

TERMS OF REFERENCE

Castries Urban Stormwater Management Plan

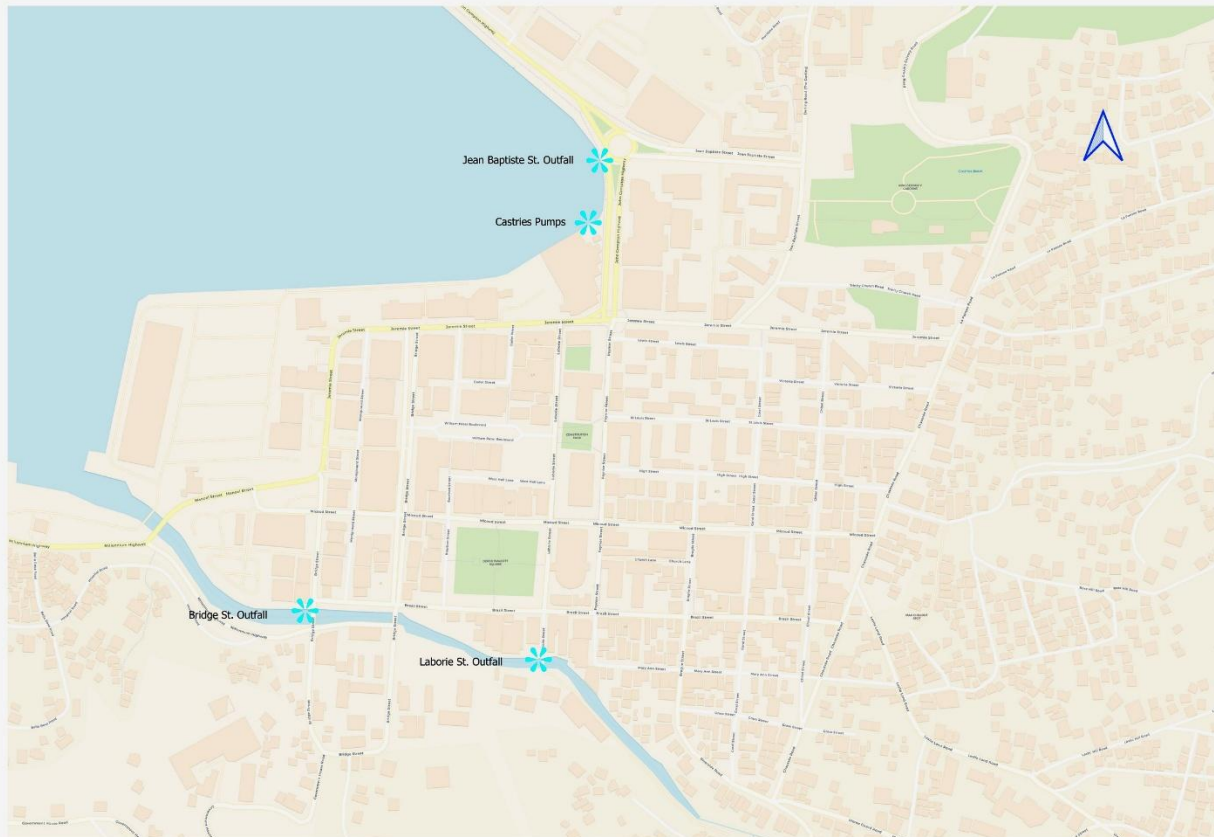
(Technical Activities)

1. BACKGROUND AND CONTEXT

The Saint Lucia Urban Resilient Flood Investment Project (SURF-IN) is financing flood mitigation investments in Castries and Anse La Raye. The Pre-Feasibility Study undertaken by HR Wallingford has revealed a critical data gap: the absence of stormwater drainage maps and detailed operation and maintenance plans for Castries. Responsibilities for drainage infrastructure remain unclear between the Castries City Council (CCC) and the Ministry of Infrastructure, Ports Services, Energy (MIPSE). Preliminary hazard modelling has demonstrated correlations between poor maintenance regimes and flood risk, underscoring the need for improved drain de-siltation and solid waste removal.

The establishment of an Urban Stormwater Management Plan will improve maintenance procedures, strengthen inter-agency coordination, enhance budgetary processes, and guide investment prioritization. Castries has separate storm water and sanitary waste drainage systems. The proposed Plan must take adequate account of future climate scenarios as well as current conditions to ensure investments perform effectively throughout their design life. The Task and Deliverables proposed for this assignment pertain only to the storm water management system.

Figure 1 presents a map of the project area noting roads and drainage system primary discharge points.



2. OBJECTIVES

The primary objectives of this consultancy are to:

- Develop a comprehensive GIS-based drainage asset inventory and management database for the Castries urban area
- Establish clear delineation of maintenance responsibilities between CCC and the MIPSE
- Assess current drainage network condition and identify accumulated deferred maintenance requirements
- Develop an optimized maintenance management plan with realistic resource requirements
- Recommend structural improvements and equipment needs to enhance maintenance efficiency

3. SCOPE OF WORK

Task 1: Data Collection, System Mapping, and Assessment

1.1 Data Collection and Asset Baseline Mapping

Under this task, the Consultant shall develop a comprehensive drainage system GIS system and database beginning with the storm water outfalls to the sea (including pump station discharges) and including all public drainage infrastructure assets up to but not including discharges from individual properties. A baseline layer shall be developed to present all elements of the system as installed and shall include conveyances both surface and subsurface. Subsurface conveyances of less than 4 inch diameter shall not be included.

Included in this layer shall be the identification and location of related structures such as drain basins, weirs and drainage restrictions such as culverts, bridges, training works. All street drain collection points shall be included in this map.

During the development of the baseline layer, the Consultant shall design and populate a descriptive database to include conveyance characteristics (dimensions, materials of construction, general condition, drop/slope etc.), collection point dimensions, construction, basin dimensions, access covers and any associated structures such as debris traps, sediment traps and other features. All surface streams shall be characterized by flow and discharge capacity. To the extent possible, the data shall note year of construction. The database design shall be approved by the Government of St. Lucia. For all drainage infrastructure, including closed and open channels, the Consultant shall determine whether the structure is lined or unlined. For conveyances with a lined invert, the Consultant shall provide an estimate of sediment volume (m^3), build-up depth, and sedimentation locations.

The database shall capture hydraulic parameters for future network analysis: invert levels, pipe gradients, Manning's roughness coefficients, and junction head loss coefficients and other relevant parameters.

Based on the network topology, the Consultant shall propose an appropriate hierarchical network classification system to permit the delineation of drainage segments into collection districts based on system flow patterns terminating at the ultimate discharge outfall. The proposed system shall eventually be approved for use by the Government of Saint Lucia.

The Consultant shall classify the network segments and features using the approved classification system. Using this system, each conveyance and their associated structures shall be assigned a unique identifying code based on their position in the classified system.

Additionally, maintenance responsibility for each conveyance shall be classified either as Ministry of Infrastructure or the City of Castries.

The Consultant shall prepare a clear institutional responsibility matrix identifying: (a) ownership; (b) current maintenance responsibility; (c) proposed responsibility; and (d) disputed jurisdictional boundaries. This matrix shall be developed through consultation with CCC and Ministry of Infrastructure.

1.2 Inspections, Condition Mapping and Assessment

During the data collection phase, the Consultant shall inspect drainage system components for condition, suitability for purpose and accessibility for routine maintenance. During this assessment, the Consultant, working with government staff shall identify and map hot-spot locations susceptible to the accumulation of debris and/or sedimentation. All pipe conveyances greater than 12 inches diameter (the minimum size accessible by standard camera inspection equipment) and all surface conveyances shall be visually inspected using camera systems as needed, above and below ground for structural condition, sediment and debris accumulation. For all inspected assets, the Consultant shall estimate accumulated debris and sediment volumes (m³) to inform maintenance programming.

During this assessment, the Consultant shall prepare a GIS layer noting damaged sections, debris and sediment accumulations, location of blockages, standing water, and flow restrictions and deviations from installed designs. Also interventions to the drainage system shall be identified and mapped. These include 3rd party interventions such as driveway pipes and culverts and other drainage modifications. These observations will be collected and described in the database noting the type, extent (length) of the modification, pipe sizes, and other blockages or restrictions.

The Consultant shall apply a standardized condition grading system (1–5 scale, 1=excellent, 5=failed) considering structural integrity, hydraulic capacity, joint condition, and infiltration/exfiltration. The GIS deliverable shall include a colour-coded condition layer (green/yellow/amber/red/black corresponding to grades 1–5) for rapid visual identification. Assets graded 4–5 shall be flagged for urgent intervention.

Data collected during this assessment shall guide recommendations for interventions needed to improve system maintenance activities.

The Consultant shall also assess tidal influences on drainage: (a) presence/condition of flap valves on sea outfalls; (b) saline intrusion evidence; (c) correlation between tidal cycles and standing water; and (d) backflow prevention measures.

1.3 Drainage Maintenance Districts

Based on the completed system map, the Consultant shall organize the network into drainage districts to be used for planning and conducting system maintenance activities. These districts shall be geographically defined, informed by contributing catchment boundaries and the network classification system, but organised around operational logistics. Districts shall be developed based on the network classification system developed and in close consultation with the City of Castries and MIPSE. It is envisioned that the classified network segments will be further subdivided into maintenance districts based on the experience and capacity of the organizations responsible for system operation. Drainage management districts shall be compiled in a separate GIS layer. In so far as is feasible and practicable The Consultant may consider/propose nature-based solutions to complement conventional “grey infrastructure” options.

1.4 GIS Format and Requirements

All location data shall be collected and presented in WGS 84, current epoch, UTM Zone 20N. GIS data shall be delivered in GeoPackage (.gpkg) format as the primary standard, with shapefile format provided as a secondary export for ESRI ArcGIS compatibility. Include ISO 19115 metadata for all spatial datasets.

Deliverables: point features (manholes, gullies, structures); line features (pipes, channels); polygon features (catchment/drainage district boundaries); network topology dataset for upstream/downstream tracing.

1.5 Piezometers

The Consultant shall install a series of four (4) piezometers to be located equidistance from the upper portions of Castries to near the coast for the purpose of monitoring groundwater levels. Piezometer depth shall be a minimum of 3 feet below the groundwater surface encountered at drilling time. These wells shall be arranged in a linear fashion from east to west and shall be installed on public land at locations provided by the government of St. Lucia. Once installed, the Consultant shall record the depth to groundwater from the local surface. Drilling locations will be provided by the Government of St. Lucia. For each installation, the Consultant shall maintain a bore hole log noting depth and characteristics of the bore hole profile.

Following standard hydrogeological practice, the minimum operational monitoring period shall be 12 months, covering at least one full wet and dry season cycle, with a minimum of four monitoring events referenced to EGM2008 datum. The piezometers shall be installed as permanent monitoring infrastructure. Upon completion of the consultancy, the Consultant shall hand over all installations with calibration records, maintenance instructions, and as-built drawings to the Government of Saint Lucia.

The Consultant shall prepare an assessment of the groundwater-surface water interactions affecting drainage performance, including system surcharging and infiltration capacity.

Task 2: Recommended Structural Improvements

Based on the findings under tasks 1 and 2, the Consultant shall propose recommended structural improvements to the drainage system. These improvements shall include network repairs and modifications designed to improve operational efficiency and reduce labour intensive maintenance activities. This is particularly important with respect to debris and sediment management. Such improvements may include the addition of sediment and debris traps which can be managed mechanically to reduce labor requirements, improvements to system access points, modifications to system components to improve operational efficiency and new constructions.

Recommended interventions shall be prioritized based on (a) condition grade, (b) network criticality, (c) cost-effectiveness, and categorize as short-term (<1 year), medium-term (1–5 years), long-term (5+ years).

Particular attention should be paid to the King George V Gardens retention basin and the Jn Baptiste Street / Darling Road pump station, which together provide critical flood attenuation for the Central Business District (CBD). Pump station rehabilitation has significant flood risk reduction potential.

These recommendations shall include removal of system choke points, 3rd party interventions, modification or replacement of structures and new constructions designed to reduce the demand for manual labour and facilitate the use of mechanical equipment for system maintenance.

For each intervention, the Consultant shall prepare a general cost estimate. These recommendations shall be captured in a GIS layer.

Task 3: Current Maintenance Program Review and Optimized System and Maintenance Management Plan

3.1 Current Program Review

Working closely with the CCC and the MIPSE, the Consultant shall conduct a detailed review of current system inspection and maintenance practices. The Consultant shall assess equipment, methods, practices, and labour requirements currently employed to manage system maintenance. This assessment shall include a review of support functions related to equipment management and equipment maintenance activities.

During this review, the Consultant shall note the frequency of network inspection and maintenance activities including hot spots requiring frequent interventions. The Consultant shall also review budget requirements and constraints for funding required activities.

To facilitate this, the Consultant shall prepare a review of the expenditures incurred over the last 2 years to support system maintenance. These will be grouped into 5 categories specifically inspections, physical maintenance activities, system repairs, equipment purchases, and equipment maintenance activities. The accounting for physical maintenance activities shall be further divided into physical labor, external contracting, and mechanical equipment costs. In this review, the Consultant shall distinguish routine/planned vs emergency/reactive maintenance. Calculate unit costs (per linear meter drain cleaning, per m³ silt removal) and document: (a) flooding complaint response times; (b) pre-storm clearance protocols; (c) NEMO coordination; and (d) post-event assessment processes to inform sustainable O&M budgets.

Additionally, the Consultant shall review the processes for prioritizing and allocating maintenance resources and the frequency and requirements for emergency interventions.

Specifically, the Consultant shall review the current CCC staffing and management structure for stormwater system maintenance. This will include the preparation of a staffing chart detailing positions, responsibilities and decision authority. The review shall include a technical capacity assessment evaluating staff qualifications, training, and experience against the competencies required to implement the management plan, identifying specific gaps and recommendations for restructuring, professional development, or recruitment. The Consultant shall also review the annual budget process to identify how funds are allocated for system maintenance.

Based on the information collected under task 1, the Consultant shall provide an estimated cost for any deferred maintenance identified and identify potential budget shortfalls under the current management system. This will include the quantification of: (a) sediment volume (m³); (b) drainage length requiring repair/replacement; (c) assets requiring rehabilitation vs. replacement; and (d) capital cost to clear backlog. Additionally, for the recommended interventions, the Consultant shall note any environmental and social issues identified that need to be addressed when implementing the recommendations identified.

3.2 Optimized System and Maintenance Management Plan

Based on the findings under tasks 1 and 2 and the operations analysis, the Consultant shall prepare an optimized system maintenance and management plan. This plan seeks to reduce system maintenance costs, improve the implementation of inspection and maintenance activities, and reduce the need for manual labor in system maintenance.

Additionally, the plan shall systematically address accumulated deferred maintenance issues. It will also address work needed to modify the system to accommodate mechanical equipment to improve accessibility.

Based on existing resources, the management plan will organize the drainage system into manageable maintenance units. Based on these units, the Consultant shall prepare an inspection program that allows all elements in the system to be inspected at a minimum annually, with the Consultant recommending differentiated inspection frequencies based on asset criticality, condition grade, sedimentation rates, and network hierarchy. The plan shall identify maintenance activities to be applied on a routine basis and provide a system for prioritizing works based on inspection findings and location.

The Plan must include: (a) annual maintenance calendar with seasonal considerations; (b) inspection checklists and SOPs; (c) KPIs; (d) escalation protocols; and (e) inter-agency reporting templates. Develop through participatory workshops with CCC and the Ministry of Infrastructure.

3.3 Equipment Recommendations

To reduce the need for manual labor, the Consultant shall provide recommendations for maintenance equipment to complement the existing equipment inventory. These may also include debris capture systems that can be removed mechanically. Based on the configuration of the system, equipment to support inspection shall also be considered to include remote pipe inspection systems.

Procurement-ready specifications must be provided for equipment to included but not limited to : capacity/performance, power, operational constraints, capital and operating costs and which are suitable for the Castries constraints (narrow streets, tropical climate, local service availability).

Priority equipment categories shall include inter alia: (a) vacuum/jetting units; (b) CCTV inspection equipment; (c) portable pumping; (d) mechanized gully emptying; (e) sediment trap lifting equipment.

3.4 Organizational Plan

Based on the current organizational structure, the Consultant shall propose a staffing plan needed to effectively implement the maintenance management plan. The Consultant shall identify: (a) minimum staffing for routine operations; (b) required competencies; (c) training requirements; (d) recommended structure. Assess in-house, contracted, and hybrid delivery options.

3.5 System Management Software

To facilitate storm water management and maintenance activities, the Consultant shall provide recommendations for the implementation of GIS enabled software. This software shall permit the scheduling of maintenance and inspection activities, assist with asset management, allow for the capture of maintenance expenditures, assist with crew scheduling, prioritization of maintenance activities and other features needed to promote operational efficiency.

Software selection shall consider: (a) CCC and Ministry of Infrastructure IT compatibility; (b) mobile data collection; (c) GIS integration; (d) reporting functionality; (e) total cost of ownership; and (f) SIDS suitability. The Consultant shall assess and compare various options commercial, open-source, and web-based/cloud-hosted options. In their comparative analysis, the Consultant shall assess each option's total cost of ownership, data interoperability with existing government GIS platforms (including QGIS), institutional sustainability for a resource-constrained municipality, and scalability across government entities. Software requiring recurrent, time based licensing fees is not desirable. The Consultant will then provide required computer equipment, install and configure approved software and provide 10 days operational training for system implementation.

Task 4: Capacity Building and Knowledge Transfer

The Consultant shall deliver a capacity building program to ensure sustainable implementation of the management plan including but not limited to:

- Technical training for CCC and the Ministry of Infrastructure staff: GIS data management, condition assessment, asset management software (minimum 3 sessions)
- Hands-on field training during the data collection phase, with government counterpart staff participating in inspections
- Development of training materials and standard operating procedure manuals for ongoing use
- Final handover workshop presenting findings and demonstrating all deliverable systems

Data Ownership and Intellectual Property

All data, GIS layers, databases, software configurations, source files, and other outputs developed under this consultancy shall be the property of the Government of Saint Lucia. The Consultant shall deliver all materials in editable source format and transfer all administrative access credentials upon completion. No proprietary restrictions shall apply to deliverables produced under this assignment.

4. DELIVERABLES AND TIMELINE

The Consultant shall provide the following deliverables:

Deliverable	Content	Month from start date
Del 1: Inception Report	Work plan, methodology, data collection protocols, database designs	1
Del 2: Draft Asset Inventory which is required output of Subtask 1.1	Complete drainage network mapping in GeoPackage format, condition assessment data with colour-coded GIS layer, institutional responsibility matrix	4
Del 3: Inspections, Condition Mapping and Assessment which is required output of Subtask 1.2 and 1.3 and 1.4	Complete drainage network condition mapping in GeoPackage format, condition assessment data with colour-coded GIS layer, institutional responsibility matrix. The Consultant will also provide the recommended Drainage Maintenance Districts layer	5
Del 4: – A Report proposing Recommended Structural Improvements to the Drainage system in the City based on undertaking Task 2	Detailed report presenting recommended structural investments together with the GIS layer capturing the locations of improvements identifies	6
Del 5: Current Maintenance Program Review and Optimized System and Maintenance Management Plan in fulfilment of Task 3.1 and Task 3.2	Detailed report presenting the analysis of the current system for storm and recommended changes to the current system for storm water system management,, technical capacity assessment, deferred maintenance assessment, equipment recommendations, staffing plan with skills gap analysis and budget recommendations. This will included	8

Equipment recommendation in fulfilment of Task 3.3	recommendations for systematic monitoring and inspections as well as recommended maintenance and inspection schedules, budget requirements and cost projections over a 5 year operating cycle. The Consultant shall prepare operational documentation required for program implementation including checklists, schedules, Standard operating procedures, reporting templates, position descriptions, MOUs for interagency coordination and other documentation required for plan implementation. Equipment recommendations shall be provided and specifications for purchase/bidding shall be provided.	
Staffing/Organizational Plan in fulfilment of Task 3.4	The Consultant shall identify: (a) minimum staffing for routine operations; (b) required competencies; (c) training requirements; (d) recommended structure. Assess in-house, contracted, and hybrid delivery options.	
Del 6: Capacity Building and Knowledge Transfer Program/Plan pursuant to the requirements of Task 4	The Consultant shall provide a report summarizing training activities, including session records and all training materials and presentations used.	11
Del 7: Draft Final Report	Consolidated findings, structural improvement recommendations with cost estimates, software recommendations, training materials	14
Del 8: Final Report & GIS	Incorporating PCU and stakeholder comments, final database in GeoPackage format, all GIS layers with colour-coded condition mapping, training documentation, software comparison report, data/IP handover checklist with administrative credentials	10
Del 9: Maintenance management Software installation, training and commissioning in fulfilment of the requirements of Task 3.5	Install and configure approved software and provide 10 days training to selected personnel for system maintenance and operation. Provide all written training materials and presentations, provide a report summarizing training activities and personnel receiving training. Consultant shall also provide 2 copies each of software operation and maintenance manuals in an electronic format.	10
Del 10: Piezometer Monitoring Report and Handover in fulfilment of the requirements of Task 1.5	12-month groundwater monitoring dataset, piezometer as-built drawings, well log, calibration records, maintenance instructions, formal handover to Government of Saint Lucia	14

		Month from start date
		1
		4
		5
		6
		8
		10
		11
		13
		10
		14

5. CONSULTANT QUALIFICATIONS

The Consultant team shall include, at minimum the following key personnel:

- Team Leader/Urban Drainage Engineer: Minimum 15 years experience in urban drainage design and asset management, experience with drainage master planning in developing country or SIDS context preferred
- GIS/Database Specialist: Minimum 10 years experience in GIS-based asset management systems, experience with drainage/utility mapping
- Hydrogeologist (short-term): Minimum 5 years experience in groundwater monitoring and piezometer installation, for piezometer-related activities under Task 1.5

6. COORDINATION REQUIREMENTS

The Consultant shall coordinate closely with:

Stakeholder	Coordination Scope
PCU/WB	Monthly progress reporting; technical review of deliverables
Castries City Council	Counterpart for urban area; equipment specifications coordination
MIPSE	Primary counterpart for urban area; equipment specifications coordination
WRMA	Surface water/river interface coordination