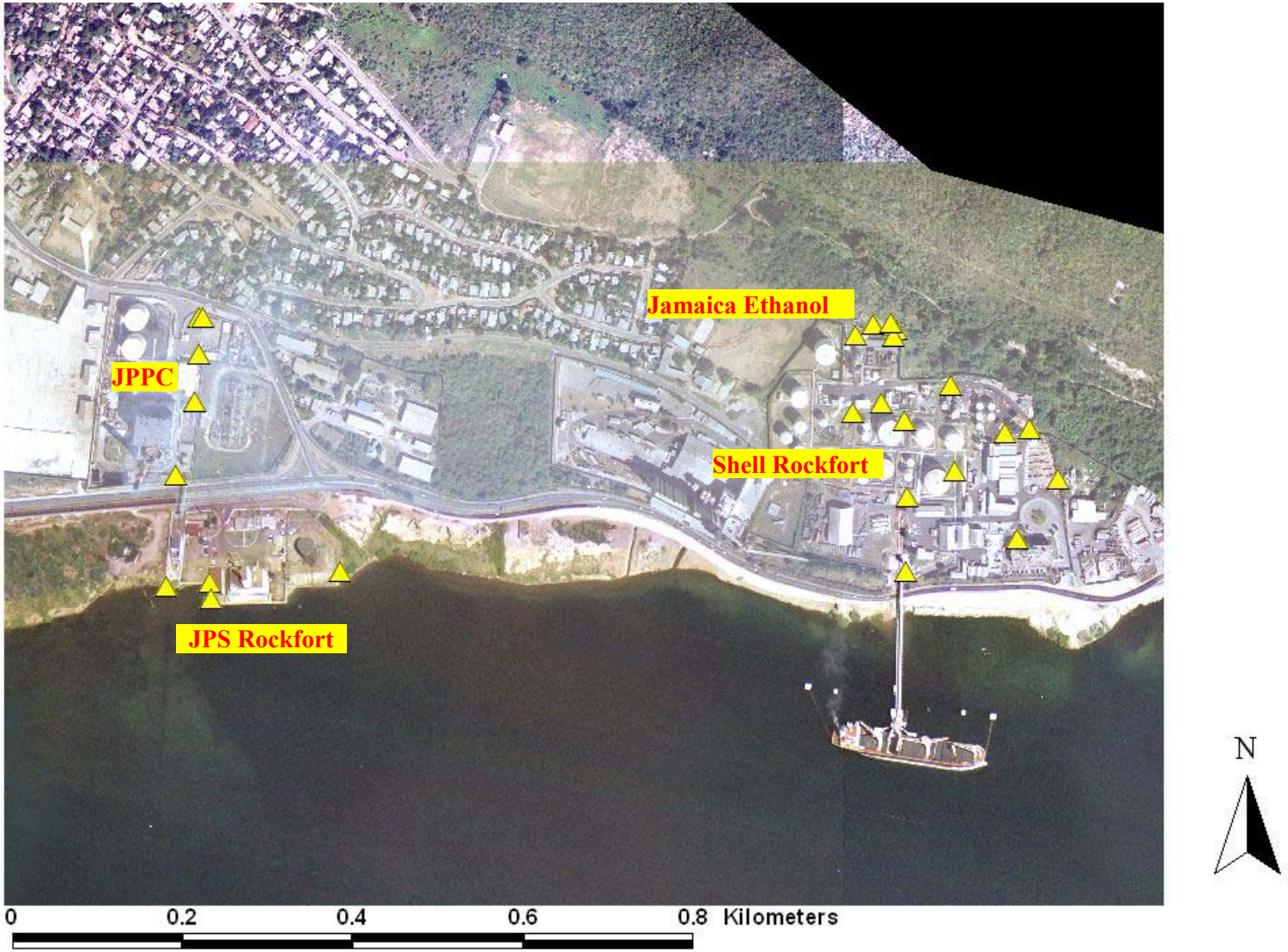


Figure 2-5 Map Showing Locations of Monitoring and Discharge Points for Facilities in Kingston & St. Andrew East B

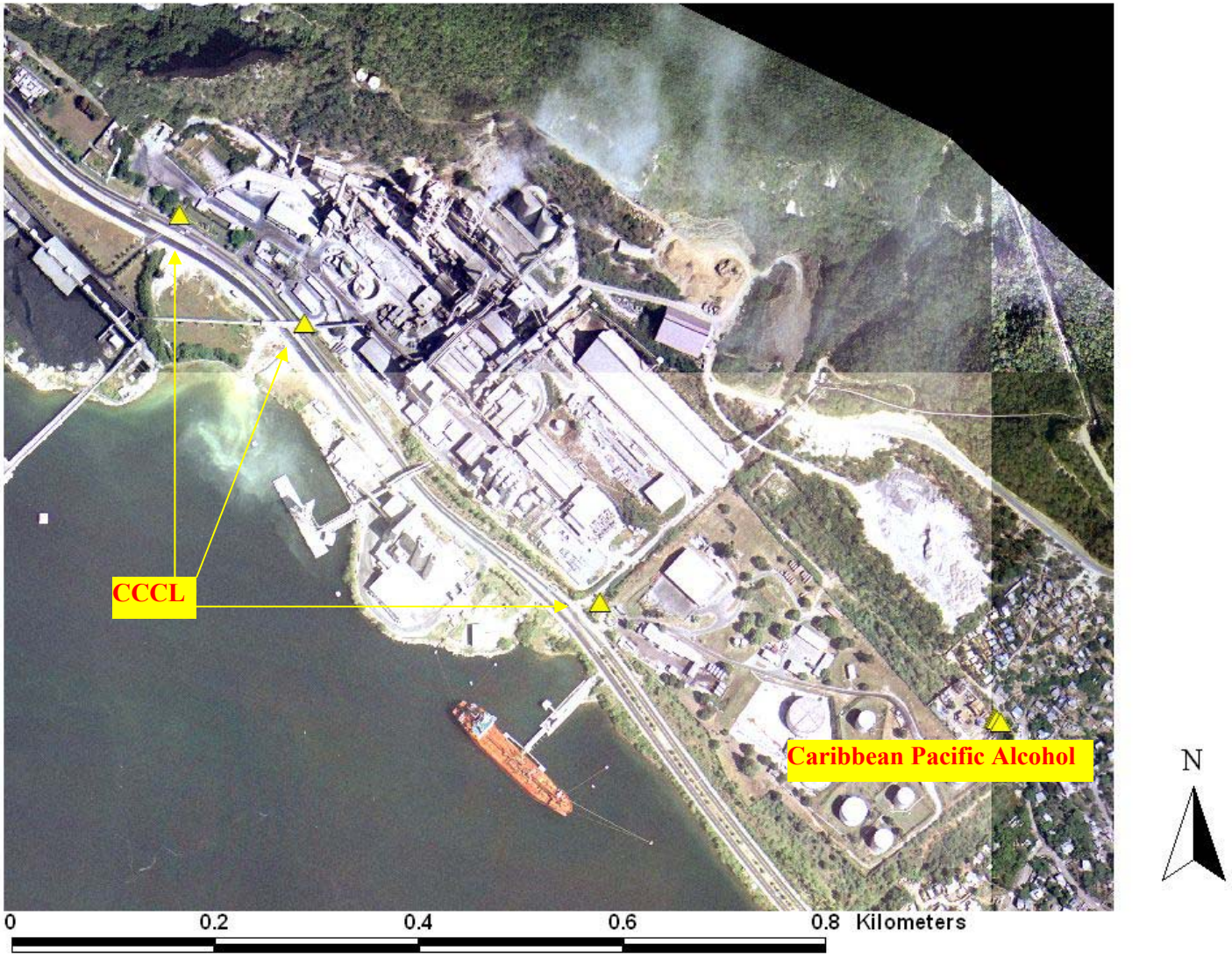


Figure 2-6 Map Showing Locations of Monitoring and Discharge Points for Facilities in Kingston & St. Andrew West A

Figure 2-7 Map Showing Locations of Monitoring and Discharge Points for Facilities in Kingston & St. Andrew West B

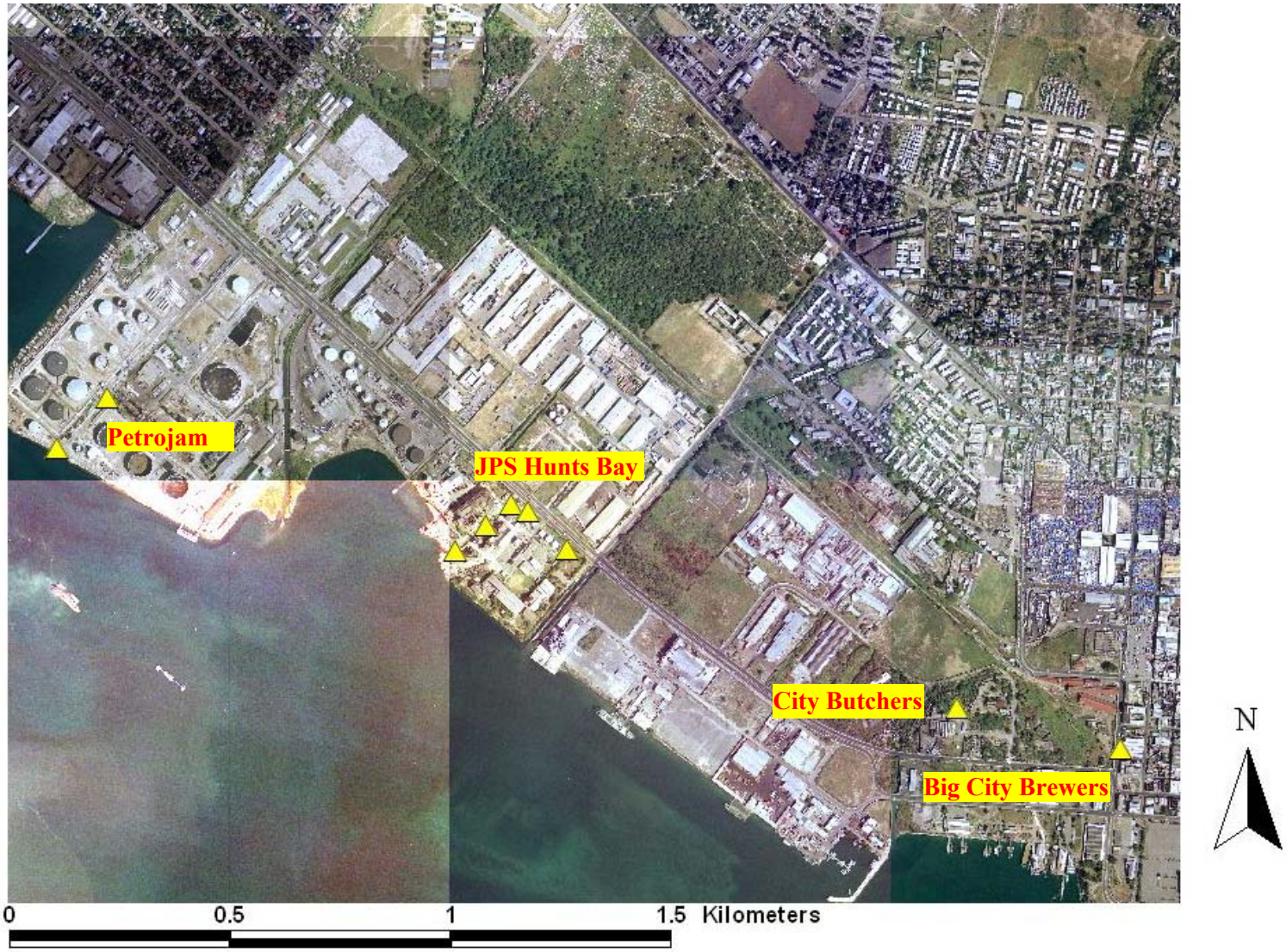


Figure 2-8 Map Showing Locations of Monitoring and Discharge Points for Facilities in Kingston & St. Andrew West C

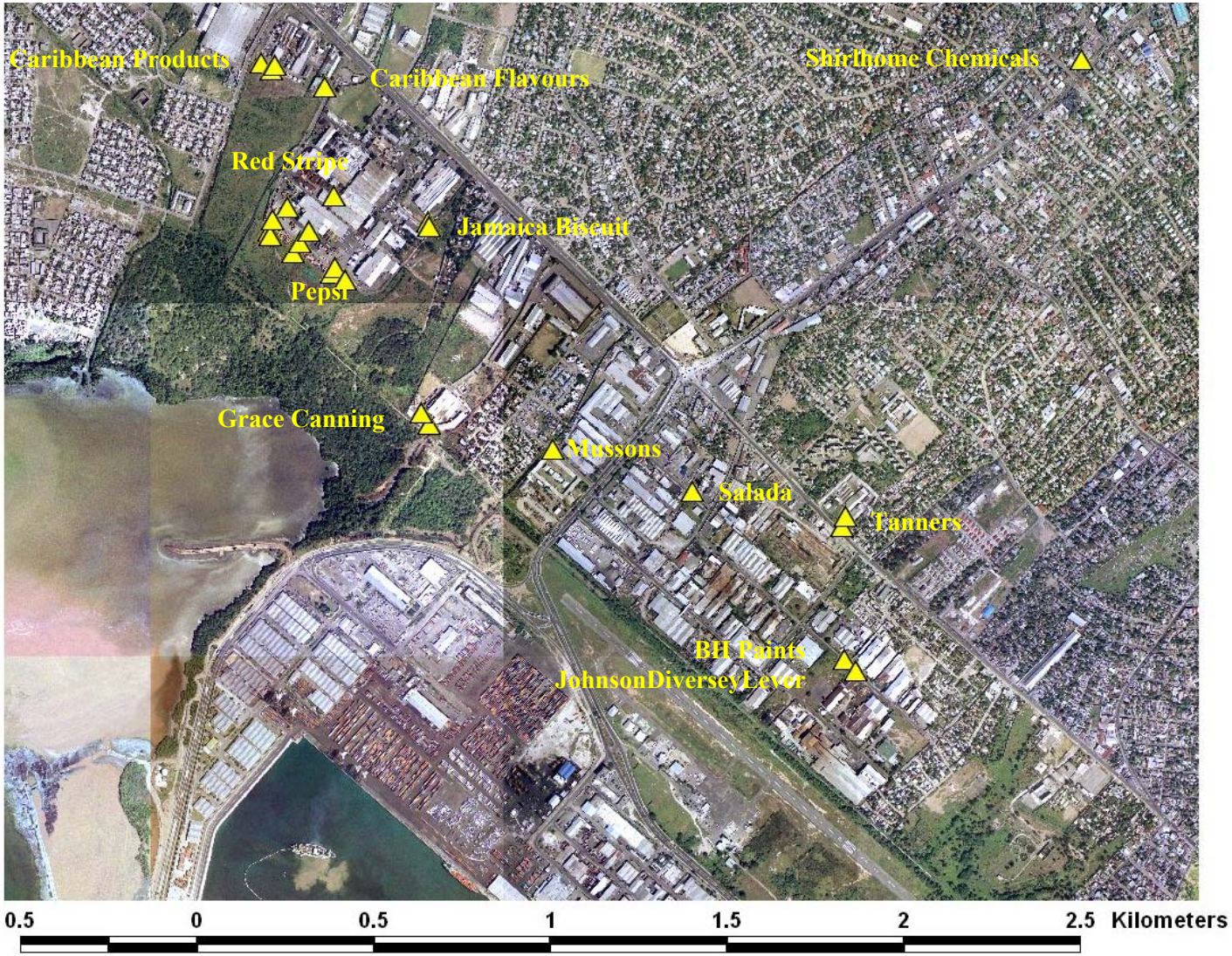


Figure 2-9 Map Showing Locations of Monitoring and Discharge Points for Facilities in Kingston & St. Andrew West D

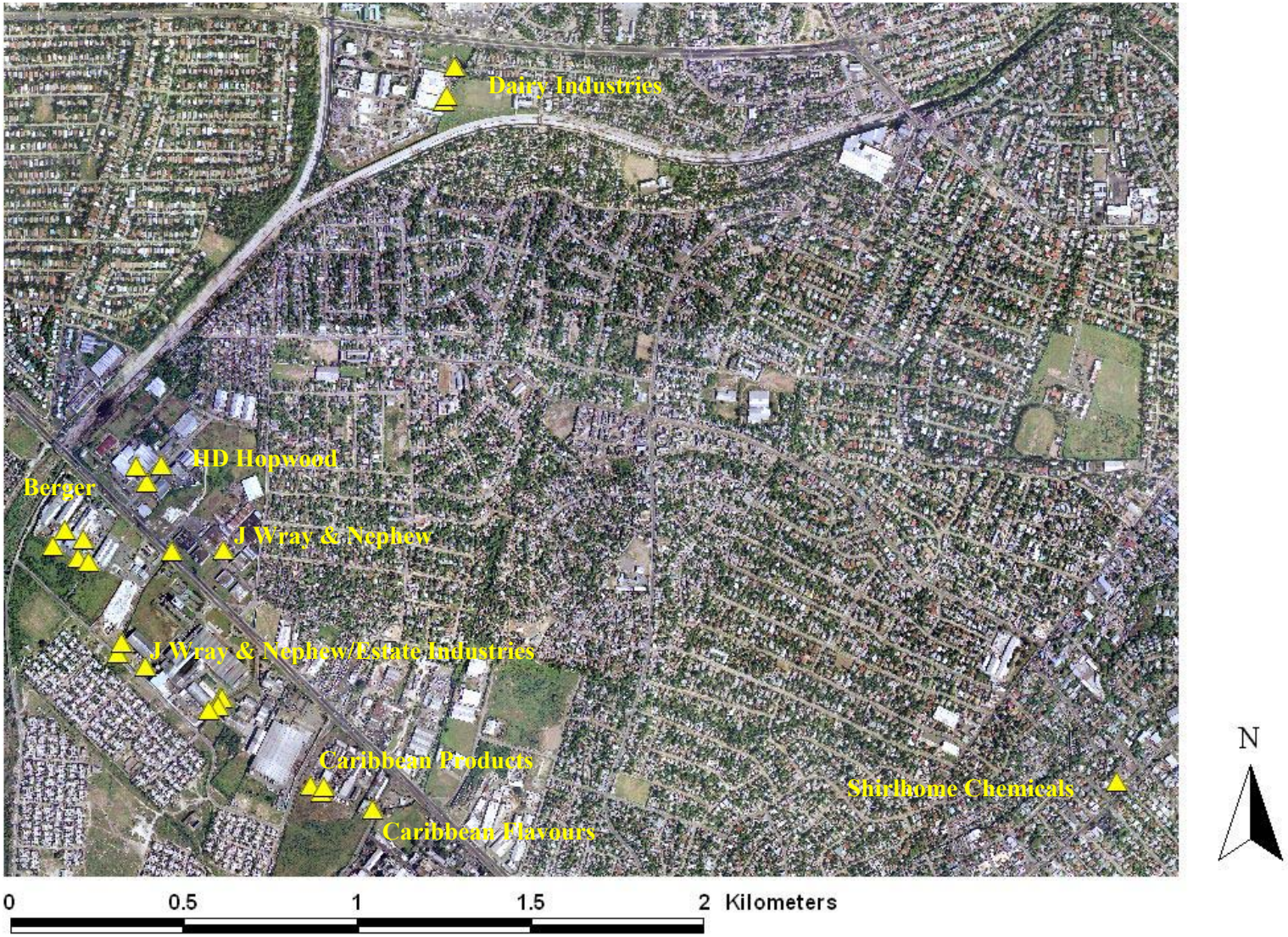


Figure 2-10 Map Showing Locations of Monitoring and Discharge Points for Facilities in St. Catherine – South

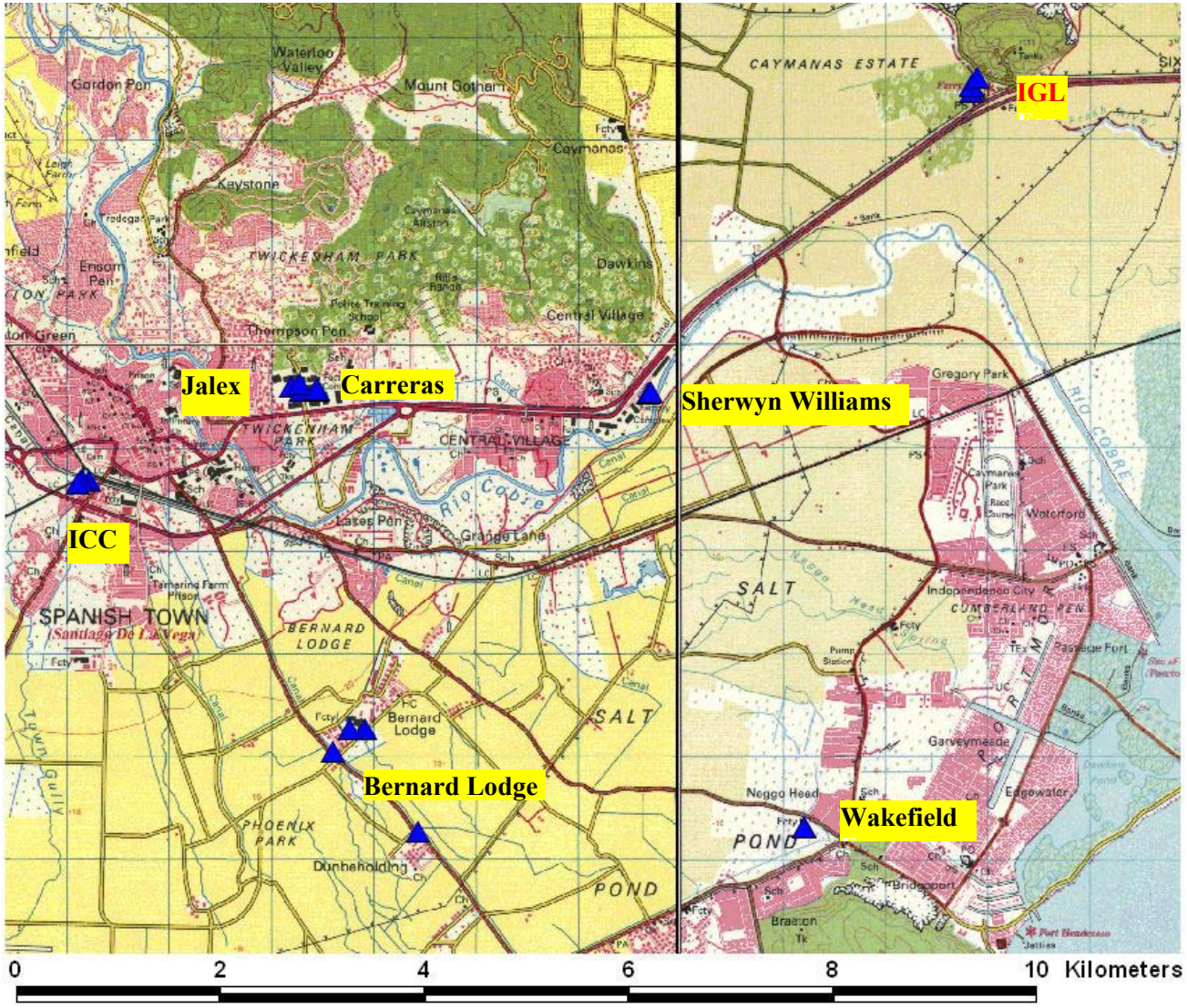
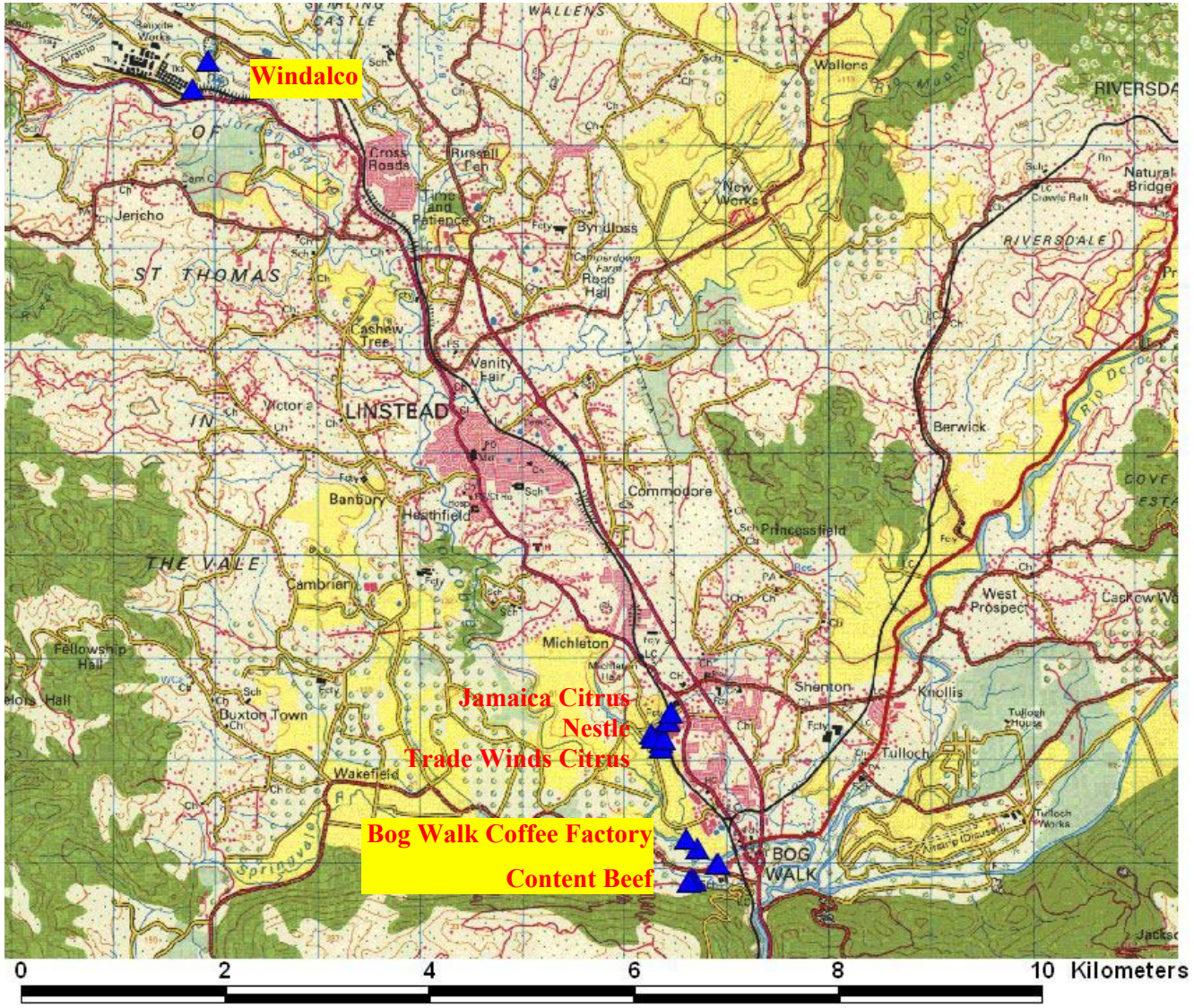


Figure 2-11 Map Showing Locations of Monitoring and Discharge Points for Facilities in St. Catherine – North



3. PROGRAMME STRATEGIES FOR ENFORCING ENVIRONMENTAL DISCHARGE LIMITS FROM INDUSTRIAL POLLUTERS

A range of strategies that will assist NEPA in the enforcement of discharge limits is described in this section. There are two types of discharge limits that are applicable to trade effluent. NEPA's proposed Trade Effluent and Industrial Sludge regulations specify discharge limits for the release of trade effluent directly into the environment. NWC has set influent standards for the discharge into their sewer system. The NEPA trade effluent standards and the NWC influent limits are given in Appendix 5. The strategies are designed to assist in the enforcement and attainment of the NEPA standards and the NWC limits.

The strategies (see list below) entail direct enforcement (A and C) as well as those that would promote compliance (B) and complement enforcement (D, E and F).

A. Design of a risk based strategy for investigation, inspection and enforcement

B. Outreach and Sector Based Training

C. Designing a strategy for a trade effluent and surface water sampling monitoring programme to assess industrial trade effluent impacts

D. Continued promotion of the adoption of EMS by industries

E. Development of incentives schemes to complement regulatory enforcement

F. Development, establishment and publication of a bank of Jamaican case studies for successful pollution prevention, clean technology production and effluent reduction projects.

These strategies will require participation by industry as well as NEPA and NWC and it is strongly recommended that a small task force with industry representatives drawn from each industrial sector (the 2 digit ISIC Codes), JMA, community groups and non-governmental organisations (NGOs) and NEPA, finalise the design for the development and implementation of the strategies.

3.1 Investigation, Inspection and Enforcement Strategy

The management of the environmental and health risks posed by trade effluent is one aspect of NEPA's mandate to manage the natural and built environment to achieve sustainability. The enforcement of trade effluent regulations and other related instruments (e.g., guidelines, memoranda of understanding) will require efficient and effective allocation of resources to ensure that trade effluent discharges do not pose unacceptable risks to human health and the environment.

The investigation of every pollution incident caused by trade effluent, the inspection of all facilities that discharge trade effluent and full enforcement of regulations would require human and other resources that are far beyond NEPA's capacity. A risk assessment approach that identifies hazards and understands their likelihood and consequences, offers a systematic method for setting priorities and for allocating scarce resources for investigations, inspections and enforcement of trade effluent (and indeed other pollution) related issues.

The strategy would entail the following:

- Data compilation

    - Trade effluent and surface water quality monitoring data (Section 17 data [initially], verification and enforcement monitoring, pollution incidents and investigations, reports from licensees [when regulations are in force])
        - Compliance history for facilities (both in terms of monitoring data and adherence to compliance plans)
        - Complementary environmental management activities at facilities (e.g., implementation of EMS, environmental related community activities)
- Data Analysis
    - Assessment of the relative risk posed by facilities to determine potential for human health and environmental impacts. For example, the facilities' discharge fees can be used as a measure since the per tonne fees in the trade effluent regulations took into account, in a very simplified manner, the relative impact (toxicity) of pollutants. Over time, more precise pollutant-specific metrics for relative risk can be used if necessary.
- Development of weightings for the relative risk based on factors such as compliance history and complementary environmental protection activities to moderate the discharge fees
- Ranking the resulting relative risk and using them as the basis for setting priorities for enforcement visits and verification monitoring

It should be noted that once regulations are implemented, over time as the routine reports from licensees are obtained, Section 17 data and the limited compliance information from post permit monitoring would be eliminated in favour of regular reporting and compliance history under the regulations.

3.2 Outreach and Sector Based Training

The purpose of this aspect of the report is to identify any special needs in the outreach and training activities for the facilities that discharge into Kingston Harbour.

During the development of the trade effluent regulations, public consultation meetings were held and stakeholders (the general public, regulators and the regulated community and related public and private sector groups) were given copies of the overview and main features of the regulations as well as the detailed drafting instructions for their review and comment. Implementation of the trade effluent and industrial sludge regulations will require public education, outreach to the regulated community and government agencies that play a supporting role in the regulations and training for both the regulators and the regulated communities. These public education, outreach and training activities should empower the stakeholders to play effective roles in the implementation of the regulations.

NEPA is aware of the need for outreach to licensees (as distinct from public education) and to government agencies indirectly involved with the regulations in addition to training for regulators (NEPA staff and others involved with implementation of the regulations)[5].

NEPA's goal for the outreach activities for the regulations is to ensure that the regulated community is fully aware of the regulations and of their roles and responsibilities in complying with the regulations. In addition, outreach should be directed at public sector agencies that are indirectly involved in implementing the regulations and those engaged in training and public education. Public sector agencies that are directly involved with implementing and enforcing the regulations should undergo training to enable them to implement and enforce the regulations.

[5] Davis, C. (2004). Training Needs for NEPA Staff and Public Education Strategy. Report submitted to NEPA, January 2004.

The outreach to the regulated community that have discharges into Kingston Harbour should be a component of an overall outreach programme. The main themes and messages of the outreach programme have been identified as:

- Information on the provisions of the regulations and how the target groups (licensees, public sector agencies) can complement and facilitate implementation
- The need for and availability of training courses
- Interdependencies among agencies (especially the flow of information required to implement the regulations) and the scope and jurisdictions of complementary or related regulations and agencies e.g., National Solid Waste Management (NSWMA) Act/NSWMA, Water Act/Ministry of Water/WRA, etc)

The outreach and training strategies developed for NEPA[6] have identified the target groups, the outreach strategies appropriate for each group and means to assess the effectiveness of the outreach programme.

The target groups included private sector organizations (JMA, PSOJ,) to which we would add the Business BCE and the Jamaica Employers Federation (JEF).

The themes and messages identified by NEPA should be complemented and enhanced by clearly articulating the following.

- The need for the regulations (poor state of Kingston Harbour, contributing sources (sewage, industry, etc.);
- the principles and strategies that underpin the regulations (polluter pays principle, incentives for beneficial use of wastes, industry self monitoring with NEPA having a verification/auditing role etc.);
- complementary activities (sewage regulations, plans for sewage treatment);
- emphasising the reduction in discharge fees when loads are reduced; and
- how voluntary actions can complement the regulations (see Sections 3.3 and 3.4 below).

In view of the long delay in enacting the air quality and sewage regulations and limited follow up actions on Section 17 reports, industry has adopted a "wait and see" attitude and indeed question the seriousness and ability of NEPA to enforce regulations. It is therefore vital for NEPA to overcome these views by clearly specifying and abiding by the schedule for implementation of the regulations and by engaging the licensees and others in an effective outreach strategy.

The strategies previously identified should be complemented by the following:

- Building deeper and stronger partnerships with private sector organizations such as the JMA, BCE, PSOJ etc., as means to provide outreach and obtain feedback on implementation issues by:
    - Using every opportunity to make presentations at regular meetings of these private sector groups
    - Providing training through these groups
    - Assisting these groups in obtaining funding for training and other needs
- Sessions/workshops directed at senior management in the private and public sectors to build awareness about the regulations and the roles and responsibilities of senior management.

The need for training of NEPA staff was also anticipated by NEPA and outlines of the content of training modules have been developed based on a gap analysis to identify training needs. A similar detailed exercise was not specifically done for the licensees but it was assumed that similar gaps exist. This is borne out by the level of information that was evident from the site visits and the data available at NEPA.

It was indicated that the courses for the licensees would be similar to those provided to NEPA staff – but from the perspective of the licensee.

The recommended training modules (see Table 3-1) could be geared to training licensees on how to comply with the regulations and how to implement cleaner production and pollution prevention activities that would reduce pollutant loads and hence discharge fees. Included in Table 3-1 are examples of some of the adaptation required for the modules. It must be stressed that a detailed design of the modules will be needed to specify all of the adaptations needed.

Additional training modules are needed especially for industry in the study area. The additional modules should focus on pollution prevention and pollution control methods. The largest numbers of facilities are engaged in the manufacture of food products and beverages and in chemicals and chemical products. The pollution prevention and pollution control methods should therefore focus on appropriate methods and techniques and use examples from these sectors.

Mechanisms to implement the outreach and training include cost recovery by industry and/or seeking funding to implement the training.

The training previously proposed envisioned the migration of the training into the curriculum of tertiary institutions. The training proposed (for both NEPA and the licensees) is directed at satisfying the immediate /short term (e.g., up to three years) needs while the migration to the regular curriculum would provide the education foundation that would satisfy longer term needs for staff in both the private and public sector. New courses at the University of Technology (UTECH) and UWI are currently being designed (with considerable input from NEPA among others) and it is therefore likely that the migration indicated may not be that extensive (if at all needed). A detailed and ongoing review of the courses should be done to determine the need for change.

3.3 Designing a Strategy for a Sampling and Monitoring Programme for NEPA to Assess Selected Facilities

Scope

The strategy for a sampling and monitoring programme described here will be limited to the assessments of discharges from the facilities that discharge into Kingston Harbour. Both trade effluent and surface water monitoring are required for such a programme. The programme should be designed to be compatible with NEPA's overall programme in which surface waters and waste water streams from selected sewage treatment plants and industrial facilities are monitored. Current documentation for NEPA's overall monitoring programme was limited to what is the articulated in the corporate plan. It is recommended that a detailed programme be developed and fully documented.

Since resources are limited, the design of an effective and efficient monitoring programme is essential in order to meet the NEPA's objectives. The design of a monitoring programme should have the following attributes:

- Clear goals and monitoring objectives
- Provide information to support the all aspects of the regulations and NEPA's programmes
- Scientifically sound design
- Up-front stakeholder "buy-in"
- Uses available information
- Employs reliable, defensible and scientifically sound sampling and analytical methods to generate accurate data

Table 3-1 Summary of Recommended Training Courses and Examples of the Type of Adaptation Needed

Module	Description	Adaptation Needed (preliminary)
Overview of Trade Effluent & Industrial Sludge Regulations	Overview of the regulation	Yes (e.g., greater focus on industry/licensees)
Workshop to receive applications and determine completeness	Overview of regulations and step-by-step procedure to review applications for completeness. Develop protocol based on a checklist as workshop output	Yes (e.g., preparation of the applications and the use of checklist, …)
Processing of licence applications for Trade Effluent & Industrial Sludge Regulations	Overview of regulations and step-by-step procedures for the technical review of applications.	Not required
Preparation and submission of licence applications for Trade Effluent & Industrial Sludge Regulations	Overview of regulations and step-by-step procedure to submit applications. Technical requirements for each item in application	Yes (e.g., focus on preparation of application and annual reports)
Workshop on compliance plans and licence conditions	Overview of regulations and procedures and information requirements for specifying licence conditions and approval of compliance plans	Yes (e.g., similar but from licensees perspective. Refer to modules on pollution prevention and pollution control methods and especially time and costs for conceptualisation, design, implementation)
Monitoring of trade effluent and Reporting requirements	Sampling techniques for trade effluent and industrial sludge. Record keeping requirements for licensees	Yes (e.g., similar. Emphasis on flow monitoring and its importance, flow measurement techniques)
Compliance and Pollution Prevention	Overview of regulations especially offences, reporting requirements. Strategies for site visits, assurance of evidence Strategies for stakeholder engagement, developing codes of practice, best practices	Yes (e.g., from the perspective of the licensee)
Data Management	Analysis and compilation of incident, complaint, and annual reports for preparation of pollutant release and transfer register (PRTR) report	Yes (e.g., especially emphasis on record keeping and reporting)

- Indicates environmental condition
- Timely data evaluation
- Regular programme evaluation and refinement
- Regular reporting
- Documentation of the programme objectives, strategy and protocols

Based upon the survey of industrial facilities conducted in this task, it is evident that there are very limited data on the volumes and characteristics (pollutant concentrations) of trade effluent discharged into the harbour. It must be stressed that the draft trade effluent and industrial sludge regulations rely on industry self monitoring (of their own effluent) with NEPA performing auditing or impact related (such as the water quality of the receiving surface waters) monitoring.

NEPA's **goals** therefore should be:

- to safeguard water resources (in this case the Rio Cobre, Fresh and Duhaney Rivers and Kingston Harbour since these are impacted by the industrial facilities that discharge into Kingston Harbour), and;
- assess potential impacts from trade effluent discharges.

The **monitoring objectives** will be to track changes in surface waters and to conduct verification monitoring for selected industrial facilities. The monitoring objectives should be complementary to the monitoring of discharges from other sources (sewage treatment plants, run off from gullies) that contribute to the loading in Kingston Harbour.

We recommend a monitoring programme (relevant to Kingston Harbour) with the following objectives:

a) assess water quality in the Rio Cobre and Kingston Harbour including the short term (e.g., pollution incidents) and medium and longer term trends (e.g., recovery of water quality;
b) verify the pollutant loading from key industrial facilities that discharge into the harbour;
c) investigate pollution incidents (spills, fish kills, etc.);
d) compile related water quality information (stream flows, rainfall);
e) interface with the enforcement, watersheds and pollution prevention branches within NEPA and with external agencies (e.g., Water Resources Authority, Ports Authority) to exchange information relevant to the Rio Cobre watershed and Kingston Harbour; and
f) include a component to determine whether programme goals are being met

The key features of the main components of the programme are given in Table 3-2

3.4 Continued Promotion of the Adoption of EMS by Industries

NEPA spearheaded the development of a Draft White Paper that outlined a national policy and strategy for environmental management systems in Jamaica. The strategy includes the building of capacity in the private sector to plan, implement, monitor and evaluate EMS and to strengthen the legal and economic framework to facilitate the promotion and implementation of EMS.

The site visits and questionnaires administered in this task included obtaining information on the number of companies that had implemented or plan to implement EMS or had conducted an environmental audit.

Only three facilities have an EMS system in place or under development and nine facilities plan to implement one.

Table 3-2 Summary of Strategies to Develop a Monitoring Programme for Kingston Harbour

Component	Strategy / Programme description
Identify data users	Identify internal and external suppliers and users of data in the public and private sectors (e.g., NEPA staff/branches, STATIN, WRA, Port Authority, JBI, JMA, KSCA, Ministry of Water
Develop criteria for establishing monitoring priorities (Bases for deployment of resources for various monitoring objectives)	
Determine monitoring characteristics	
Monitoring locations Surface Facilities	 Identify suitable locations upstream (2) and downstream of the industrial sources in the Bog Walk (2) and Ewarton (one) areas of the Rio Cobre. Review other monitoring activities (e.g., NWC monitoring of drinking water sources in the Rio Cobre, WRA stream flow and other monitoring) Licensed facilities. Selection of facilities to be monitored to be based on risk management approach (see text box)
Parameters to be monitored Sampling and analytical methods Quality assurance and quality control requirements Frequency of monitoring Types of samples	Parameters included in regulations Methods specified in regulations Standard laboratory QA/QC procedures. Include documentation and routine reporting of QA/QC activities Participate in laboratory inter-comparison studies Establish standard frequency for tracking surface water quality. Note frequency for Rio Cobre and Kingston Harbour should fit within and be compatible with national programme for watershed monitoring Grab samples for surface. For trade effluent base sampling on consistency of streams monitored
Data management	Develop a database consistent with NEPA's AMANDA system. The system should allow entry and retrieval of all information and data related to monitoring. In the case of water quality reports, the annual reporting forms in the draft regulations specify the information and data requirements. The validation monitoring conducted by NEPA should compile similar information
Data assessment and interpretation	Use standard assessment techniques (comparison with standards, averages, distribution of data, plots etc.)

Table 3 2 Summary of Strategies to Develop a Monitoring Programme for Kingston Harbour (Cont'd)

Reporting	NEPA to provide routine internal reports regarding compliance issues and use data for annual reporting (PRTR, Environmental Statistics, supply to other data users in agreed formats or make raw data available to users so they can perform their own analyses
Determine monitoring priorities	Develop a risk management based strategy in which the discharges are ranked by the product of the flow, concentration and a pollutant weighting index. Examples of such an index are the Chimiotox index[6], the U.S. EPA toxic pollutant weighting index[7] or the weighting used in the New South Wales[8] or derivable from the British Columbia waste management regulations[9].
Estimation of the monitoring costs (logistics, resources (instrumentation available, etc.)	Estimate costs based on numbers of samples, cost/sample, logistics costs etc.

[6] Pigeon, B. (1992) *Évaluation externe du modèle CHIMIOTOX*, BPC Environnement, for St. Lawrence Action Team, May 1992.

[7] USEPA. 1996. *Toxic and Pollutant Weighting Factors for Pesticide Formulating, Packaging, and Repackaging Industry Final Effluent Guidelines*. Final Report. U.S. Environmental Protection Agency Office of Science and Technology Standards and Applied Science Division. March.

[8] New South Wales Protection of the Environment Operations (General) Regulation 1998

[9] Waste Management Act, Waste Management Permit Fees Regulation, http://www.qp.gov.bc.ca/statreg/reg/W/WasteMgmt/299_92.htm

The JMA has been facilitating the conduct of environmental audits as part of the Environmental Audits for Sustainable Tourism (EAST) project. Seven of the 55 facilities have taken part in an audit and four additional companies plan to participate. The audits include gathering information on the facilities' environmental performance and plans, both of which are key component of developing an EMS.

A strategy to promote EMS was included in the Draft White Paper (see Appendix 6) and is considered complete. The Draft White Paper also included strategies for industry to implement EMS and criteria for acceptability of such systems by NEPA. It is implicit in the criteria that International Standards Organisation (ISO) 14001 certification is not a requirement although the EMS system must follow the general principles espoused by ISO 14001. Details of the strategy are included in the Draft White Paper.

Further promotion of EMS among the facilities that discharge into Kingston Harbour should entail the following:

- Renewed promotion of the establishment of EMS through the JMA
- Invite facilities who have been audited and who have EMS to relate their experiences and to publish these experiences (see Section 3.5 below).

3.5 Incentives to Complement Enforcement

Several jurisdictions now employ a variety of incentives to increase awareness of the implementation of sound environmental practices and to promote compliance with environmental regulations. The range of incentives includes economic and other instruments such as the following:

- Economic Instruments
  - Emission and effluent charges
  - User charges for the treatment and/or disposal of waste
  - User charges for natural resources and/or environmental amenity
  - Product charges
  - Deposit refunds
  - Performance bonds
  - Tradable discharge permits
  - Environmental taxes and levies
  - Tax credits or subsidies
- Other Instruments
  - Environmental awards or recognition programmes
  - Promotion of environmental management systems
  - Favoured loan schemes

These incentives can be implemented within regulations or as complements to regulations. The proposed Trade Effluent and Industrial Sludge regulations include effluent charges and makes allowance for future trading within defined watersheds.

The instruments that can be used to complement the regulations are those listed in the Other Instruments category above.

- Establishment of national awards and/or means to recognise environmental performance for facilities that exceed regulatory requirements. The awardees could be granted greater reporting flexibility, expedited permitting and licensing and access to revolving funds for environmental projects to reduce pollutant discharges.

- Establishment of an Environmental Neighbours Partners scheme to recognise facilities or companies that implement local environmental projects in partnership with the neighbouring communities. The goal is to promote communication between facilities and the adjacent community.
- Favourable loans (to be developed in Task B4)

3.6 Development and Establishment of a Bank of Jamaican Case Studies of Successful Pollution Prevention and Effluent Reduction Projects

Promotion of successful application of pollution prevention and pollution control projects can be effected by publication of such studies. We propose that NEPA encourage the documentation of such projects and publish them on a section of the NEPA web site that is devoted to pollution prevention, compliance assurance and enforcement information. The web pages could also include links to similar web sites in other countries. The publication of such activities could also be linked to national recognition and awards initiatives (see above). Examples of web sites with similar programmes are listed below.

The web site should also include the experiences of Jamaican companies that have successfully established and EMS system.

US EPA Enviro$ense web site	http://es.epa.gov/describe.html
Environment Canada Pollution Prevention Success Stories	http://www.ec.gc.ca/pp/en/index.cfm
Canadian Centre for Pollution Prevention (C2P2)	http://www.c2p2online.com/

4. APPENDICES

4.1 APPENDIX 1 Facilities Considered for Potential Discharge into Kingston Harbour: Assigned categories, Status of Information Obtained from Telephone Calls, Visits and Questionnaires

Category	Company Name	Address	Parish	Water Use m3/y	ISIC	Status of Information
A	Abattoir/City Butchers	85 Darling St	Kingston	NA	1511	Site visited. No data
A	Berger Paints Jamaica Ltd	256 Spanish Town Road	Kingston 11	9814.989	2422	Site visited. Questionnaire completed
A	Bernard Lodge Sugar Factory	Bernard Lodge	Spanish Town	560000	1542	Site visited. Questionnaire completed
A	Big City Brewing Co. Ltd.	7 Pechon Street	Kingston	899	1553	Site visited. Questionnaire completed. No pollutant concentration data
A	Bog Walk Coffee Company	Bog Walk	St. Catherine	NA	1513	Site visited. Questionnaire completed. No pollutant concentration data
A	Brandram Henderson W I Ltd	10 Bell Road	Kingston 11	2361.84	2422	Site visited. Questionnaire completed. No pollutant concentration data
A	Caribbean Broilers Ltd	49 Arnold Road	Kingston	154294.1179	1511	Site visited. Questionnaire completed
A	Caribbean Cement Company Ltd.	Rockfort	Kingston 2	31312.42411	2694	Questionnaire completed. Site visited only for mapping.
A	Caribbean Foods Ltd.	449 Spanish Town Road	Kingston 11	10809.96	1531	Contacted. Unable to arrange site visit
A	Caribbean Pacific Alcohol Company Ltd.	Rockfort	Kingston	40560	1551	Site visited. Questionnaire completed
A	Caribbean Products Companies Ltd. (Seprod Group)	228 Spanish Town Road	Kingston 11	3087.109547	2424	Site visited. Questionnaire completed
A	Carreras Group Ltd	Twickenham Park	Spanish Town	8200	1600	Site visited. Questionnaire completed
A	Content Agricultural Products Ltd. (Jamaica Broilers)	Bog Walk P.O.	Bog Walk	NA	1511	Site visited. Questionnaire completed
A	Dairy Industries (Ja.) Ltd.	111 Washington Boulevard	Kingston 11	9991.201056	1520	Site visited. Questionnaire completed

Category	Company Name	Address	Parish	Water Use m3/y	ISIC	Status of Information
A	Food Ingredients Ltd.	13 Diamond Avenue	Kingston 11	5859.18	1514	Contacted. Unable to arrange site visit. Questionnaire sent
A	Grace Food Processors (Canning) Ltd	2-6 Twickenham Close	Kingston 11	142391.7	1513	Site visited. Questionnaire completed. No pollutant concentration data
A	H D Hopwood & Co Ltd	3 Carifta Avenue	Kingston 11	5404	2423	Contacted. Unable to arrange site visit. Questionnaire sent
A	Industrial Chemical Co Ja Ltd	Windsor Road	Spanish Town	30000	2411	Site visited. Questionnaire completed
A	Industrial Gases Ltd. (Ferry)	Ferry	St. Catherine	35745.54	2411	Site visited. Questionnaire completed
A	J. Wray & Nephew Group (Estate Industries Ltd.)	232 Spanish Town Road 234 and 473 Spanish Town Road	Kingston 11	7085.52	1551	Site visited. Questionnaire completed
A	J. Wray & Nephew Ltd.	234 Spanish Town Road	Kingston 11	93247.26	1551	Site visited. Questionnaire completed
A	Jalex Manufacturing Co. Ltd.	Twickenham Park, P. O. Box 721	Spanish Town	10174.08	2892	Site visited. Questionnaire completed. No pollutant concentration data
A	Jamaica Biscuit Company Ltd.	206 Spanish Town Road	Kingston 11	10900.8	1541	Site visited. Questionnaire completed
A	Jamaica Citrus Company	Bog Walk P.O.	St. Catherine	588643	1554	Site visited. Questionnaire completed
A	Jamaica Ethanol Processing Ltd	Rockfort	Kingston 2	8748	1551	Site visited. Questionnaire completed
A	Jamaica Private Power Company	100 Windward Road	Kingston 2	23027.94	4010	Contacted. Questionnaire sent. Data obtained from other sources
A	JPS Hunts Bay	100 Windward Road	Kingston 2	9629.04	4010	Site visited. Questionnaire completed. No pollutant concentration data
A	JPS Rockfort	Marcus Garvey Drive	Kingston 11	63072000	4010	Site visited. Questionnaire completed. No pollutant concentration data
A	LASCO DISTBRS LTD	White Marl	St. Catherine	5495.82	1549	Contacted. Unable to arrange

Category	Company Name	Address	Parish	Water Use m3/y	ISIC	Status of Information
						site visit
A	Mussons (Jamaica) Ltd.	178 Spanish Town Road	Kingston 11	16941.66	2424	Site visited. Questionnaire completed
A	Nestle Jamaica Ltd.	Bog Walk P.O.	St. Catherine	NA	1549	Site visited. Questionnaire completed
A	Omni Industries Ltd./Thermoplastics	Twickenham Park, P.O. Box 680	Spanish Town	18134.02992	2520	Contacted. Unable to arrange site visit
A	Pepsi-Cola Jamaica Bottling Co. Ltd.	214 Spanish Town Road	Kingston 11	365000	1554	Site visited. Questionnaire completed
A	Petrojam Ltd.	96 Marcus Garvey Drive	Kingston 11	49825.74	2320	Site visited. Questionnaire completed
A	Red Stripe	214 Spanish Town Road	Kingston 11	1825000	1553	Site visited. Questionnaire completed
A	Roberts Products Co. Ltd.	7 Norwich Avenue 82B Waltham Park??	Kingston 11	5495.82	1513	Contacted. Questionnaire sent. Unable to arrange site visit
A	Salada Foods Jamaica Ltd.	20 Bell Road	Kingston 11	16815.19138	1513	Site visited. Questionnaire completed. No pollutant concentration data
A	Shell Rockfort Jetty	236 Windward Road	Kingston 2	77142.06335	2914	Site visited. Questionnaire completed
A	Sherwin Williams (W.I.) Ltd.	White Marl, Spanish Town	White Marl, Spanish Town	2004	2422	Site visited. Questionnaire completed. No pollutant concentration data
A	Shirlhome Chemicals Corp.	78c, e & f Hagley Park Road	Kingston 11	360	2422	Site visited. Questionnaire completed
A	Smith & Stewart Distributors Ltd.	3-7 McArthur Avenue	Kingston 11	10370.8667	1544	Contacted. Unable to arrange site visit
A	Spike Industries Ltd.	99 Windward Road	Kingston 2	12968.57897	1554	Site visited. Questionnaire completed. No pollutant concentration data
A	Tanners	259 Spanish Town Road	Kingston 11	14988.6	1911	Site visited. Questionnaire completed

Category	Company Name	Address	Parish	Water Use m3/y	ISIC	Status of Information
A	Trade Winds Citrus Ltd.	Bog Walk P.O.	St. Catherine	6813	1554	Site visited. Questionnaire completed. Pollutant concentration data obtained specially for this study
A	Wakefield Juices	Lot # 7, Naggo Head Industrial Estate	P.O. Box 191, Bridgeport P.O.	11173.53575	1554	Site visited. Questionnaire completed. No pollutant concentration data
A	Windalco (Ewarton)	Ewarton P.O.	St. Catherine	1802698.5	2720	Data from Section 17 reports
B	Caribbean Flavours & Fragrances Ltd.	226 Spanish Town Road	Kingston 11	908.4	1549	Site visited. Questionnaire completed
B	Cosmetic International Ltd.	455 Spanish Town Road	Kingston 11	3606.823581	2424	Contacted. Unable to arrange site visit
B	Electric Arc (Jamaica) Ltd. Welding Industries	Twickenham Park Industrial Estate,	Spanish Town	1478.697756	2899	Contacted. Unable to arrange site visit
B	Facey Commodity Company Limited Bottling	61 Newport Blvd	Kingston	NA	1549	Contacted. Unable to arrange site visit
B	Federated Pharmaceuticals Ltd.	1 Bell Road	Kingston 11	1226.34	2423	Contacted. Unable to arrange site visit Data obtained from Section 17 data
B	Jamaica Drink Co. Ltd. (Wisynco Group)	P.O. Box 367, WISYNCO Complex	White Marl, Spanish Town	181.68	1554	Contacted. Unable to arrange site visit
B	JohnsonDiverseyLever Jamaica Ltd.	8 Bell Road	Kingston 11	363.36	2411	Site visited. Questionnaire completed. No pollutant concentration data
B	P. A. Benjamin Mfg. Co. Ltd. (ICD Group Ltd.)	95-97 East Street	Kingston	1978.257809	2423	Contacted. Unable to arrange site visit
B	Solomon Armstrong & Co.	17 Chancery Lane	Kingston	NA	1513	Contacted. Unable to arrange site visit

4.2 APPENDIX 2 Facilities Considered for Potential Discharge into Kingston Harbour: Facilities Eliminated From Consideration

Category	Company Name	Address	Parish	*Water Use m3/y*
x	Air Jamaica Ltd.	72-76 Harbour Street	Kingston	#N/A
x	AlChem Ltd (Chemco Ltd)	26 Collins Green Road	Kingston 5	30.28
x	Antilles Chemicals Co. Ltd.	96 Marcus Garvey Drive	Kingston 15	1368.794545
x	Arc Systems Ltd.	14 Bell Road	Kingston 11	1408.02
x	B. W. Manufacturing Company	14-20 Beckford Street	Kingston	136.26
x	Barco Caribbean Ltd.	1 Weymouth Close	Kingston 20	142.5428949
x	Beal Industries Ltd.	2 Bell Road	Kingston 11	#N/A
x	Boss Furniture Company Ltd.	112c Church Street	Content Gap	799.2960845
x	C. A. Industries Ltd.	55 Barry Street	Kingston	#N/A
x	Cap-Pack Solutions Ltd.	7-9 Norman Road	Kingston CSO	14352.72
x	Carnaud Metal Box (Ja.) Ltd.	196 Spanish Town Road	Kingston 11	841.4214859
x	Chem-Quip Water Treatment Ltd.	16 - 18 Bell Road	Kingston 11	114.6098
x	Coates Brothers	9 Nanse Pen Close, PO Box 317	Kingston 11	166.54
x	Cocoa Cola	693 Spanish Town Road	Kingston 11	9735.02
x	Colgate Palmolive Co. (Ja.) Ltd.	216 Marcus Garvey Drive	Kingston 11	2588.94
x	Consumer Packaging Ltd.	76 Marcus Garvey Drive	Garmex Freezone	1914.224201
x	Containers Company Ltd.	9 Bell Road	Kingston 11	393.64
x	Cremo	Newport West	Kingston 11	#N/A
x	Crooks Greve Co. Ltd.	110 Hagley Park Road	Kingston	539.524857
x	Desonel Mfg. Co. Ltd.	LOJ Complex, 7-9 Norman Road	Kingston	3596.83238
x	Diamond Paints Ltd.	67 Waltham Park Rd	Kingston 11	72
x	Edgechem Jamaica Ltd.	18 Carifta Avenue,	Nanse Pen Industrial Estate	1771.38
x	ESSO Standard Oil	75-77 Marcus Garvey Drive	Kingston 11	#N/A
x	Factories Corporation Of Jamaica Ltd.	1 King Street	Kingston	#N/A
x	Flavorlan Ltd.	2 Olympic Way	Kingston 11	96
x	General Packaging Co. Ltd.	14 Riverton Boulevard	P.O. Box 19	159.8592169
x	Graymill Engineering Ltd.	104 Hagley Park Road	Kingston 11	2.497800266

Category	Company Name	Address	Parish	*Water Use m3/y*
x	Hardware & Lumber Ltd	697 Spanish Town Road	Kingston 11	7539.72
x	Heart/Garmex	76 Marcus Garvey Drive	Kingston	1900.07
x	Henkel Chemicals (Caribbean)	36 Red Hills Road	Kingston 10	10.82380114
x	IGL Spanish Town Road	593-595 Spanish Town Road	Kingston 11	7176.36
x	J & E Industries Ltd.	4-6a Norman Road	Kingston 16	#N/A
x	Jamaica Alcohol	Marcus Garvey Drive	Kingston	#N/A
x	Jamaica Broilers Group Ltd. (Processing Plant)	Spring Village	St. Catherine C.S.O.	#N/A
x	Jamaica Feeds	3 Felix Fox Blvd	Kingston 11	#N/A
x	Jamaica Fibreglass Prods. Ltd.	11 Ashenheim Road	Kingston 11	30.80620325
x	Jamaica Flour Mills	209 Windward Road	Kingston 2	8342.652882
x	Jamaica Grain & Cereals Ltd. (Seprod Group)	3 Felix Fox Boulevard	P.O. Box 271, GPO	#N/A
x	Jamaica Packaging Industries Ltd.	214 Spanish Town Road	Kingston 11	#N/A
x	JP Foods (formerly Trinjam)	0	St. Thomas	492
x	KEM PRODUCTS LTD (also CEK Jamaica Ltd)	68 Riverton Blvd	Kingston 11	#N/A
x	Konvertra Limited	93 Port Royal Street	Kingston	227.1
x	LASCO FOODS LTD	38 1/2 Red Hills Rd	Kingston 10	#N/A
x	Ledermode Ltd. (Tanners)	259 Spanish Town Road	Kingston 11	105.98
x	Mcintosh Group Of Companies MCINTOSH BEDDING/SEALY	585-591 Spanish Town Road	Kingston 11	#N/A
x	Norman Manley International Airport	0	Kingston	#N/A
x	Oriental Packing Ltd.	237 Tower Street	Kingston	#N/A
x	Paper Processors Ltd.	214 Marcus Garvey Drive	Kingston 11	#N/A
x	Petroleum Company Of Jamaica Ltd.	695 Spanish Town Road	Kingston 11	4496.58
x	Phoenix Printery Ltd.	141 East Street	Kingston	37.85
x	Plastic Containers Ltd. (Lascelles Group)	2e Ashenheim Road	Kingston 11	#N/A
x	Produce to Products Ltd	2 Salt Hill Road	Content Gap	#N/A
x	Quality Chemicals Ltd.	237 Marcus Garvey Drive	Kingston	#N/A
x	Roto Plastics (Jamaica) Ltd.	Lot #7, Twickenham Park	Spanish Town,	#N/A
x	SEPROD	3 Felix Fox Blvd	Kingston CSO	37.85
x	SEPROD (Jamaica Grains and Cereals)	0	Kingston	#N/A

Category	Company Name	Address	Parish	*Water Use m3/y*
x	Serge Island Dairies Ltd. (ICD Group Ltd.)	95-97 East Street	Kingston	#N/A
x	Serv-Wel Industries Ltd.	8-10 Ashenheim Road	Kingston	5115.494941
X	Starfish Oils	7 Norman Road, LOJ Complex, Unit 30, P.O. Box 9080	Kingston	#N/A
X	Steinhol Chemicals Limited	12-14 Wellworth Avenue, P.O. Box 427(Off Diamond Road),	Kingston	1226.34
X	Sun Island Jamaica	45 Molynes Road	Kingston 10	399.6480422
X	Tank-Weld Civil Engineers & Bldg Contrs	27 Seaward Drive	Kingston	#N/A
X	Therapedic (Carib.) Ltd. (Morgan's Industries Group)	P.O. Box 52, Bridgeport P.O.	St. Catherine	#N/A
X	Tropicair Limited	227 ½ Marcus Garvey Drive	Kingston	#N/A
X	Tropical Battery	14 Ashenheim Road	Kingston 11	454.2
X	Tropical Metal Products Ltd	18 Westport Avenue	Kingston	58.28200616
X	United Plastics Co Ltd.	4 Olympic Way	Kingston	120.7270128
X	Van Leer (Jamaica) Ltd.	279 Spanish Town Road	Kingston	85.75780906

4.3 APPENDIX 3 Sampling and Discharge Locations for Industries that Discharge into Kingston Harbour

Company Name	Sampling Point #1	Sampling Point #2	Discharge Point #1	Discharge Point #2	Discharge Point #3
Abattoir/City Butchers	Discharge to Sewer				
Berger Paints Jamaica Ltd	Effluent from open rectangular settling tank	Near solvent recovery system	SW corner drain	Central drain discharge	SE corner drain discharge
Bernard Lodge Sugar Factory	Discharge Point Factory Effluent - spray pond over	Sampling point - cane wash & mud filter wash water	Discharge Point Factory Effluent irrigation Canal	Discharge Point Factory Effluent IR 2	
Big City Brewing Co. Ltd.			Outside building on Pechon St. near manhole		
Bog Walk Coffee Company	Discharge Pits (1 of 8)	Discharge Pits (2 of 8)	Discharge Pits (3 of 8)	Discharge Pits (4 of 8)	Discharge Pits (5, 6, 7 &8 of 8)
Brandram Henderson W I Ltd			Sewer South boundary on Bell Road		
Caribbean Broilers Ltd	Sewer manhole outside plant	Sewer manhole outside plant			
Caribbean Cement Company Ltd.	Central drain - South boundary - accessible from road	West drain - South boundary - accessible from road	East drain discharge (adjusted to fence)		
Caribbean Foods Ltd.	NA	NA	NA	NA	NA
Caribbean Pacific Alcohol Company Ltd.	Sampling Stage 1 treatment	Sampling Stage 2 treatment	Sampling Stage 3 treatment	Discharge Point #2	
Caribbean Products Companies Ltd. (Seprod Group)	Discharge Point Factory Effluent (Minor)	Potential Sampling Point Fat Trap	Discharge Point Factory Effluent Major		
Carreras Group Ltd	Discharge from Treatment Plant to Storage	Sampling Point Influent	Sampling Point Effluent		
Content Agricultural Products Ltd. (Jamaica Broilers)	Discharge to Pit	Potential Sampling Point Prior to Pit			
Dairy Industries (Ja.) Ltd.	Discharge from property	Discharge Point Effluent	Sampling Point Effluent		

Company Name	Sampling Point #1	Sampling Point #2	Discharge Point #1	Discharge Point #2	Discharge Point #3
Food Ingredients Ltd.	NA	NA	NA	NA	NA
Grace Food Processors (Canning) Ltd	Drain for RO rejects and process waste (P) west drain		Drain Storm water drain (running south) east of Plant	Drain through storage?	
H D Hopwood & Co Ltd	Discharge Point Factory Effluent at Fence to Sewer	Sampling Point Factory Effluent	Discharge Point Mixed Effluent at Fence to Sewer	NA	NA
Industrial Chemical Co Ja Ltd	Canal on western boundary (Salt/ICC3)	North canal (Alum/ICC2)	ICC3	Treatment plant pH	
Industrial Gases Ltd. (Ferry)	Effluent from neutralisation	Discharge Point Fence	Sampling Point Influent	Discharge Point Fresh River	
J. Wray & Nephew Group (Estate Industries Ltd.)	North complex - RO discharge - manhole	North complex - drain to Spanish Town Rd	Estate Industry operation (Drain 5)		
J. Wray & Nephew Ltd.	Sewage influent	Bottling Hall (Wash down) (Drain 1)	Blending Hall and RO plant (Drain 2)	Winery and LAB (Drain 3)	Sewage Plant (Drain 4)
Jalex Manufacturing Co. Ltd.	Discharge from Storm Drain	Discharge from Production	Sampling Point after Sedimentation Tank		
Jamaica Biscuit Company Ltd.	Drain from plant into earthen drain outside the wall	Sampling Point (New Treatment System)			
Jamaica Citrus Company	Manhole - concentrate, animal feed plant (718)	Manhole - crate washing, juice blending, packaging	Drain - fruit washing	Drain - milk washing plus crate washing & juice packaging	Sampling from Milk Production
Jamaica Ethanol Processing Ltd	Influent to WWT plant	Effluent from WWT plant	Also boiler blow down - not treated by discharged after sand filter to soak away pit	Storm water to shell property	
Jamaica Private Power Company	Wells A & B	Sewage treatment effluent	Sewage Treatment Plant Inlet	Storm drain outlet	Cooling water discharge
JPS Rockfort		Sump from API separator	Cooling water pipe		
JPS Hunts Bay	Brine where temp is monitored	Sampling Point Plant Effluent	Storm water + brine from demineraliser drain - South fence	Cooling water drain along east wall of property	Sampling Point Demineralisation Plant

Company Name	Sampling Point #1	Sampling Point #2	Discharge Point #1	Discharge Point #2	Discharge Point #3
			along shore (inside property)		
LASCO DISTBRS LTD	NA	NA	NA	NA	NA
Mussons (Jamaica) Ltd.	Near drain in NW corner				
Nestle Jamaica Ltd.	Discharge from Wet Production	Sampling from Wet Production	Discharge from Dry Production	Sampling from Dry Production	
Omni Industries Ltd./Thermoplastics	NA	NA	NA	NA	NA
Pepsi-Cola Jamaica Bottling Co. Ltd.	Line 1 sampling	Line 2 sampling from Red stripe	Drain from sewage overflow	Drain 1 South boundary	Drain 2 South boundary
Petrojam Ltd.	API separator	Process stream 1, 2, 3	Drain from API separator	Storm water on south boundary line on shore	
Red Stripe	Brewing waste	Packaging Waste	RO Rejects	Sampling Point within factory	
Roberts Products Co. Ltd.	NA	NA	NA	NA	NA
Salada Foods Jamaica Ltd.			Manhole near fence on Bell Road		
Shell Rockfort Jetty	Discharge Shell Jetty Pump (Shell 5)	Discharge by Colas Plant (Shell 3.6)	Discharge - Lube Oil Blending Plant Shell South 4.	Discharge by East Drum Yard (Shell 3.5)	Note: up to 11 additional sampling points within plant
Sherwin Williams (W.I.) Ltd.	Soak away area Behind drying bed				
Shirlhome Chemicals Corp.	Pit influent	Pit effluent			
Smith & Stewart Distributors Ltd.	NA	NA	NA	NA	NA
Spike Industries Ltd.			Drain to road (east)	Drain to road (west0	Discharge Centre drain
Tanners	Discharge Point Fence to Culvert	Potential Sampling Point Factory Effluent			
Trade Winds Citrus Ltd.	Influent to pond	Effluent from pond	River upstream	River downstream	
Wakefield Juices	Discharge Point Factory Effluent	Potential Sampling Point Factory Effluent			
Windalco (Ewarton)		Discharge from plant towards Pleasant Farm Gully	Sampling point - Pleasant Farm Gully		

Company Name	Sampling Point #1	Sampling Point #2	Discharge Point #1	Discharge Point #2	Discharge Point #3
Caribbean Flavours & Fragrances Ltd.	Effluent from treatment system		Storm water drain along east fence		
Cosmetic International Ltd.	NA	NA	NA	NA	NA
Electric Arc (Jamaica) Ltd. Welding Industries	NA	NA	NA	NA	NA
Facey Commodity Company Limited Bottling	NA	NA	NA	NA	NA
Federated Pharmaceuticals Ltd.	NA	NA	NA	NA	NA
Jamaica Drink Co. Ltd. (Wisynco Group)	NA	NA	NA	NA	NA
JohnsonDiverseyLever Jamaica Ltd.	Effluent from treatment system		Sewer - south fence along Bell Road		

4.4 APPENDIX 4 Coordinates of Sampling and Discharge Points for Industries that Discharge into Kingston Harbour

COMMENT	NORTHING	EASTING	COMPANY	LOCATION	DES
BER 1D	651367.0	766573.0	Berger Paints	Spanish Town Rd	SW corner drain
BER 2S	651414.0	766608.0	Berger Paints	Spanish Town Rd	Effluent from open rectangular settling tank
BER 3D	651335.0	766645.0	Berger Paints	Spanish Town Rd	Central drain discharge
BER 4S	651389.0	766663.0	Berger Paints	Spanish Town Rd	Near solvent recovery system
BER 5D	651325.0	766678.0	Berger Paints	Spanish Town Rd	SE corner drain discharge
BEL 1S	646555.3	757033.8	Bernard Lodge	St. Catherine	Discharge Point Factory Effluent - spray pond over
BEL 2S	646561.0	756882.0	Bernard Lodge	St. Catherine	Sampling point - cane wash & mud filter wash water
BEL 3D	646329.5	756715.5	Bernard Lodge	St. Catherine	Discharge Point Factory Effluent irrigation Canal
BEL 4D	645564.9	757549.4	Bernard Lodge	St. Catherine	Discharge Point Factory Effluent IR 2
BHP 1D	648996.4	768966.2	BH Paints	Bell Road	Discharge Point Fence to Sewer
BCB 1D	646394.0	771518.0	Big City Brewing	Pechon St	Sewer manhole outside plant
BWC 1D	661138.1	748779.3	Bog Walk Coffee Factory	Bog Walk	Discharge Pits (1 of 8)
BWC 2D	661130.7	748791.3	Bog Walk Coffee Factory	Bog Walk	Discharge Pits (2 of 8)
BWC 3D	661131.5	748796.5	Bog Walk Coffee Factory	Bog Walk	Discharge Pits (3 of 8)
BWC 4D	661131.6	748810.9	Bog Walk Coffee Factory	Bog Walk	Discharge Pits (4 of 8)
BWC 5D	661122.7	748760.6	Bog Walk Coffee Factory	Bog Walk	Discharge Pits (5 of 8)
BWC 6D	661115.8	748753.2	Bog Walk Coffee Factory	Bog Walk	Discharge Pits (6 of 8)
BWC 7D	661109.9	748744.4	Bog Walk Coffee Factory	Bog Walk	Discharge Pits (7 of 8)
BWC 8D	661107.1	748743.6	Bog Walk Coffee Factory	Bog Walk	Discharge Pits (8 of 8)
CBR 1D	648830.0	773043.0	Caribbean Broilers	Arnold Rd	Sewer manhole outside plant
CBR 2D	648820.0	773041.0	Caribbean Broilers	Arnold Rd	Sewer manhole outside plant
CCL 1D	646154.0	778204.0	Caribbean Cement Company Ltd	Rockfort	West drain discharge & sampling
CCL 2D	646048.0	778326.3	Caribbean Cement Company Ltd	Rockfort	Central drain discharge & sampling
CCL 3D	645775.0	778615.0	Caribbean Cement Company Ltd	Rockfort	East drain discharge (adjust to fence)
CFL 1D	650613.2	767496.5	Caribbean Flavours	Spanish Town Rd	Discharge Point Factory Effluent Fence)
CPA 1S	645661.0	779002.0	Caribbean Pacific Alcohol	Rockfort	Effluent treatment first section
CPA 2S	645661.0	779003.0	Caribbean Pacific Alcohol	Rockfort	Effluent treatment second section
CPA 3S	645660.0	779005.0	Caribbean Pacific Alcohol	Rockfort	Effluent treatment third section

COMMENT	NORTHING	EASTING	COMPANY	LOCATION	DES
CPA 4D	645657.0	779008.8	Caribbean Pacific Alcohol	Rockfort	Discharge from plant
CPA 4D	645657.0	779009.0	Caribbean Pacific Alcohol	Rockfort	Discharge from plant
CPR 1D	650681.7	767314.7	Caribbean Product	Spanish Town Rd	Discharge Point Factory Effluent (Minor)
CPR 2S	650675.8	767352.7	Caribbean Product	Spanish Town Rd	Potential Sampling Point Fat Trap
CPR 3D	650661.6	767346.0	Caribbean Product	Spanish Town Rd	Discharge Point Factory Effluent Major
CRG 1D	649850.2	756563.8	Carreras Group	Twickenham Park	Discharge from Treatment Plant to Storage
CRG 2S	649849.6	756563.9	Carreras Group	Twickenham Park	Sampling Point Influent
CRG 3S	649855.2	756559.5	Carreras Group	Twickenham Park	Sampling Point Effluent
CBU 1D	646485.0	771150.0	City Butchers	Darling St	Entry to sewer system
JBC 1D	661288.4	749021.7	Content Beef	Bog Walk	Discharge to Pit
JBC 2S	661292.6	749034.5	Content Beef	Bog Walk	Potential Sampling Point Prior to Pit
DRI 1D	652645.4	767701.2	Dairy Industries Ja Ltd.	Washington Blvd	Discharge from property
DRI 2S	652747.5	767730.4	Dairy Industries Ja Ltd.	Washington Blvd	Discharge Point Effluent
DRI 3S	652662.7	767709.0	Dairy Industries Ja Ltd.	Washington Blvd	Sampling Point Effluent
GCN 1D	649658.9	767790.2	Grace Canning	Spanish Town Rd	Discharge Point Factory Effluent
GCN 2D	649692.8	767767.4	Grace Canning	Spanish Town Rd	Discharge Point Factory Effluent
HPD 1D	651599.8	766885.1	H. D. Hopwood	Spanish Town Rd	Discharge Point Factory Effluent at Fence to Sewer
HPD 2S	651597.0	766813.0	H. D. Hopwood	Spanish Town Rd	Sampling Point Factory Effluent
HPD 3D	651553.0	766842.8	H. D. Hopwood	Spanish Town Rd	Discharge Point Mixed Effluent at Fence to Sewer
IGL 1	652811.6	762964.1	IGL	Ferry	Sampling Point Effluent
IGL 2D	652806.2	762961.5	IGL	Ferry	Discharge Point Fence
IGL 3S	652749.2	762962.7	IGL	Ferry	Sampling Point Influent
IGL 4R	652889.9	763022.0	IGL	Ferry	Discharge Point Fresh River (Adjust)
ICC 1D	648968.5	754331.0	Industrial Chemical Company L	Spanish Town	Alum plant effluent discharge North canal ICC2
ICC 2DS	648983.0	754255.0	Industrial Chemical Company L	Spanish Town	Discharge from treatment system NW corner
ICC 3S	648973.0	754252.0	Industrial Chemical Company L	Spanish Town	Effluent from treatment system sampling point
ICC 4DS	648940.0	754214.0	Industrial Chemical Company L	Spanish Town	Discharge
JWN 10S	651356.0	767066.0	J Wray & Nephew	Spanish Town Rd	North complex - RO discharge - manhole
JWN 1S	650936.0	767056.0	J Wray & Nephew	Spanish Town Rd	Bottling Hall drain
JWN 2D	650931.0	767062.0	J Wray & Nephew	Spanish Town Rd	Discharge from bottling hall drain
JWN 3DS	650909.0	767051.0	J Wray & Nephew	Spanish Town Rd	Blending Hall drain effluent
JWN 4DS	650897.0	767022.0	J Wray & Nephew	Spanish Town Rd	Estate Industries drain & sampling

COMMENT	NORTHING	EASTING	COMPANY	LOCATION	DES
JWN 5S	651021.0	766841.0	J Wray & Nephew	Spanish Town Rd	Winery, lab and floor wash sampling
JWN 6S	651062.0	766763.0	J Wray & Nephew	Spanish Town Rd	Effluent from sewage treatment plant
JWN 7D	651060.0	766762.0	J Wray & Nephew	Spanish Town Rd	Discharge from STP and winery/lab/floor wash
JWN 8D	651092.0	766771.0	J Wray & Nephew	Spanish Town Rd	Discharge from STP and winery/lab/floor wash
JWN 9E	651355.0	766917.0	J Wray & Nephew	Spanish Town Rd	North complex - drain to Spanish Town Rd
JLX 1D	649836.5	756401.5	Jalex	Twickenham Park	Discharge from Storm Drain
JLX 2D	649906.5	756389.5	Jalex	Twickenham Park	Discharge from Production
JLX 3S	649888.5	756309.8	Jalex	Twickenham Park	Sampling Point after Sedimentation Tank
JBI 1D	650217.2	767789.8	Jamaica Biscuit	Spanish Town Rd	Discharge Point Fence
JBI 2S	650230.2	767788.1	Jamaica Biscuit	Spanish Town Rd	Sampling Point (New Treatment System)
JCG 1D	662554.2	748383.5	Jamaica Citrus Growers	Bog Walk	Discharge from Crate Washing (CW)
JCG 2S	662536.9	748459.9	Jamaica Citrus Growers	Bog Walk	Sampling Point from Juice Production & CW
JCG 2S	662475.7	748482.7	Jamaica Citrus Growers	Bog Walk	Sampling from Packaging
JCG 3D	662518.0	748397.3	Jamaica Citrus Growers	Bog Walk	Discharge from Juice Production
JCG 4D	662425.6	748470.6	Jamaica Citrus Growers	Bog Walk	Discharge from Packaging & Milk Production
JCG 5S	662500.7	748499.4	Jamaica Citrus Growers	Bog Walk	Sampling from Milk Production
JET 1S	646797.5	777014.5	Jamaica Ethanol	Rockfort	Influent to treatment system sampling point
JET 2S	646810.0	777035.0	Jamaica Ethanol	Rockfort	Effluent from treatment system sampling point
JET 3D	646805.0	777062.0	Jamaica Ethanol	Rockfort	Discharge from treatment plant
JET 4S	646796.0	777059.0	Jamaica Ethanol	Rockfort	Cooling water effluent sampling point
JET 5D	646812.8	777056.0	Jamaica Ethanol	Rockfort	Discharge from treatment
JPP 1S	646819.0	776244.0	Jamaica Private Power Company	Rockfort	Well A
JPP 2S	646818.0	776249.0	Jamaica Private Power Company	Rockfort	Well B
JPP 3S	646776.0	776244.0	Jamaica Private Power Company	Rockfort	Sewage treatment effluent
JPP 4S	646719.0	776239.0	Jamaica Private Power Company	Rockfort	Sewage Treatment Plant Inlet
JPP 5S	646634.0	776217.0	Jamaica Private Power Company	Rockfort	Storm drain outlet
JPP 6CWS	646502.0	776205.0	Jamaica Private Power Company	Rockfort	Cooling water discharge
JDI 1D	648962.9	768997.3	Johnson Diversey	Bell Road	Discharge Point Fence to Sewer
JPH 1D	646840.2	770012.5	JPS Hunts Bay	Marcus Garvey Dr	Discharge Point Plant Effluent
JPH 2S	646944.4	770140.6	JPS Hunts Bay	Marcus Garvey Dr	Sampling Point Demineralisation Plant
JPH 3S	646896.3	770083.5	JPS Hunts Bay	Marcus Garvey Dr	Sampling Point Plant Effluent

COMMENT	NORTHING	EASTING	COMPANY	LOCATION	DES
JPH 4D	646845.0	770264.4	JPS Hunts Bay	Marcus Garvey Dr	Discharge Point CW (Fence)
JPH 5CW	646928.6	770178.5	JPS Hunts Bay	Marcus Garvey Dr	Discharge Drain Cooling Water (CW)
JPR 1DS	646508.0	776257.0	JPS Rockfort	Rockfort	Plant waste and old soldiers area grey water
JPR 2CW	646489.0	776258.0	JPS Rockfort	Rockfort	Cooling water discharge
JPR 3D	646520.0	776409.0	JPS Rockfort	Rockfort	Grey water admin bldg
MUS 1D	649590.0	768142.0	Mussons	Marcus Garvey Drive	Near drain in NW corner
NSL 1D	662686.8	748543.2	Nestle	Bog Walk	Discharge from Wet Production
NSL 2S	662690.1	748542.9	Nestle	Bog Walk	Sampling from Wet Production
NSL 3D	662765.7	748568.7	Nestle	Bog Walk	Discharge from Dry Production
NSL 4S	662761.6	748573.2	Nestle	Bog Walk	Sampling from Dry Production
PEP 1D	650237.8	767346.7	Pepsi	Spanish Town Rd	Discharge Point RO Pepsi Fence
PEP 2S	650273.5	767388.2	Pepsi	Spanish Town Rd	Sampling Point RO Plant
PEP 3D	650174.3	767423.7	Pepsi	Spanish Town Rd	Discharge Point Production Pepsi Fence Mixed RS
PEP 4S	650204.5	767450.0	Pepsi	Spanish Town Rd	Sampling Point Production (Outside Building
PEP 5S	650066.4	767554.4	Pepsi	Spanish Town Rd	Pepsi Sampling (Packaging - discontinued)
PEP 6GATE	650103.3	767524.6	Pepsi	Spanish Town Rd	Discharge Drain Pepsi Gate (Mixed RS RO)
PEJ 1S	647184.1	769225.4	Petrojam	Marcus Garvey Dr	Sampling Point Oil Separator
PEJ 2D	647071.0	769111.0	Petrojam	Marcus Garvey Dr	Discharge to harbour
RST 1D	650193.8	767340.7	Red Stripe	Spanish Town Rd	Discharge Point Beer Production
RST 2S	650204.8	767338.0	Red Stripe	Spanish Town Rd	Sampling Point Beer Production
RST 3D	650143.0	767404.0	Red Stripe	Spanish Town Rd	Discharge Point Packaging (Mixed Pepsi)
RST 4S	650151.5	767406.5	Red Stripe	Spanish Town Rd	Sampling Point Packaging (Mixed Pepsi)
RST 5D	650085.3	767514.2	Red Stripe	Spanish Town Rd	Discharge Drain RS and Pepsi Mixed
RST 6S	650303.6	767521.0	Red Stripe	Spanish Town Rd	Sampling Point within factory
SAL 1D	649469.9	768535.4	Salada	Bell Road	Discharge Point Fence to Sewer
SHL 10S	646697.0	777072.0	Shell	Rockfort	Tank No 9 Shell 3.1
SHL 11S	646718.0	777044.0	Shell	Rockfort	Fire equipment station
SHL 1D	646608.2	777074.4	Shell	Rockfort	Discharge Shell Jetty Pump (Shell 5)
SHL 2D	646738.2	777126.3	Shell	Rockfort	Discharge by Colas Plant (Shell 3.6)
SHL 3D	646688.1	777218.6	Shell	Rockfort	Discharge - Lube Oil Blending Plant Shell South 4.
SHL 4D	646628.3	777251.5	Shell	Rockfort	Discharge by East Drum Yard (Shell 3.5)
SHL 5S	646707.0	777012.0	Shell	Rockfort	
SHL 6S	646521.0	777074.0	Shell	Rockfort	Shell 3.2 Duplicate Tank 18
SHL 8S	646683.0	777190.0	Shell	Rockfort	Lube oil Blending Plant North Shell 4.3
SHL 9S	646638.0	777131.0	Shell	Rockfort	Tank No 3

COMMENT	NORTHING	EASTING	COMPANY	LOCATION	DES
SHL7S	646558.0	777204.0	Shell	Rockfort	Shell 3.7 Kitchen
SHW 1D	649835.2	759829.7	Sherwin Williams	White Marl	Discharge to Ground Adjacent Property Fence
SHW 2S	649819.8	759805.7	Sherwin Williams	White Marl	Sampling Point Influent
SHW 3S	649827.6	759812.7	Sherwin Williams	White Marl	Sampling Point Effluent
SHC 1DS	650690.7	769636.1	Shirlhome Chemicals	Hagley Park Rd	Manhole for septic pit
SPK 1D	647036.5	774996.8	Spike Industries	Windward Road	Discharge Centre drain
SPK 2D	647035.6	774971.5	Spike Industries	Windward Road	Discharge West drain
SPK 3D	647036.2	775018.3	Spike Industries	Windward Road	Discharge East drain
TAN 1D	649370.8	768960.0	Tanners	Spanish Town Rd	Discharge Point Fence to Culvert
TAN 2S	649398.5	768969.6	Tanners	Spanish Town Rd	Potential Sampling Point Factory Effluent
TRW 1D	661432.7	748831.6	Trade Winds Citrus	Bog Walk	Discharge from Treatment Ponds to Rio Cobre
TRW 2DRC	661527.7	748716.3	Trade Winds Citrus	Bog Walk	Drain from JCG & Nestle to Rio Cobre
WKF 1D	645596.7	761328.5	Wakefield	St. Catherine	Discharge Point Factory Effluent
WKF 2S	645604.3	761329.1	Wakefield	St. Catherine	Potential Sampling Point Factory Effluent
WEW 1D	668849.0	743897.0	Windalco Ewarton	Ewarton	Discharge from plant towards Pleasant Farm Gully
WEW 2S	669119.0	744046.0	Windalco Ewarton	Ewarton	Sampling point - Pleasant Farm Gully

4.5 APPENDIX 5 Trade Effluent Standards and NWC Influent Limits

PARAMETER	NEPA Trade Effluent Standard	NWC Influent Limit
Ammonia/ammonium measured as NH4	1.0 mg/l	
Barium	5.0 mg/l	
Beryllium	0.5 mg/l	
Biological oxygen demand (BOD)	<30 mg/l	215 mg/l
Boron	5.0	
Calcium	No standard	
Chemical Oxygen Demand (COD)	100 mg/l or 0.1 kg/1000 kg product	350 mg/l
Chloride	300 mg/l	4 mg/l (available chlorine)
Colour	100 TCU	
Cyanide (free) Cyanide (Total as CN)	0.1 0.2	0.9 mg/l
Detergent	15 mg/l	
Dissolved oxygen (DO)	>4 mg/l	
Faecal Coliform	<100 MPN/100 ml	
Fluoride	3.0 mg/l	
Iron	3.0 mg/l	
Magnesium	No standard	
Manganese	1.0 mg/l	
Nitrate as NO3	10 mg/l	9 mg/l (as N)
Oil and grease	10mg/l or < 0.01 kg/1000 kg product	15 mg/l
pH	6.5 – 8.5	6.0 to 11.0
Phenols	5.0 mg/l	1 mg/l
Phosphate as PO4	5 mg/l	6 mg/l
Sodium	100 mg/l	
Sulphate	250 mg/l	
Sulphide	0.2 mg/l	0.25 mg/l
Temperature	±2o of ambient	<45 C
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/l	250 mg/l (settleable solids)
Trace Metals: Zinc Lead Cadmium Arsenic Chromium Copper Mercury	 1.5 mg/l 0.1 mg/l 0.1 mg/l 0.5 mg/l 1.0 mg/l 0.1 mg/l 0.02 mg/l	 0.5 mg/l 0.5 mg/l 0.5 mg/l 0.5 mg/l 0.5 mg/l 0.5 mg/l 0.5 mg/l

PARAMETER	NEPA Trade Effluent Standard	NWC Influent Limit
Nickel Selenium Silver Tin Total Heavy Metals	1.0 mg/l 0.5 mg/l 0.1 mg/l - 2.0 mg/l	0.5 mg/l 0.5 mg/l 0.5 mg/l 0.5 mg/l 2.5 mg/l
		No cooling water, surface water or sea water to foul sewer
		a. There shall be eliminated from the discharge into the sewer any matter, which, either alone or in combination with any matter with which it is likely to come into contact within the sewer, would damage or obstruct the sewer or cause injury to the health of any person lawfully present in the sewer, pumping station or treatment works through which it passes or would make difficult or expensive treatment or disposal of the sewage. In particular but without prejudice to the above: 1. Petroleum spirit, oils and volatile solvents. 2. Non biodegradable organics (including detergents). 3. Pesticides or Herbicides

4.6 APPENDIX 6 Promotion Strategy EMS in Private Sector

Strategy 1.4: Build capacity to plan, implement, monitor and evaluate EMS in the Private Sector

The Government will encourage companies to implement environmental safeguards, to maintain the standards and environmental performance to which they are committed, and to share their experiences with other local businesses. Some private sector companies have already begun to implement EMS and the GOJ through various projects e.g. GOJ/CIDA-ENACT, GOJ/USAID-CWIP and USAID-EAST will continue to work with trade associations and industry sectors to support this trend. Special emphasis will be placed on small and medium sized enterprises (SMEs). The Government will implement pilot projects, conduct training programmemes and develop frameworks for information dissemination and exchange.

Roles / Responsibilities:	**ACTIONS:**	**Timeline (years)** 1 2 3 4 5
NEPA will have overall responsibility for implementing all these actions except for Action.7 for which JBS will be responsible. NEPA and JBS will collaborate in implementing Action 3.	1. Develop Local EMS Case Studies	**1 2 3 4 5**
	2. Assist local environmental consulting firms to acquire the skills to facilitate EMS implementation by their clients.	**1 2 3 4 5**
Desired Policy/Strategy Outcomes: *Most Jamaican businesses* *Implementing some form of EMS and are rated high in environmental performance.*	3. Develop and Implement Pilot Projects in small & medium sized businesses (SMEs) including the use of a mentorship programmeme in Private Sector.	**1 2 3 4 5**
	4. Develop and implement a Corporate Leadership Programme including environmental reporting concepts.	**1 2 3 4 5**
	5. Implement EMS in Solid Waste Management Companies.	**1 2 3 4 5**
Outcome Indicators: *The number of businesses implementing EMS.*	6. The training of auditors from the private sector to carry out 3rd party certification audits of EMS and Environmental Performance including certification of the auditors [See Action 1.3.4].	**1 2 3 4 5**

The extent to which companies have improved their environmental performance.	7. Develop waste management strategies and cleaner technology approaches to move practices towards prevention of pollution and reduction in the use of natural resources.	**1 2 3 4 5**
The extent to which companies have improved their international competitiveness.	8. Develop a Waste Exchange Network with UWICED.	**1 2 3 4 5**
	9. Develop Codes of Practice with key private sector groups.	**1 2 3 4 5**
	10. Develop and implement an EMS Information Network.	**1 2 3 4 5**

4.7 APPENDIX 7 Exhibits of Selected Trade Effluent Systems and Effluent Streams in the Kingston Harbour Study Area - "The Good, the Bad and the Ugly"

Exhibit 1

Exhibit2 2

Exhibit 3

Exhibit 4

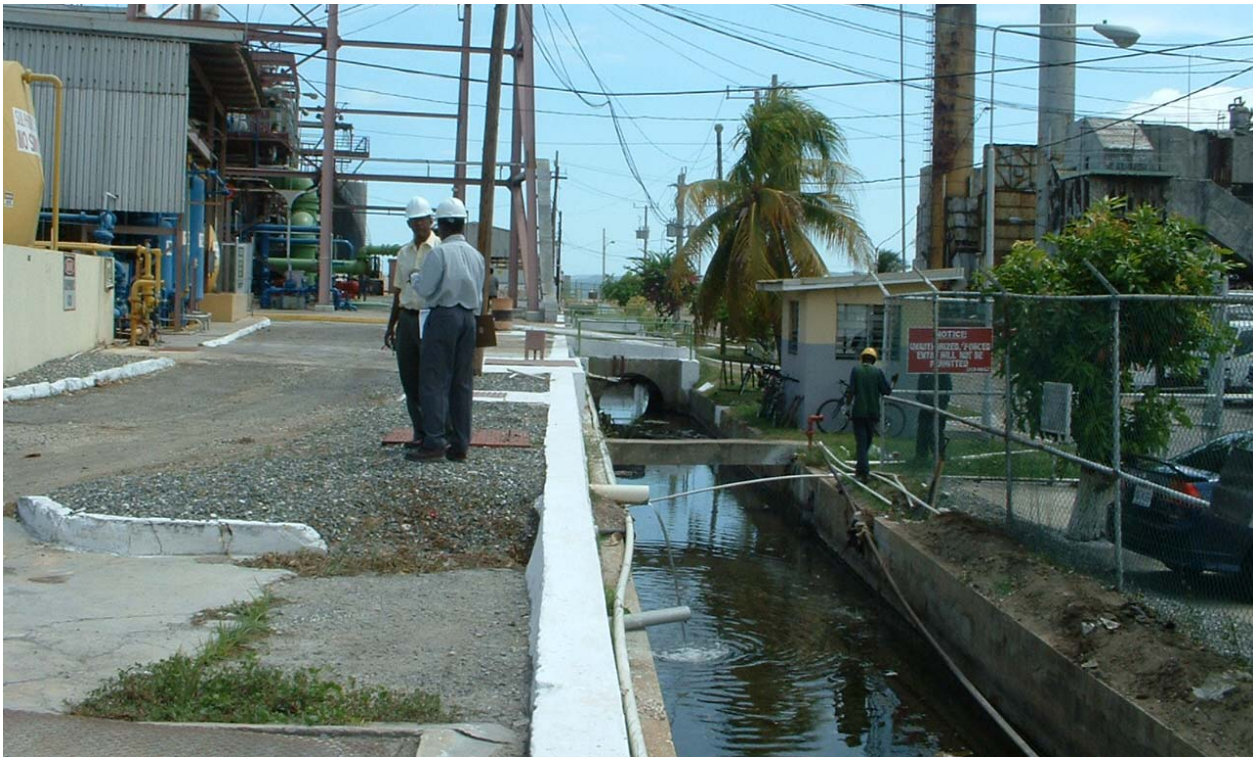


Exhibit 5

Exhibit 6

Exhibit 7

Exhibit 8

Exhibit 9

Exhibit 10

Exhibit 11

Exhibit 12

Exhibit 13

Exhibit 14