Improvement of Urban Environment Through Sewer Network Monitoring Using CCTV Technology

S.P.N.D. Senarath

(169166N)

Research submitted in partial fulfilment of the requirements for the degree Master of Science in Environmental Engineering and Management

Department of Civil Engineering

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Dedication

This research is dedicated to those who have encouraged me all the way and those who have contributed to the betterment of life in the World.

Declaration of the Candidate & Supervisor

I declare that this is my own work, and this thesis does not incorporate without acknowledgment any material previously submitted for a degree or Diploma in any other University or institute of higher learning, and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

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Abstract

The Colombo Municipality has recognized that the maintenance of the sewer network is an important part of upgrading the city's urban environment. However, The Maintenance of the Colombo Municipality Sewer Network is a challenging task due rapid deterioration of the pipe system. The city sewerage system which is 100 years old has frequently experienced collapses and overflows, operation failures due to Sulphide attacks, root ingress, and infiltration to the pipe. More ever, Prior identification of the Failure location and carrying out proactive maintenance work is vital and becomes extremely difficult due to limited budgetary provisions and the lack of actionable information on the underground sewer network. Apart from that, CMC does not possess advanced asset management software to predict the pipe renewal plan. So, it was a challenge to make immediate decisions on the underground utility service's rehabilitation and quickly attend to repair work.

This Thesis has presented a study for developing an asset Management framework that accurately assesses the condition of pipe segment, the status of sewer pipe, and lastly, identifies the most sustainable rehabilitation priorities of sewer network within the particular catchment. The catchment area has 40 km of sewer network has been assessed in this study, ranked according to the maximum grade of sewer lines, and identified potential risks within the sewer system. And scientifically derive pipe renewal schedules based on economic, social, and environmental aspects. The study of the pipe segments area has identified that the pipe distress is localized and randomly distributed, not depending on the age of the asset. It has been found that most of the pipe segments in the network need replacement within the next 10 years. In comparison, 63% of pipe segments require immediate action on rehabilitation within five years to prevent the failure of the pipe.18% of pipe segments require to be attended to within 5-10 years.14% of pipes require to be repaired within 10-20 years. Sound management of the underground pipe infrastructure can be achieved by paying more attention to environmental aspects than economic aspects. Every outcome of the study may be used by the municipality and other agencies handling underground pipe networks. Every outcome of the study may be used to sustain the city sewer network. It will be beneficial not only for delivering the service but also for improving the environment of the city.

Keywords: CCTV condition assessment, risk analysis, lifetime, Sewer rehabilitation Asset management systems; Risk management; Consequences; Prioritization

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1 INTRODUCTION

1.1 Background of Study

The developed infrastructure is the road map for economic prosperity. But maintenance of utility services like sewer and drainage systems becomes extremely difficult due to rapid deterioration and changes in the urban footprint. Hence Municipalities must develop new methods to maintain city infrastructure and public assets. The city of Colombo is the commercial capital of Sri Lanka, and the Colombo Municipal Council is the main service provider for sewer and wastewater management and disposal within the city. The sewer Network of Colombo city can serve sewerage and drainage facilities to over one million both residents and migrant populations within the city limit. In addition to that, it receives cross-border wastewater from Kolonnawa, Kotte, Dehiwala, and Mount Lavanya. The network discharges 22.7 MGD (Millions of gallons per day) flow through two long sea outfalls located at Modara and Wellawatta. The Current Network consists of 350 kilometers of gravity sewer lines with diameters ranging between 150mm and 1500 mm, and 25 kilometers of force main with diameters ranging from 600mm-1200 mm.

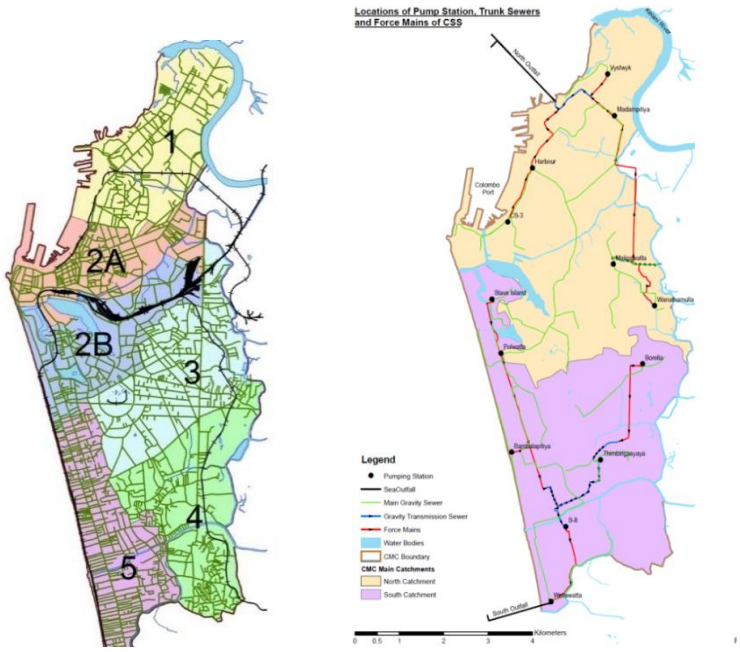


Figure 1.1: Colombo Sewer Network, Pumping Station, and Main Sea Outfall

The existing sewerage system was established in the late 1900s by the British government and most of the parts are aged more than 100 years. Sewer pipes are made of mainly vitrified clay, polyvinyl chloride (PVC), brickwork, and concrete. The city sewerage system which is 100 years old has frequently experienced collapses and overflows, operation failures due to Sulfide attacks, root ingress, and infiltration to the pipe. Bearing failures occurred due to the consolidation of clays and the weight of the traffic vehicle.

The failure of the sewer network will damage roads and buildings, disrupt vital services, pollute waterways and affect public health. Most of the time these failures are well below the surfaces and are unknown for a long time until service disruptions, road collapse, or basement flooding (Khan, 2009).

1.2 Problem & Justification

The Colombo municipality is facing so many challenges not only financially but also organizationally in delivering service to its residents. They are sudden pipe bursts, road collapses, frequent overflow, challenges in emergency repair, and many more. it has to be satisfied with many regularity requirements relevant to the environment as well. Large-scale urban regeneration programmes that have been initiated during the last 15-20 years such as Colombo Port City Project, Urban Regeneration Project, Maritime City, etc. have increased the service demand of the system. Thus, immediate action is needed to eliminate sudden accidents and provide a proactive maintenance programme to fulfill future demands and comply with the regularity requirement.

The Colombo Municipal Council has continuously conducted various types of programmes to upgrade the underlying sewerage network. The CCTV investigation and Rehabilitation work related to the 125 km of sewer network at the North catchment has been completed and another 125 km of CCTV investigation relevant to the south catchment has been progressing under the GCWWMP project funded by ADB (Asian Development Bank). The sewerage rehabilitation process relies on the experience and knowledge of professional engineers who analyze all the scenarios related to the CCTV inspection and determine solutions accordingly. This process is

difficult and subjective. In addition, it usually focused on economic and financial aspects rather than environmental and social aspects to identify an optimal solution on a catchment basis.

Apart from that, CMC does not possess an advanced asset management software tool to derive the condition data into actionable information. So, it was a challenge to make immediate decisions on underground utility service and to quickly attend to work. The situation will cause the city to lose its productive output from investment in CCTV work. This study aims at transforming all condition data into actionable information. CMC only allows annual budgetary provisions for the rehabilitation of a small section of the network. In addition to that, it is very difficult to carry out open trench construction in highly congested city areas. So, most rehabilitation work is performed only when a major failure occurs. Recent repairs at Dilasal place and Chithra Lane are very costly. The cost of an emergency repair of a failed sewer can be two to ten times more than the preventive repair of a damaged sewer. (Hahn, 2002).

Well-maintained sewer system ensures better service delivery for commuters as well as a strong foundation for urban development. It will minimize the sudden breakdown of pipes and subsequence disruptions to the city area. So, the Development of an innovative decision tool that can predict the failure locations will reduce the stress of attending to the costly emergency repairs and service disruptions to daily city life. Its facilities to the maintenance staff/Drainage Engineer to identify and locate assets and service failures in near future. In Addition, this system will let decision-makers (utility providers, political hierarchy) take financial-biased decisions on sewer improvement projects.

Ultimately it will lead to the improvement of the environment of Colombo City and the development of the living condition of society.

1.3 Research Objectives

The main objective of this study focuses on the improvement of the Urban Environment through sewer network monitoring. To achieve the above objective,

attention is paid to developing the optimal rehabilitation framework which will utilize the condition assessment survey data of the existing sewer network in the Colombo municipal area. The above framework support making better financial decisions by analyzing multiple scenarios related to the location and delivering the following goals to the utility agency.

- To develop the methodology to derive the condition state of the pipe segment based on the defects along the pipe.
- To rank the sewer according to its criticality and consequences of failure.
- To Provide the Drainage maintenance crews with images of failure location and defective pipes before attending to the repair work.

1.4 Scope & Limitation

The prime goal of this study is to develop a user-friendly framework that is easy to follow by a technical person. It includes the assessment of the criticality of the pipe segment, identifying the consequence of pipe failure, and lastly, prioritizing the rehabilitation work. But it does not include the valuation of the economic loss of the service.

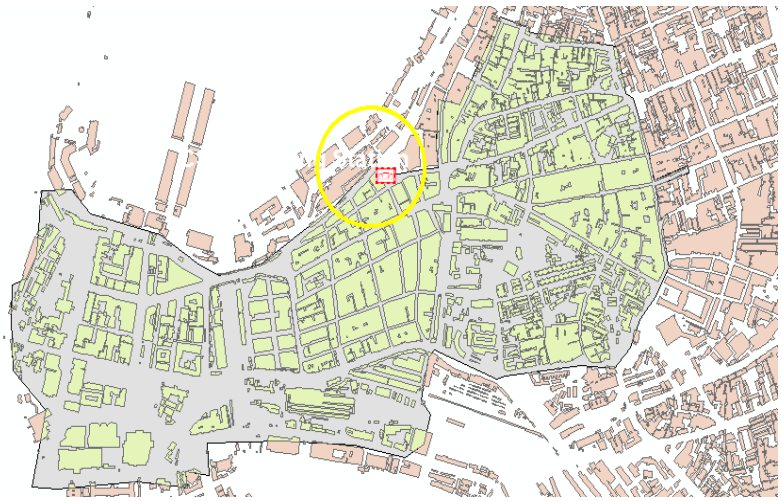


Figure 1.2: Case Study Area-CS3 Catchment

1.5 Guide to Thesis

This section identifies the chapters included in the research.

Chapter 01: Introduction provides the general information and the background of the research. Further, it provides the objectives and the research requirement.

Chapter 02: Literature Review provides an in-depth review of previous research studies relevant to this research.

Chapter 03: Research methodology develops the hypotheses based on the literature review. Further, it provides the proposed research model. This chapter mainly discusses the design of the research and data collection.

Chapter 04: The data Collection & Analysis. Chapter describe how the data obtained relevant to the field and develop data base accordingly

Chapter 04: The Results ad Discussion chapter provide important findings and graphical representation of the results using geographical information software.

Chapter 05: Conclusion chapter provides the answers to the objectives. Also, it provides recommendations for the rehabilitation of the network

2 Literature Review

2.1 General

Water and sewer system is considered to be the backbone of developing community infrastructure facilities and investment for the well-being of mankind (Motele,2010). A Sewer network is one of the essential features of wastewater infrastructure systems (Ariaratnam, 2002). Gravity sewers provide for more than 90% of the population in the developed world (WHO, 2000).

This wastewater conveyance system has undergone aging and deterioration resulting in frequent pipe collapses and sewer overflowing. With the frequent failure of the sewer systems and inconvenience to the public, Municipalities tend to prioritize carrying out rehabilitation and maintenance of sewer work in terms of budgetary allocation and investment planning. Therefore, there is a high demand to develop a framework that enables the management/engineers to prioritize the critical sewers for further rehabilitation. This chapter includes a review of literature in various Engineering Research publications in the field of condition assessment, asset management, and Geo application. It allowed identifying best practices and applying asset management concepts in the sewer rehabilitation field.

2.2 Impact of Pipe Failure on Environment and Public Health

Pipeline failures are common in Colombo city due to its aging pipeline infrastructure. In the event of urban wastewater discharge, the two main concerns are adverse public health Impact and Environmental Degradation of water bodies, lakes, and ecosystem.

2.2.1 Public Health Impact

It is recognized that the failure of the sewer system leads to an unhealthy environment for habitat and a breeding ground for harmful diseases. The most notable is the presence of the bacterium Escherichia coli (or E. coli), which causes diarrheal diseases. In addition, it provides a home to the bacteria Vibrio cholera,

Shigella, and Campylobacter, as well as viruses and rotaviruses that cause terrible human diseases such as bancroftian filariasis, and worm-borne schistosomiasis.

2.2.2 Environmental Degradation of Water Bodies, Lakes, and Ecosystem

The discharge of wastewater due to pipe failures creates an environment unsuitable for habitat and living beings. it causes eutrophication and algal blooms, depleting the oxygen level of the water body. It will result in the killing of aquatic life and economic hardship on the fishing community relay on particular command area.

2.3 Pipe Failure Mechanisms

Sewer pipe failure can be subdivided into three stages.

(1) Initial Defects- this may be by cracking due to excessive vertical load or bad bedding, bad construction practice by damage caused when making connections.

(2) Deterioration – this involves the deterioration of the sewer material itself, e.g., by erosion of joint material and mortar (especially in brick sewers) or by concrete corrosion due to hydrogen sulfide. Deterioration could also involve soil migration due to infiltration or exfiltration of cracked sewers, leading to ground loss and reduction of support around the sewer.

(3) Collapse – this is often triggered by some random event after the sewer deteriorated sufficiently for collapse to be likely (WRc,2001).

2.3.1 Factors Contributing to the Failure of the Pipe

There are several factors contributing to pipe failure. An investigation has been done to identify those factors and further separate them into three categories. Physical, functional, and operational as shown in fig 3. (Anbari, Tab, Roozbahani, 2017) (Chughtai & Zayed, 2008).

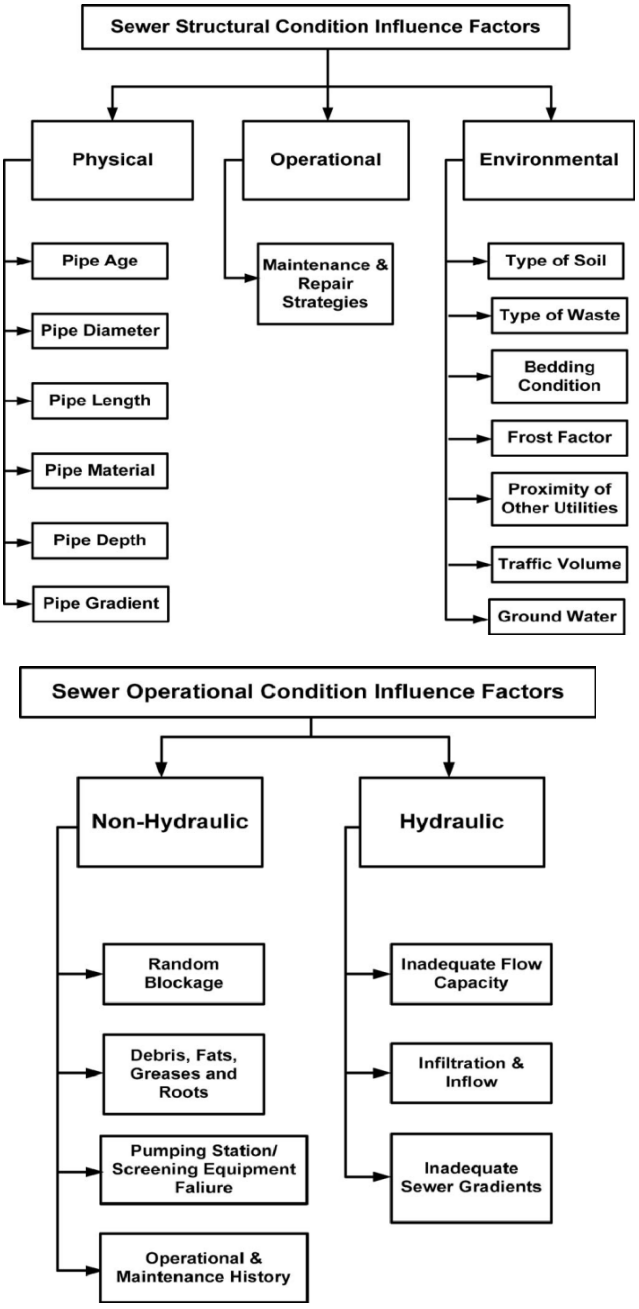


Figure 2.1: Condition Influence Factors

Table 2.1: Factors affecting sewer pipes deterioration (Mohammadi,2019)

Physical Factors	Environmental Factors	Operational Factors
End Invert Elevation	Back Fill Type	Blockages
Installation Method	Bedding Material	Burst History
Joint Type	Ground Movement	Debris
Pipe Length	Groundwater Level	Flow Velocity
Pipe Shape	PH	Hydraulic Condition
Pipe Age	Road Type	Infiltration
Pipe Depth	Root Interference	Previous Maintenance
Pipe Material	Soil Corrosively	Sedimentation Level
Start Invert Elevation	Soil Fracture Potential	Sewer Type
Pipe Slope	Soil Moisture	
Pipe Size	Soil Type	
	Soil Surface Level	

2.3.2 Physical Factors Contributing to the Pipe Failure

Pipe Material

Sewer pipes-Sanitary sewer systems are constructed with different pipe materials with unique characteristics to use different conditions. It can be mainly designated as a gravity line, Force main, and lateral line as per operation condition and level of service. In the force main sewers, a pump generates the pressure and conveys the sewage through the pipe. And, service laterals are the pipes that transfer wastewater from buildings to sanitary lanes (EPA, 2010b). According to EPA (2010) sanitary and wastewater sewer systems are generally constructed with ferrous pipes, concrete pipes, ceramic-based pipes, and plastic pipes as presented in Table 2. (Page 18).

Sewer pipes cast with different material shows various reaction to environmental factors, such as soil type, water table, etc. (Salman, 2010). In recent years (Singh and Adachi, 2013) found those concrete pipes are highly resistant to abrasion, and clay pipes act very well against acids. Plastic pipes, such as PVC or HDPE, resist acid and alkaline wastes, however, they can suffer excessive deformations under loading.

Table 2.2: Types of Sewer Pipe Material

Pipe Types	**Pipe Material**
Ferrous Pipe	Ductile Iron, Cast Iron, Steel
Concrete Pipe	Reinforced concrete (RC), Prestressed Concrete Cylinder (PCC)
Ceramic Based Pipe	Brick, Verified Clay (VC)
Plastic Pipe	Polyvinyl Chloric (PVC), High-Density Polyethylene (HDPE)

Pipe Diameter

The greater the diameter, rigidity will increase and resulting in better behavior than with a smaller diameter. Salman and Salem (2012).

Pipe Length

Typically, longer sewer pipes have a higher deterioration rate due to the higher probability of occurrence of defects, however. Salman and Salem (2012) found that longer pipes save better in sewers from their research.

Pipe Slope

Sediment deposition, Hydrogen sulfide attacks occur more in pipes with low slopes (Laakso et al. (2018).

Pipe Depth

Higher pipe depth leads to a negative effect on the condition level due to greater dead load ground water table Khan et al. (2010). And controversially shallow depth leads to higher deterioration resulting from root intrusion, traffic load, and activities carried closer to ground surfaces. (Salman and Salem (2012).

Pipe Shape

Modica (2007) indicated that circular sewer pipes are stronger and show higher structural performance. Baur and Herz (2002) found deterioration rate of egg-shaped sewers is significantly slower in comparison to circular sewers.

2.3.3 Environmental Factors Contributing to the Pipe Failure

Sewer Location

The surface load and motor vehicle load above the sewer pipe are the factors that mainly affect the stability of the pipe. Deterioration of the pipe may mainly rely on the type of land use pattern and behavior of its users (Ashoori et al., 2017; Marlow et al., 2009.). (Salman and Salem ,2012). (Bakry,(2016).

Groundwater Level

The availability of groundwater hurts the durability of the pipe due to the loss of support and infiltration defects. (Davies, 2001).

Soil Type

The stability of the pipe heavily depends on the type of soil cover. Soil with a very high fracture potential has a significantly higher resistance to deterioration and failure. Fractures are highly observed in clay soils.

Soil Corrosivity

Soil corrosivity is a soil characteristic that increases the probability of external corrosion on pipe surfaces due to chemical corrosion by certain soil. The rate of

corrosion is highly influenced by the characteristic of the pipe material and the surrounding soil around the pipe (Kaushal et al., 2018; Yajima, 2015). Davies et al. (2001) demonstrated that sewers buried into a high corrosive soil were at a significantly higher risk of deterioration. Mashford et al. (2011) showed that the soil corrosively is a factor contributing to the deterioration of the pipe by increasing the corrosion.

Soil Erosion

According to Tan and Moore (2007) (Law and Moore, 2007). Spasojevic et al. (2007). Moore (2008). development of erosion void around the pipe causes pipe damage, due to water entering through joints and fractures.

Soil pH

The soil pH is considered the most important factor affecting underground corrosion. Almost, all the studies in the field of underground corrosion indicated that the pH of the soil increases the corrosion rate of buried pipes (Wasim et al., 2018). Hou et al. (2016) conducted comprehensive research to evaluate the effect of soil pH on pipes made with different materials on the research outcome, cast iron pipes are more likely to be corroded in the same corrosive environments compared to steel pipes. The effect of soil pH was investigated more in water pipe systems. For instance, Rajani and Maker (2000) and Doyle et al. (2003) used soil pH as a feature to predict the remaining useful life of water pipelines. The outcome showed that the pH was not a significant factor to generate the model. Based on their results, pH alone is not a good indicator to predict the condition of pipes. In general, there is no direct relationship between pH and corrosion rate (Wasim et al., 2018).

2.3.4 Operational Factors Contributing to the Pipe Failure

Sewer Type

The deterioration of combined sewer is higher than sanitary sewer due to the high potentiality of soil loss, infiltration, and high flow velocity during rainy seasons Salman and Salem (2012).

Sewer Velocity

A minimum velocity is required inside the sewer pipelines to prevent any settlement of solids and particles along the pipe and should at least occur once a day. Otherwise, the settlement of material leads to obstruction of free flow and finally causes complete blockage. (Mohomadi 2019).

Sewer Hydraulic Condition

There is a direct relationship between structural deterioration with hydraulic deterioration (Traet al., 2008). However, Micevski et al. (2002) indicated that the hydraulic condition is not a significant factor to analyze the deterioration of sewer pipes.

Sewer Maintenance

Davies et al. (2001) discussed that the use of inappropriate maintenance methods accelerates the deterioration rate of sewer pipelines. For example, high water pressure during pipe cleaning is one of the concerns regards increasing the defects along the pipe. In another example, the sewer flushing technique may cause damage to the pipe wall during the cleaning process (Najafi, 2016; Najafi and Gokhale, 2005).

2.4 Sewer Line Investigation Pipe Failure Assessment

Different Inspections and technology can be used to get pipe assessment data and to detect structural and operational problems along with the pipe segments. The selection of the most appropriate technique depends on the types of assets, surrounding conditions, and expected output. According to EPA (2009), inspection technologies for wastewater systems can be classified into the following categories.

- Camera
- Acoustic
- Electrical/electromagnetic
- Laser
- Innovative technologies

2.4.1 Camera Inspection

Closed Circuit Television (CCTV) is the most popular technology currently being used in the industry. It can identify various types of defects mainly cracks, infiltration, inflow, tree roots, collapse, obstacles, protruding laterals, offset joints, and the presence of grease (WEF/ASCE, 2009). The primary disadvantages of the CCTV inspection method are the limitation of detecting the pipe surface above the wastewater line, and the restriction on giving information about wall integrity and surrounding soil around the pipe (EPA, 2009). According to EPA (2009), data resulting from the survey includes the following.

- Presence of sediment, debris, roots, etc.
- Presence of pipe sags and deflections
- Off-set joints
- Pipe cracks
- Leaks
- Location and condition of service connections

The quality of defect identification and accuracy of CCTV is highly dependent on operator experience, picture quality, and flow level (Salman, 2010; EPA, 2009; Allouche and Freure, 2002; Chae and Abraham, 2001).

Figure 2.2: CCTV Camera and Output Images

2.4.2 CCTV Technology

The CCTV inspection technology is used for identifying failure segments in the condition assessment of underground pipes. The CCTV instrument contains the sense/cameras needed to produce reliable, reproducible data in a normal pipeline without operating conditions. The win has also developed appropriate software and can generate reports that allow accumulating determination of the location of detected anomalies.

The high-definition CCTV camera can be inserted into the pipeline through the manhole, and it can travel through the pipeline take pictures and record video while rotating its camera 360 angles. After the inspection is complete and the CCTV camera has been removed from the line. The data is downloaded and analyzed the result from the CCTV analysis will provide the location, failure mode, and condition grade. Analysis can identify areas of failure and locate them both circumferentially and longitudinally on the pipe. Assessment of sewers can be done while maintaining the operational condition is one of the major advantages of this method.

2.4.3 CCTV Analysis Software

There are several software for facilitate the CCTV investigatione to review the video, and CCTV reports, and do the assessment based on CCTV data. Some of these are Pipetech®, Flexidata®, Granite XP®, Wincan®, and Subcam®. For the GCWWMP project Gravity sewer data was analyzed using a win scan.

Rehabilitation Assessment Protocol

Several protocols to assess the condition of sewers are currently practiced by the authorities throughout the world as follows.

- Rehabilitation Manual (SRM) -Water Research Centre in the UK (WRC 1986).
- Sewer Inspection Reporting Codes - Water Service Association of Australia (WSAA 2002; 2006).

- Pipe Assessment Certificate Program (PACP) - National Association for Sewers Service Company (NASSCO)-US.
- North American Association of Pipeline Inspectors (NAAPI, 2004) -Canada.

2.4.4 WRc Condition Assessment Protocols and Guidelines

WRC sewer pipeline condition classification protocol is the first protocol in sewer rehabilitation work in the world. It was developed by the Water Research center (WRC) in the UK. It helps utilities to do inspections, monitoring, rehabilitation, and manage the system effectively.

We categorize the condition of pipes starting from 1 to 5 based on the result obtained from CCTV inspections and operator judgments. Table 3 provides information on condition grading relevant to the WRC protocol.

As per the WRc rating,

- Grade 5 – The pipe segment has failed or will likely fail within the next five years - requires immediate attention.
- Grade 4 – The pipe segment has severe defects – the risk of failure within the next five to ten years.
- Grade 3 – Pipe segment has moderate defects - deterioration may continue, at a ten to twenty-year timeframe.
- Grade 2 – Pipe segment has minor defects - pipe unlikely to fail for at least 20 years.
- Grade 1 – Pipe segment has minor defects - failure unlikely in the foreseeable future.

Table 2.3: Severity Condition Grade for WRC Protocol

Condition Grade	Description	Peak Structural defect score	Peak operational defect score
1	Acceptable condition	< 10	< 1

Condition Grade	Description	Peak Structural defect score	Peak operational defect score
2	Minimal collapse risk but the potential for further deterioration	Oct-39	1-1.9
3	Collapse is unlikely but further deterioration likely	40-79	2-4.9
4	Collapse likely shortly	80-164	5-9.9
5	Collapse imminent or collapsed	165 and higher	> 10

2.4.5 Important Parameters in Condition Assessment

Peak Score

The Peak Score indicates the value maximum defect score for any one-meter length of pipe within a pipeline. Where more than one defect occurs within a one-meter length the scores are aggregated.

Peak Score = Maximum Deduct Value

Mean Score

The Mean Score indicates the average value of the defect scores per meter of pipeline, in each pipeline.

$$\text{Mean Value} = \frac{\Sigma \text{ (Deduct Values)}}{\text{Length of the Pipe segment}}$$

$$\text{Mean Value} = \frac{\Sigma \text{ (Deduct Values)}}{\text{Length of the Pipe segment}}$$

Total Score Σ (Deduct Values) = Sum of all the deducted weight within an assessment length

2.5 Consequence of Pipe Failure

The deterioration and subsequent failure of sewer pipes impact the community, and the environment, and has significant economic consequences for utility owners (Vladeanu, 2018), disruption of services, interruption of normal operation, and adverse effects on public health and ecosystems. Consequences of pipe failure (COP) are analyzed based on the triple bottom line concept considering environmental, social, and economic impact as described below.

2.5.1 Consequence of Failure (COF) Analysis

The consequences of pipe failure can be calculated as social. Environmental and economic impact accommodate the overall impact imposed on the relevant area. (Salman & Salem, 2011) introduced the use of weighting scores to integrate the different impact factors when calculating the total consequences of failure as described in the following equation.

$$\textbf{COF = Consequences of failure(pipe)} = \sum \textbf{(Sij XWj)}$$

Where Sij = Performance score for pipe in terms of impact factor j

Wj = Weight of impact factor j

2.5.2 Assessment of the Degree of Impact Factors

This assessment will focus on the investigation of various impact criteria which should be considered in the replacement or repair of a particular sewer line. By incorporating these impacts on pipe rehabilitation work, the study may not only take the financial feasibility of sewer improvement but also the effects on residents and social relationships in society.

Table 2.4: Impact Criteria for Pipe Rehabilitation

Criteria	Factor	Description and Importance
Economic Impact	Pipe Age	The time (in years), between pipe installation and inspection year. Aged pipes have a higher probability of collapsing.
	Pipe Diameter	Nominal pipe diameter. Smaller diameter pipes are more likely to suffer pipe failure.
	Pipe Length	Length of the Pipe segment. Bending stresses affect longer pipes.
	Depth	Higher depth sewer ecosystem is the consequence of failure.
	Access to Pipe	The ease of access of repair crews to the pipe in case of a potential failure: Right of way, public land, private land, behind structures, with and without vehicle access.
	Distance to Critical Laterals	The distance (ft.) from the affected sewer line to other critical buried infrastructure assets such as gas mains, and water lines.
	Soil type	Low, low to moderate, moderate, moderate - to - high, and high corrosiveness.
Social Impact	Proximity to other infrastructure	distance from the affected sewer line to other major infrastructure components such as roads (based on category any of the roads), major collectors, buildings, and highways/ waterways
	Distance to Critical Laterals	The distance (ft.) from the affected sewer line to other critical buried infrastructure assets such as gas mains, and water lines.
	Average Daily Traffic	Low, low to moderate, moderate, moderate - to - high, and high corrosiveness.
Environmental Impact	Proximity to other infrastructure	distance from the affected sewer line and other major infrastructure components next to such roads (based on the category of the road), major collectors, buildings, and highways/ waterways
	Distance Between Pipe and Water Body	distance (ft.) between the affected sewer line and major water bodies such as rivers, lakes, etc.
	Land Use	Type of use of the land/ property the affected sewer line is on, such as recreational. Residential, commercial, industrial, wetlands/ preservation areas.

2.5.3 Performance Weights for the COF Impact Factors

Table 2.5: Performance weights for the COF Impact Factors

Factors	Weights	Sub factors	Local weights	Global Weights
1. Environmental	22%	1.1 Soil type	32%	7.10%
		1.2 Flow Conveyed	33%	7.30%
		1.3 Proximity to surface water	34%	7.50%
2. Economic	51%	2.1 Depth	30%	15.50%
		2.2 Diameter	20%	10.30%
		2.3 Water Table	5%	2.8%
		2.4 Length	24%	12.4%
		2.5 Accessibility	20%	10.4%
3. Public	27%	3.1 Population Density	32%	8.6%
		3.2 Road Type	29%	7.8%
		3.3 Diameter	10%	2.7%
		3.4 Length	10%	2.7%
		3.5 Depth	15%	4.0%
		3.6 Accessibility	2%	0.5%
		3.7 Land use	2%	0.5%

Table 2.6: Performance Values and Predetermined Weights for The COF Impact Factors

Impact Factor	Impact factor sub-criteria	Performance value (PV)	Weight (Wj)
Roadway type	Intersecting ON road class 2	3	0.2
	Intersecting ON road class 4	2.4	
	Intersecting ON Road class 5	1	
Intersecting a railway track	Yes	3	0.2
	No	0	
Pipe Diameter	Diameter ≤300 mm	1	0.16
	Diameter >300 m and ≤600 m	1.5	
	Diameter >600 m and ≤900 m	2.25	
	Diameter >900 m	3	
Pipe burial depth	Depth ≤3 m	1	0.16
	Depth >3 m and ≤10m	1.5	

Impact Factor	Impact factor sub-criteria	Performance value (PV)	Weight (Wj)
	3: Depth >10 m	3	
Located downtown	Yes	3	0.2
	No	0	
Proximity to hospital	Pipe distance ≤120 m	3	0.2
	Pipe distance >120 m	0	
Proximity to school	Pipe distance ≤200 m	3	0.2
	Pipe distance >200 m	0	
Distance to building	3: Distance <5 m	3	0.2
	Distance ≥5 m and ≤10 m	1.5	
	Distance >10 m	0	
Proximity to river	Pipe distance ≤15 m	3	0.2
	Pipe distance >15 m	0	
Proximity to park or recreational areas	Pipe distance ≤20 m	3	0.16
	Pipe distance >20 m	0	
Proximity to bad storm water pipe	Distance ≤ 10	3	0.2
	Distance >10	0	

2.5.4 Application of Triple Bottom Line Analysis in Pipe Repair **Works**

Triple bottom line (TBL) aims to produce sound products removing negative consequences of the action. It has been developed to consider social and environmental performance in addition to financial performance. In a Pipe Failure, A TBL approach accounts for various impact factors such as,

(1) Economic impact due to repair cost bared by the utility urgency, delays in transporting goods and services, and loss of property value in environmental degradation.

(2) impacts to society will be the customer how the public is affected by the sewer pipe failure such as the number of affected households, type of affected buildings and properties. It can be a threat to public health, service disruption, traffic delays, accidents and disgusting odor caused by overflow in basements or streets.

(3) Environmental impacts due to pollution caused by sewer failures such as contamination of groundwater and wildlife habitats. Sewer overflow and leaking into water sources make the environment unsuitable for living habitats such as hypoxia, harmful algal blooms, habitat degradation, and floating debris.

Table 2.7: Criticality Sub-Factors and their Importance

Criteria	Factor	Description and Importance
Economic Impact	Pipe Age	The time (in years), between pipe installation and inspection year. Aged pipes have a higher probability of collapsing.
	Pipe Diameter	Nominal pipe diameter. Smaller diameter pipes are more likely to suffer pipe failure.
	Pipe Length	Length of the Pipe segment. Bending stresses affect longer pipes.
	Depth	Higher-depth sewers increase the consequence of failure.
	Access to Pipe	The ease of access of repair crews to the pipe in case of a potential failure: Right of way, public land, private land, behind structures, with and without vehicle access.
	Distance to Critical Laterals	The distance (ft.) from the affected sewer line to other critical buried infrastructure assets such as gas mains, and water lines.
	Soil type	Low, low to moderate, moderate, moderate - to - high, and high corrosiveness.
	Seismic Zone	Zone 1, Zone 2, Zone 3m Zone 4, and Zone 5
Social Impact	Proximity to other infrastructure	distance from the affected saline is the major infrastructure component next such as road roadside on the category of the road), major collectors, buildings, and highways/ waterways
	Distance to Critical Laterals	The distance (ft.) from the affected sewer line to other critical buried infrastructure assets such as gas mains, and water lines.
	Average Daily Traffic	Low, low to moderate, moderate, moderate - to - high, and high corrosiveness.
Environmental Impact	Proximity to other infrastructure	distance from the affected sewer line and other major infrastructure components such as roads (based on the category of the road), major collectors, buildings, and highways/ waterways
	Distance Between Pipe and Water Body	distance (ft.) between the affected sewer line and major water bodies such as rivers, lakes, etc
	Land Use	Type of use of the land/ property the affected sewer line is on, such as recreational. Residential, commercial, industrial, wetlands/ preservation areas.

2.6 Developing Risk Matrix

A risk Matrix can be used to determine the risk associated with a particular pipe network by multiplying the consequence of failure and its predicted grade of the internal condition of the pipe segment. (Salman and Salem, 2011).

2.6.1 Identify Risk and Consequence Assessment

Risk can be calculated using the probability of failure and the consequence of failure as in Equation (1).

$$\boldsymbol{Risk = (Probability\ of\ Failure)\ X\ (Consequence\ of\ Failure)}$$

2.6.2 Probability of Pipe Failure

The pipe grading is used to predict the probability of failure, each pipe segment is assigned a probability score and a criticality score. The probability score rates the likelihood that a pipe segment will fail in the next several years. It takes into account the structural and O&M scores developed through the CCTV process as well as the pipe segment's maintenance history.

2.7 Background in Similar Research

The impact of location-related factors such as size, location, and buried depth on the condition of sewer pipes was assessed by Mcdonald&zho,2001 for large-diameter sewer pipes. Similarly, Baur & Herzz predicted the impact of material, period of construction, and location on the sewer condition of sewer pipes. Yan and Varim proposed a fuzzy-based approach considering soil conditions. Ruwanpura projected the impact of age, material, and length on the condition of a particular sewer pipe.

Even though so many studies had been conducted throughout the world. There is no standard framework is established in this regard. Therefore, this study aims to establish a framework for an optimized rehabilitation plan utilizing CCTV reports and provides knowledge on the condition assessment of sewers, consequences, and

rehabilitation solutions for a drainage engineer to optimize rehabilitation work based on practical scenarios.

2.7.1 Deterioration Modeling

Deterioration models are currently utilized for projecting future life spans and the performance of infrastructure systems based on straight-line extrapolation, regression techniques, and the probability-based Markovian model (Sinha, Angkasuwansiri, and Thomasson, 2011).

2.7.2 Sewer Deterioration-Related Studies

A wide variety of pipe deterioration and condition prediction models were developed to forecast the requirement for sewer networks.

Mehle et al., 2001 expressed the need for Condition-based deterioration models to predict the remaining useful life of sewers and the risk factor related to the failure.

- Kulandaivel (2004) suggested improving the neural network model for the deterioration of sewer pipes by considering more historical input variables, such as surface load, groundwater, bedding conditions, soil corrosion and stability, and sewer location. (Review *et al.*, 2019).
- Tran (2007) recommended that different case studies should be used to develop sewer deterioration models to verify the finding of previous studies. Also, more investigation can improve the results of previous neural network models by considering extra input variables (Review *et al.*, 2019).
- Chughtai (2008) suggested using more predictors, such as soil conditions, and seismic factors for developing condition deterioration models for sewer pipes. Also, the application of other prediction models should be investigated in future studies. (Review *et al.*, 2019).

- Park (2009) indicated that not much work regarding the deterioration mechanism for the sewer pipes has been conducted and more research is needed to identify the parameters that affect the deterioration of sewer pipes. (Review *et al.*, 2019).

- Syachrani (2010) once again suggested incorporating some additional attributes such as soil type, and water table into the condition models (Review *et al.*, 2019).

- Salman(2010) recommended improving deterioration models by consideration of more variables, such as soil type, groundwater level, and initial quality of construction. Some models such as Markov chains, survival function, and simulation methods are appropriate to forecast the condition of pipe networks or groups of pipes (Salman, 2010).

- Moustafa Abdel Mote (2010) stated that asset management is the combination of activities that analyze the inventory of assets, assets condition, age, service history, estimated useful life, and criticality; and then prioritizes assets based on a risk factor associated with the asset and its replacement or rehabilitation costs Infrastructure management system.

- Mashford et al. (2011) recommended a detailed comparison of support vector machines and artificial neural network models. (Review *et al.*, 2019).

- Opila (2011) indicated that additional development of the condition prediction models would result in more accurate failure predictions. Other prediction models may provide more accurate results. (Review *et al.*, 2019).

- Sousa et al. (2014) suggested employing more advanced deterioration models and comparing the results with machine learning and neural network models. (Review *et al.*, 2019).
- Atique (2016) added more different variables of soil data such as dry/wet condition of soil, chloride level, sulfate level of soil, and study on the impact on pipe deterioration.
  - Bakry et al. (2016) recommended gathering more data to investigate more influential factors for pipe failure (Review *et al.*, 2019)
  - Anbari et al. (2017) introduced the method of ~~calculating~~ the risk factor of pipes using the weighted average method (Review *et al.*, 2019)

- Kabir et al. (2018) suggested the importance of the study of the impact of other independent variables such as sewer function, groundwater level, soil type, road class, and initial quality of construction. (Review *et al.*, 2019)
- Laakso et al. (2018) indicated that future research is needed to show how pipe condition depends on predictor variables. (Review *et al.*, 2019)

Malek Mohammadi et al. (2019) predicted the condition rating of sanitary sewer pipes with 81% accuracy by using logistic regression models (Review *et al.*, 2019).

2.8 Importance of Developing a Framework

There had been a sophisticated computer-based software application (WIndscan) used in prioritizing rehabilitation work in related fields in a developing country.But due to the financial limitation, the manual user-friendly framework will be more productive and viable to cater to the demand of the field.

2.9 Selection and Justification

The deterioration can be classified into two areas such as pipe models and pipe group models. In the pipe-level models, the individual effect is assessed and whereas in the pipe-group levels, the global network is assessed (Hawari *et al.*, 2020).

By using the GIS system, a huge amount of data in different layers can be managed and updated easily. Application of the monitoring data in condition assessment is highly important. Monitoring data can be utilized to verify the effectiveness of the new methods and projects (Sterpi et al. 2017, 2018).

3 METHODOLOGY

3.1 Overview

This chapter discusses a frame for identifying optimum rehabilitation requirements based on secondary data available from CCTV investigation which was recently done under the ADB grant. First, it assesses the pipe risk utilizing the condition of the sewer pipe, and then it develops a prioritized maintenance and rehabilitation schedule considering the impacts of the consequences. Further, it explains the data analysis technique and sample calculation at each stage.

The research consists of ten main phases as follows,

- Step 1: Problem definition and model formation
- Step 2: Comprehensive literature review
- Step 3: Data collection
- Step 4: Development of pipe inventory model
- Step 5: Development of pipe condition models
- Step 6: Development of Consequence of Failure model
- Step 7: Data analysis using GIS environment
- Step 8: Model validation

3.2 Step 1 - Problem definition and model formation

In Colombo Municipal Area, Maintenance and rehabilitation work of the drainage network is very crucial and needs to be attended to immediately with limited a budget. But there has to be a practical user-friendly framework that guides the development of rehabilitation schedules long term and short-term basis. So that the very first step of work was devoted to identifying the maintenance framework utilizing existing resources.

The second step was to focus on studying similar works and technologies currently practiced throughout the world. The third step was mainly looking for deriving collecting data and information from relevant agencies. The fourth step was to

develop an infrastructural pipe inventory database using asset inventory data relevant to the network. The fifth step is the formation of the condition assessment database. Here first analyze the maximum condition of the asset data. And then forecast the failure ranking of the pipes. The Sixth step is building a prediction database to forecast the consequences of failure associated with each pipe segment. And then prioritize renewal work based on the environmental, economic, and social impacts on society.

For example, in Colombo municipality's decision to replace the pipe with a higher no of critical customers or pipes closer to important waterways and ecosystems. It will be done based on the globally accepted weighted ranking method of the expected consequences in relevant catchment areas. In the seventh step, all the management steps are merged with a geographic information system (GIS) and performed the analysis while transforming all the condition data into actionable information.

The final step is the model validation process to organize the decision-making plan for the existing network in the selected catchment area for future rehabilitation work, considering funding capabilities, prevailing regulations, organizational goals, and commitment.

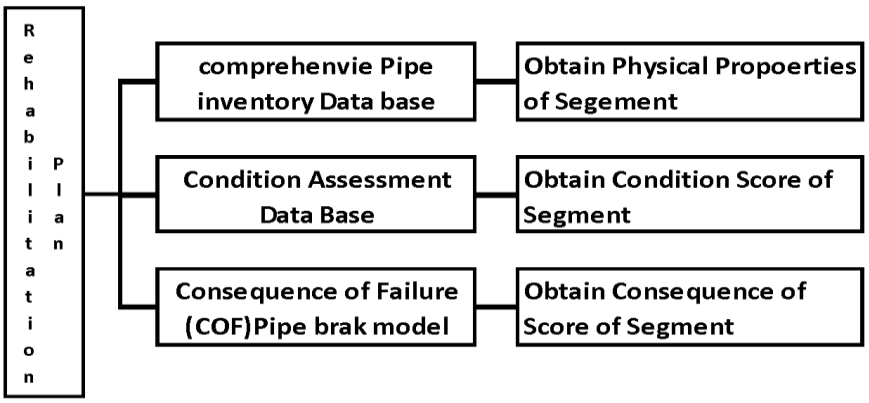


Figure 3.1: Proposed Models and Output

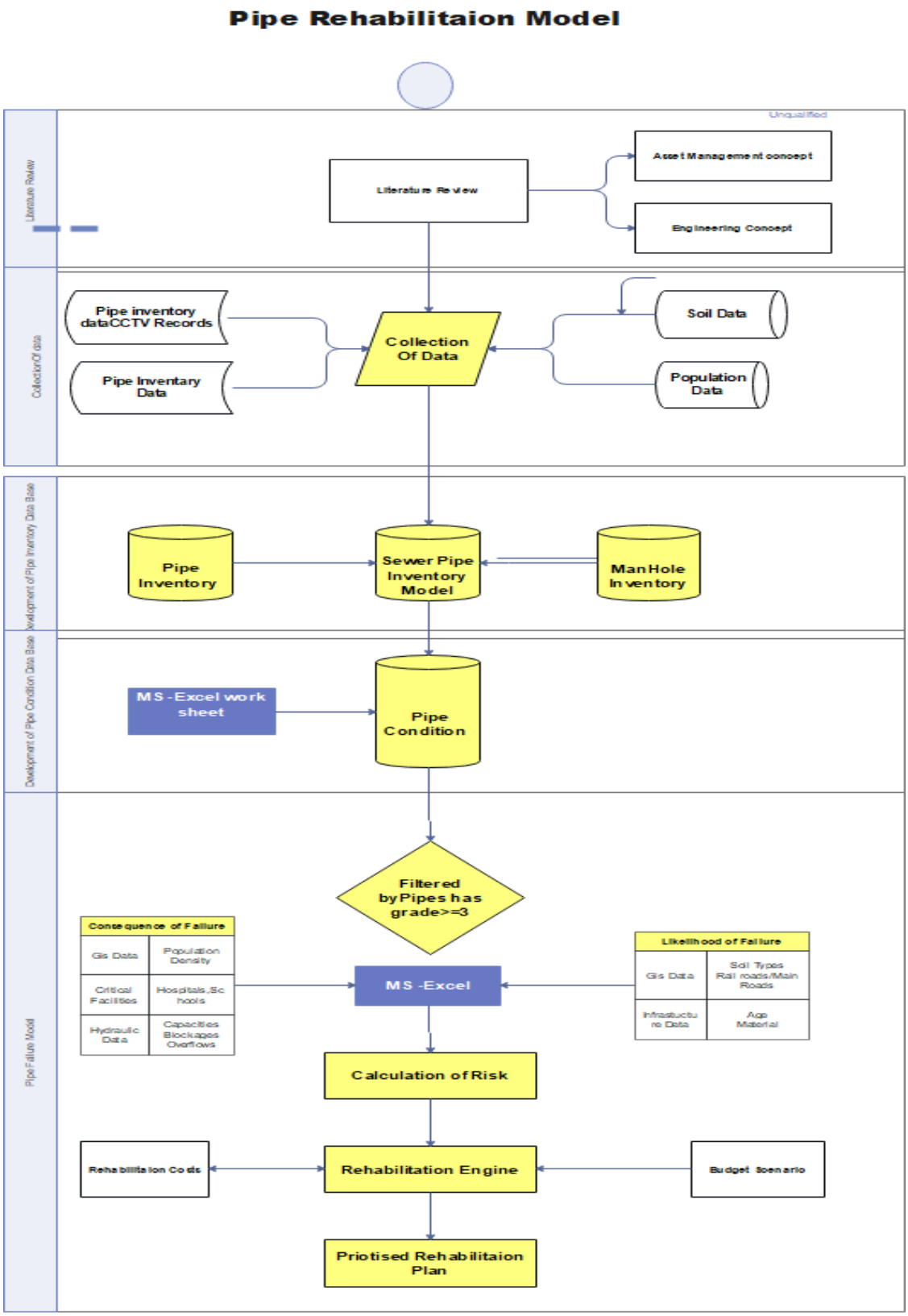


Figure 3.2: Methodology for Developing a Framework

3.3 Step 2 - Literature Survey

A literature survey was carried out to find out technical and research development in the field of condition assessment, development of deterioration model, assets Management, the criticality of pipes, and impacts on repair work.

As per the literature survey, the model has been developed by accommodating various techniques and knowledge from previous studies which have been adjusted to suit local conditions as well as to address the prevailing problem associated with the municipality.

Table 3.1: Important References Related to The Study

Topic	References	Output
Factors Contributing to the Failure of the pipe	Mohammadreza Malek Mohammadi 2019(Salman, 2010, Baur and Herz (2002)	Physical Pipe material, size, diameter, depth, slope, shape, Operational-sewer type, velocity, Hydraulic condition, sewer maintenance, Environmental location, ground level, soil, soil corrosively, soil erosion. soil PH
Sewer Line Investigation Pipe Failure assessment	(Salman, 2010; EPA, 2009; Allouche and Freure, 2002; Chae and Abraham, 2001).	CCTV Technology
Rehabilitation assessment Protocol	UK (WRC 1986) Australia (WSAA 2002; 2006), EPA-US	Rehabilitation Manual (SRM) -Water Research Centre in the UK (WRC 1986)

Topic	References	Output
parameters in condition assessment	UK (WRC 1986)	Condition Grade Peak Score =Maximum Deduct Value - Performance Weights for the COF Impact Factors
A consequence of Failure (COF Analysis	(Salman & Salem, 2011) (Greta J. Vladeanu, 2018),	COF=Probability of Pipe Failure
Developing Risk Matrix	Anbari et al. (2017)	weighted average method Total COF= $\sum(S_{Env} XW_{Env})+ \sum(S_{Eco} XW_{Eco})+ \sum(S_{ocial} XW_{socio})$
3Application of Triple Bottom Line Analysis in pipe repair works		Social= Accessibility, road type, Zoning, location Economic=Water table, Pipe Length, Diameter Environmental-Soil type, Flow conveyed, Proximity to Surface

3.4 Step 3 - Data Collection

In this evaluation, a high amount of data must be collected to provide reliable, useful, actionable information. This collection of data may include,

- A physical Characteristic of the pipe segment to achieve an exciting pipe property.
- Adequate data on soil profile to build the soil profile underneath it.
- Operation-related data based on operating conditions, design standards, maintenance issues, and complaints received by the drainage division.
- Hydraulic analysis based on current demand, future development, design standards/details, and current condition.

Data and information were gathered from the following agencies as follows.

- CCTV Data condition - GCWWP
- Pipe Inventory Data - GIS &Network data from the drainage Division
- Longitudinal data - Survey Department
- Soil - NBRO
- Population data - UDA
- Building Layer - UDA
- Ground Water - NWS&DB
- Water consumption - NWS&DB
- Land use a pattern - CMC
- Roadway information - Classification type and name CMC
- Property lines and parcels - CMC
- Hydraulic information - Specifically peak average daily demand values GCWWMP
- History of pipe breaks - CMC

Three databases namely the physical pipe property database, condition database, and Risk (COF). Database were formulated utilizing the above information in various stages of the framework.

3.5 Step 4 - Development of Database - Pipe Inventory Database

The sewer pipe inventory database was developed by identifying the physical properties of the pipe material, length, diameter, etc. And later recorded in Excel format. The sample record of the attribute table is listed below. (Refer to Annex 6-Pipe Inventory Data-CS3 Catchment).

3.5.1 Attributes of Pipe Properties Database

Field Name	Entry Example(s)
Pipe ID	762 T1
UP stream MH ID	T1-04
Downstream MH ID	T1-05

Year of Installation	1925
Material	VC pipes
Length	300 m
Slope	1.0%
Shape	circular, lip
Dimension	1200 mm
Joint-type	Bell and spigot
Soil Type	Clay, native
Burial Depth	3m
Sewer function	Major regional Inceptor
Avg Groundwater level above the pipe invert	300mm
Internal Lining type	Mortar/Asphalt
Service lateral connection	yes
Service lateral-type	concrete
Land use	Industrial
Wall thickness	10mm
Location	near hospital
Road name	Mara dana Road
Catchment	
Name	Norris Canal

3.5.2 Attributes of Manhole Inventory Manhole

Manhole ID	T1-04
The installation year	1925
Outgoing pipe _+ID	225mm
Number of incoming pipes	3
Wall constructions	concrete
Construction Method	Cast insitu
Location	Driveway
Size	200X450
Chimney depth	3m
Wall dimension	Diameter x width

Structure Brick

. (Refer to Annex 7-Pipe Manhole Data-CS3 Catchment)

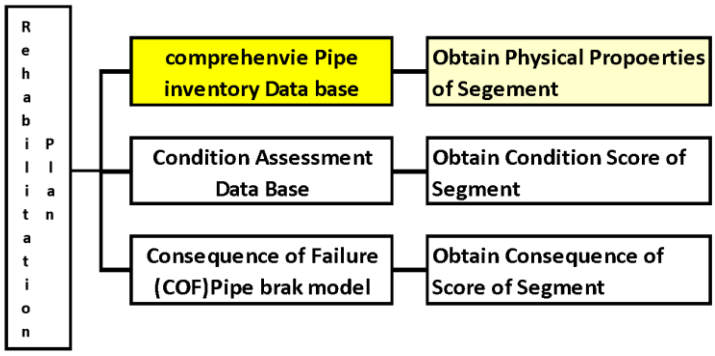


Figure 3.3: Proposed Inventory Database and Output to the Model

3.6 Step 5 - Developing Condition Assessment Database

Condition Assessment Database was formulated by deriving the condition-related parameters such as max grade, average grade, and no of event grade (1,2,3,4,5) and recorded in an excel environment.

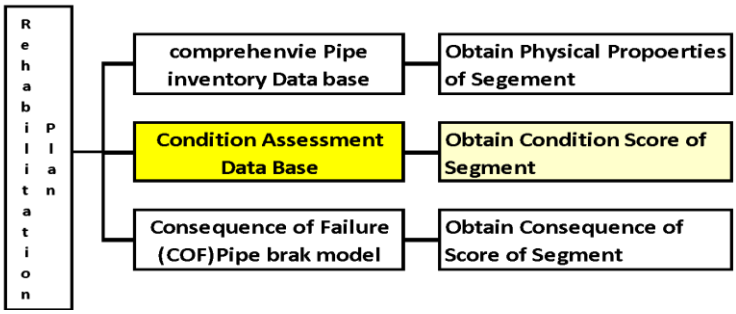


Figure 3.4: Proposed Condition Assessment Database and Its Output

3.6.1 Condition Assessment and Rating of Pipe Segment

The process of formulating a database can be divided into seven stages.

- Step1 -Assessment of condition along the pipe segment
- Step2 -Assigning the defect code to the system using condition grading
- Step3 -Preparation condition grade value table for the pipe segment

- Step4 -Preparation of condition grade value table for the pipeline
- Step5 -Assigning the max defect code to the pipe network using CCTV reports
- Step 6 -Categorization of the pipeline for rehabilitation
- Step7 - Preparation of condition assessment database

3.6.2 Step - 1 Assessment of Condition Along the Pipe Segment

The high-definition CCTV (Closed circuits television) camera was inserted into the pipeline through the manhole and it traveled through the pipeline, captured pictures, and recorded video while rotating its camera 360 at angles. After the inspection was completed, the CCTV camera was removed from the line. The data was downloaded and analyzed. The result from the CCTV analysis provided the location, failure mode, and condition grade. The occurrence of defects (e.g., collapses, Breaks, blockages) identified in the investigation is then evaluated through the classification system. The analysis identified the areas of failure and locate them both circumferentially and longitudinally on the pipe.

Figure 3.5: CCTV Investigation at Site

3.6.3 Step 2 - Assigning the Defect Code to the System

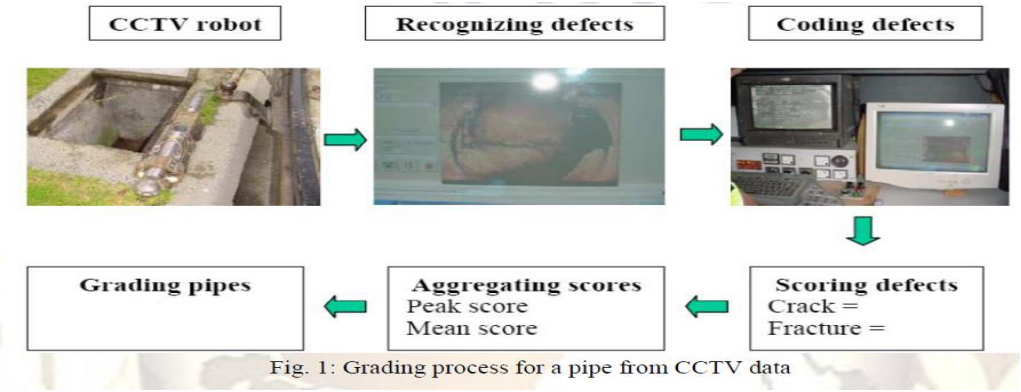


Fig. 1: Grading process for a pipe from CCTV data

Figure 3.6: Coding Process for a Pipe from CCTV Data

CCTV reports obtained from the condition assessment survey performed under GCWWMP (ADB Funded) were utilized for the study. It consists of the date of assessment, condition score, inspection videos, log sheets, images, and general notes photographs. (Refer to Annex 8- A49-4-A49-3 Pipe segment Condition Assessment Survey-Summary Sheet). A spreadsheet application had been used to organize the inspection data and to analyze the defect ratings of a sewer pipe. The result was converted to CS file format and merged with the GIS shape file for the City's sewer assets. The following figure 3.7 shows an excel data sheet developed to illustrate condition assessment data along the pipe segment.

S/N	Location Reference	Sewer Diameter (mm)	Sewer -ID	US MH ID	DS MH ID	Chainage Total (m)	Defect Chainage (m)	WRC Code	Description	WRC Grading
1	4th Cross Street	225	A49	A49-1	A48-1	66.50	0.00	MH	Start node type,manhole	0
							0.60	CLJ	Crack longitudinal at joint	2
							0.60	CCJ	Crack circumferential at joint	2

Figure 3.7: Condition assessment Report for a Pipe Segment

3.6.4 Step 3 - Preparation of Condition Grade Value Table

As will be discussed Condition grading score calculation was done considering the deduct values for the various defects in the pipe segment. The value, or weight, for each defect, was assigned as per the guideline stated in the condition assessment protocol used.

During CCTV inspections, a pipe section is typically divided into segments of 1-meter length, and each segment is given a condition rating based on its observed defect(s). Normally, the condition rating of the pipe section follows the rating of the worst segment ratings also (. E.V. Anaa & W. Bauwens,2001).

It determines the impact of the defect on the service life and performance of the sewer pipe segment. The length of the pipe segment should be less than 120 meters from the manhole to the manhole.

Table 3.2: WRC Condition Grade

Condition Grade	Description	Peak Structural defect score	Peak operational defect score
1	Acceptable condition	< 10	< 1
2	Minimal collapse risk but the potential for further deterioration	10-39	1-1.9
3	Collapse is unlikely but further deterioration likely	40-79	2-4.9
4	Collapse likely shortly	80-164	5-9.9
5	Collapse imminent or collapsed	165 and higher	> 10

There are five condition grades ranging from 1 to 5 with 1 being a minor defect and 5 being a severe defect that needs immediate attention.

As per the WRc rating,

- Grade 5 – The pipe segment has failed or will likely fail within the next five years - requires immediate attention.

- Grade 4 – The pipe segment has severe defects – the risk of failure within the next five to ten years.
- Grade 3 – Pipe segment has moderate defects - deterioration may continue, at a ten to twenty-year timeframe.
- Grade 2 – Pipe segment has minor defects - pipe unlikely to fail for at least 20 years.
- Grade 1 – Pipe segment has minor defects - failure unlikely in the foreseeable future.

As per the WRc protocol, Condition grade is the numerical representation of defects that are presented along the sewer line. All the defect value along the pipeline was summarized and prepared summary table for critical grade defects 3,4 and 5 accordingly. Table 3.7 shows the condition assessment data along the pipe segment using a CCTV report relevant to the particular pipe segment. Note that the no of occurrences for a condition score of 3,4,5 in the pipe segment was taken into consideration in evaluating the condition assessment of the pipe segment.

Table 3.3: Condition Assessment Data - Pipe @ Olcott Mawatha,4th Cross St.

Location Reference	**Dia. (mm)**	**US-MH**	**DS-MH**	**3**	**4**	**5**
Olcott MW (4th Cross St)	225	A4-4	A9-3	239	92	12

Sample Calculation of Grade Value for Pipe A49

Olcott Mawatha (4th cross street A49) line has the following defect value

No of the event in moderate defect -Grade (3) = 239

No of the event in severe defect -Grade (4) = 92

No of the event in very severe defect -Grade (5) = 12

3.6.5 Step 4 - Preparation of Condition Grade Value

The above procedure was repeated for each pipe segment and formulated a condition grade value table for a particular line.

Table 3.4: Condition Grade Value-A49 Pipe Line

Location Reference	Dia. (mm)	US MH ID	DS MH ID	Length (m)	3	4	5
Olcott MW (4th Cross St)	225	A49-4	A49-3	57.2	239	92	12
Olcott MW (4th Cross St)	225	A49-3	A49-2	13.5	68	17	5
Main Street (4th Cross St)	225	A36-2	A36-2A	48.2	52	21	1
Main Street (4th Cross St)	225	A36-2A	A49-4	47.3	55	21	6
Olcott (4th Cross Street)	225	A49-2	A49-1	82.1	56	13	5
4th Cross Street	225	A49-1	A48-1	66.5	14	3	0

3.6.6 Step 5 - Assigning the Max Defect Code to the Pipe

Maximum grading was the, most critical grade present in the pipe segment.

Max Score = Maximum of (1,2,3,4,5)

Table 3.5 Maximum grade Value, Average grade Value-Olcott Mawatha

Location Reference	Dia. (mm)	US MH ID	DS MH ID	Length (m)	Max. Grade	3	4	5
Olcott MW (4th Cross St)	225	A49-4	A49-3	57.2	5	239	92	12
Olcott MW (4th Cross St)	225	A49-3	A49-2	13.5	5	68	17	5
Main Street (4th Cross St)	225	A36-2	A36-2A	48.2	5	52	21	1

Location Reference	Dia. (mm)	US MH ID	DS MH ID	Length (m)	Max. Grade	3	4	5
Main Street (4th Cross St)	225	A36-2A	A49-4	47.3	5	55	21	6
Olcott (4th Cross Street)	225	A49-2	A49-1	82.1	5	56	13	5
4th Cross Street	225	A49-1	A48-1	66.5	4	14	3	0

If grade 5 is assigned to a particular location, it alarms that collapse is imminent and needs immediate attention for rehabilitation. Otherwise, it will fall within the next 5 years. So, Rehabilitation is done based on the maximum deduct value of the pipe segment**.** (Refer Annex-9-Condition Assessment Grade Values-Summary Data-CS3 Catchment).

3.6.7 Step 6 - Categorization of the Pipeline for Rehabilitation

All the pipe renewals can be categorized into 4- time zone as per the presence of most critical defects and vulnerability of location. For example, if no 5 defects are present, they should be rectified immediately. If the max grade value is 4 it should be rectified within 5 years. If the max grade value is 3 it should be rectified within the next 10 years.

Then categorization of pipes for rehabilitation was done as explained follows.

Category 1-6 represents pipes having grade 5 defects, that need immediate attention. It contains a large no of pip segments. So that it has been categorized into 6 levels as per the presence of critically graded defect value.

category 7 represents pipes having max. grade 4 defects and should be renovated within 5 yrs. category 8 represents the pipe having max. grade 3 and should be renovated within 10 years. category 9 represents pipes having minor defects and does not need any repair within 20 years.

Table.3.6: Categorization of Pipe Rehabilitation

Category	No	Condition	Rehabilitation - Time line
category	1	G_5 >10	Very Critical Immediately
category	2	5 <G_5 >= 10	
category	3	1 <= G_5 >= 5 AND G_4 > 15	
category	4	1 <= G_5 >= 5 AND 5< G_4 <= 15	
category	5	1 <= G_5 >= 5 AND 1< =G_4 <= 5	
category	6	1 <= G_5 >= 5 AND G_4 = 0	
category	7	G_5 = 0 AND G_4 >= 1	Critical within 5 yrs.
category	8	G_5 = 0 AND G_4 = 0 AND G_3<=1	Need within 10 yrs.
category	9	G_5 = 0 AND R_4 = 0 AND R_3 =0	No Need within 20 yrs.

Sample Calculation

For example, select the pipe segment A49-4 to A49-3 located at Olcott MW (4th cross street) has grade 5 defects-12, grade 4 defects-92, and grade 3 defects=239.

So max grade value =5 and since it has 12 nos. of grade 5 defects, it falls into category 1

Location Reference	Dia. (mm)	US MH ID	DS MH ID	Length (m)	Max. Grade	3	4	5	Cat
Olcott MW (4th Cross St)	225	A49-4	A49-3	57.2	5	239	92	12	1

3.6.8 Step 7 - Preparation of Condition Assessment Database

Attributes of Pipe Condition Database

Field Name	Entry Example(s)
Sewer ID	762 T1
Sewer unique ID	
UP stream MH ID	T1-04
UP stream MH unique ID	1923
Downstream MH ID	T1-05
UP stream MH unique ID	1924
Sewer diameter(mm)	225
Chainage	56
Location	Sea Street
Inspection Date	2018-08-24
Inspection complete(Y/N)	Y
Lining (Y/N)	Y
No of occurrence grade=1	23
No of occurrence grade=3	23
No of occurrence grade=4	23
No of occurrence grade=5	23
Avg. Grade	4
Max. Grade	5
Remarks during CCTV	found cracks, broken pipe,
Remarks during Cleaning	minor debris removed
Report no	CCTV/Sewer/D2A/0219
Final report submission Date	19-11-2018
Video ref. no	A7-14-A713~191116V1C

Location Reference	Dia. (mm)	Sewer -ID	US MH ID	DS MH ID	length (m)	Ma. Grade	3	4	5	Cat
1st Cross Street	225	A60	A60-3	A60-2	84	5	83	15	3	4
1st Cross Street	225	A60	A75-1B	A60-4	62.6	5	84	5	7	2
1st Cross Street	225	A60	A60-4	A60-4A	59	5	25	8	4	4
1st Cross Street	225	A60	A60-4A	A60-3	56.3	5	58	28	16	1
1st Cross Street	225	A60	A75-1	A75-1B	25	4	31	1	0	7
1st Cross Street	225	A75	A75-1A	A76-1	33	4	27	1	0	7
1st Cross Street	225	A75	A75-1	A75-1A	35.5	4	21	3	0	7

Figure 3.8: Condition assessment Table for Catchment CS3 (refer to Annex 8)

3.7 Development of Consequence Failure Model

Consequences of failure can be used to determine the risk associated with a particular Pipe network by multiplying the consequence of failure and its predicted grade of the internal condition of the pipe segment. (Salman and Salem, 2011).

3.7.1 COF Model

The COF model is giving pathways to assess the impact of a potential sewer failure from the perspectives of economic, social, and environmental areas. It mainly identified a total of eleven attribute factors that tributes to the pipe failure and analyzed the global effects by combining these factors using numerical weights. Relevant numerical weights were determined from the guidelines and extensive literature review. The process of the assessment of consequences of failure relevant to a particular pipeline can be done as follows.

1. 1Identify the impact factors, which are going to be considered in the event of pipe failure. Categories these factors based on economic, social, and environmental effects.
2. Assign numerical weights to each factor based on its importance Evaluate and assigned a performance value for the sewer-pipe section.

3. Calculate the overall consequence of the failure by using the weighted sum equation.
4. sections having a higher risk of failure.

3.7.2 Step 1 - Identify the Impact Factors in the Event of Pipe Failure

This assessment was focused on the investigation of various impact criteria which should be considered in the replacement or repair of a particular sewer line. as per the literature review, eleven factors relating to failure were identified and categorized based on economic, social, and environmental effects as shown below.

Environmental Impacts (3)

Environmental impacts assess the pollution caused by sewer failure and the resulting impact on the environment. In the event of pipe failure, sewer flows to water sources and makes the environment unsuitable for a living being. relevant Impact factors are,

- Soil distribution
- Flow Distribution
- Proximately to Surface Water

Economic Impacts (4)

Economic impact assesses the repair cost bared by the utility urgency, delays in transporting goods and services, and loss of property value in environmental degradation.

- Eco Water Table
- Pipe Line Depth
- Pipeline Length
- Pipeline Diameter

Social Impact (4)

Social Impact assesses how the public is affected by the sewer pipe failure such as the number of affected households, and the type of affected buildings it can be a threat to public health, service disruption, traffic delays, accident, and disgusting odor caused by overflow in basements or streets.

- Accessibility
- Road Type
- Zoning
- Location

Table 3.7: Impact Factors and Its Importance (Source EPA)

Criteria	Factor	Description and Importance
Economic Impact	Pipe Age	The time (in years), between pipe installation and inspection year. Aged pipes have a higher probability of collapsing.
	Pipe Diameter	Nominal pipe diameter. Smaller diameter pipes are more likely to suffer pipe failure.
	Pipe Length	Length of the Pipe segment. Bending stresses affect longer pipes.
	Depth	Higher-depth sewers increase the consequence of failure.
	Access to Pipe	The ease of access of repair crews to the pipe in case of a potential failure: Right of way, public land, private land, behind structures, with and without vehicle access.
	Distance to Critical Laterals	The distance (ft.) from the affected sewer line to other critical buried infrastructure assets such as gas mains, and water lines.
	Soil type	Low, low to moderate, moderate, moderate - to - high, and high corrosiveness.
	Seismic Zone	Zone 1, Zone 2, Zone 3m Zone 4, and Zone 5
Social Impact	Proximity to other infrastructure	distance from the affected saline is another major infrastructure component next such as roads (based on the category of the road), major collectors, buildings, and highways/ waterways
	Distance to Critical Laterals	The distance (ft.) from the affected sewer line to other critical buried infrastructure assets such as gas mains, and water lines.

Criteria	Factor	Description and Importance
	Average Daily Traffic	Low, low to moderate, moderate, moderate - to - high, and high corrosiveness.
Environmental Impact	Proximity to other infrastructure	distance from the affected sewer line and other major infrastructure components such as roads (based on the category of the road), major collectors, buildings, and highways/ waterways
	Distance Between Pipe and Water Body	distance (ft.) between the affected sewer line and major water bodies such as rivers, lakes, etc.
	Land Use	Type of use of the land/ property the affected sewer line is on, such as recreational. Residential, commercial, industrial, wetlands/ preservation areas.

3.7.3 Step 2 - Assign Numerical Weights to Each Impact Factor

(Salman & Salem, 2011) introduced the use of weighting scores to integrate the different impact factors when calculating the total consequences of failure as described in the following equation.

$$\textbf{COF = Consequences of failure(pipe)} = \sum(\textbf{ Sij XWj})$$

Where Sij = performance score for pipe in terms of impact factor j

Wj = weight of impact factor j

$$\textbf{Total COF} = \textbf{COF}_{\textbf{Env}} + \textbf{COF}_{\textbf{Economic}} + \textbf{COF}_{\textbf{Social}}$$

3.7.4 Step 3 - Determination of weighting factor for relevant impact factor

The relative weighting value published by (Salman & Salem,2011) was incorporated into the assessment of the consequences of the pipe failure model accordingly.

Table 3.8: Performance Values for The COF Impact Factors (Salman & Salem, 2011)

Factors	Weights	Sub factors	Local weights	Global Weights
1. Environmental	22%	1.1 Soil type	32%	7.10%
		1.2 Flow Conveyed	33%	7.30%
		1.3 Proximity to surface water	34%	7.50%
2. Economic	51%	2.1 Depth	30%	15.50%
		2.2 Diameter	20%	10.30%
		2.3 Water Table	5%	2.8%
		2.4 Length	24%	12.4%
		2.5 Accessibility	20%	10.4%
3. Public	27%	3.1 Population Density	32%	8.6%
		3.2 Road Type	29%	7.8%
		3.3 Diameter	10%	2.7%
		3.4 Length	10%	2.7%
		3.5 Depth	15%	4.0%
		3.6 Accessibility	2%	0.5%
		3.7 Land use	2%	0.5%

The weight of each factor is determined in the range of 0 to 10 based on previous studies as illustrated in the literature review in section 2 (refer to Annex Table 17 - Performance score for Sub Impact Factors (Data Source-EPA,2019). The weighted values incorporated into the study were as listed in the table below.

Table 3.9: The Weighted Value for Environmental. Economic Impact Factors

1. Environmental								**2. Economic**					
22%								51%					
Soil type		**Flow Conveyed**		**Proximity. to surface. water**		**Pipe Depth(m)**		**Water Table**		**Length (m)**		**Diameter(mm)**	
7.10%		7.30 %		7.50%		15.50%		2.80%		12.40%		10.30%	
gravel	1	<2	1	>=450	1	<=2	1	above WT	1	<=2	1	<225	1
Coarse Sand	2	2<2.4	2	450-215	2	2-3	2	below WT	5	2-3	2	225-450	2
Find Sand	3	.4-0.5	3	215-120	3	3-3.5	3			3-3.5	3	450-750	3

1. Environmental								2. Economic					
22%								51%					
Soil type		**Flow Conveyed**		**Proximity. to surface. water**		**Pipe Depth(m)**		**Water Table**		**Length (m)**		**Diameter(mm)**	
Silt	4	0.6-0.8	4	120-45	4	3.5-4	4			3.5-4	4	750-1200	4
Clay	5	0.8-1	5	<=45	5	>4	5			>4	5	>1200	5

Table 3.10: The Weighted Value for Social Impact Factors

3. Social		
27%		
Land use		Location
0.50%		20
Park/Open space	1	Location to Down Town
Residential (Low)	2	Proximity To School <= 200m
Residential (Medium))	3	Proximity to Hospital<12m
Industrial/Residential	4	distance to the building<5m
Commercial/Industrial/Residential	5	Proximity to Park/Recreational Area,10m

3.7.5 Step 4 - Calculate the Overall Consequence of the Failure

A consequence of failure states the magnitude level of the consequence of impact due to pipe failure; calculates separately for each pipe (Mohammadi, 2019). The consequence for an individual pipe segment in a sewer disposal system is to multiply its cumulative Impact Score by its respective Weighting score. The following equation illustrates this process:

$$\mathbf{COF = Consequences\ of\ failure(pipe) = \sum(Sij\ XWj)}$$

Where Sij = performance score for pipe in terms of impact factor j

Wj = weight of impact factor j

$$\textbf{Total COF} = \textbf{COF}_{\textbf{Env}} + \textbf{COF}_{\textbf{Economic}} + \textbf{COF}_{\textbf{Social}}$$

Where: Total COF = Cumulative Impact Score for each pipe segment

COFEnv = ∑(SEnv XWEnv) = Environmental demand impact score

COFEco = ∑(SEco XWEco) = Economical demand impact score

COFSocio = ∑(SSocioo XWsocio) = Social demand impact score

$$\textbf{Total COF} = \sum(S_{Env}\, XW_{Env}) + \sum(S_{Eco}\, XW_{Eco}) + \sum(S_{Socioo}\, XW_{socio})$$

Priority was given based on the consequences related to the location for each category as illustrated in the sample calculation below. (Refer to Annex 14-COF Values-CS3 Catchment).

Sample calculation

Sewer pipe segment (A19-2 to A19-1 located at Andival Street, the commercial hub of Colombo with a diameter of 225mm, of length 71.2 m, and 3.855 m below the ground level. The water level of the area is 1m below the ground level and find sand layer is underneath the line.

Step 1-Find the COF Data relevant to the pipe

Table 3.11: COF Data-Andival Street

Location Reference	US MH ID	DS MH ID	Dia (mm)	Chainage (m)	Flow (m3/s)	Depth to Invert	Soil Type	Flow	Prox. surface	Water Table	Depth	Pipe length	Dia.
Andival St.	A19-2	A19-1	225	2.3	< 0.1209	3.496	3	5	1	5	3	2	2

Step 2-Find the Impact Score, Performance Score relevant to the pipe

Table 3.12 The Impact Score, Performance Score relevant to the pipe

	Soil Type	Flow con.	Proximity to surface	Water Table	Pipe Line Depth	Pipe length	Pipe Line Dia.	Accessibility		Road Type	Land use	Location
Performance score	7.1	7.30	7.5	2.8	15.5	12.4	10.3	10.4	0.5	7.8	0.5	20
Impact Score	0.22	0.22	0.22	0.51	0.51	0.51	0.51	0.51	0.27	0.27	0.27	0.27

Table 3.13: Impact Sore, Performance Score -Andival Street

Consequence Factor	Con. Factor weight	Impact Factor	Impact Score	Performance value		Per. Score
Environmental	22	Soil	7.1	Fine sand	Fine sand	3
		Flow conveyed	7.3	<0.1209 m3/	0.8-0.1	5
		Proximity to surface	7.5	3.855	>450 mm	1
Economic	51	Water table	2.8	1m below ground level	Asset Below Water Table	5
		depth	15.5	4.255m	>4m	5
		Pipeline length	12.4	71.2	>30m	2
		Pipeline Diameter	10.3	225	225-450	2
Social	27	Accessibility	10.4	Accessible	Accessible	1
		Road Type	7.8	urban main	Collector	2
		Land use	0.5	Commercial	Commercial	5
		Location	20	proximity to building<1	proximity to building<2	3

Step 3 - Calculation COF Value for a pipe

$$\textbf{Total COF} = \textbf{COF}_{\textbf{Env}} + \textbf{COF}_{\textbf{Economic}} + \textbf{COF}_{\textbf{Social}}$$

Where: Total COF = Cumulative Consequences Impact Score for each pipe segment,

COF_{Env} = $\sum(\mathbf{S_{Env}\ XW_{Env}})$ = Environmental demand impact score=

COF_{Eco} = $\sum(\mathbf{S_{Eco}\ XW_{Eco}})$ = Economical demand impact score

COF_{Socio} = $\sum(S_{Socioo}\ XW_{socio})$ = Social demand impact score

Total COF = $\sum(S_{Env}\ XW_{Env}) + \sum(S_{Eco}\ XW_{Eco}) + \sum(S_{Socioo}\ XW_{socio})$

Total COF = 22(7.1*3+7.3*5+7.5*5)

+51(2.8*5+15.5*5+12.4*1+10.3*2)+22(10.4*1+7.8*2+).5*5+20*3)

=76.082

Refer to Annex 14-COF Values for CS3 Catchment)

3.7.6 Prioritize Sections Having a Higher Risk of Failure Ranking of Sewer

Using the weighted factor assigned in the criteria, as well as the consequences factor risk will be calculated for each pipe segment and will be used as the final ranking for the rehabilitation recommendations.

Sample Calculation

For example, take pipe segment A19-2 to A19-1 @Andival Street having COF=72.31, which becomes 6^{th} place in the category 1 list as follows.

Table 3.14: COF Values Relevant to the Pipe Segment A19-2 to A19-1 @Andival Street

	US MH	DS MH	Dia (mm)	Length (m)	Max. Grade	Cat	3	4	5	COF	Rank
Dam Street	A14-8	A14-7	225	96.7	5	1	5	3	16	76.8	1
Sri Kathiresan Street	A17-3A	A17-2	225	41.8	5	1	45	33	27	75.61	2
Sri Kathiresan Street	A17-3	A17-3A	225	42	5	1	43	15	19	75.1	3
3rd Cross Street	A36-3	A51-3	225	92.5	5	1	51	51	11	74.82	4
K.B Christie Perera Mw	C3A-2	C3A-1	225	123.5	5	1	94	67	11	74.15	5
Andival St.	A19-2	A19-1	225	2.3	5	1	30	44	18	72.31	6

(Refer Annex-15-23-Priority Rehabilitation List).

3.8 Data Analysis Using GIS Environment

The GIS tools were used to do the analysis -collect organize, manage, communicate and distribute geographic information (Arc map 10.4).

By using the GIS system, a huge amount of data in excel format was converted into CSV format and formed the shape file in the GIS environment, interpolated each layer, and derive the results.

Refer Annex3-Sewer Network-CS3 Catchment

Refer Annex4-Strom water Network-CS3 Catchment

4 DATA COLLECTION AND ANALYSIS

4.1 Introduction

This chapter identifies the data collection and analysis of this research. It presents the analysis of the results that were conducted using GIS Software. Initially, it assesses the grade of the pipe and the condition of the pipe segment considering the CCTV investigation data. Further, it assesses the risk model considering the impact of the consequences of failure. And then it concludes by analyzing the priorities relevant to pipe rehabilitation.

4.2 CS3 Catchment

The Proposed Methodology was evaluated by Selecting CS3 Catchment Area as the Case study site (Figure) With an area of 37 Sq.km and 160,000 properties,30 000m of sewer network installed in the year 1908 to 1921. 85% of the system run under gravity and the remaining forces mainly consist of highly vulnerable city structures such as the president's office, reputed hotels, the defense ministry, and the largest commercial harbor in south Asia.

Figure.4.1: Pilot Project Area - CS3 Catchment-Colombo North

Significant Aggregate and Silt work was recorded at the CS3 pumping Station located in the Colombo Peta Area. It shows the significant no of failures of the sewer pipes and the future collapse of the network in the CS3 catchment.

Figure.4.2: Aggregates collected at the Manhole in CS3 Area

4.3 Data Collection Methodology

Data and information relevant to the CS3 catchment were attached as follows.

- CCTV Data condition Source-GCWWP
- Pipe Inventory Data Source. CMC
- Longitudinal data Source -Survey Department
- Soil Source-NBRO
- Population data Source -UDA
- Building Layer Source -UDA
- Ground Water Source -NWS&DB
- Water consumption Source -NWS&DB
- Land use a pattern Source – CMC
- Roadway information Source -CMC
- Property lines and parcels Source CMC
- peak average daily Demand Source GCWWMP
- History of pipe breaks Source - CMC

The information listed above is utilized in various stages of the study as follows.

4.4 Data Acquisition to Pipe Inventory Model

The following information was extracted from The MC Drainage database to the pipe inventory database and then form the shape file on a GIS model.

Table 4.1: Attribute Table of Pipe Property Database

Location	Diameter (mm)	Sewer -ID	US MH ID	DS MH ID	Lining (Y/N)	Chainage Total (m)
Olcott Mw.	225	A7	A7-11	A7-10	N	58.5
Sri Kathiresan Street	225	A17	A17-3	A17-3A	Y	42
Sri Kathiresan Street	225	A17	A17-2A	A17-2B	Y	3.3
Hussainiya Street	225	A27	A26-4	A27-9	N	57
1st Mosque Lane	225	A30	A30-1	A29-2	N	7.5

Table 4.2: Attribute Table of Manhole Inventory Database

Manhole _no	Sheet	X_Cord	Y_Cord	District	Catchment	Cover Level
0	66_8_7D	98663.4232	193226.7	2A	20	4.85
4251	66_8_7D	98403.7773	193280.7	2A	20	4.42
4152	66_8_7D	98410.5074	193145.9	2A	20	3.69
4252	66_8_7D	98410.6395	193212.1	2A	20	3.74
4151	66_8_7D	98410.9078	193151.2	2A	20	3.68
4253	66_8_7D	98418.7525	193215.3	2A	20	3.92

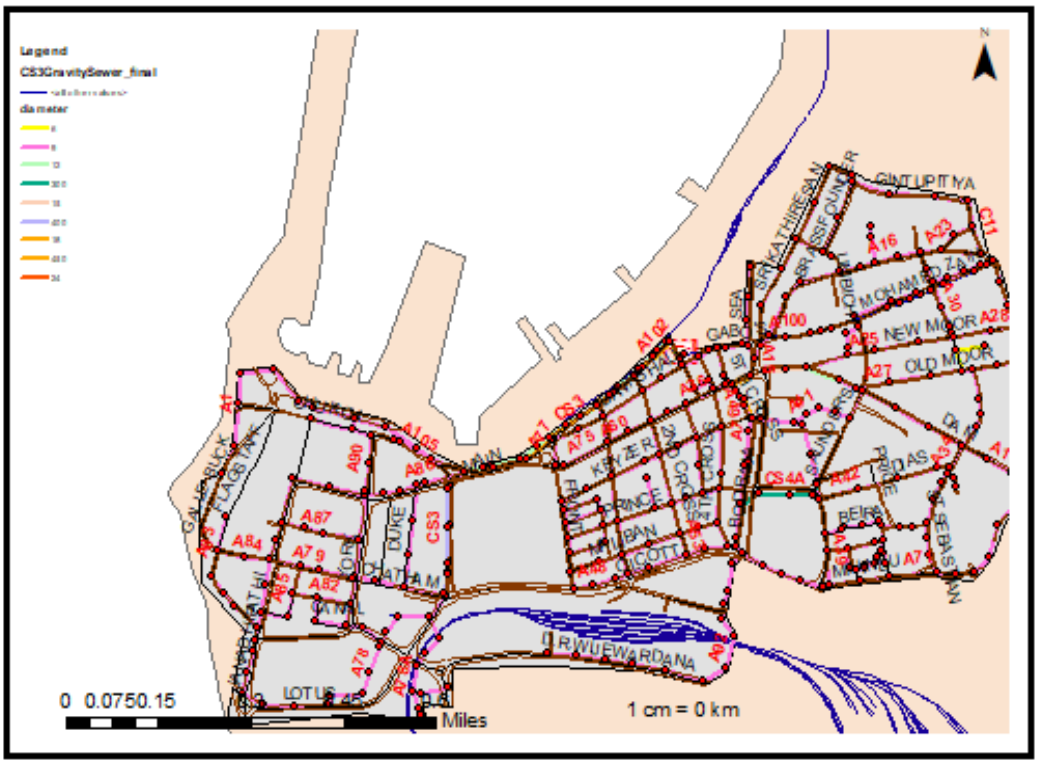


Figure 4.3: A Map of Sewer Network in CS3 Catchment Area

Refer

Annex 3-Map of Sewer pipe Network in CS3 Catchment

Annex4-Map of Manhole in CS3 Catchment

Annex 6-Pipe Inventory Database

Annex7 -Manhole Inventory Database

4.5 Data Acquisition to Condition Model

The information was extracted from the condition assessment survey report and then transformed into actionable information as explained in the methodology formed the condition assessment database and then form the shape file on a GIS model.

Refer

Annex 9-Condition Assessment Database

Annex5--Map of condition grade value of pipe in CS3 Catchment

4.6 Final Ranking for CS3 Catchment

Priority of Rehabilitation List - Category =1 for CS3 catchment -Annex 15

Priority of Rehabilitation List - Category =2 for CS3 catchment -Annex 16

Priority of Rehabilitation List - Category =3 for CS3 catchment -Annex 17

Priority of Rehabilitation List - Category =4 for CS3 catchment -Annex 18

Priority of Rehabilitation List - Category =5 for CS3 catchment -Annex 19

Priority of Rehabilitation List - Category =6 for CS3 catchment -Annex 20

Priority of Rehabilitation List - Category =7 for CS3 catchment -Annex 21

Priority of Rehabilitation List - Category =8 for CS3 catchment -Annex 22

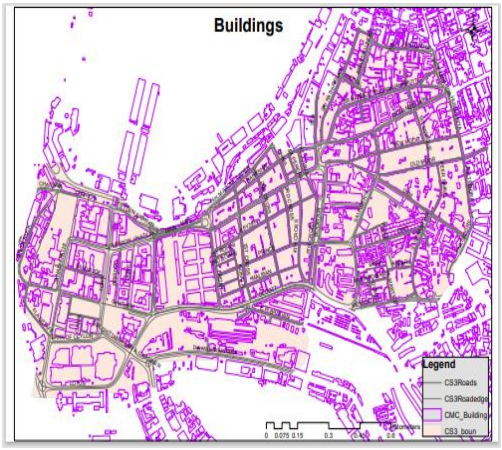
Priority of Rehabilitation List - Category =9 for CS3 catchment -Annex 23

5 RESULTS AND DISCUSSION

5.1 CS3 Catchment

The Proposed Methodology was evaluated by Selecting the CS3 Catchment Area With an area of 37 Sq.km and 160,000 properties,30 000m of sewer network installed in the year 1908 to 1921. 85% of the system run under gravity and the remaining forces mainly consist of highly vulnerable city structures such as the president's office, reputed hotels, Central Bank, and the largest commercial harbor in south Asia.

Figure .5.1 Important Lank Marks in CS3 Catchment



(a)Building Laouto of The Area

(b)Aerial View of The Area

Figure .5.2: (a) Building Map of The Area (b)Aerial View of The Area

5.2 General Sewer Network with Details

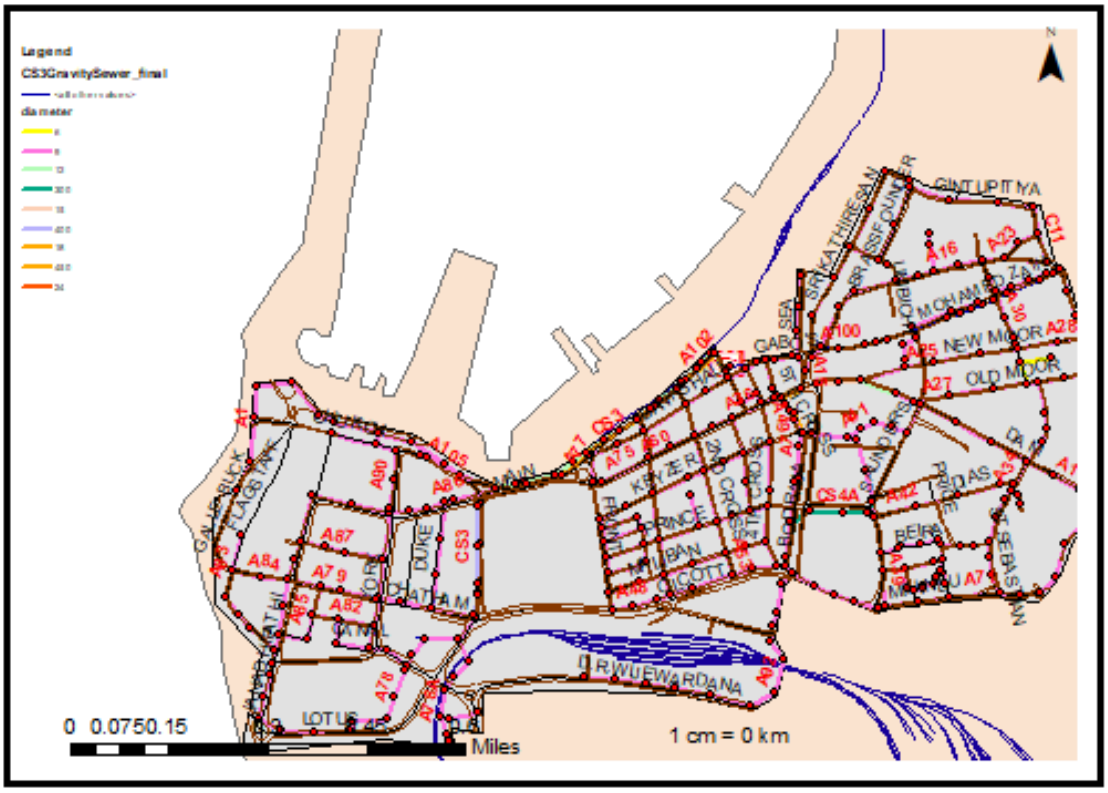


Figure 5.3: Sewer Pipe Network in CS3 Catchment

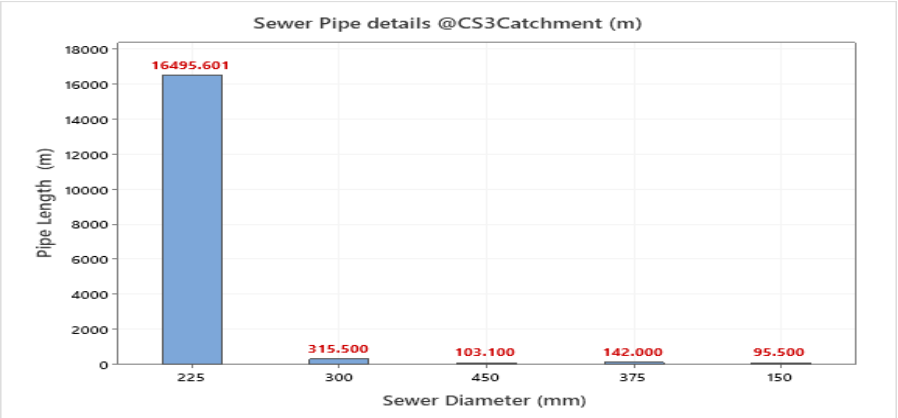


Figure 5.4: Distribution of Pipe size in CS3 Catchment

CMC Sewer network mainly consists of 225mm in diameter pipes. Pipe sizes in the case study area varied between 150 mm-450 mm in diameter. But 16.5 km of sewers are 225 mm in diameter. The above charts show the pipe inventory view of the catchment.

5.3 Condition Assessment

Condition assessment was carried out to get a representative understanding of the drainage network under GCWWMP and completed successfully for the northern catchment.

Investigation reveals utilities in understanding the system-wide risk along with the network. The results obtained from the aforementioned procedure considered 360 pipe segments and 33 km length of about 330000 independent observations of events related to CCTV inspection. These data sets were analyzed and the most critical pipe segments were identified. All identified failure-related problem was rated with a score and graded from 1-5 in increasing order of severity. The sewers having maximum grades 3,4,5, were classified as critical and they should be replaced or repaired within a given period. The pipes having max grade 1,2 were considered non-critical. Figure 5.5 shows the distribution of max grade value throughout the catchment.

Max. Grade Value

5	**4**	**3**	**1,2**
232	68	52	9
64%	19%	14%	3%

Ranking Criticality

Non-Critical Rank=0. 1,2	**Critical Rank=3,4,5**
8	352
2%	98%

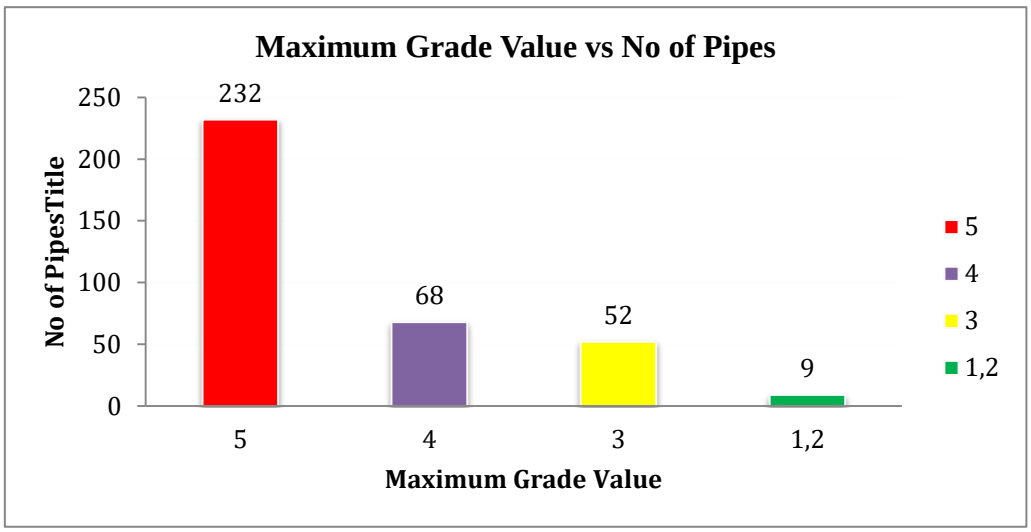
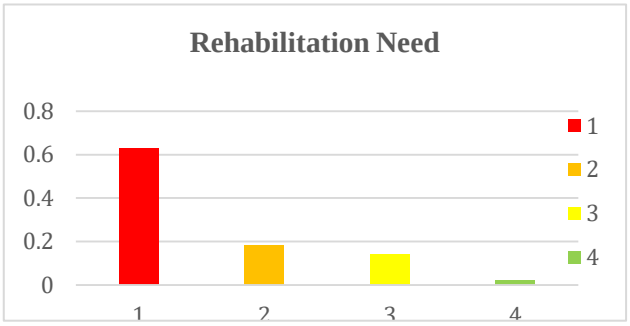


Figure 5.5: Maximum Grade Value Distribution @ the Catchment

5.4 Identify Rehabilitation Need

In the next approach, three rehabilitation time schedules were identified according to the criticality of the line. In comparison, 64% of pipe segments require immediate action on rehabilitation within five years to prevent the failure of the pipe. Nineteen present 19% of pipe segments require to be attended to within 5 years.14% of requiring to be repaired within 5-10 years.



Rehabilitation Need

0-5 year	5-10 yrs.	10-20 yrs.	More than 20 yrs.
232	68	52	8
63%	18%	14%	2%

Figure 5.6: Rehabilitation Need @ CS3 Catchment

The pipe with Max. grade value no 5 is in the most severe risk status, and most probably has defects (e.g., Collapsed pipes, Holes in Pipes, Broken Pipes, Surface Damage (corrosion), and Deformed pipes) that need immediate attention.

Since the catchment has a considerable amount of severe risk pipes fall into the highest priority. It was further divided into 6 categories as follows.

Table 5.1: Risk Categorizations Criteria

Category	No	Condition	Rehabilitation-Time line
category	1	$G_5 > 10$	Very Critical Immediately
Category	2	$5 < G_5 >= 10$	
category	3	$1 <= G_5 >= 5$ AND $G_4 > 15$	
category	4	$1 <= G_5 >= 5$ AND $5 < G_4 <= 15$	
category	5	$1 <= G_5 >= 5$ AND $1 <= G_4 <= 5$	
category	6	$1 <= G_5 >= 5$ AND $G_4 = 0$	

Table 5. 2 shows the distribution of rehabilitation needs into 09 categories between one to nine.

Table 5.2: Classification of Rehabilitation Needs

Category	No	Condition	Rehabilitation-Time line
category	1	$G_5 > 10$	Very Critical Immediately
category	2	$5 < G_5 >= 10$	
category	3	$1 <= G_5 >= 5$ AND $G_4 > 15$	
category	4	$1 <= G_5 >= 5$ AND $5 < G_4 <= 15$	
category	5	$1 <= G_5 >= 5$ AND $1 <= G_4 <= 5$	
category	6	$1 <= G_5 >= 5$ AND $G_4 = 0$	
category	7	$G_5 = 0$ AND $G_4 >= 1$	Critical within 5 yrs.
category	8	$G_5 = 0$ AND $G_4 = 0$ AND $G_3 <= 1$	Need within 10 yrs.
category	9	$G_5 = 0$ AND $R_4 = 0$ AND $R_3 = 0$	No Need within 20 yrs.

Table 5.3: Summary of the Final Ranking-CS3 Catchment

Rank1	Rank2	Rank3	Rank4	Rank5	Rank6	Rank7	Rank 8	Rank 9
24	40	53	49	51	15	68	52	8
7%	11%	14%	13%	14%	4%	18%	14%	2%

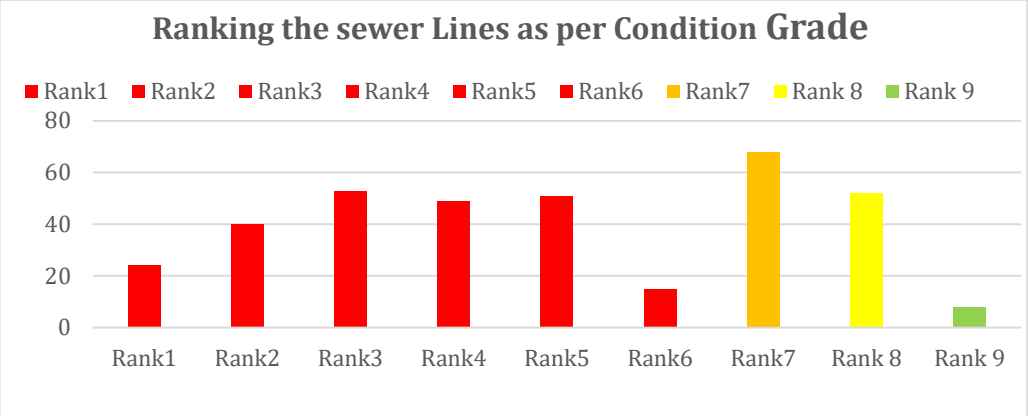


Figure 5.7: Ranking of Pipes

The above results will provide an overall figure on the Colombo sewer network, and it will be useful in the preparation of the sewer rehabilitation plan. In addition, Top-level Managers can decide on budget all0cation and improvement of pipeline projects.

5.5 Deliverable 1 - Quick Assessment of Sewer Pipe

This unable utility service provider quickly captures the problematic places to be attained without detailed engineering analysis. For example, immediate attention is to be paid to replacing or rehabilitating sections between MH A49-4 to A49-3- where a greater no of failures were observed.

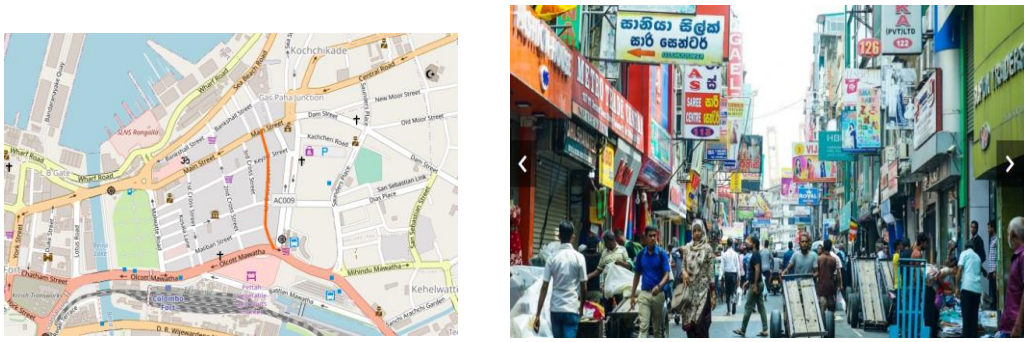


Figure 5.8: Olcott Mw - 4th Cross Street

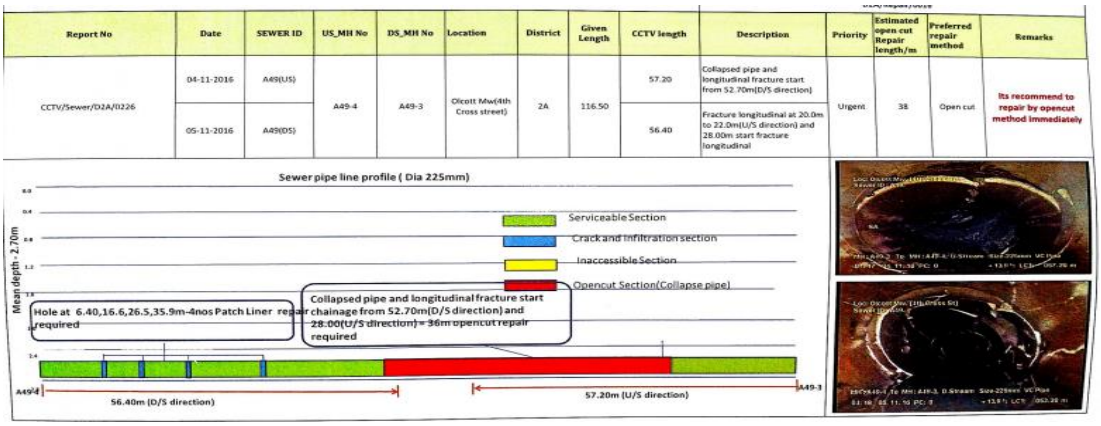


Figure 5.9: Failure Information -Olcott Mw (4th Cross Street)-refer to Annex 25

Table 5.4: Calculation of Condition Rank Based on Failure

Location Reference	Dia. (mm)	Sewer -ID	US MH ID	DS MH ID	Length (m)	Max grade	Avg grade	3	4	5
Olcott MW (4th Cross St)	225	A49	A49-4	A49-3	57.2	5	3	239	92	12
Olcott MW (4th Cross St)	225	A49	A49-3	A49-2	13.5	5	3	68	17	5
Main Street (4th Cross St)	225	A49	A36-2	A36-2A	48.2	5	3	52	21	1
Main Street (4th Cross St)	225	A49	A36-2A	A49-4	47.3	5	3	55	21	6

Olcott (4th Cross Street)	225	A49	A49-2	A49-1	82.1	5	3	56	13	5
4th Cross Street	225	A49	A49-1	A48-1	66.5	4	2	14	3	0

Figure 5.10 shows the summary sheet for the particular pipeline e.g. Olcott MW

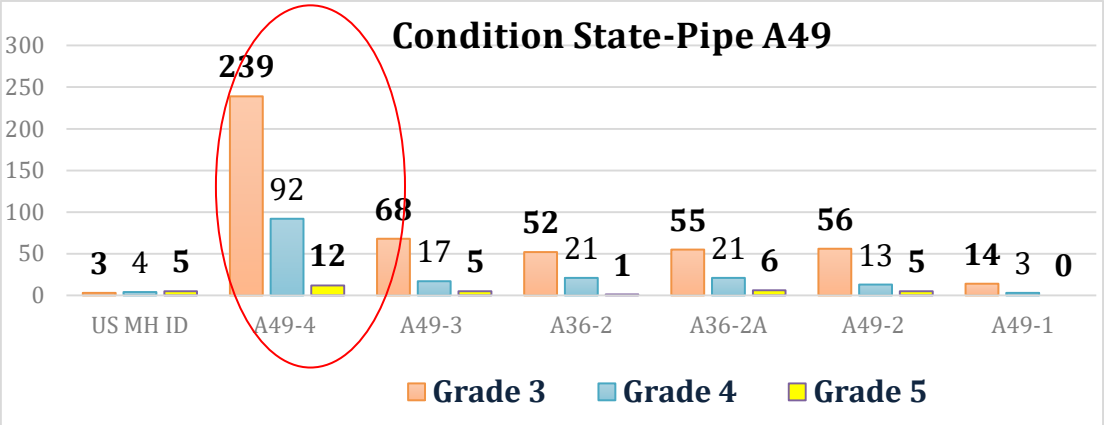


Figure 5.10: Illustration of Condition Grade Along Olcott Mawatha

This unable utility service provider quickly captures the problematic places to be attained without detailed engineering analysis. CCTV data can be viewed on a map and easily shared around an organization. Links to digital pictures and videos of observations are preserved and can be accessed via a map. Spatial analytics can be applied to the data providing additional asset management insights.

for example, immediate attention is to be paid to replacing or rehabilitating sections between MH A49--4 to A49-3 where a greater no of failures are observed.

5.6 Deliverable 2 - Ranking of Sewer Pipe in a Catchment

The following map represents a closer view of the pipe failure based on the condition assessment of the sewer for the CS3 catchment developed using ARC GIS software and shows the location map of these pipes and their corresponding risk levels.

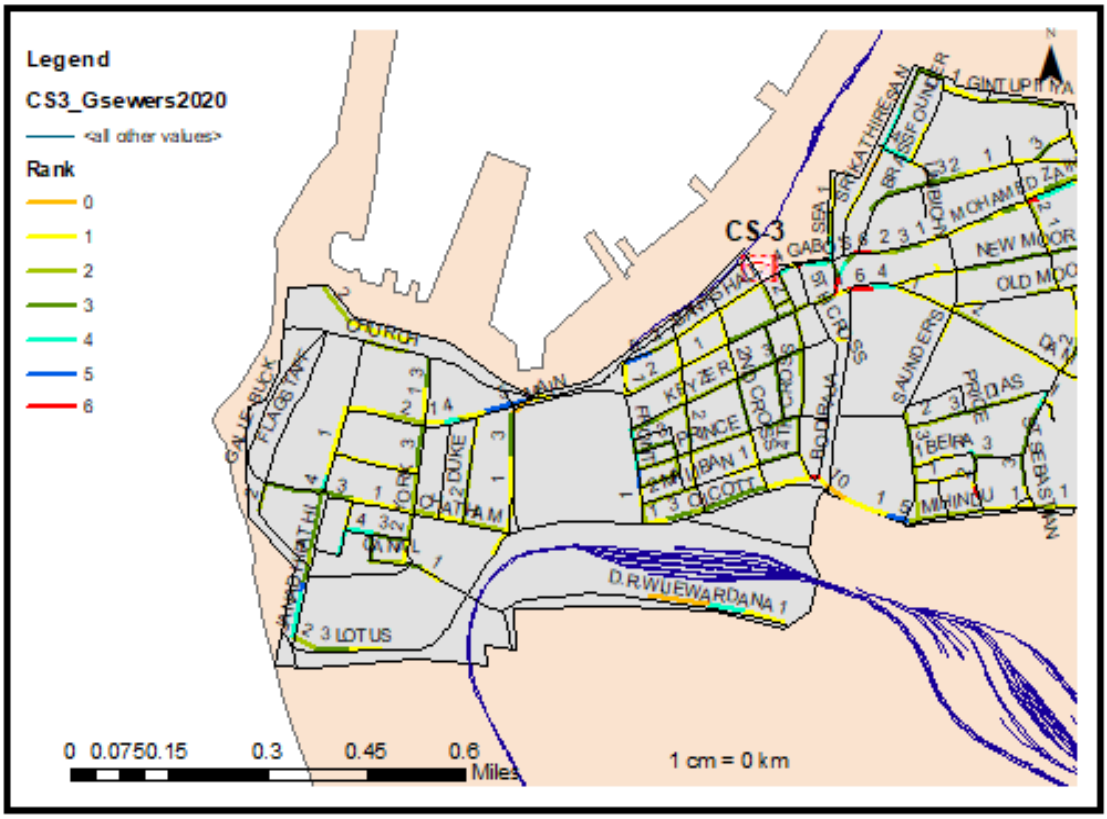


Figure 5.11: Map of Pipe Failure in the Catchment

5.7 Deliverable 3 - Priorities List for Rehabilitation

Prioritizing the rehabilitation was done on the fundamental principal risk assessment hazard and vulnerability of failure. The Hazard is a measure of the physical intensity of the consequence es at a location and the associated problem of this intensity. for example, the pipeline is located in a high-traffic area with a weak soil profile underneath and a higher potential to collapse in the locations of mild-traffic areas with a strong soil profile underneath it. Similarly, in locations with critical customers like a hospital, residents are far higher than in locations with inland land and residential area.

Similarly, Vulnerability is a measure of the consequences that the particular Failure can cause to the urban environment (infrastructure, transportation, and Utilities) at a location where a location closer to a railway line can need more attention than a location on an abnormal artillery road.

Annexes 10-12 summarized the different impact variables considered in analyzing COF in this study. For a small area, soil type, and water table will not differ much. But the length of the sewer line is most important in four out of 5 sub-criteria. Since the length of the pipe increases, the risk of the pipe is also increased.

There were a total of 8 individual pipe segments in the most severe status. located along Banker street, Dam Street, Albar Lane, Olcott Mawatha, and Mohemed Zen Mawatha. Avenue, four of which were comprised of cast iron and two of which were galvanized iron. These pipes also had an installation date as early as 1929 and as late as 1982.Clay pipe experience deteriorated due to aging; however, in addition to that illegal connection and, grease and oil deposition, root extrusion problems exist in the network.

Refer to Annex 10-12 Table 28 Priority schedule for Renovation of Very High-Risk PipesIts classification and identification of risk levels using only Consequences of failure for each pipe segment resulted in the same results In a Selected Pilot Area in which service demand, land use, and availability of the ecosystem were similar for the risk assessment impact criteria.

The only limitation is conducting sewer line investigations using CCTV or any other technology which is highly expensive and limited in the south Asian Region.

6 CONCLUSION

Colombo municipal sewer pipeline networks were installed more than a century ago facilitating drainage and sanitation disposal for the citizens. However, many of these pipeline networks are reaching the end of their intended design life.

Historically, Drainage managers have managed these networks using several factors for renewal, most notably age, failure history, and desktop evaluation. But at present, a Sound condition assessment framework is needed to prepare for the external challenges of population growth, regularity demand, climate change, and a vision for a sustainable urban environment in the future,

The research aims to help the municipality to evaluate the current state of their buried infrastructure and provide them with high-confidence conditions and operating data in their asset renewal plans. Hence the study was focused to prepare, implement, and evaluate a condition assessment framework to prioritize the pipe renewal work. It was based on massive amounts of CCTV data in the form of both images and PDFs obtained from a CCTV survey conducted under GCWWMP in 2017.

In developing the pipe rehabilitation framework, the previous researchers mostly focused on finding optimal policies for sewer rehabilitation using complex mathematical analysis (A, Castellett, R.Soncini,2006), but they didn't pay attention to accommodate any tool to assess the information from condition assessment and to predict the condition reliability of rating infrastructure.

In addition, in the past, the prioritizing plan was more or less based on the economic and financial approach. But here focus to concentrate on the importance of non-tangible values like environmental, social, and public factors in decision-making in pipe renewal work

During the research, all the condition assessment data in PDF format was converted into actionable information and stored in the geographical information system. First

attention was drawn to finding out the critical pipe segments of the network and then priority schedules were prepared based on the Spatial basis risk assessment performed on the previous work. The framework was tested and verified on real data relevant to the sewer network in the CS3 catchment area. The Case study has identified that the pipe distress is localized and randomly distributed, not depending on the age of the asset. but condition rank, depth, and vulnerability of the zone have a greater impact on the criticality of pipe failure.

As per the result of research, it has been found that most of the pipe segments in the selected Catchment area need replacement within the next 10 years. In comparison, 63% of pipe segments require immediate action on rehabilitation within five years to prevent the failure of the pipe.18% of pipe segments require to be attended to within 5-10 years.14% require to be repaired within 10-20 years.

The finding highlights the relevance of using condition assessment data in strategic asset management and the need for extensive repair work in aging infrastructure.

Moreover, the study is to transform inspection data into actionable information about actual pipeline conditions. It was done in a graphically appealing and very simple manner on a GIS platform. The linkage of massive amounts of sewer system data in the form of both video image files and sewer system condition ratings to the physical characteristics of the sewer system. It has enabled engineers to manage, access, interpret transform these data sources into planning and management assets, and make scientifically defensible decisions for pipeline renewal.

The framework support identifying the failure zone and generating geographic maps accordingly in the GIS system and the information required for planning repair work such as location, land usage, building layout, surface geology, and utilities nearby are freely available in the application.

So that it improves the understanding of the pipe infrastructure, and the condition contribution blockages and pipe bursts and prepares the technical team to efficiently summarize the data, investigate, understand, evaluate and quickly attend to react proactively with less budget when compared with traditional reactive maintenance

programme which has been practiced during the past decades. It will help to solve O&M problems, and structural problems, ultimately leading to extending the remaining useful life of their water networks

By moving from a reactive maintenance strategy to a Proactive strategy the city will be able to avoid the introduction of sewage into its waterways, reduce inflow and infiltration and most importantly; eliminate and backup problems of property flooding and subsequent pollution into the marine environment and inland waterways, and step towards a sustainable environment.

6.1 Contribution to Practice

In addition to the contribution to research, this study provides timely important rehabilitation applications for utility organizations regarding selecting Priorities of rehabilitation., Also it provides the potential impact of pipe failures on society and consequently select a most viable solution.

It has been proved that individual component of the study such as condition assessment of the line and risk assessment of the study is simple and can be effectively applied to any sewerage system as per their requirement and availability of resources management of sewer system. So that Every outcome of the study may guide not only the municipality but also other agencies handling underground pipe networks.

6.2 Limitations and Future Research

This study has some limitations which will also become the baseline for future research studies.

It includes the assessment of the criticality of the pipe segment, identifying the consequence of pipe failure, and lastly, prioritizing the rehabilitation work. But it does not include the valuation of the economic loss of the service.

Secondly, the area of data validation is limited to one catchment in a small area So at most of the consequences of pipe failure are more or less similar to the particular

area resulting in similar impacts. Therefore, future research should have to focus on areas with different urban activities.

Thirdly, As the Sewer lines and related networks are limited in Sri Lanka, research work relevant to application of impact score is still at the early stage. So global weighted scores are applied in calculating risk associated with pipe failure. So that Further studies are required in several catchments to fine - tune the weighted scores relevant to the local context and validate the findings of this research.

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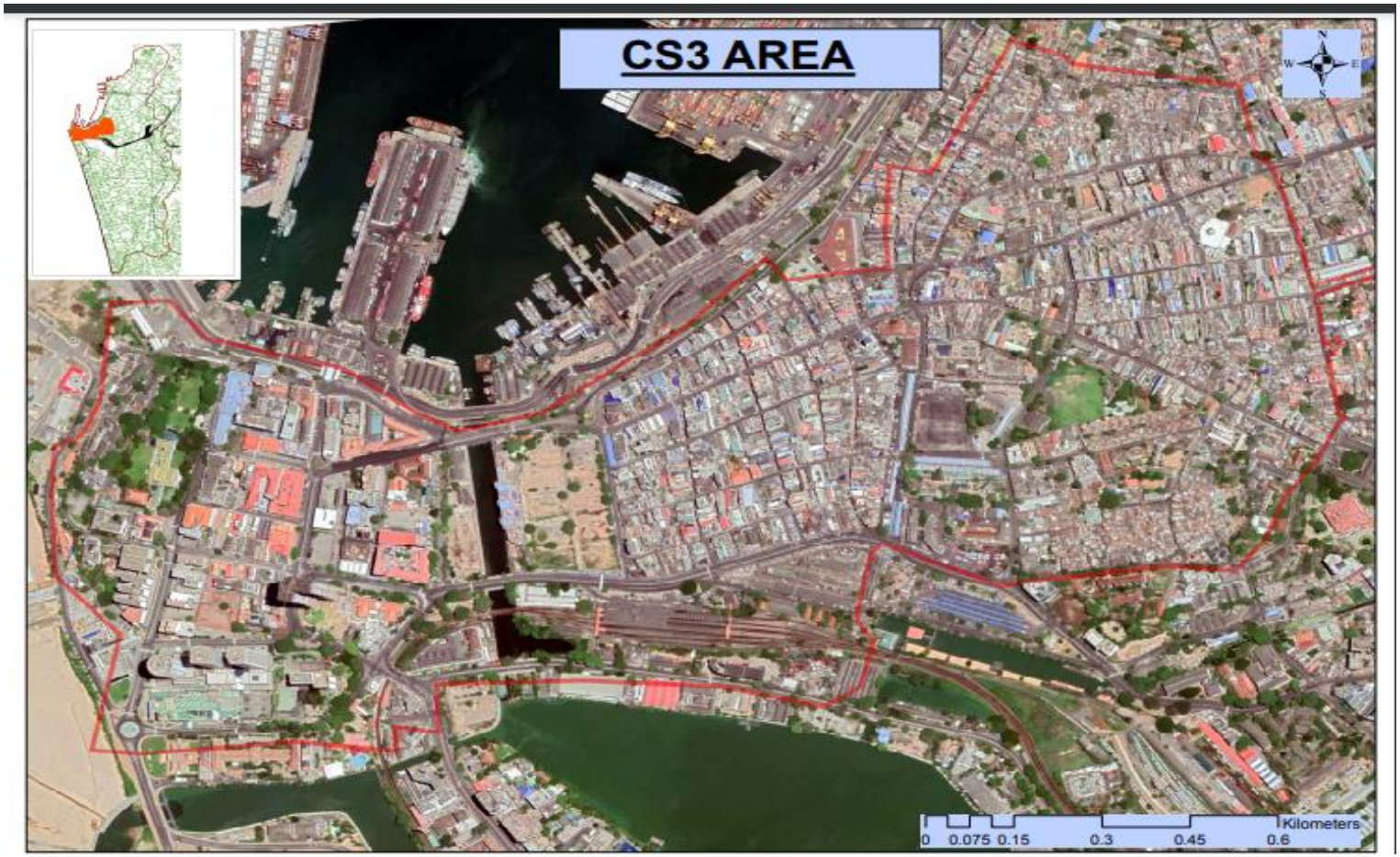
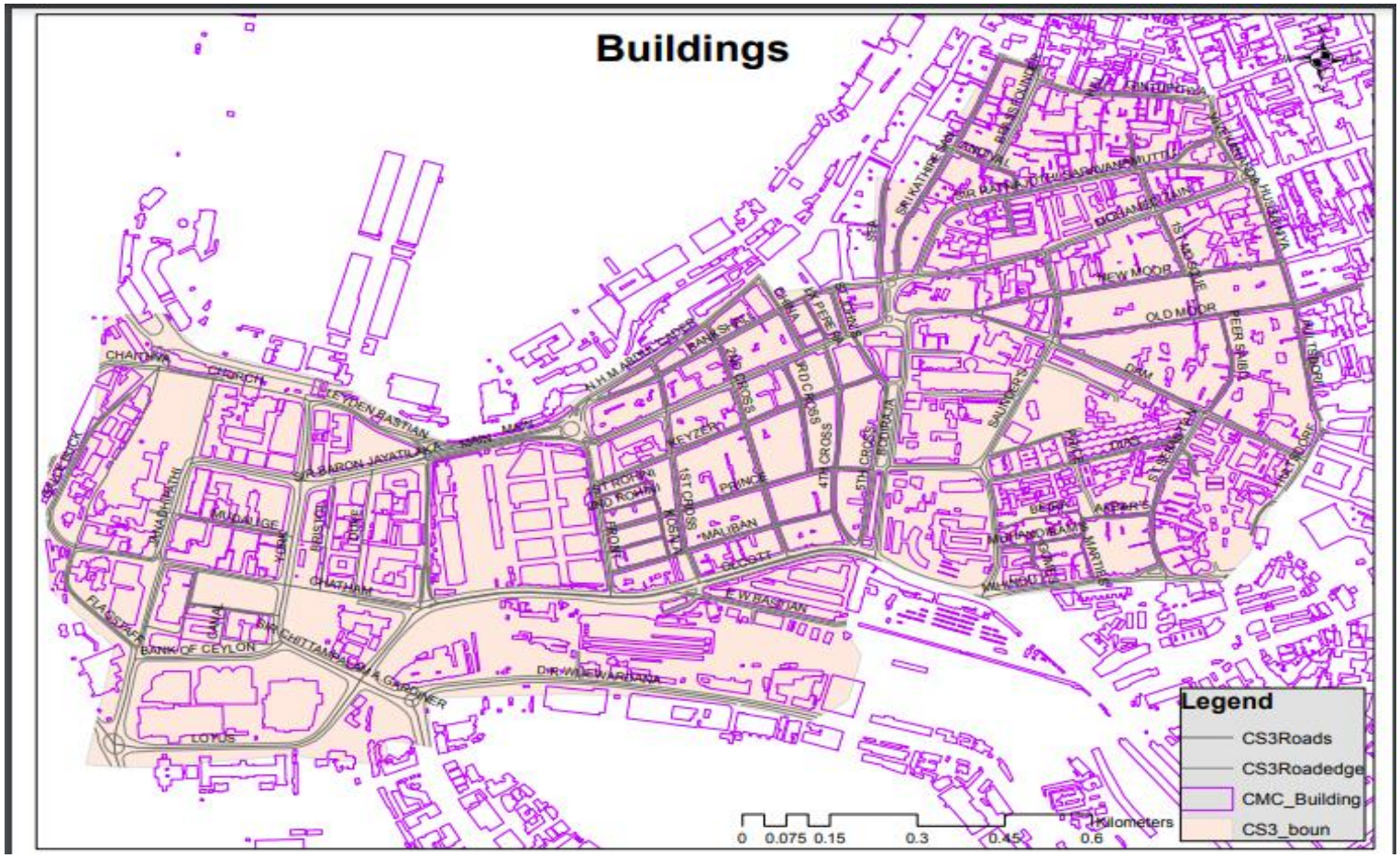
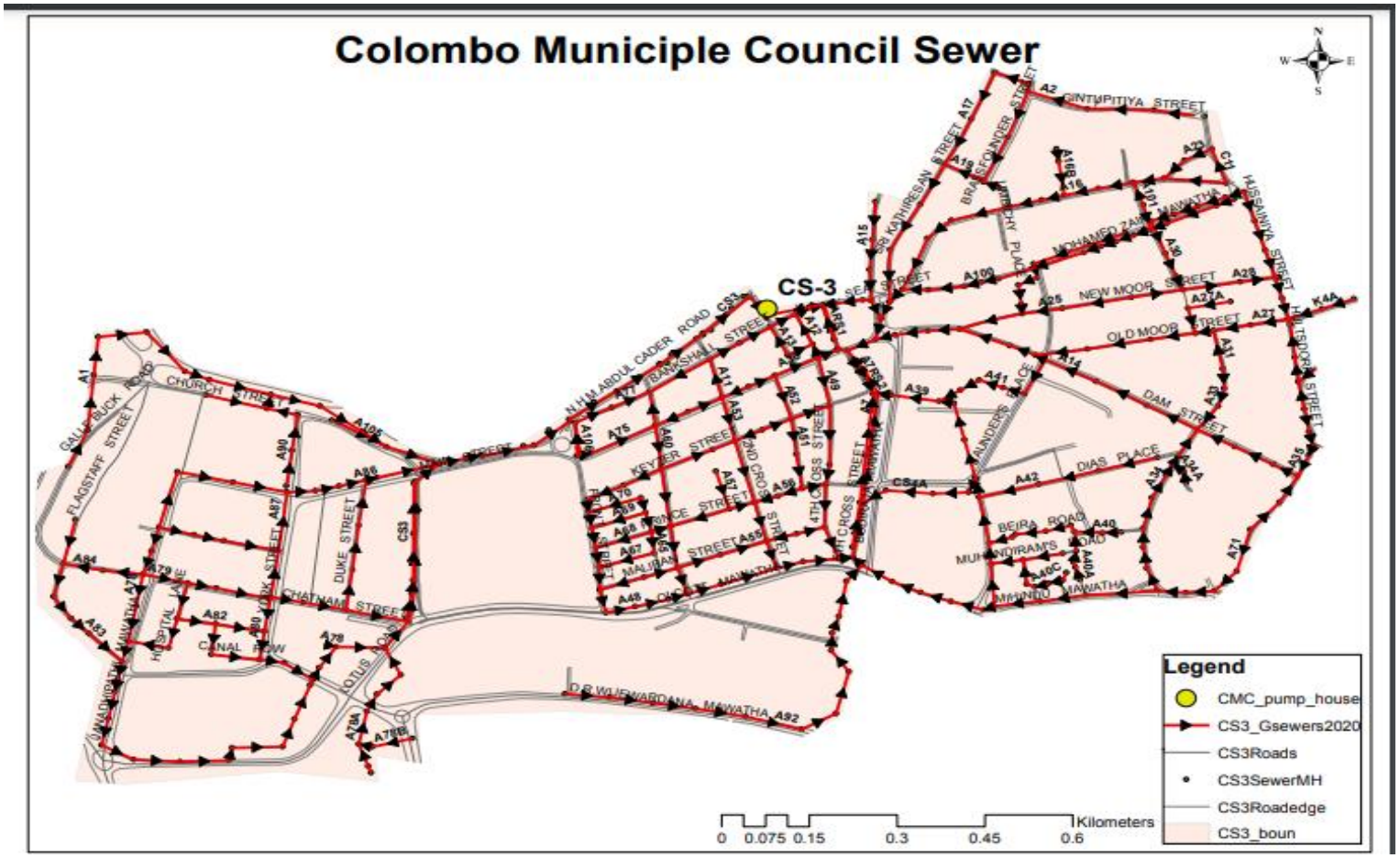
Annex 1 CS3 Catchment Area Arial View



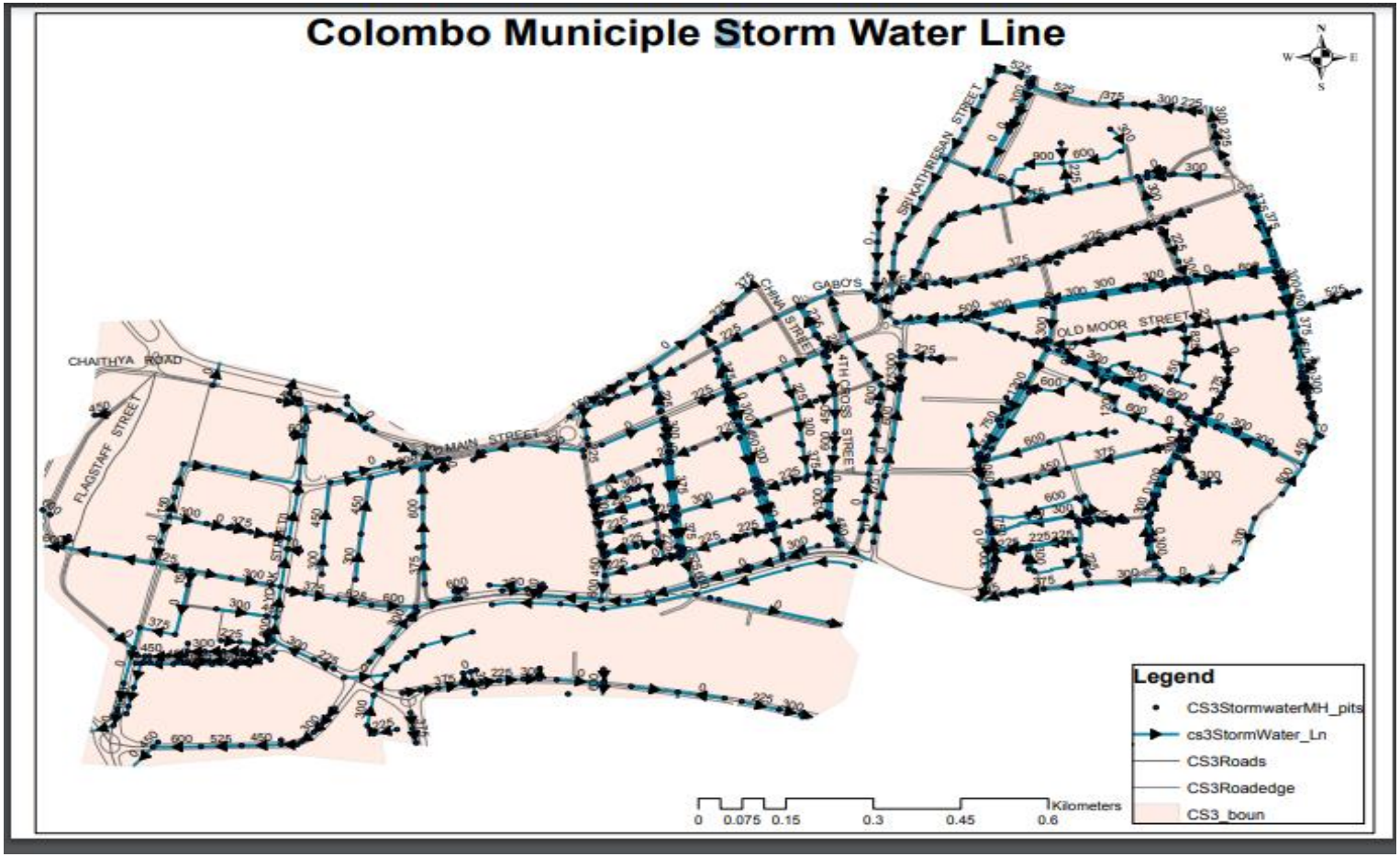
Annex 2 Building Layout - CS3 Catchment Area



Annex 3 Sewer Network - CS3 Catchment Area



Annex 4 Storm Water Network - CS3 Catchment Area



Annex 5 Pipe Property Details - CS# Catchment Pipe Property Details

Sewer –ID	Location Reference	US MH ID	DS MH ID	Sewer Diameter (mm)	Chainage (m)	US MH _ID	DS MH _ID
A1	Wharf Road	A1-30	A1-29	225	74	1497	1496
A1	Wharf Road	A1-29	A1-28	225	45.1	1496	1495
A1	Wharf Road	A1-28	A1-28A	225	29.1	1495	1495A
A1	Main Street	A1-23	A1-22A	300	100	1659	1658
A2	Gintupiiya Street	A2-8	A2-8A	225	65.9	1719	1719A
A2	Gintupiiya Street	A2-8A	A2-7	225	21.4	1719A	1720
A2	Gintupiiya Street	A2-7	A2-6	225	105.7	1720	1721
A2	Gintupiiya Street	A2-6	A2-5	225	14.1	1721	1722
A2	Gintupiiya Street	A2-5	A2-4	225	64.4	1722	1724
A2	Gintupiiya Street	A2-4	A2-3	225	36.1	1724	1723
A2	Gintupiiya Street	A2-3	A4-2	225	38.6	1723	1080
A2	Sea Beach Road	A2-2	A2-1	225	27.7	1730	1728
A2	Sea Beach Road	A2-1	A1-7	225	7.8	1728	1736
A2	Gintupiiya Street	C11-6	A2-8	225	111.5	1717	1719
A7	Olcott Mw.	A7-14	A7-13	225	56.1	3860	3861
A7	Olcott Mw.	A7-13	A7-12	225	55	3861	3862
A7	Olcott Mw.	A7-12	A7-11	225	50.3	3862	3863
A7	Olcott Mw.	A7-11	A7-10	225	58.5	3863	4184
A7	Olcott Mw.	A7-10	A7-9	225	20.2	4184	4220
A10	Gabos' Lane	A15-2	A10-1	225	11.4	1663	1594
A10	Gabos' Lane	A10-1	A10-2	225	44.4	1594	1593
A11	Bankshall Street	A11-2	A11-1	225	20.4	1638	1639
A11	Main Street	A11-8	A11-7	225	11.6	1623	1622
A11	2nd Cross Street	A11-7	A11-6	225	77.5	1622	1634
A11	Bank shall Street	A11-6	A11-5	225	60.1	1634	1635
A11	Bankshall Street	A11-5	A11-4	225	24.3	1635	1636
A11	Bank shall Street	A11-3	A11-2	225	17	1637	1638
A11	Bank shall Street	A11-1	A7-2	225	2	1639	1606
A12 A	China Lane	A13-1	A12-1	225	20.8	1618	1617
A12	I.X.Perera Mawatha	A36-2	A12-1	225	24.6	1614	1617
A12	I.X.Perera Mawatha	A12-1	A11-3	225	65	1617	1637
A14	Main Street	A14-1	A7-4	450	53.1	1570	1604
A14	Dam Street	A14-2	A14-1	375	33.5	1569	1570
A14	Dam Street	A14-3	A14-2	375	55	1568	1569
A14	Dam Street	A14-4	A14-3	375	53.5	1567	1568
A14	Dam Street	A14-5A	A14-4	300	45.7	1515A	1567

A14	Dam Street	A14-5	A14-5A	300	43.3	1515	1515A
A14	Dam Street	A14-6	A14-5	225	43.5	1516	1515
A14	Dam Street	A14-7	A14-6	225	19.1	1517	1516
A14	Dam Street	A14-8	A14-7	225	96.7	1518	1517
A14	Dam Street	A14-9	A14-8	225	96.2	1519	1518
A14	Dam Street	A14-10	A14-10A	225	15.2	1520	1520A
A14	Dam Street	A14-10A	A14-10B-1	225	11	1520A	1520B-1
A14	Dam Street	A14-10B-1	A14-10B	225	2.5	1520B-1	1520B
A14	Dam Street	A14-10B	A14-9	225	35.6	1520B	1519
A14	Hulftsdorp Street	A14-14	A14-13	225	59.5	3837	3836
A14	Dam Street	A14-13	A14-12	225	47.3	3836	1522
A14	Dam Street	A14-12	A14-12A	225	7.7	1522	1522A
A14	Dam Street	A14-12A	A14-11	225	66.3	1522A	1521
A14	Dam Street	A14-11	A14-10	225	70.5	1521	1520
A15	Sea Street	A3-4	A15-4	225	74.5	1744	1665
A15	Sea Street	A15-4	A15-3	225	59	1665	1664
A15	Sea Street	A15-3	A15-2	225	32.6	1664	1663
A15	Sea Street	A15-2	A15-1	225	38	1663	1662
A15	Wholfendhal Street	A15-1	A14-1	225	43	1662	1570
A16	Wolfendhal Street	A16-11	A16-10	225	107.1	1711	1710
A16	Wolfendhal Street	A16-10	A16-9	225	53.7	1710	1709
A16	Wolfendhal Street	A16-9	A16-9A	225	10.3	1709	1709A
A16	Wolfendhal Street	A16-9A	A16-8	225	47.7	1709A	1708
A16	Wolfendhal Street	A16-7	A16-7A	225	36.4	1707	1707A
A16	Wolfendhal Street	A16-8	A16-7	225	58.4	1708	1707
A16	Wolfendhal Street	A16-7A	A16-6	225	1	1707A	1706
A16	Wolfendhal Street	A16-6	A16-6A	225	24.2	1706	1706A
A16	Wolfendhal Street	A16-6A	A16-5	225	30.2	1706A	1705
A16	Wolfendhal Street	A16-5	A16-5A	225	84.4	1705	1705A
A16	Wolfendhal Street	A16-2	A16-1	225	32.1	1587	1589
A16	Wolfendhal Street	A16-5A	A16-4	225	15.9	1705A	1704
A16	Wolfendhal Street	A16-4	A16-3	225	52.2	1704	1588
A16	Wolfendhal Street	A16-1	A15-1	225	10.4	1589	1662
A17	Sri Kathiresan Street	A2-4A	A17-4	225	60	1724	1725
A17	Sri Kathiresan Street	A17-4	A17-3	225	100.6	1725	1726
A17	Sri Kathiresan Street	A17-3	A17-3A	225	42	1726	1726A
A17	Sri Kathiresan Street	A17-3A	A17-2	225	41.8	1726A	1727
A17	Sri Kathiresan Street	A17-2	A17-2A	225	48.2	1727	1727A
A17	Sri Kathiresan Street	A17-2A	A17-2B	225	3.3	1727A	1727B
A17	Sri Kathiresan Street	A17-2B	A17-1	225	34.5	1727B	1590
A17	Sri Kathiresan Street	A2-4	A2-4A	225	42.2	12006	12006A
A19	Andival Street	A19-3	A19-2	225	27.5	1683	1684

A19	Andival St.	A19-2	A19-1	225	2.3	1684	1682
A19	Andival St.	A19-1	A17-3	225	71.2	1682	1726
A20	Brass Founder Street	A20-1	A20-1A	225	17.1	1681	1681A
A20	Brass Founder Street	A20-1A	A19-1	225	77.9	1681A	1682
A20	Brass Founder Street	A2-6	A20-1	225	48,5	1721	1681
A23	Wolfendhal Lane	A23-1	A16-10	225	49.3	1712	1710
A23	Wolfendhal Lane	C11-7	A23-1	225	50	1713	1712
A25	New Moor Street	A25-1	A25-1A	225	31.5	1566	1566A
A25	New Moor Street	A25-1A	A14-4	225	81.8	(566A	1567
A25	New Moor Street	A25-2	A25-1	225	67	1565	1566
A25	New Moor Street	A29-1	A25-2	225	120.5	1564	1565
A26	Mohamed Zain Mw	A26-4	A26-3	225	29.8	1690	1689
A26	Mohamed Zain Mw	A26-3	A26-2	225	52.4	1689	1688
A26	Mohamed Zain Mw	A26-2	A26-1	225	40	1688	1687
A26	Mohamed Zain Mw	A26-1	A26-1A	225	25.9	1687	1687A
A26	Mohamed Zain Mw	A26-1A	A30-4	225	16.9	1687A	1562
A27	Old Moor Street	A27-1	A14-6	225	90	1548	1516
A27	Old Moor Street	A27-2	A27-1	225	108.5	1549	1548
A27	Old Moor Street	A27-2B	A27-2	225	65.6	1550A	1549
A27	Old Moor Street	A27-2A	A27-2B	225	10	1550	1550A
A27	Old Moor Street	A27-3	A27-2A	225	31.7	1551	1550
A27	Old Moor Street	A27-4	A27-3	225	45.5	1552	1551
A27	Old Moor Street	A27-5A	A27-4	225	33.1	1553A	1552
A27	Old Moor Street	A27-5	A27-5A	225	31.4	1553	1553A
A27	Hulftsdorp Street	A27-6	A27-5	225	42	1554	1553
A27	Hulftsdorp Street	A27-7	A27-6	225	42	1555	1554
A27	Hussainiya Street	A27-8	A27-7	225	59.6	1556	1555
A27	Hussainiya Street	A27-9	A27-8	225	57.6	1557	1556
A27	Hussainiya Street	A26-4	A27-9	225	57	1690	1557
A27A	Old Moor Street	A27A-1C	A27-2A	150	19.3	1527C	1550
A27A	Old Moor Street	A27A-1B	A27A-1C	150	13.5	1527B	1527C
A27A	Old Moor Street	A27A-1A	A27A-1B	150	5	1527A	1527B
A27A	Old Moor Street	A27A-1	A27A-1A	150	11.6	1527	1527A
A28	New Moor Street	A29-2	A28-1	225	21	1563	1558
A28	New Moor Street	A28-1	A27-7	225	60.1	1558	1555
A29	New Moor Street	A29-1	A29-2	225	86	1564	1563
A30	Rifai Thangal Lane	A30-4	A30-3	225	1.7	1562	1561
A30	1st Mosque Lane	A30-3	A30-2	225	47.4	1561	1560
A30	1st Mosque Lane	A30-2	A30-1	225	21.3	1560	1559
A30	1st Mosque Lane	A30-1	A29-2	225	7.5	1559	1563
A31	Peer Saibo Street	A33-1	A27-3	225	78	1525	1551
A32	Hulftsdorp Street	A32-4	A32-3	225	29.4	1538	1539

A32	Hulftsdorp Street	A32-3	A32-2	225	47.1	1539	1540
A32	Hulftsdorp Street	A32-2	A32-1	225	64	1540	1541
A32	Hulftsdrop Street	A32-1	A27-5	225	10.5	1541	1553
A33	Peer Saibo Street	A33-3	A14-10	225	59.3	1523	1520
A33	Peer Saibo Street	A33-2	A33-3	225	32.6	1524	1523
A33	Peer Saibo Street	A33-1	A33-2	225	35	1525	1524
A34	St Sebastian Street	A71-3	A34-5	225	47.9	3856	3835
A34	St Sebastian Street	A34-5	A34-4	225	42.5	3835	3834
A34	St Sebastian Street	A34-4	A34-3	225	35.5	3834	3833
A34	St.Sebastian Street	A34-3	A34-2	225	61.9	3833	3832
A34	San Sebastian Street	A34-2	A34-1	225	70.3	3832	3831
A34	St.Sebastian Street	A34-1	A34-1A	225	19.5	3831	1513
A34	St. Sebastian Street	A34-1A	A34-1B	225	20.4	1513	1514
A34	St.Sebastian Street	A34-1B	A14-10	225	60	1514	1520
A34A	Sebastian Street	A34A-2	A34A-1	150	22.3	3830	1512
A34A	Sebastian Street	A34A-1	A34-1A	150	23.8	1512	1513
A35	Hulftsdorp Street	A35-1	A14-13	225	45.9	1535	3836
A35	Hulftsdorp Street	A35-2	A35-1	225	19.1	1536	1535
A36	Main Street	A36-4	A36-3	225	50.2	1616	1615
A36	Main Street	A36-3	A36-3A	225	19.8	1615	1615A
A36	Main Street	A36-3A	A36-2	225	65.6	1615A	1514
A36	Main Street	A36-2	A36-1	225	32	1614	1613
A36	Main Street	A36-1	A7-3	225	3.5	1613	1605
A39	Saunders Place	A39-9	A39-9A	225	41.7	3859	3859A
A39	Saunders Place	A39-9A	A39-9B	225	30.6	3859A	3859B
A39	Saunders Place	A39-9B	A39-8	225	7	3859B	3872
A39	Saunders Place	A39-8	A39-7	225	39.6	3872	4146
A39	Saunders Place	A39-7	A39-7A	225	23.8	4146	4146A
A39	Saunders Place	A39-7A	A39-6	225	65.1	4146A	4148
A39	Sounders Place	CS4A-1A	A39-5	225	1.6	4150	4149
A39	Saunders Place	A39-6	CS4A-1A	225	16.5	4148	4150
A39	5th Cross Street	A39-1	A7-6	225	21.9	1509	1602
A40	Akbar Lane	A40-7	A40-6	225	29.9	3847	3848
A40	Akbar Lane	A40-6	A40-5	225	46.1	3848	4141
A40	Akbar Lane	A40-5	A40-4	225	11.2	4141	4142
A40	Beira Road	A40-4	A40-3	225	43.1	4142	4143
A40	Beira Road	A40-3	A40-2	225	49.2	4143	4144
A40	Beira Road	A40-2	A40-1	225	6.5	4144	4145
A40	Beira Road	A40-1	A39-7	225	39.5	4145	4146
A40A	Akbar Lane	A40A-4	A40A-3	225	25.8	3849	3850
A40A	Akbar Lane	A40A-3	A40A-2	225	10.9	3850	3851
A40A	Akbar Lane	A40A-2	A40A-1	225	21.1	3851	3852

A40A	Akbar Lane	A40A-1	A40-5	225	37.6	3852	4141
A40B	Muhandiram Road	A40B-2	A40B-1	225	68	3870	3871
A40B	Muhandiram Road	A40B-1	A39-8	225	54.8	3871	3872
A41	Saunders Place	A14-7	A41-2	225	74.1	1517	1505
A42	Dias Place	A42-3	A42-2	225	103	1511	1510
A42	Dias Place	A42-2	A42-2A	225	56.5	1510	1510A
A42	Dias Place	A42-2A	A42-2B	225	13.2	1510A	1510B
A42	Dias Place	A42-2B	A42-1	225	31.3	1510B	4147
A42	Dias Place	A42-1	A39-6	225	30.3	4147)	4148
A48	Olcott Mawatha	A48-1	A7-9	300	24	4219	4220
A48	Olcott Mawatha	A48-2	A48-1	300	57.5	4218	4219
A48	Olcott Mawatha	A48-3	A48-2	300	45	4217	4218
A48	Olcott Mawatha	A48-4	A48-3	225	15.1	4216	4217
A48	Olcott Mawatha	A48-5	A48-4	225	60.8	4215	4216
A48	Olcott Mawatha	A48-6	A48-5	225	30	4214	4215
A48	Olcott Mawatha	A48-7	A48-6	225	58.1	4205	4214
A48	Olcott Mawatha	A48-8	A48-7	225	50.7	4213	4205
A48(VIII)	Front Street	A48-9	A48-8	225	45		
A48(VII)	Front Street	A48-10	A48-9	225	41		
A48(VI)	Front Street	A48-11	A48-10	225	38		
A48(V)	Front Street	A48-12	A48-11	225	37		
A48(IV)	Front Street	A48-13	A48-12	225	29		
A48	Keyzer Street	A48-15	A48-14	225	70	4206	4207
A48	Keyzer Street	A60-4	A48-15	225	70.8	1626	4206
A48(III)	Front Street	A48-14	A48-13	225	23		
A49	Olcott Mw (4th Cross)	A49-4	A49-3	225	57.2	1609	1608
A49	Olcott MW(4th Cross)	A49-3	A49-2	225	13.5	1608	4188
A49	Main Street(4th Cross)	A36-2	A36-2A	225	48.2	1614	1614A
A49	Main Street (4th Cross)	A36-2A	A49-4	225	47.3	1614A	1609
A49	Olcott(4thCross Street)	A49-2	A49-1	225	82.1	4188	4194
A49	4th Cross Street	A49-1	A48-1	225	66.5	4194	4219
A50	Maliban Street	A54-1	A49-1	225	49.8	4193	4194
A51	Keyzer Street	A51-4	A51-3	225	33.1	1612	1611
A51	3rd Cross Street	A51-3	A51-2	225	70.3	1611	1610
A51	3rd Cross Street	A51-2	A51-1	225	68.8	1610	4189
A51	Prince Street	A51-1	A49-2	225	41.9	4189	4188
A52	3rd Cross Street	A36-3	A51-3	225	92.5	1165	1161
A52	Keyzer Street	A51-3	A51-3A	225	24.5	11629	11629A
A52	Keyzer Street	A51-3A	A49-4	225	47.7	11629A	11631
A53	Main Street	A36-4	A11-7	225	1.1	1616	1622
A53	2nd Cross Street	A11-7	A11-7A	225	44.2	1622	1622A
A53	2nd Cross Street	A11-7A	A53-3	225	42.4	1622A	1624

A53	2 nd Cross Street	A53-3	A53-2	225	19	1624	4191
A53	2nd Cross Street	A53-2	A53-1	225	79.4	4191	4195
A53	2nd Cross Street	A53-1	A48-3	225	53.8	4195	4217
A55	Maliban Street	A61-1	A53-1	225	84.2	4196	4195
A56	Prince Street	A51-1	A56-1	225	15	4189	4190
A57	Prince Street	A63-1	A53-2	225	43.2	4192	4191
A58	Keyzer Street	A51-4	A53-3	225	48.8	1612	1624
A59	Keyzer Street	A60-4	A59-1	225	11.6	1626	1625
A59	Keyzer Street	A59-1	A53-3	225	41.2	1625	1624
A60	1st Cross Street	A75-1B	A60-4	225	62.6	1627B	1626
A60	1st Cross Street	A60-4	A60-4A	225	59	1626	1626A
A60	1st Cross Street	A60-4A	A60-3	225	56.3	1626A	4201
A60	1st Cross Street	A60-3	A60-2	225	84	4201	4197
A60	1st Cross Street	A60-2	A60-1	225	51.5	4197	4199
A60	1st Cross Street	A75-1	A75-1B	225	25	1627	1627B
A60	Main Street	A11-8	A75-1	225	62.4	1623	1627
A61	Maliban Street	A60-2	A61-1	225	77	4197	4196
ID	Maliban Street	A62-1	A60-2	225	60.3	4198	4197
A63	Prince St	A63-1	A60-3	225	107	4192	4201
A64	Prince St	A68-1	A60-3	225	35	4202	4201
A65	Kosala Lane	A65-1	A68-1	225	38.3	4203	4202
A65	Kosala Lane	A68-1	A67-1	225	43.6	4202	4200
A66	Maliban Street	A62-1	A48-9	225	31.4	4198	4212
A67	Mayuri Lane	A67-1	A67-1A	225	5.8	4200	4200A
A67	Mayuri Lane	A67-1A	A48-10	225	50.2	4200A	4211
A68	Prince Street	A68-1	A68-1A	225	50	4202	4202A
A68	Prince Street	A68-1A	A48-11	225	55	4202A	4210
A69	2nd Rohini St	A65-1	A65-1A	225	49.2	4203	4203A
A69	2nd Rohini St	A65-1A	A48-12	225	48.3	4203A	4209
A71	Mihindu Mawatha	A71-5	A71-4	225	48	3854	3855
A71	Mihindu Mawatha	A71-4	A71-3	225	48	3855	3856
A71	Mihindu Mawatha	A71-3	A71-2	225	122.6	3856	3857
A71	Mihindu Mawatha	A71-2	A71-1	225	78.3	3857	3858
A71	Mihindu Mawatha	A71-1	A39-9	225	76.7	3858	3859
A75	Main Street	A75-3	A75-2	225	16.3	1629	1628
A75	Main Street	A75-2	A75-2A	225	59.1	1628	1628A
A75	Main Street	A75-2A	A75-1	225	63.5	1628A	1627
A75	1st Cross Street	A75-1	A75-1A	225	35.5	1627	1627A
A75	1st Cross Street	A75-1A	A76-1	225	33	1627A	1633
A76	Bank shall Street	A11-6	A11-6A	225	34.9	1634	1634A
A76	Bank shall Street	A11-6A	A76-1	225	35.7	1634A	1633
A77	Bank shall Street	A77-2	A77-1	225	68.8	1631	1632

A77	Bank shall Street	A77-1A	A76-1	225	31.2	1632A	1633
A77	Bank shall Street	A77-1	A77-1A	225	38.2	1632	1632A
A78	Janadhipathi Mawatha	A78-19	A78-18A	225	49.6	1928	1929
A78	Janadhipathi Mawatha	A78-18A	A78-18	225	48.1	1929	1947
A78	Janadhipathi Mawatha	A78-18	A78-17	225	64.8	1947	1946
A78	Janadhipathi Mawatha	A78-17	A78-16	225	70.2	1946	1943
A78	Janadhipathi Mawatha	A78-16	A78-15	225	38.4	1943	-1944
A78	Janadhipathi Mawatha	A78-15	A78-15A	225	18.1	1944	1944A
A78	Janadhipathi Mawatha	A78-15A	A78-14A	225	17	1944A	3813
A78	Janadhipathi Mawatha	A78-14A	A78-14	225	24.8	3813	3812
A78	Janadhipathi Mawatha	A78-14	A78-13A	225	55	3812	3811
A78	Janadhipathi Mawatha	A78-13A	A78-13	225	55.4	3811A	3794
A78	Lotus Road	A78-13	A78-12	225	8.6	3794	3793
A78	Lotus Road	A78-12	A78-11	225	51.3	3793	3792
A78	Lotus Road	A78-11	A78-10A	225	67.3	3792	3791
A78	Lotus Road	A78-5	A78-4	225	64	3807	1934
A78	Lotus Road	A78-4	A78-3	225	62	1934	1918
A78	Lotus Road	A78-3	A78-2	225	111.2	1918	1921
A78	Lotus Road	A78-2	A78-1	225	97	1921	1922
ID A78	Main Street	A78-1	A1-23	450	50	1922	1659
A79	Chatham Street	A78-18	A79-5	225	79.2	1947	1930
A79	Chatham Street	A79-5	A79-4	225	51.6	1930	1931
A79	Chatham Street	A79-4	A79-3A	225	94.8	1931	3810
A79	Chatham Street	A79-3	A79-2	225	56.3	3809	3808
A79	Chatham Street	A79-2	A79-1	225	74.2	3808	1935
A79	Chatham Street	A79-1	A78-4	225	107.7	1935	1934
A80	York Street	A79-3	A80-4	225	65.5	3809	1936
A80	York Street	A80-4	A80-3	225	53.4	1936	1937
A80	York Street	A80-3	A80-2	225	38	1937	1932
A80	York Street	A80-2	A80-1	225	56.5	1932	1933
A81	Canal Road	A82-2	A81-1	225	53.4	1939	1938
A81	Canal Road	A81-1	A80-3	225	83	1938	1937
A82	Hospital Street	A82-1	A82-2	225	67	1940	1939
A82	Hospital Street	A82-2	A82-4	225	84.4	1939	1936
A83	Flag Staff Street	A83-3	A83-2	225	54.3	3815	1948
A84	Upper Chatham Street	A78-18	A84-1	225	67.8	1947	3814
A84	Upper Chatham Street	A84-1	A83-3	225	69.6	3814	3815
A85	Hospital Lane	A79-5	A82-1	225	64.3	1930	1940
A86	Sir Baron Jayathilaka Mw	A78-19	A86-5	225	105.1	1928	1490
A86	Sir Baron Jayathilaka Mw	A86-5	A86-4	225	97.4	1490	3795
A86	Sir Baron Jayathilaka Mw	A86-4	A86-3	225	81.5	3795	3797
A86	Sir Baron Jayathilaka Mw	A86-3	A86-2	225	45.4	3797	1925

A86	SirBaron Jayathilaka Mw	A86-2	A86-2A	225	41.9	1925	1924
A86	Sir Baron Jayathilaka Mw	A86-2A	A86-1A	225	49	1924	1923
A86	Sir Baron Jayathilaka Mw	A86-1A	A86-1	225	21.3	1923	3796
A86	Sir Baron Jayatilaka Mw	A86-1	A1-23	225	106.3	3796	1659
A86A	Duke Street	A79-1	A86A-2	225	80.3	1935	1919
A86A	Duke Street	A86A-2	A86A-1	225	87.5	1919	1920
A86A	Duke Street	A86A-1	A86-1A	225	86.7	1920	1923
A87	Mudalige mawatha	A78-19	A78-19A	225	52.5	1928	1928A
A87	Mudalige mawatha	A78-19A	A87-3	225	5.5	1928A	1927
A87	Mudalige Mawatha	A87-3	A87-2	225	52.8	1927	1926
A87	Mudalige mawatha	A87-2	A87-1	225	94.9	1926	3799
A87	York Street	A87-1	A86-3	225	115.3	3799	3797
A88	York Street	A79-3	A87-1	225	91.7	3809	3799
A89	Chruch Street	A89-2	A89-1	225	56.8	1489	1488
A90	York Street	A90-3	A90-2	225	68.8	3798	1487
A90	York St	A90-2	A90-1	225	71.4	1487	1486)
A90	Church St	A90-1	A89-1	225	55.2	1486	1488
A92	D. R. Wijewardena Mw	A92-13	A92-11	225	73.7	4173	4174
A92	D. R. Wijewardena Mw	A92-11	A92-10	225	73.6	4174	4175
A92	D. R.Wijewardena Mw	A92-10	A92-10A	225	43.9	4175	4175A
A92	D. R. Wijewardena Mw	A92-10A	A92-9	225	29	4175A	4176
A92	D. R. Wijewardena Mw	A92-9	A92-8	225	85.3	4176	4177
A92	D. R. Wijewardena Mw	A92-8	A92-7	225	94.2	4177	4171
A100	Mohamed Zain Mw	A100-12	A100-11	225	29	1691	1692
A100	Mohamed Zain Mw	A100-11	A100-11A1	225	30	1692	1692B
A100	Mohamed Zain Mw	A100-11A1	A100-11A	225	5.2	1692B	1692A
A100	Mohamed Zain Mw	A100-11A	A100-10	225	29	1692A	1580
A100	Mohamed Zain Mw	A100-10	A100-9	225	29.6	1580	1579
A100	Mohamed Zain Mw	A100-9	A100-8	225	31.6	1579	1578
A100	Mohamed Zain Mw	A100-8	A100-7	225	29.2	1578	1577
A100	Mohamed Zain Mw	A100-7	A100-7A	225	7.8	1577	1577A
A100	Mohamed Zain Mw	A100-7A	A100-6	225	20.2	1577A	1576
A100	Mohamed Zain Mw	A100-6	A100-5	225	30	1576	1575
A100	Mohamed Zain Mw	A100-5	A100-5A	225	30	1575	1575A
A100	Mohamed Zain Mw	A100-4	A100-3	225	28.8	1574	1573
A100	Mohamed Zain Mw	A100-3	A100-2	225	30.4	1573	1572
A100	Mohamed Zain Mw	A100-2	A100-1A	225	28.5	1572	1571A
A100	Mohamed Zain Mw	A100-1A	A100-1	225	28.4	1571A	1571
A100	Mohamed Zain Mawatha	A100-1	A16-2	225	52.1	1571	1587
A101	2nd Mosque Lane	A101-1	A16-9	225	3.4	1685	1709
A1RS1	Beach Road	A1RS1-3	A1RS1-2	225	96.5	1740	1734
A1RS1	Beach Road	A1RS1-2	A1RS1-2A	225	49	1734	1734A

A1RS1	Beach Road	A1RS1-2A	A1RS1-1	225	44	1734A	1733
A1RS1	Beach Road	A1RS1-1	A1-7	225	10.5	1733	1736
C11	Vivekananda Hill	A16-11	C11-7	225	69.3	1711	1713
C11	Vivekananda Hill	C11-7	C11-6	225	64.6	1713	1717
C11	Vivekananda Hill	C11-6	C11-5	225	18.3	1717	1718
C11	Vivekananda Hill	C11-5	C11-4	225	32.4	1718	1716
C11	Vivekananda Hill	C11-4	C11-4A	225	68.9	1716	1716A
C11	Vivekananda Hill	C11-4A	C11-3	225	18.4	1716A	1715
C11	Vivekananda Hill	C11-3	C11-3A	225	28.1	1715	1715A
C11	Vivekananda Hill	C11-3A	C11-2	225	64.7	1715A	1714
C11	Vivekananda Hill	C11-2	C11-1	225	86	1714	1087
C11	Vivekananda Hill	C11-1	C11-1A	225	32.1	1087	1087A
C11	Vivekananda Hill	C11-1A	C10-1	225	34.2	1087A	1088
C3A	Maha Vidyalaya Mw	C3A-11	C3A-11A	225	28.2	1693	1693A
C3A	Maha Vidyalaya Mw	C3A-11A	C3A-10	225	23.7	1693A	1694
C3A	Maha Vidyalaya Mw	C3A-10	C3A-9	225	52.5	1694	1695
C3A	Maha Vidyalaya Mw	C3A-9	C3A-8	225	87.9	1695	1884
C3A	Sangamitta Mawatha	C3A-8	C3A-7	225	91.9	1884	1883
C3A	Sangamitta Mawatha	C3A-7	C3A-6	225	90.7	1883	1882
C3A	Sangamitta Mw	C3A-6	C3A-6A	225	64.3	1882	1882A
C3A	Sangamitta Mw	C3A-6A	C3A-5	225	25.8	1882A	1703
C3A	Sangamitta Mw	C3A-5	C3A-4	225	90.8	1703	1092
C3A	K.B Christie Perera Mw	C3A-4	C3A-2	225	123.2	1092	1256
C3A	K.B Christie Perera Mw	C3A-2	C3A-1	225	123.5	1256	1917
C3A	K.B Christie Perera Mw	C3A-1	C1-3	225	36.8	1917	1171
C3A	Maha vidyala mawatha	A26-4A	A26-4	225	23.3	1690A	1690
C3A	Maha vidyala mawatha	A26-4B	C3A-11	225	21	1690B	1693
C3A	Maha vidyala mawatha	A26-4A	A26-4	225	23.3	1690A	1690
K4A	Old Moor Street	K4A-2	K4A-1	225	57.8	1542	1543
K4A	Old Moor Street	K4A-1	A27-5	225	58	1543	1553
K5A	Hultdort Street	K5A-8	A32-3	225	39	1534	1539

Annex 6 Pipe Manhole Details - CS3 Catchment

FID	MnH No	X_Cord	Y_Cord	Location	Cover_Level	Chamber		
						Hei	Wid	EQ
0	6255	98663.42	193227	JUST Saunders PL-Dam ST	4.85	2000	2000	2256.3
1	4251	98403.78	193281	JNCT Dam ST/Bodhiraja Mw	4.42	490		490
2	4152	98410.51	193146	OPP Peoples Park Bodhiraja Mw	3.69	790	790	891.24
3	4252	98410.64	193212	ADJ 212/1 Bodhiraja MAW	3.74	1240	920	1204.95
4	4151	98410.91	193151	OPP Peoples Park Bodhiraja MW	3.68	780	710	839.54
5	4253	98418.75	193215	ADJ 212/1 GAS Works ST	3.92	700	580	718.83
6	4451	98419.2	193481	ADJ NO 62 Sri Kathiresan ST	5.84	1520	900	1319.5
7	4351	98422.59	193354	JNCT Central RD Wolendhal ST	4.67	1200	920	1185.36
8	4453	98445.02	193404	ADJ NO 78 Wolfendhal ST	4.78	1050	910	1102.76
9	4551	98447.66	193533	OPP No 88, Sri Kathiresan Street	6.44	625	630	707.9
10	4254	98463.82	193210	ADJ 212/12 GAS Works ST	3.82	580	700	718.83
11	4352	98470.29	193360	ADJ NO 60/21 Central RD	5.04	1190	900	1167.51
12	4452	98483.08	193479	ADJ 85 Wolfenedhal ST	5.63			0
13	4255	98483.1	193207	ADJ 212/39 GAS Works ST	3.57	480		480
14	4353	98483.67	193370	ADJ 190 Central RD	4.82			0
15	4654	98488.68	193611	JNCT Sri Kathiresan ST/Andival	7.06	1220	1210	1370.69
16	5351	98506.64	193362	ADJ 191 Central RD	5.38	1160	900	1152.7
17	5651	98521.36	193672	OPP No 170, Kathiresan Street	7.28	610	610	688.17
18	5251	98523.9	193287	JUST NEW Moor ST/Dam Street	3.92			0
19	5254	98524.27	193291	ADJ NO 67 Dam ST	3.95	1330	910	1241.12
20	5051	98530.31	193073	INSDIE Temple OFF Saundde PL	2.86	560		560
21	5951	98545.59	192993	ADJ Colombo Gas CO. Saunders PL	2.46			0
22	5054	98548.12	193015	ADJ Colombo Gas CO Saunders PL	2.19	490		490
23	5953	98549.36	192949	Saunders PL/Dias Place	2.87	490		490
24	5952	98552.36	192952	JUNC Dias PL/Saunders PL	2.93			0
25	5754	98555.74	192744	JUNC Saunders PL/Olcott MW	3.61			0
26	5552	98557.34	193580	Junc Andival S /Brass Founder Street	7.13	610	620	693.79
27	5253	98557.54	193298	ADJ 08 New Moor ST	4.55			0
28	5758	98558.23	192775	NO.8/1 Saunders Place	3.48	920	760	943.34
29	5753	98559.62	192772	OPP 8/1 Saunders Place	3.38			0
30	5352	98559.89	193375	ADJ NO 185 Central RD	5.63	1160	900	1152.7
31	5852	98560.88	192871	NO.19 Saunders Place	3.22	490		490
32	5851	98564.28	192878	NO.19 Saunders Place	3.1	490		490
33	5752	98570.43	192779	NO.1O Saunders Place	3.48	580	560	642.94
34	5551	98570.64	193515	Wodfendhal Street	7.12	610	610	688.17
35	5751	98573.83	192794	NO.1O Saunders Place	3.41	1220	880	1168.93
36	5853	98574.15	192858	JUNC Saunders PL/Beria RD	3.08			0
37	5854	98574.34	192823	Saunders PL/Muhandiram RD	3.25	620	580	676.51
38	5855	98574.54	192821	Saunders PL/Muhandiram RD	3.25	490		490
39	5856	98574.81	192818	JUNC Saunders PL/Muhundiram RD	3.22			0
40	5752	98575.94	193789	ADJ Velanknni Chur, Kathiration St.	8.86	1210	750	1074.7
41	5053	98577.7	193085	OPP Gunasinghe Park Saunders PL	2.73	1040	1030	1167.62
42	5252	98583.77	193264	ADJ NO 117 Dam ST	4.8	520		520

43	5052	98583.94	193073	ADJ Pradeepa Hall Saunders PL	2.31	2000	2000	2256.3
44	5553	98584.03	193569	OPP: NO 46, ANDIVAL STREET	7.37			0
45	5755	98584.89	192733	G2B Mihindu MW	3.75	1510	920	1329.68
46	5751	98585.97	193790	OPP No 38,Ginthupitiya Street	9.29	2200	650	1349.07
47	5353	98587.92	193383	Inside Wedding Mall, Central RD	6.58	1160	900	1152.7
48	5151	98592.45	193130	ADJ Peoples park Saunders Place	3.23	1050	1050	1184.55
49	5152	98596.17	193120	ADJ Peoples park Saunders Place	2.56	1000	1020	1139.37
50	6553	98600.5	193567	ADJ No 5054, Andival Street	7.72	940	900	1037.65
51	6952	98601.08	192959	NO 28 Dias Place	3.36	1200	920	1185.36
52	6751	98618.37	192738	ADJ G20 Mihindu MW	4.59	1510	910	1322.44
53	6851	98619.77	192825	ADJ GOV Flats Muhandiram RD	4.32	440	420	484.97
54	6251	98621.38	193249	ADJ District Ministry-DAM ST	5.3	520		520
55	6152	98623.75	193151	ADJ Peoples park Saunders Place	3.29	2000	2000	2256.3
56	6852	98625.14	192826	ADJ GOV Flats Muhandiram RD	4.31	440	420	484.97
57	6552	98626.11	193525	A.dj 210,WOLFENDHAL STREET	8.36	740	560	726.23
58	6151	98627.16	193158	ADJ Peoples park Saunders Place	3.47	490		490
59	6751	98633.38	193757	JN Ginthupitiya St/Brass Founder St	12.47	580	560	642.94
60	6951	98646.58	192969	ADJ Dias Place	3.8	1190	910	1173.98
61	6452	98648.31	193401	ADJ 786 Central RD	7.52	1200	910	1178.9
62	6153	98648.92	193147	ADJ CMC Parking Office Saunders	2.92	600		600
63	6253	98651.31	193238	ADJ NO 153 Dam ST	5.24	560		560
64	6551	98654.36	193537	A.D.J.Police sta/Wolfenal St.	9.32			0
65	6254	98654.76	193235	OPP NO.155 Dam ST	5.22	910	680	887.44
66	6752	98657.07	192744	ADJ NO 25 Mihindu MW	6	1520	910	1326.81
67	6256	98662.49	193228	JNCT Sauders PL/Dam St	4.95			0
68	6252	98667.01	193244	JNCT DAM Steer/Saunders Place	5.29	1210	910	1183.8
69	6453	98668.48	193411	ADJ 121 Central RD	8.14	1210	920	1190.29
70	6352	98672.79	193311	ADJ NO.155/6 Dam Street	7.43	1220	910	1188.68
71	6351	98678.39	193323	ADJ 76 New Moor ST	8.07	800	610	788.09
72	6451	98689.58	193420	ADJ 113 Central RD	9.33	750		750
73	7451	98705.18	193425	ADJ 111A Central RD	0	1150	880	1134.9
74	7251	98711.69	193240	ADJ 22 Old Moor ST	5.64	1520	910	1326.81
75	7951	98726.9	192930	ADJ GOV Flats Akbar Lane	4.57	720	700	800.9
76	7452	98733.12	193436	ADJ 97/21 Central RD	0	1150	880	1134.9
77	5455	97547.38	192460	ADJ 6 PARSONS ROAD	7.01	915	900	1023.76
78	5451	97570.45	192493	Ir Chithampalan Gardinar St.	8.28			0
79	5452	97574.5	192462	Opp Regel cimema/Sir C.Gardinar	7.72	915	915	1032.25
80	5453	97580.52	192433	Adj Regel cimema/Sir C.Gardinar	6.95	910	915	1029.43
81	6551	97618.59	192544	Lakehouse, D.R.Wijewardane MW	7.68	910	910	1026.61
82	6751	97646.97	192722	ADJ DEPT Of Food, Olcott MW	4.21	3650	1370	2522.75
83	6552	97664.26	192551	Lakehouse, D.R.Wijewardane MW	6.97	1510	1510	1703.5
84	6554	97673.56	192576	In Lake House, D.R Wijewardena	1.48			0
85	6555	97680.81	192534	ADJ Gout Supply DPT Under D.R	1.5	880	910	1009.55
87	7551	97722.54	192558	Above Canal Locks D.R.Wijewardhana	6.56	890	900	1009.68
88	7751	97728.21	192740	OPP World Market Olcott MW	4	920	930	1043.52
89	7552	97764.62	192561	Adj SL STC D.R Wijewardhana MW	5.65	910	900	1020.96
90	7753	97770.24	192743	OPP Day & Night Bazar Olcott MW	4.14	2800		2800
91	7752	97790.93	192730	OPP World Market Olcott MW	4.21	1150	910	1154.08

92	7553	97791.66	192562	ADJ SLSTC D.R Wijewardane MW	5.24	750	750	846.11
93	8551	97821.48	192560	ADJ SLSTC D.R Wijewardane MW	4.58	900	900	1015.33
94	8751	97827.76	192713	NO.52/A, Olcott MW	4.19	500		500
95	8552	97841.18	192531	Adj SLSTC -Off D.R Wijewardane	3.65	900	880	1003.99
96	8951	97881.01	192949	JNCT Fort ST/ STN.Keyser ST	5.67			0
97	8952	97884.64	192921	JUNC Front ST/1ST Rohini Lane	5.32	1520	910	1326.81
98	8851	97889.89	192891	JUNC Front ST/2nd Rohini Lane	5.17	1520	910	1326.81
99	8853	97896.53	192851	JUNC Prince ST/Front ST	5.11	1500	900	1310.79
100	8852	97897.03	192854	JUNC Prince ST/Front ST	5.12			0
101	8752	97897.24	192721	0PP Railway Station Olcott MW	4.27	1130	900	1137.7
102	9755	97901.27	192703	0PP Railway Station Olcott MW	4.68	500		500
103	9854	97901.85	192813	JUNC Front ST/Mayuri Lane	4.87	1530	920	1338.46
104	9553	97902.76	192558	Rear Fort R/Way STN	3.24	630	620	705.07
105	9551	97902.84	192554	Rear Fort R/Way STN D.R.Wijerwardana MW	3.28	590	580	659.94
106	9751	97903.47	192770	JUNC Maliban Street/Front ST	4.73	1550	880	1317.57
107	9754	97944.8	192719	OPP 59 Ollcot MW	4.25	4520	920	2300.54
108	9951	97945.59	192978	Pettah Police STN.Keyser ST	5.96	1520	910	1326.81
109	9954	97946.49	192943	NO.24,1ST Rohini ST	5.7			0
110	9953	97948.2	192946	NO.24,1ST Rohini Lane	5.65	810	410	650.13
111	9552	97949.2	192546	C.M/Mackie LTD,D.R.Wijewardana	3.15			0
112	9851	97954.25	192872	ADJ NO 31 Prince Street	5.17	1020	580	867.72
113	9752	97955.89	192788	ADJ 13 Maliban Street	4.71	1520	810	1251.79
114	9852	97964.21	192876	ADJ NO40 Prince Street	5.19	1520	810	1251.79
115	9952	97977.9	192993	NO.58A, Keyser ST	6.15	560		560
116	9753	97985.88	192797	NO.27, Maliban Streer	4.61			0
117	9853	97991.54	192885	JUNC Prince ST/Kosala P lace	5.11	1250	900	1196.58
118	855	98007.49	192806	NO.35, Maliban Streer	4.49			0
119	852	98025.25	192881	NO.65 1ST Cross ST	5.17	1520	910	1326.81
120	851	98025.73	192897	JUNC Prince ST	5.36	1520	920	1334.08
121	551	98029.29	192535	C.M/Mackie LTD,D.R.Wijewardana	3.06			0
122	853	98032.23	192828	NO.31 1ST Cross ST	4.73	1510	910	1322.44
123	854	98037.64	192813	JUNC 1ST Cross ST/Maliban ST	4.73	1510	910	1322.44
124	751	98053.01	192763	1ST Cross ST/Olcott MW	3.71			0
125	752	98057.92	192750	Olcott MW/1ST Cross ST	3.85	4920	920	2400.18
126	1851	98106.3	192839	NO.73 Maliban ST	4.53	1530	920	1338.46
127	1551	98109.31	192523	Bank D.R.Wijewardana MW	3.13			0
128	1852	98123.34	192844	NO.79 Maliban ST	4.54	1520	890	1312.15
129	1951	98125.55	192929	ADJ NO.116, Prince Street	5.11	1520	910	1326.81
130	1751	98132.54	192779	NO.65, Olcott MW	3.69			0
131	1552	98138.72	192516	People Bank, D.R.Wijewardane MW	3.2	880	900	1003.99
132	1853	98145.55	192852	NO.93 Maliban ST	4.54	1520	920	1334.08
133	1752	98154.9	192787	NO.69, Olcott MW	3.71	3800	920	2109.37
134	1952	98170.03	192941	JUNC Prince ST/ 2nd Cross ST	5.05	1520	900	1319.5
135	1855	98190.7	192863	JUNC Maliban st/2ND Cross	4.38	690	680	772.76
136	1854	98191.01	192866	JUNC Maliban ST1/2nd Cross ST	4.41	1520	910	1326.81
137	2854	98207.89	192812	JUNC 2nd Cross ST/ Olcott MW	3.83	1070	910	1113.21
138	2855	98208.64	192804	2ND Cross ST/Olcott MW	3.87			0
139	2951	98214.8	192958	ADJ 151 1/4 Prince Street	5.09	1520	920	1334.08

140	2751	98218.93	192784	ADJ S1551 IN Manning MKT Olcott	3.27	490		490
141	2851	98236.99	192880	ADJ 137 Maliban Street	4.49	1530	940	1352.93
142	2853	98247.07	192817	M.D.Gunasena Bookshop Olcott MW	4.04	570		570
143	2952	98252.25	192972	JUNC Prince ST/ 3rd Cross ST	5.18	1550	920	1347.18
144	2856	98262.92	192889	NO.151, Maliban Streer	4.37			0
145	2857	98270.2	192831	ADJ 227 Olcott MW	3.78	1520	930	1341.31
146	2852	98291.08	192894	JNCT,Maliban Streer/4TH Cross ST	4.2			0
147	2953	98291.87	192979	JNCT 4TH Cross ST/Prince ST	4.74			0
148	3854	98303.88	192831	ADJ NO.01, Olcott MW	3.91	910	690	893.94
149	3853	98310.24	192833	JUNC 4th Cross ST/ Olcott MW	3.93	1520	900	1319.5
150	3852	98364.97	192838	ADJ Bodhiraja MW	4.19	1510	900	1315.15
151	3851	98371.62	192897	Central Bus Stand, Bodhiraja	3.86	910	790	956.53
152	9855	97906.83	192811	JUNC Front ST/Mayuri Lane	4.91			0
153	151	98038.32	193193	ADJ NO 49 Bankshall ST	5			0
154	52	98057.89	193027	ADJ NO.53A Keyser ST	6.25	1510	920	1329.68
155	152	98088.09	193131	ADJ 152 Main ST	6.59	490		490
156	252	98093.53	193228	JUNC Bank shall ST/2nd Cross ST	5.53			0
157	251	98094.27	193290	OPP NO 88 Reclamation RD	3.52	2140	1640	2113.47
158	253	98094.28	193282	ADJ 84 Sea Beach RD	3.53			0
159	51	98096.57	193046	ADJ NO.81 Keyser ST	6.24	1510	910	1322.44
160	1251	98105.26	193291	ADJ 98 Reclamation RD	3.64			0
161	1151	98116.62	193140	JNCT Main ST-2nd Cross ST	6.33			0
162	1353	98119.78	193305	ADJ NO 98 Reclamation RD	3.8	580	420	556.8
163	1052	98137.43	193064	JUNC Keyser ST/2ND Cross ST	6.1	1520	880	1304.76
164	1352	98149.38	193347	OPP NO 116 Reclamation RD	4	2100	2100	2369.11
165	1252	98161.73	193271	ADJ 123 Bank shall ST	5.95	1550	930	1354.48
166	1051	98185.58	193087	ADJ NO135 Keyser ST	5.98	1500	900	1310.79
167	1253	98196.74	193290	ADJ 143 Bank shall ST	6.03			0
168	2155	98200.91	193185	JNCT Main ST-3rd Cross ST	6.3	1780	620	1185.15
169	2151	98213.19	193166	ADJ 126 3rd Cross ST	6.19	1520	910	1326.81
170	2154	98233.94	193107	JUNCT 3rd Cross ST/Keyser ST	5.97			0
171	2051	98242.24	193034	ADJ Memon Hanafi Mosque 3rd Cross	5.5	1550	910	1339.84
172	2252	98280.71	193215	ADJ 209 4th Cross ST	5.64	1520	910	1326.81
173	2251	98281.53	193223	OPP NO.303 Main ST	5.73	680	790	826.86
174	2152	98294.27	193158	OPP 198,4th Cross ST	5.96			0
175	2153	98297.96	193136	JUC Keyser ST/4th Cross ST	6.01	1510	900	1315.15
176	2352	98298.68	193307	OPP 31, ST John,s ST	4.55			0
177	2052	98298.77	193057	ADJ 130 4th Cross ST	5.28	1540	930	1350.11
178	3251	98323.42	193241	ADJ Trade Centre 5th Cross ST	5.23			0
179	3354	98366.99	193325	ADJ NO.31 Sea ST	4.73			0
180	3352	98369.87	193381	ADJ NO.44 Sea ST	5.24	1460	910	1300.36
181	3451	98371.93	193444	ADJ NO.88 Sea ST	6.19	1500	920	1325.27
182	3151	98378.39	193156	OPP NO 195 5th Cross ST	3.65			0
183	3353	98395.48	193331	ADJ ST Pauls Wolfendal ST	4.55	944		944
184	3051	98397.79	193045	ADJ Colombo GAS Co,Bodhiraja	3.73			0
185	3452	98399.22	193422	ADJ NO.36 Sir Katheresan ST	5.24	620	620	699.45
186	2053	98297	193027	ADJ 104 4th Cross ST	4.97			0
187	2451	98241.12	192490	ADJ 50 (CWE) D.R.Wijewardena	3.33	1210	1220	1370.69

188	51	97029.49	193094	Near Navy Hospital Upper Chatham	4.75	1530	920	1338.46
189	52	97051.27	193098	Near Navy Hospital Upper Chatham .	5.12	1520	760	1212.54
190	2151	97231.75	193154	NO.19 Chaittiya RD	5.87			0
191	3151	97362.77	193137	OPP.O2, York Street	0	1230	930	1206.59
192	3152	97365.61	193149	Near Handling Unit,Bandaranayake QUAY	1.61	685		685
193	3154	97379.37	193116	OPP.02, York Street	5.92	1160	900	1152.7
194	3153	97381.15	193118	OPP.02, York Street	6.02	560		560
195	3051	97387.22	193053	OPP.08, York Street	5.15	510		510
196	4151	97447.6	193104	NO.14,Leyden Bastian RD	4.74			0
197	4051	97493.9	193068	Leyden Bastian RD ADJ Bank of Ceylon	3.24		910	0
198	5051	97576.72	193018	Bank of Ceylon,Laydem Bastian RD	3.19	1200	920	1185.36
199	7551	98735.68	193557	A.D.J. NO.211, WOLFENDHAL St	12.63			0
200	7751	98736.83	192755	JUNC Mihindu MW/Martes Lane	8.92			0
201	7751	98741.08	193724	Near No 113,Ginthupitiya Street	16.11	2000	680	1315.64
202	7252	98742	193244	ADJ NO 38 Old Moor ST	5.71	530		530
203	7151	98745.86	193187	OPP Peoples bank Dam ST	3.83	500		500
204	7851	98752.05	192884	ADI NO 37 Akabar Lane	5.39	590	580	659.94
205	7453	98762.07	193448	ADJ 93 Central RD	13.43	1270	900	1206.12
206	7454	98789.35	193461	ADJ 75/5859 Central RD	15.15	1200	910	1178.9
207	8751	98811.41	193722	A.D.J NO.156,GINTHUPITIYA St	17.87	640	430	591.82
208	8553	98817.74	193576	A.D.J.NO.290 WOLFENDHAL St.	16.9	460		460
209	8451	98818.42	193471	ADJ 51/8 Central RD	0	1220	940	1208.12
210	8151	98824.03	193146	ADJ NO 257 Dam ST	4.07	1060	660	943.61
211	8351	98829.82	193356	OPP NO 117 New Moor Street	13.58	1520	920	1334.08
212	8251	98830.25	193260	ADJ 98 Old Moor ST	5.08	500		500
213	8051	98832.83	193022	ADJ Gunasinghe Pura-Dias PL	4.19	900	780	945.22
214	8554	98833.95	193578	A.D.J.NO.267 WOLFENDHAL St.	17.88	560		560
215	8551	98834.18	193573	ADJ No288,Wolfendhal Street	17.88	600	560	653.93
216	8851	98836.31	192887	NO.52, ST Sebastian ST	7.67	1450	900	1288.76
217	8852	98841.96	192809	ADJ NO.7 ST Sebastian ST	11.55			0
218	8752	98844.17	193720	A.D.J NO.170,GINTHUPITIYA STREET	18.48	1130	520	864.78
219	8452	98846.29	193479	just central rd-1st mosque ln	0	1210	940	1203.16
220	8951	98853.83	192954	no.77, st sebastian st	6.27	910	660	874.29
221	8751	98855.36	192763	jun mihindu mw/st. sebastian st	13.16	1510	880	1300.46
222	8052	98860.34	193029	adj no 5 dias pl	4.44	1220	760	1086.31
223	8152	98871.52	193120	opp no 184 dam st	4.22	1070	680	962.3
224	8453	98871.72	193491	adj 52/4 central rd	0	1220	930	1201.68
225	8552	98879.83	193581	adj no 310/33, wolfendhal street	20.59	1520	910	1326.81
226	8056	98887.71	193008	opp sucharita library st sebastian	5.36	700	570	712.61
227	8054	98888.94	193024	adj no 3 st sebastian st	5.12	880	670	866.25
228	8053	98891.21	193038	jnct st sebastian st/dias pl	4.96			0
229	8055	98896.72	193021	opp no 3 st sebastian st	5.18	500	500	564.07
230	8352	98897.91	193369	junc 1st mosque lane /new moor	11.78	1050	890	1090.57
231	9351	98901.33	193361	junc 1st mosque lane /new moor	11.76	900	750	926.87
232	9051	98903.71	193045	jnct dias place/st sebatian st	4.94			0
233	9751	98907.41	192760	adj h.a.s.associates, mihindu mw	14.13	1530	910	1331.17
234	9054	98907.91	193043	jnct dias place/st sebatian st	5.05	600	470	599.09

235	9951	98910.73	192968	in premises pm15 residence off	8.44	900	730	914.42
236	9254	98916.37	193275	jnct no 147 old moor st	5.01	620	610	693.79
237	9251	98916.38	193297	adj no 19 ghouse mohideen mw	5.37	620	460	602.47
238	9252	98919.97	193280	adj no 147 old moor st	5.1			0
239	9052	98925.02	193090	jnct st sebastian st/dam st	4.62	1070	680	962.3
240	9751	98925.17	193707	inct .gintupitiya/vivekananda hill	20.44	920	750	937.11
241	9053	98928.73	193088	jnct dam steer/sebastian st	4.64	1070	680	962.3
242	9155	98940.74	193105	adj no 24/7 peer saibo st	4.66	490		490
243	9253	98953.87	193282	jnct old moor st/sebastian st	5.25	1510	880	1300.46
244	9551	98954.59	193577	a.d.j. churchwolfendhal st	22.08			0
245	9153	98958.84	193130	adj no 28 peer saibo st	4.57	1020	920	1092.85
246	9255	98962.98	193239	adj no 87 peer st	4.99	560		560
247	9154	98963.22	193129	in premises no 32 peer saibo st	5.12	750	480	676.89
248	9152	98963.29	193139	opp no 35 peer saibo st	4.53			0
249	9256	98965.51	193231	adj no 83 peer saibu st	4.96	1550	900	1332.46
250	9257	98970.66	193211	adj 75 peer saibu st	4.8			0
251	9258	98972.3	193200	adj no 70 peer saibu st	4.72	1520	900	1319.5
252	9151	98972.38	193167	adj no.48/1 peer saibo st	4.54	1520	900	1319.5
253	9055	98987.69	193056	opp no.252 dam st	7.14	530		530
254	9851	98995.55	192804	adj no 272 hultsdore st	16.81	1520	670	1138.48
255	253	99003.12	193289	adj 196 old moor street	5.66			0
256	851	99018.53	192886	law college hultsdorf st	18.49	1520	920	1334.08
257	451	99027.17	193485	adj no 47 husainia street	0	1520	910	1326.81
258	452	99048.79	193404	adj 07 husaniya st	13.22	750	750	846.11
259	351	99055.82	193396	junct husania st/new moor st	12.32	520		520
260	353	99059.41	193379	adj no 4 hulsdorf street	0	1500	910	1318.05
261	951	99065.62	192935	law college hultsdorf st	12.27	1510	900	1315.15
262	352	99065.69	193385	junc hultsdore st/new moor st	11.93			0
263	354	99072.43	193332	adj 28 hultsdorf street	8.24	1520	910	1326.81
264	251	99077.76	193295	adj 44 hultsdorf st	7.34	510		510
265	355	99080.28	193302	jnct old moor st hultsdorf st	7.27	1520	910	1326.81
266	252	99088.01	193257	adj no 62 hulsdorf street	9.6	1520	910	1326.81
267	151	99098.45	193181	junc hultsdore st/bandaranayaka	14.71			0
268	1151	99100.17	193173	adj no 108 hultsdorf st	0	1520	910	1326.81
269	1951	99101.31	192993	junc dam street / hulsdorf st	15.74			0
270	1153	99104.88	193141	adj no 124, hultsdorf st	5.82	1530	900	1323.83
271	1152	99112.1	193111	adj no 109 hultsdorf st	0	1500	1070	1429.24
272	1254	99119.95	193202	adj no 15 srimath bandaranaike m	15.56	1510	910	1322.44
273	1051	99125.51	193057	jnct hultsdorf st /wilaon st	15.62	1520	910	1326.81
274	1351	99158.61	193330	adj 273 old moor st	7.42	1210	910	1183.8
275	1352	99197.17	193345	adj 302/b old moor st	7.43	1070	920	1119.31
276	5652	98597.74	193667	opp no 47, brass founder street	9.09	530		530
277	6651	98609.56	193693	adj no 61, brass founder street	9.95	610	610	688.17
278	6752	98619.72	193718	opp: no.79, brass founder st	10.88	350		350
279	1451	97129.04	192425	opp old parliament rd/lotus rd	4.54	1520	920	1334.08
280	2451	97211.32	192425	opp o.r.s.o lotus rd	4.64	1510	920	1329.68
281	3453	97349.32	192429	opp o.r.s.o lotus rd	5.71	1200	900	1172.41
282	3452	97376.26	192429	near o.r.s.o. lotus road	6.26	1520	920	1334.08
283	3451	97384.66	192436	opp new hilton hotel site lotus rd	6.62	920	920	1037.89

284	4453	97404.83	192454	adj hotel hilton site lotus rd	7.26	1530	870	1301.58
285	4452	97416.71	192468	near hotel hilton site lotus rd	7.73	920	920	1037.89
286	4451	97428.12	192485	opp temple lotus rd	8.18	920	910	1032.24
287	4454	97496.16	192467	adj 12 parsons road	5.3			0
288	5456	97507.63	192451	adj 12 parsons road	5.99	915	915	1032.25
289	3553	98374.22	193507	adj 124, sea street	7.13	1500	940	1339.6
290	3554	98382.39	193549	adj 187, sea street	7.67	1520	920	1334.08
291	1751	97194.37	192781	june. hospital road/chatham street	10.56	750	1050	1001.13
292	2551	97205.55	192597	new road, adj. BOC	7.13	860	760	912.06
293	2653	97218.25	192617	new road, adj. BOC	6.94	900	765	936.09
294	2552	97224.99	192597	new road, adj. BOC	7.25	890	720	903.08
295	2553	97230.48	192591	new road, adj. BOC	7.54	1710	1410	1751.76
296	2951	97233.37	192988	adj. drugs control blg. sir baron jayatilake mawat	7.66	1100	820	1071.44
297	2752	97237.92	192703	adj 27 hospital road	8.29	510		510
298	2651	97245.63	192639	opp 23 canal row	6.17			0
299	2654	97250.51	192618	new road, adj. BOC	7.05	915	760	940.77
300	2554	97251.01	192598	new road, adj. BOC	7.31	790	710	844.9
301	2751	97263.4	192765	adj. 95, chatham street	9.82	1180	760	1068.35
302	2652	97277.81	192636	opp 33 canal row	5.8	1210	900	1177.28
303	2556	97278.2	192594	on new road, adj. BOC	7.55	1210	1200	1359.41
304	2555	97279.57	192600	on new road, adj. BOC	7.58	890	700	890.45
305	2655	97282.88	192619	on new road, adj. BOC	7.22	915	785	956.12
306	2656	97283.77	192612	on new road, adj. BOC	7.4	765	900	936.09
307	2851	97295.74	192859	adj.18, mudalige mawatha	9.61	1380	1680	1717.75
308	2557	97295.83	192593	on new road, adj. BOC	7.81	1420	1230	1490.95
309	2558	97297.14	192595	on new road, adj. BOC	7.82	605	605	682.53
310	3654	97302.9	192615	on new road, adj. BOC	7.42	900	750	926.87
311	3551	97311.71	192601	on new road, adj. BOC	7.82	1210	1260	1392.98
312	3655	97323.6	192609	on new road, adj. BOC	7.57	1260	1270	1427.1
313	3651	97323.96	192689	junc. hospital road/york street	6.99	1200	950	1204.53
314	3653	97327.2	192658	opp 116, york street	6.77	900	900	1015.33
315	3751	97332.6	192751	adj. 108, chatham street	8.28	720	710	806.6
316	3656	97336.8	192616	on new road, adj. BOC	7.27	710	750	823.24
317	3652	97340.07	192687	just york street/hospital road	7.09	740	740	834.83
318	3851	97361.88	192845	adj. 93 york street	6.82	1180	1220	1353.59
319	3852	97362.73	192824	opp laksala york street	6.96	3100	910	1894.82
320	3951	97377.12	192937	adj. cargill's york street	5.7	480		480
321	3752	97388.17	192734	adj. min. of women aff. chatham street	6.34	1500	910	1318.05
322	4552	97404.69	192601	opp min. for land development york street	8.44	920	920	1037.89
323	4951	97432.75	192958	just bristol st-baron jayathilake mawatha	4.7	1520	910	1326.81
324	4751	97444.02	192722	adj.min of state chatham street	5.46	1520	910	1326.81
325	4952	97459.79	192975	adj state pharmaceutical corp, sir baron jayathilake	4.24	460	500	541.04
326	4851	97485.9	192854	opp 60 duke street	4.27	1510	910	1322.44
327	5551	97500.97	192596	adj. gov. publications unit lotus road	8.95	1530	910	1331.17
328	5954	97502.71	192968	jmct duke st./51r baron jayathilake mw.	3.37			0
329	5751	97503.69	192711	opp.min. of state chatham street	4.92	1520	910	1326.81
330	5553	97507.48	192528	govt. press road	3.53	910	910	1026.61
331	5951	97525.66	192992	adj y.m.b.a,b aron jayathilake mw	3.28			0

332	5552	97528.59	192570	60vt press road	3.39	1520	910	1326.81
333	5652	97540.53	192646	adj. aviation authority lotus road	6.81	1520	920	1334.08
334	5554	97556.41	192534	d.r.wijewardhana Mw/jnct. sir c gardiner	8.63	1980	915	1518.48
335	5654	97564.66	192604	government press road	2.88			0
336	5752	97579.44	192707	adj telegraph office, chatham st	4.52	1530	910	1331.17
337	5651	97582.31	192698	junc. lotus road/chatham street	4.74	2370	2290	2628.2
338	5851	97583.43	192827	adj. c.t.o. lotus road	2.63	1160	910	1159.09
339	5555	97587.27	192540	adj. to lake house d.r.wijewardena Mw	8.19	910	910	1026.61
340	5952	97589.09	192985	jmct lotus rd/sir baron jayathilake mw.	3.19	560		560
341	5953	97590.89	192907	opp. no.78, lotus road	2.6	890	900	1009.68
342	5653	97591.59	192629	government press road	2.52	1500	910	1318.05
343	5753	97595.15	192753	opp nos 11&12 lotus road	3.44	1520	910	1326.81
344	1852	97141.85	192839	adj. zia janadhipathi mawatha	10.28	690	680	772.76
345	4551	97438.86	192500	opp temple lotus road	8.54	910	910	1026.61
346	9852	96973.08	192828	adj swiss embassy, upper chatham st.	8.59	820	1030	1036.79
347	851	97046.26	192812	opp 19 upper chatham street	9.41	1530	915	1334.82
348	552	97078.79	192553	opp hotel intercontinental	6.65			0
349	553	97086.93	192506	adj hotel g. meridian, janadhipathi Mw	5.53	1810	1780	2024.96
350	551	97099.24	192593	adj ceylinco, new road BOC	7.23	910	740	925.77
351	1551	97107.62	192593	on new road, adj BOC	7.2	2270	1990	2397.76
352	1552	97113.47	192595	on new road, opp.BOC	7.05	890	730	909.33
353	1651	97115.57	192607	adj ceylinco, new road BOC	7.15	915	770	946.94
354	1652	97122.98	192607	on new road, adj. BOC	7.15	910	760	938.19
355	1553	97123.57	192595	on new road, adj. BOC	7	910	750	932
356	1554	97139.26	192596	on new road, adj. BOC	7.02	945	725	933.79
357	1653	97154.83	192609	adj. ceylinco, new road, near BOC	7.18	760	600	761.81
358	1851	97157.22	192889	adj. presidents house, janadhipathi Mw	11.23	560		560
359	1656	97166.92	192651	adj. ceylinco house, off janadhipathi Mw	7.07	640	620	710.64
360	1555	97171.29	192597	on new road, adj. BOC	7.09	900	790	951.26
361	1556	97182.48	192594	on new road, adj. BOC	7.29	920	735	927.69
362	1654	97184.77	192609	on new road, adj. BOC	7.04	915	760	940.77
363	1655	97187.96	192617	on new road, adj. BOC	6.82	885	790	943.3
364	1557	97187.98	192597	on new road, adj. BOC	7.11	870	750	911.29
365	6051	97625.94	193004	adj 28 main st	4.18	1520	910	1326.81
366	6052	97695.05	193020	adj no 128 main st	4.47	950	940	1066.08
367	7051	97762.12	193035	adj no 151/b main st	4.82	1520	910	1326.81
368	8051	97843.47	193091	junc reclamation rd/front st	4.89	930	600	842.72
369	8151	97863.84	193111	JNCT Reclamation RD/Bank shall St	4.79	860	860	970.21
370	8053	97867.47	193023	JUNC Front ST/ Manin ST	5.96	1510	910	1322.44
371	8052	97873.59	193048	ADJ Clock Tower Main Street	5.53			0
372	8152	97897.23	193119	OPP 20 Bank shall Street	4.44	1540	920	1342.83
373	9151	97909.97	193144	ADJ DPT Pensions Reclamation RD	4.26	1180	1120	1296.93
374	9156	97925.29	193133	OPP NO 4O Bankshall ST	4.42			0
375	9152	97929.05	193159	ADJ DPT Pensions Reclamation RD	3.96	1090	1340	1363.43
376	9154	97950.98	193170	ADJ DPT Pensions Reclamation RD	3.81	930	850	1003.04
377	9153	97980.46	193190	ADJ 16 Reclamation RD	3.52	1440	1100	1419.85
378	9155	97990.66	193164	ADJ 182 1st Cross ST	4.63			0
379	54	98003.61	193086	JNCT Main ST-1st Cross ST	6.52			0

Annex 7 Condition Assessment Survey Sheet-A49-4 A49-3 Pipe Segment

S/N	Location Reference	Dia. (mm)	Date of Ins	Sewer -ID	US MH ID	DS MH ID	Camera Dir.	Total (m)	Chainage (m)	WRC Code	Description	Defect Located Angle (o'clock)	Grading
1	Olcott MW (4th Cross St)	225	04/11/16	A49	A49-4	A49-3	Ups	57.2	0.00	MH	Start node type, manhole	Upstream direction	0
									0.60	CLJ	Crack longitudinal at joint,	at 3 o'clock	2
									0.60	FMJ	Fracture multiple at joint	from 9 to 3 o'clock	4
									0.70	CMJ	Cracks multiple joint	from 8 to 4 o'clock	3
									1.30	CLJ	Crack longitudinal at joint	at 3 o'clock	2
									1.30	CMJ	Cracks multiple joint	from 9 to 3 o'clock	3
									1.30	CLJ	Crack longitudinal at joint	at 6 o'clock	2
									2.00	CN	Connection other than a junction, diameter 150mm	at 10 o'clock	0
									2.20	CLJ	Crack longitudinal at joint	at 9 o'clock	2
									2.20	FLJ	Fracture longitudinal at joint	at 12 o'clock	3
									2.20	CLJ	Crack longitudinal at joint	at 4 and 6 o'clock	2
									2.80	FLJ	Fracture longitudinal at joint	at 2 and 12 o'clock	3
									2.80	FCJ	Fracture circumferential at joint	from 8 to 4 o'clock	3
									2.80	CLJ	Crack longitudinal at joint	at 7 o'clock	2

Annex 8 Condition Grade Value Summary - CS3 Catchment

Location Reference	Dia. (mm)	Sewer - ID	US MH ID	DS MH ID	Length (m)	Max. Grade	3	4	5	Cat
1st Cross Street	225	A60	A60-3	A60-2	84	5	83	15	3	4
1st Cross Street	225	A60	A75-1B	A60-4	62.6	5	84	5	7	2
1st Cross Street	225	A60	A60-4	A60-4A	59	5	25	8	4	4
1st Cross Street	225	A60	A60-4A	A60-3	56.3	5	58	28	16	1
1st Cross Street	225	A60	A75-1	A75-1B	25	4	31	1	0	7
1st Cross Street	225	A75	A75-1A	A76-1	33	4	27	1	0	7
1st Cross Street	225	A75	A75-1	A75-1A	35.5	4	21	3	0	7
1st Cross Street	225	A60	A60-2	A60-1	51.5	4	41	8	0	7
1st Mosque Lane	225	A30	A30-3	A30-2	47.4	3	5	0	0	8
1st Mosque Lane	225	A30	A30-2	A30-1	21.3	3	2	0	0	8
1st Mosque Lane	225	A30	A30-1	A29-2	7.5	2	0	0	0	9
2 nd Cross Street	225	A53	A53-3	A53-2	19	5	27	15	9	2
2nd Cross Street	225	A53	A53-1	A48-3	53.8	5	32	0	1	6
2nd Cross Street	225	A11	A11-7	A11-6	77.5	5	98	7	1	4
2nd Cross Street	225	A53	A11-7	A11-7A	44.2	5	60	9	2	4
2nd Cross Street	225	A53	A11-7A	A53-3	42.4	5	58	3	7	2
2nd Cross Street	225	A53	A53-2	A53-1	79.4	4	127	5	0	7
2nd Mosque Lane	225	A101	A101-1	A16-9	3.4	4	0	2	0	7
2nd Rohini St	225	A69	A65-1	A65-1A	49.2	5	31	24	4	3
2nd Rohini St	225	A69	A65-1A	A48-12	48.3	4	29	36	0	7
3rd Cross Street	225	A51	A51-3	A51-2	70.3	5	46	38	3	3
3rd Cross Street	225	A51	A51-2	A51-1	68.8	5	58	49	6	2
3rd Cross Street	225	A52	A36-3	A51-3	92.5	5	51	51	11	1
4th Cross Street	225	A49	A49-1	A48-1	66.5	4	14	3	0	7
5th Cross Street	225	A39	A39-1	A7-6	21.9	3	7	0	0	8
Akbar Lane	225	A40A	A40A-1	A40-5	37.6	5	5	5	1	5
Akbar Lane	225	A40A	A40A-4	A40A-3	25.8	5	0	0	1	6
Akbar Lane	225	A40A	A40A-2	A40A-1	21.1	4	3	1	0	7
Akbar Lane	225	A40	A40-6	A40-5	46.1	4	10	15	0	7
Akbar Lane	225	A40	A40-5	A40-4	11.2	4	1	4	0	7
Akbar Lane	225	A40	A40-7	A40-6	29.9	3	2	0	0	8
Akbar Lane	225	A40A	A40A-3	A40A-2	10.9	3	1	0	0	8
Andival St.	225	A19	A19-1	A17-3	71.2	5	30	44	18	1

Andival St.	225	A19	A19-2	A19-1	2.3	3	2	0	0	8
Andival Street	225	A19	A19-3	A19-2	27.5	3	13	0	0	8
Bank shall Street	225	A77	A77-2	A77-1	68.8	ade	3	4	5	5
Bank shall Street	225	A11	A11-6	A11-5	60.1	5	64	12	3	4
Bank shall Street	225	A77	A77-1	A77-1A	38.2	5	66	20	1	3
Bank shall Street	225	A76	A11-6	A11-6A	34.9	5	35	13	1	4
Bank shall Street	225	A76	A11-6A	A76-1	35.7	5	68	25	4	3
Bank shall Street	225	A11	A11-3	A11-2	17	5	14	6	6	2
Bank shall Street	225	A11	A11-1	A7-2	2	5	0	0	1	6
Bank shall Street	225	A11	A11-2	A11-1	20.4	4	7	2	0	7
Bank shall Street	225	A77	A77-1A	A76-1	31.2	4	30	9	0	7
Bank shall Street	225	A11	A11-5	A11-4	24.3	3	16	0	0	8
Beach Road	225	A1RS1	A1RS1-3	A1RS1-2	96.5	5	175	8	7	2
Beach Road	225	A1RS1	A1RS1-2	A1RS1-2A	49	5	76	16	4	3
Beach Road	225	A1RS1	A1RS1-1	A1-7	10.5	5	5	2	1	5
Beach Road	225	A1RS1	A1RS1-2A	A1RS1-1	44	4	62	4	0	7
Beira Road	225	A40	A40-4	A40-3	43.1	5	29	11	2	4
Beira Road	225	A40	A40-1	A39-7	39.5	4	10	1	0	7
Beira Road	225	A40	A40-3	A40-2	49.2	4	46	9	0	7
Beira Road	225	A40	A40-2	A40-1	6.5	3	2	0	0	8
Brass Founder St.	225	A20	A20-1A	A19-1	77.9	5	150	29	3	3
Brass Founder St.	225	A20	A2-6	A20-1	48,5	5	53	37	8	2
Brass Founder St.	225	A20	A20-1	A20-1A	17.1	4	30	4	0	7
Canal Road	225	A81	A81-1	A80-3	83	5	86	36	2	3
Canal Road	225	A81	A82-2	A81-1	53.4	5	34	44	5	3
Chatham Street	225	A79	A79-4	A79-3A	94.8	5	110	4	1	5
Chatham Street	225	A79	A78-18	A79-5	79.2	5	95	4	2	5
Chatham Street	225	A79	A79-5	A79-4	51.6	5	62	3	2	5
Chatham Street	225	A79	A79-3	A79-2	56.3	5	60	10	4	4
Chatham Street	225	A79	A79-1	A78-4	107.7	5	100	34	4	3
Chatham Street	225	A79	A79-2	A79-1	74.2	4	64	4	0	7
China Lane	225	A12 A	A13-1	A12-1	20.8	5	24	15	1	4
Church Street	225	A89	A89-2	A89-1	56.8	5	114	42	14	1
Church St	225	A90	A90-1	A89-1	55.2	5	42	6	6	2
D. R. Wijewardena	225	A92	A92-9	A92-8	85.3	5	2	0	1	6
D. R. Wijewardena	225	A92	A92-13	A92-11	73.7	3	4	0	0	8
D. R. Wijewardena	225	A92	A92-8	A92-7	94.2	3	2	0	0	8
D. R. Wijewardena	225	A92	A92-11	A92-10	73.6	2	0	0	0	9
D. R. Wijewardena	225	A92	A92-10	A92-10A	43.9	2	0	0	0	9
D. R. Wijewardena	225	A92	A92-10A	A92-9	29	2	0	0	0	9
Dam Street	225	A14	A14-12A	A14-11	66.3	5	68	6	1	4
Dam Street	225	A14	A14-9	A14-8	96.2	5	113	13	1	4

Dam Street	225	A14	A14-13	A14-12	47.3	5	53	5	1	5
Dam Street	225	A14	A14-10B	A14-9	35.6	5	42	5	3	5
Dam Street	225	A14	A14-8	A14-7	96.7	5	23	5	2	5
Dam Street	225	A14	A14-10A	A14-10B-1	11	5	10	5	1	5
Dam Street	375	A14	A14-4	A14-3	53.5	5	13	10	6	2
Dam Street	375	A14	A14-3	A14-2	55	5	5	3	16	1
Dam Street	300	A14	A14-5A	A14-4	45.7	4	15	2	0	7
Dam Street	225	A14	A14-11	A14-10	70.5	4	37	5	0	7
Dam Street	375	A14	A14-2	A14-1	33.5	4	14	3	0	7
Dam Street	225	A14	A14-10	A14-10A	15.2	4	19	6	0	7
Dam Street	225	A14	A14-10B-1	A14-10B	2.5	4	3	1	0	7
Dam Street	300	A14	A14-5	A14-5A	43.3	3	33	0	0	8
Dam Street	225	A14	A14-6	A14-5	43.5	3	25	0	0	8
Dam Street	225	A14	A14-7	A14-6	19.1	3	13	0	0	8
Dam Street	225	A14	A14-12	A14-12A	7.7	3	9	0	0	8
Dias Place	225	A42	A42-1	A39-6	30.3	5	8	1	1	5
Dias Place	225	A42	A42-2B	A42-1	31.3	5	10	5	1	5
Dias Place	225	A42	A42-2	A42-2A	56.5	5	13	10	1	4
Dias Place	225	A42	A42-3	A42-2	103	4	79	34	0	7
Dias Place	225	A42	A42-2A	A42-2B	13.2	4	1	2	0	7
Duke Street	225	A86A	A86A-1	A86-1A	86.7	5	115	5	2	5
Duke Street	225	A86A	A86A-2	A86A-1	87.5	5	81	20	3	3
Duke Street	225	A86A	A79-1	A86A-2	80.3	5	136	60	9	2
Flag Staff Street	225	A83	A83-3	A83-2	54.3	5	182	54	13	1
FRONT STREET	225	A48-VIII	A48-9	A48-8	45	5	13	5	1	5
FRONT STREET	225	A48-V	A48-12	A48-11	37	5	4	6	1	4
FRONT STREET	225	A48-VI	A48-11	A48-10	38	5	3	1	2	5
FRONT STREET	225	A48-IV	A48-13	A48-12	29	4	6	13	0	7
FRONT STREET	225	A48-III	A48-14	A48-13	23	4	2	11	0	7
FRONT STREET	225	A48-VI	A48-10	A48-9	41	3	2	0	0	8
Gabos' Lane	225	A10	A15-2	A10-1	11.4	5	7	3	2	5
Gabos' Lane	225	A10	A10-1	A10-2	44.4	5	35	14	15	1
Gintupiiya Street	225	A2	A2-6	A2-5	14.1	5	15	0	1	6
Gintupiiya Street	225	A2	A2-4	A2-3	36.1	5	36	5	1	5
Gintupiiya Street	225	A2	A2-3	A4-2	38.6	5	32	5	1	5
Gintupiiya Street	225	A2	C11-6	A2-8	111.5	5	127	13	19	1
Gintupiiya Street	225	A2	A2-8	A2-8A	65.9	5	34	10	4	4
Gintupiiya Street	225	A2	A2-5	A2-4	64.4	5	36	13	9	2
Gintupiiya Street	225	A2	A2-7	A2-6	105.7	4	91	7	0	7
Gintupiiya Street	225	A2	A2-8A	A2-7	21.4	4	16	2	0	7
Hospital Lane	225	A85	A79-5	A82-1	64.3	5	60	18	5	3
Hospital Street	225	A82	A82-2	A82-4	84.4	5	13	2	1	5

Hospital Street	225	A82	A82-1	A82-2	67	5	19	64	8	2
Hulftsdorp Street	225	A32	A32-2	A32-1	64	5	8	0	1	6
Hulftsdorp Street	225	A27	A27-6	A27-5	42	5	84	23	5	3
Hulftsdorp Street	225	A27	A27-7	A27-6	42	5	42	12	4	4
Hulftsdorp Street	225	A35	A35-1	A14-13	45.9	5	30	16	1	3
Hulftsdorp Street	225	A14	A14-14	A14-13	59.5	5	38	13	5	4
Hulftsdorp Street	225	A32	A32-4	A32-3	29.4	5	9	3	3	5
Hulftsdorp Street	225	A35	A35-2	A35-1	19.1	5	11	9	3	4
Hulftsdorp Street	225	A32	A32-3	A32-2	47.1	3	11	0	0	8
Hulftsdrop Street	225	A32	A32-1	A27-5	10.5	5	3	1	3	5
Hultdort Street	225	K5A	K5A-8	A32-3	39	5	8	0	1	6
Hussainiya Street	225	A27	A27-8	A27-7	59.6	5	52	9	1	4
Hussainiya Street	225	A27	A27-9	A27-8	57.6	5	37	11	1	4
Hussainiya Street	225	A27	A26-4	A27-9	57	2	0	0	0	9
I.X.Perera Mw	225	A12	A12-1	A11-3	65	5	46	36	1	3
I.X.Perera Mw	225	A12	A36-2	A12-1	24.6	4	18	6	0	7
Janadhipathi Mw	225	A78	A78-19	A78-18A	49.6	5	37	0	3	6
Janadhipathi Mw	225	A78	A78-16	A78-15	38.4	5	23	6	3	4
Janadhipathi Mw	225	A78	A78-15A	A78-14A	17	5	17	3	3	5
Janadhipathi Mw	225	A78	A78-15	A78-15A	18.1	5	19	2	5	5
Janadhipathi Mw	225	A78	A78-17	A78-16	70.2	5	34	42	3	3
Janadhipathi Mw	225	A78	A78-18	A78-17	64.8	5	27	41	3	3
Janadhipathi Mw	225	A78	A78-18A	A78-18	48.1	5	10	30	3	3
Janadhipathi Mw	225	A78	A78-13A	A78-13	55.4	5	5	57	2	3
Janadhipathi Mw	225	A78	A78-14A	A78-14	24.8	5	3	24	4	3
Janadhipathi Mw	225	A78	A78-14	A78-13A	55	4	5	62	0	7
K.B Christie Perera	225	C3A	C3A-2	C3A-1	123.5	5	20	7	1	4
K.B Christie Perera	225	C3A	C3A-4	C3A-2	123.2	5	94	67	11	1
K.B Cistie Perera	225	C3A	C3A-1	C1-3	36.8	3	4	0	0	8
Keyzer Street	225	A59	A60-4	A59-1	11.6	5	84	39	8	2
Keyzer Street	225	A58	A51-4	A53-3	48.8	5	63	30	6	2
Keyzer Street	225	A51	A51-4	A51-3	33.1	5	44	33	4	3
Keyzer Street	225	A52	A51-3	A51-3A	24.5	5	15	16	1	3
Keyzer Street	225	A48	A48-15	A48-14	70	5	44	49	8	2
Keyzer Street	225	A48	A60-4	A48-15	70.8	5	45	59	7	2
Keyzer Street	225	A52	A51-3A	A49-4	47.7	5	28	33	6	2
Keyzer Street	225	A59	A59-1	A53-3	41.2	5	18	40	1	3
Kosala Lane	225	A65	A68-1	A67-1	43.6	5	38	24	4	3
Kosala Lane	225	A65	A65-1	A68-1	38.3	5	21	33	2	3
Lotus Road	225	A78	A78-4	A78-3	62	5	72	6	1	4
Lotus Road	225	A78	A78-5	A78-4	64	5	14	1	1	5
Lotus Road	225	A78	A78-13	A78-12	8.6	5	70	13	6	2

Lotus Road	225	A78	A78-12	A78-11	51.3	5	43	10	9	2
Lotus Road	225	A78	A78-2	A78-1	97	5	7	2	2	5
Lotus Road	225	A78	A78-11	A78-10A	67.3	4	106	8	0	7
Lotus Road	225	A78	A78-3	A78-2	111.2	4	15	2	0	7
Maha vidyala Mw	225	C3A	A26-4B	C3A-11	21	5	25	14	3	4
Maha vidyala Mw	225	C3A	A26-4A	A26-4	23.3	5	37	35	5	3
Maha vidyala Mw	225	C3A	A26-4A	A26-4	23.3	4	12	5	0	7
Maha vidyala Mw	225	C3A	C3A-9	C3A-8	87.9	5	60	10	2	4
Maha vidyala Mw	225	C3A	C3A-11	C3A-11A	28.2	5	32	8	4	4
Maha vidyala Mw	225	C3A	C3A-11A	C3A-10	23.7	5	19	10	1	4
Maha vidyala Mw	225	C3A	C3A-10	C3A-9	52.5	5	49	35	3	3
Main Street	225	A60	A11-8	A75-1	62.4	5	66	1	2	5
Main Street	225	A11	A11-8	A11-7	11.6	5	75	1	4	5
Main Street	225	A75	A75-2A	A75-1	63.5	5	77	19	3	3
Main Street	225	A36	A36-2	A36-1	32	5	20	9	1	4
Main Street	225	A36	A36-3A	A36-2	65.6	5	68	58	4	3
Main Street	225	A36	A36-3	A36-3A	19.8	5	16	10	2	4
Main Street	225	A53	A36-4	A11-7	1.1	5	13	4	3	5
Main Street	225	A36	A36-4	A36-3	50.2	5	49	32	11	1
Main Street	225	A75	A75-3	A75-2	16.3	4	19	3	0	7
Main Street	450	A14	A14-1	A7-4	53.1	4	18	6	0	7
Main Street	225	A75	A75-2	A75-2A	59.1	4	65	22	0	7
Main Street	300	A1	A1-23	A1-22A	100	3	3	0	0	8
Main Street	225	A36	A36-1	A7-3	3.5	3	1	0	0	8
Main St.	450	ID A78	A78-1	A1-23	50	2	0	0	0	9
Main St. (4 th Cro	225	A49	A36-2	A36-2A	48.2	5	52	21	1	3
Main St. (4 th Cro	450	A14	A14-1	A7-4	53.1	4	18	6	0	7
Main St. (4 th Cro	225	A49	A36-2A	A49-4	47.3	5	55	21	6	2
Maliban Street	225	ID	A62-1	A60-2	60.3	5	50	41	1	3
Maliban Street	225	A61	A60-2	A61-1	77	5	43	54	1	3
Maliban Street	225	A66	A62-1	A48-9	31.4	5	75	34	16	1
Maliban Street	225	A55	A61-1	A53-1	84.2	4	191	3	0	7
Maliban Street	225	A50	A54-1	A49-1	49.8	5	35	31	2	3
Mayuri Lane	225	A67	A67-1	A67-1A	5.8	5	38	6	6	2
Mayuri Lane	225	A67	A67-1A	A48-10	50.2	4	37	28	0	7
Mihindu Mawatha	225	A71	A71-5	A71-4	48	5	49	7	1	4
Mihindu Mawatha	225	A71	A71-3	A71-2	122.6	5	153	57	2	3
Mihindu Mawatha	225	A71	A71-2	A71-1	78.3	5	69	26	3	3
Mihindu Mawatha	225	A71	A71-1	A39-9	76.7	5	56	25	6	2
Mihindu Mawatha	225	A71	A71-4	A71-3	48	4	30	16	0	7
Moham. Zain Mw	225	A26	A26-1	A26-1A	25.9	5	21	0	2	6
Moham. Zain Mw	225	A26	A26-3	A26-2	52.4	5	43	8	6	2

Moham. Zain Mw	225	A100	A100-3	A100-2	30.4	5	7	3	1	5
Moham. Zain Mw	225	A100	A100-8	A100-7	29.2	5	4	1	1	5
Moham. Zain Mw	225	A26	A26-1A	A30-4	16.9	5	13	0	4	6
Moham. Zain Mw	225	A100	A100-4	A100-3	28.8	5	20	13	5	4
Moham. Zain Mw	225	A26	A26-2	A26-1	40	5	23	5	9	2
Moham. Zain Mw	225	A100	A100-11	A100-11A1	30	5	2	1	1	5
Moham. Zain Mw	225	A100	A100-11A1	A100-11A	5.2	5	3	0	6	2
Moham. Zain Mw	225	A100	A100-10	A100-9	29.6	5	1	3	7	2
Moham. Zain Mw	225	A100	A100-1	A16-2	52.1	5	0	0	1	6
Moham. Zain Mw	225	A100	A100-1A	A100-1	28.4	4	10	1	0	7
Moham. Zain Mw	225	A100	A100-2	A100-1A	28.5	4	2	1	0	7
Moham. Zain Mw	225	A100	A100-6	A100-5	30	4	1	1	0	7
Moham. Zain Mw	225	A100	A100-12	A100-11	29	3	1	0	0	8
Moham. Zain Mw	225	A100	A100-11A	A100-10	29	3	3	0	0	8
Moham. Zain Mw	225	A100	A100-9	A100-8	31.6	3	3	0	0	8
Moham. Zain Mw	225	A100	A100-7	A100-7A	7.8	3	2	0	0	8
Moham. Zain Mw	225	A100	A100-7A	A100-6	20.2	3	2	0	0	8
Moham. Zain Mw	225	A100	A100-5	A100-5A	30	3	7	0	0	8
Moham. Zain Mw	225	A26	A26-4	A26-3	29.8	5	25	5	3	5
Mudalige mawatha	225	A87	A78-19	A78-19A	52.5	5	40	6	3	4
Mudalige mawatha	225	A87	A87-3	A87-2	52.8	4	33	3	0	7
Mudalige mawatha	225	A87	A87-2	A87-1	94.9	4	62	11	0	7
Mudalige mawatha	225	A87	A78-19A	A87-3	5.5	3	4	0	0	8
Muhandiram Road	225	A40B	A40B-2	A40B-1	68	5	51	11	1	4
Muhandiram Road	225	A40B	A40B-1	A39-8	54.8	4	13	1	0	7
New Moor Street	225	A28	A28-1	A27-7	60.1	5	41	4	1	5
New Moor Street	225	A25	A25-1A	A14-4	81.8	5	51	12	1	4
New Moor Street	225	A28	A29-2	A28-1	21	5	93	32	17	1
New Moor Street	225	A29	A29-1	A29-2	86	5	13	0	4	6
New Moor Street	225	A25	A29-1	A25-2	120.5	5	99	45	21	1
New Moor Street	225	A25	A25-2	A25-1	67	4	28	1	0	7
New Moor Street	225	A25	A25-1	A25-1A	31.5	3	15	0	0	8
Olcott (4th Cross S	225	A49	A49-2	A49-1	82.1	5	56	13	5	4
Olcott Mawatha	225	A48	A48-8	A48-7	50.7	5	22	4	1	5
Olcott Mawatha	225	A48	A48-6	A48-5	30	5	10	1	1	5
Olcott Mawatha	225	A48	A48-4	A48-3	15.1	5	18	1	5	5
Olcott Mawatha	225	A48	A48-5	A48-4	60.8	5	18	1	5	5
Olcott Mawatha	225	A48	A48-7	A48-6	58.1	5	4	1	1	5
Olcott Mawatha	300	A48	A48-1	A7-9	24	5	7	0	11	1
Olcott Mawatha	300	A48	A48-2	A48-1	57.5	3	2	0	0	8
Olcott Mawatha	300	A48	A48-3	A48-2	45	3	2	0	0	8
Olcott (4th Cross S	225	A49	A49-3	A49-2	13.5	5	68	17	5	3

Olcott (4th Cross S	225	A49	A49-4	A49-3	57.2	5	239	92	12	1
Olcott Mw.	225	A7	A7-14	A7-13	56.1	5	3	1	4	5
Olcott Mw.	225	A7	A7-13	A7-12	55	3	3	0	0	8
Olcott Mw.	225	A7	A7-12	A7-11	50.3	3	2	0	0	8
Olcott Mw.	225	A7	A7-10	A7-9	20.2	3	1	0	0	8
Olcott Mw.	225	A7	A7-11	A7-10	58.5	2	0	0	0	9
Old Moor Street	225	A27	A27-2	A27-1	108.5	5	102	5	3	5
Old Moor Street	225	A27	A27-2B	A27-2	65.6	5	45	2	2	5
Old Moor Street	225	A27	A27-5A	A27-4	33.1	5	44	5	1	5
Old Moor Street	225	A27	A27-3	A27-2A	31.7	5	17	2	1	5
Old Moor Street	225	A27	A27-4	A27-3	45.5	5	50	13	3	4
Old Moor Street	225	A27	A27-5	A27-5A	31.4	5	20	9	1	4
Old Moor Street	225	K4A	K4A-1	A27-5	58	5	35	16	2	3
Old Moor Street	150	A27A	A27A-1B	A27A-1C	13.5	4	13	1	0	7
Old Moor Street	225	K4A	K4A-2	K4A-1	57.8	4	43	4	0	7
Old Moor Street	150	A27A	A27A-1C	A27-2A	19.3	4	10	1	0	7
Old Moor Street	225	A27	A27-1	A14-6	90	4	63	16	0	7
Old Moor Street	225	A27	A27-2A	A27-2B	10	4	6	5	0	7
Old Moor Street	150	A27A	A27A-1A	A27A-1B	5	3	8	0	0	8
Old Moor Street	150	A27A	A27A-1	A27A-1A	11.6	3	5	0	0	8
Peer Saibo Street	225	A31	A33-1	A27-3	78	5	50	6	1	4
Peer Saibo Street	225	A33	A33-1	A33-2	35	5	18	1	1	5
Peer Saibo Street	225	A33	A33-2	A33-3	32.6	5	16	1	2	5
Peer Saibo Street	225	A33	A33-3	A14-10	59.3	3	38	0	0	8
Prince St	225	A63	A63-1	A60-3	107	5	115	25	6	2
Prince St	225	A64	A68-1	A60-3	35	4	22	8	0	7
Prince Street	225	A57	A63-1	A53-2	43.2	5	44	24	2	3
Prince Street	225	A68	A68-1A	A48-11	55	5	39	42	3	3
Prince Street	225	A68	A68-1	A68-1A	50	5	30	35	2	3
Prince Street	225	A56	A51-1	A56-1	15	5	21	6	6	2
Prince Street	225	A51	A51-1	A49-2	41.9	4	35	28	0	7
Rifai Thangal Lane	225	A30	A30-4	A30-3	1.7	5	79	17	4	3
San Sebastian St	225	A34	A34-2	A34-1	70.3	5	66	53	8	2
Sangamitta Mw	225	C3A	C3A-7	C3A-6	90.7	5	83	73	7	2
Sangamitta Mw	225	C3A	C3A-8	C3A-7	91.9	5	63	86	12	1
Sangamitta Mw	225	C3A	C3A-6A	C3A-5	25.8	5	29	20	1	3
Sangamitta Mw	225	C3A	C3A-5	C3A-4	90.8	5	100	70	10	2
Sangamitta Mw	225	C3A	C3A-6	C3A-6A	64.3	5	57	45	6	2
Saunders Place	225	A39	A39-9	A39-9A	41.7	5	17	4	1	5
Saunders Place	225	A39	A39-9A	A39-9B	30.6	5	21	8	2	4
Saunders Place	225	A39	A39-6	CS4A-1A	16.5	5	19	7	2	4
Saunders Place	225	A39	A39-8	A39-7	39.6	5	14	8	1	4

Saunders Place	225	A39	A39-7	A39-7A	23.8	5	4	0	1	6
Saunders Place	225	A39	A39-7A	A39-6	65.1	4	14	3	0	7
Saunders Place	225	A39	A39-9B	A39-8	7	4	5	3	0	7
Saunders Place	225	A41	A14-7	A41-2	74.1	3	16	0	0	8
Sea Beach Road	225	A2	A2-2	A2-1	27.7	5	28	0	1	6
Sea Beach Road	225	A2	A2-1	A1-7	7.8	3	2	0	0	8
Sea Street	225	A15	A15-4	A15-3	59	5	65	19	5	3
Sea Street	225	A15	A15-2	A15-1	38	5	32	11	14	1
Sea Street	225	A 15	A15-3	A15-2	32.6	5	27	2	14	1
Sea Street	225	A15	A3-4	A15-4	74.5	3	5	0	0	8
Sebastian Street	150	A34A	A34A-2	A34A-1	22.3	3	8	0	0	8
Sebastian Street	150	A34A	A34A-1	A34-1A	23.8	3	1	0	0	8
Sir.Baron Jayathilak	225	A86	A86-2A	A86-1A	49	5	75	9	4	4
Sir.Baron Jayathilak	225	A86	A86-2	A86-2A	41.9	5	32	5	13	1
Sir.Baron Jayathilak	225	A86	A86-1A	A86-1	21.3	3	4	0	0	8
Sir.Baron Jayathilak	225	A86	A86-3	A86-2	45.4	5	87	5	1	5
Sir.Baron Jayathilak	225	A86	A86-5	A86-4	97.4	5	129	6	3	4
Sir.Baron Jayathilak	225	A86	A86-4	A86-3	81.5	5	68	8	9	2
Sir.Baron Jayathilak	225	A86	A78-19	A86-5	105.1	5	66	20	14	1
Sir.Baron Jayathilak	225	A86	A86-1	A1-23	106.3	5	5	1	5	5
Sounders Place	225	A39	CS4A-1A	A39-5	1.6	4	3	1	0	7
Sri Kathiresan Street	225	A17	A17-2B	A17-1	34.5	5	5	3	1	5
Sri Kathiresan Street	225	A17	A2-4	A2-4A	42.2	5	27	8	9	2
Sri Kathiresan Street	225	A17	A2-4A	A17-4	60	5	43	15	19	1
Sri Kathiresan Street	225	A17	A17-4	A17-3	100.6	5	45	33	27	1
Sri Kathiresan Street	225	A17	A17-3A	A17-2	41.8	3	2	0	0	8
Sri Kathiresan Street	225	A17	A17-2	A17-2A	48.2	3	2	0	0	8
Sri Kathiresan Street	225	A17	A17-3	A17-3A	42	2	0	0	0	9
Sri Kathiresan Street	225	A17	A17-2A	A17-2B	3.3	0	0	0	0	9
St Sebastian Street	225	A34	A34-4	A34-3	35.5	5	14	26	2	3
St Sebastian Street	225	A34	A71-3	A34-5	47.9	4	24	3	0	7
St Sebastian Street	225	A34	A34-5	A34-4	42.5	4	11	32	0	7
St. Sebastian Street	225	A34	A34-1A	A34-1B	20.4	5	18	15	7	2
St.Sebastian Street	225	A34	A34-3	A34-2	61.9	5	53	71	3	3
St.Sebastian Street	225	A34	A34-1	A34-1A	19.5	5	16	12	7	2
St.Sebastian Street	225	A34	A34-1B	A14-10	60	4	34	5	0	7
Upper Chatham St	225	A84	A78-18	A84-1	67.8	5	70	16	1	3
Upper Chatham St	225	A84	A84-1	A83-3	69.6	5	63	69	4	3
Vivekananda Hill	225	C11	C11-2	C11-1	86	5	102	19	2	3
Vivekananda Hill	225	C11	C11-1	C11-1A	32.1	5	38	7	1	4
Vivekananda Hill	225	C11	C11-3A	C11-2	64.7	5	60	16	1	3
Vivekananda Hill	225	C11	C11-1A	C10-1	34.2	5	43	9	3	4

Vivekananda Hill	225	C11	C11-4	C11-4A	68.9	4	20	1	0	7
Vivekananda Hill	225	C11	A16-11	C11-7	69.3	4	10	1	0	7
Vivekananda Hill	225	C11	C11-3	C11-3A	28.1	4	36	5	0	7
Vivekananda Hill	225	C11	C11-6	C11-5	18.3	4	1	2	0	7
Vivekananda Hill	225	C11	C11-7	C11-6	64.6	3	9	0	0	8
Vivekananda Hill	225	C11	C11-5	C11-4	32.4	3	6	0	0	8
Vivekananda Hill	225	C11	C11-4A	C11-3	18.4	3	9	0	0	8
Wharf Road	225	A1	A1-29	A1-28	45.1	5	45	7	2	4
Wharf Road	225	A1	A1-30	A1-29	74	5	28	10	3	4
Wharf Road	225	A1	A1-28	A1-28A	29.1	3	5	0	0	8
Wholfendhal Street	225	A15	A15-1	A14-1	43	5	7	1	26	1
Wolfendhal Lane	225	A23	C11-7	A23-1	50	5	56	11	6	2
Wolfendhal Lane	225	A23	A23-1	A16-10	49.3	5	28	25	1	3
Wolfendhal Street	225	A16	A16-6	A16-6A	24.2	5	17	6	3	4
Wolfendhal Street	225	A16	A16-5	A16-5A	84.4	5	54	73	4	3
Wolfendhal Street	225	A16	A16-4	A16-3	52.2	5	39	51	6	2
Wolfendhal Street	225	A16	A16-6A	A16-5	30.2	5	11	27	1	3
Wolfendhal Street	225	A16	A16-1	A15-1	10.4	5	14	17	5	3
Wolfendhal Street	225	A16	A16-5A	A16-4	15.9	5	7	20	2	3
Wolfendhal Street	225	A16	A16-7A	A16-6	1	5	1	0	1	6
Wolfendhal Street	225	A16	A16-10	A16-9	53.7	4	14	1	0	7
Wolfendhal Street	225	A16	A16-11	A16-10	107.1	4	12	3	0	7
Wolfendhal Street	225	A16	A16-7	A16-7A	36.4	4	33	22	0	7
Wolfendhal Street	225	A16	A16-2	A16-1	32.1	4	17	22	0	7
Wolfendhal Street	225	A16	A16-9	A16-9A	10.3	3	2	0	0	8
Wolfendhal Street	225	A16	A16-9A	A16-8	47.7	3	2	0	0	8
Wolfendhal Street	225	A16	A16-8	A16-7	58.4	3	9	0	0	8
York St	225	A90	A90-2	A90-1	71.4	5	56	13	19	1
York Street	225	A80	A79-3	A80-4	65.5	5	48	1	2	5
York Street	225	A90	A90-3	A90-2	68.8	5	118	8	5	4
York Street	225	A80	A80-4	A80-3	53.4	5	34	4	2	5
York Street	225	A88	A79-3	A87-1	91.7	5	124	60	6	2
York Street	225	A87	A87-1	A86-3	115.3	5	18	6	3	4
York Street	225	A80	A80-3	A80-2	38	5	61	31	9	2
York Street	225	A80	A80-2	A80-1	56.5	3	3	0	0	8

Annex 9 Preliminary Criticality Weighted Factors

Factors	Weights	Subfactors	Local Weights	Global Weights
1. Environmental	22%	1.1 Soil type	32%	7.1%
		1.2 Flow Conveyed	33%	7.3%
		1.3 Proximity to Surface Water	34%	7.5%
2. Economic	51%	2.1 Depth	30%	15.5%
		2.2 Diameter	20%	10.3%
		2.3 Water Table	5%	2.8%
		2.4 Length	24%	12.4%
		2.5 Accessibility	20%	10.4%
3. Public	27%	3.1 Population Density	32%	8.6%
		3.2 Road Type	29%	7.8%
		3.3 Diameter	10%	2.7%
		3.4 Length	10%	2.7%
		3.5 Depth	15%	4.0%
		3.6 Accessibility	2%	0.5%
		3.7 Land Use	2%	0.5%

Annex 10 Performance Values and Predetermined Weights for the COF Factors

Impact factor	Impact factor sub-criteria (S_{ij})	Performance values (PV)	Weight (W_j)
Roadway type	Intersecting ON road class 2	3	0.2
	Intersecting ON road class 4	2.4	
	Intersecting ON road class 5	1	
Intersecting a railway track	Yes	3	0.2
	No	0	
Pipe size	Diameter ≤300 mm	1	0.16
	Diameter >300 m and ≤600 m	1.5	
	Diameter >600 m and ≤900 m	2.25	
	Diameter >900 m	3	
Pipe burial depth	Depth ≤3 m	1	0.16
	Depth >3 m and ≤10 m	1.5	
	3: Depth >10 m	3	
Located downtown	Yes	3	0.2
	No	0	
Proximity to hospital	Pipe distance ≤120 m	3	0.2
	Pipe distance >120 m	0	
Proximity to school	Pipe distance ≤200 m	3	0.2
	Pipe distance >200 m	0	
Distance to building	3: Distance <5 m	3	0.2
	Distance ≥5 m and ≤10	1.5	
	Distance >10 m	0	
Proximity to river	Pipe distance ≤15 m	3	0.2
	Pipe distance >15 m	0	
Proximity to park or recreational areas	Pipe distance ≤20 m	3	0.16
	Pipe distance >20 m	0	
Proximity to bad stormwater pipe	Distance ≤10	3	0.2
	Distance >10	0	

Annex 11 Performance Score for Sub Factors – COF

Criterion	Factor	Attributes	Rating
	Pipe Length	> 20'	1
		≥ 20' and < 40'	2
		≥ 40' and < 60'	3
		≥ 60' and < 80'	4
		≥ 80'	5
	Depth	≤ 4'	1
		> 4' and < 10'	2
		≥ 10' and < 18'	3
		≥ 18' and < 24'	4
		≥ 24'	5
	Access	Right-of-Way W/-W/O Traffic Control	1
		Public Land W/Vehicle Access	2
		Public Land W/O Vehicle Access	3
		Private Land W/Vehicle Access	4
		Behind Structures W/O Vehicle Access	5
	Distance to Critical Laterals	≥ 20,000'	1
		12,000' to 20,000'	2
		7,000' to 12,000'	3
		1,000' to 7,000'	4
		< 1,000'	5
	Soil Type	Granular (Crushed Stone/Gravel)	1
		Course Grained (Gravelly Sand)	2
		Silty/Clayey Gravels	3
		Fine Grained (Sands/Silts)	4
		Inorganic Silts/Clays	5
	Seismic Zone	Zone 1	1
		Zone 2	2
		Zone 3	3
		Zone 4	4
		Zone 5	5
Social Cost	Proximity to Other Infrastructure	Unpaved Road	1
		Major Local Road	2
		Collector	3
		Arterial/ Building	4
		Highway/ Waterway	5
	Distance to Critical Laterals	≥ 20,000'	1
		12,000' to 20,000'	2
		7,000' to 12,000'	3
		1,000' to 7,000'	4
		< 1,000'	5
	Average Daily Traffic	Low	1
		Low to Moderate	2

Annex 12 Hydraulic Flow Details - CS3 Catchment

Location Reference	US MH ID	DS MH ID	Sewer Diameter (mm)	Chainage Total (m)	Flow (m3/s)	Depth to Invert
Wharf WWarf Rdod	A1-29	A1-28	225	45.1	0.024	0.144
Main Street	A1-23	A1-22A	300	100	0.372	2.995
Gintupiiya Street	A2-8	A2-8A	225	65.9	0.1209	2.747
Gintupiiya Street	A2-8A	A2-7	225	21.4	< 0.1209	
Gintupiiya Street	A2-7	A2-6	225	106	< 0.1209	2.203
Gintupiiya Street	A2-6	A2-5	225	14.1	< 0.1209	
Gintupiiya Street	A2-5	A2-4	225	64.4	< 0.1209	3.264
Gintupiiya Street	A2-4	A2-3	225	36.1	< 0.1209	3.165
Gintupiiya Street	A2-3	A4-2	225	38.6	< 0.1209	3.171
Sea Beach Road	A2-2	A2-1	225	27.7	< 0.1209	3.467
Sea Beach Road	A2-1	A1-7	225	7.8	< 0.1209	5.951
Gintupiiya Street	C11-6	A2-8	225	112	< 0.1209	2.726
Olcott Mw.	A7-14	A7-13	225	56.1	0.0207	4.365
Olcott Mw.	A7-13	A7-12	225	55	0.0230	4.449
Olcott Mw.	A7-12	A7-11	225	50.3	0.0257	4.946
Olcott Mw.	A7-11	A7-10	225	58.5	0.0266	4.812
Olcott Mw.	A7-10	A7-9	225	20.2	0.0519	5.272
Gabos' Lane	A15-2	A10-1	225	11.4	<0.1710	5.799
Gabos' Lane	A10-1	A10-2	225	44.4	<0.1710	4.121
Bank shall Street	A11-2	A11-1	225	20.4	<0.1710	1.645
Main Street	A11-8	A11-7	225	11.6	<0.1710	1.600
2nd Cross Street	A11-7	A11-6	225	77.5	<0.1710	0.986
Bank shall Street	A11-6	A11-5	225	60.1	<0.1710	2.360
Bank shall Street	A11-5	A11-4	225	24.3	<0.1710	1.803
Bank shall Street	A11-3	A11-2	225	17	<0.1710	2.000
Bank shall Street	A11-1	A7-2	225	2	<0.1710	4.215
China Lane	A13-1	A12-1	225	20.8	<0.1710	1.215
I.X.Perera Mawatha	A36-2	A12-1	225	24.6	<0.1710	1.932
I.X.Perera Mawatha	A12-1	A11-3	225	65	<0.1710	2.151
Main Street	A14-1	A7-4	450	53.1	< 0.1209	4.875
Dam Street	A14-2	A14-1	375	33.5	< 0.1209	4.255
Dam Street	A14-3	A14-2	375	55	< 0.1209	4.105
Dam Street	A14-4	A14-3	375	53.5	< 0.1209	3.955
Dam Street	A14-5A	A14-4	300	45.7	< 0.1209	
Dam Street	A14-5	A14-5A	300	43.3	< 0.1209	3.928
Dam Street	A14-6	A14-5	225	43.5	< 0.1209	4.024
Dam Street	A14-7	A14-6	225	19.1	< 0.1209	3.915
Dam Street	A14-8	A14-7	225	96.7	< 0.1209	3.290
Dam Street	A14-9	A14-8	225	96.2	< 0.1209	2.609
Dam Street	A14-10	A14-10A	225	15.2	< 0.1209	2.733
Hulftsdorp Street	A14-14	A14-13	225	59.5	< 0.1209	3.249

Dam Street	A14-13	A14-12	225	47.3	< 0.1209	3.103
Dam Street	A14-12	A14-12A	225	7.7	< 0.1209	2.494
Dam Street	A14-11	A14-10	225	70.5	< 0.1209	2.605
Sea Street	A3-4	A15-4	225	74.5	<0.1710	1.533
Sea Street	A15-4	A15-3	225	59	<0.1710	1.674
Sea Street	A15-3	A15-2	225	32.6	<0.1710	1.279
Sea Street	A15-2	A15-1	225	38	<0.1710	1.393
Wholfendhal Street	A15-1	A14-1	225	43	<0.1710	2.795
Wolfendhal Street	A16-11	A16-10	225	107	< 0.1209	2.468
Wolfendhal Street	A16-10	A16-9	225	53.7	< 0.1209	2.017
Wolfendhal Street	A16-9	A16-9A	225	10.3	< 0.1209	2.172
Wolfendhal Street	A16-7	A16-7A	225	36.4	< 0.1209	2.275
Wolfendhal Street	A16-8	A16-7	225	58.4	< 0.1209	1.960
Wolfendhal Street	A16-6A	A16-5	225	30.2	< 0.1209	3.039
Wolfendhal Street	A16-5	A16-5A	225	84.4	< 0.1209	2.519
Wolfendhal Street	A16-2	A16-1	225	32.1	< 0.1209	2.912
Wolfendhal Street	A16-4	A16-3	225	52.2	< 0.1209	2.631
Wolfendhal Street	A16-1	A15-1	225	10.4	< 0.1209	3.659
Sri Kathiresan Street	A2-4A	A17-4	225	60	< 0.1209	3.195
Sri Kathiresan Street	A17-4	A17-3	225	101	< 0.1209	3.645
Sri Kathiresan Street	A17-3	A17-3A	225	42	< 0.1209	5.377
Sri Kathiresan Street	A17-2	A17-2A	225	48.2	< 0.1209	6.450
Sri Kathiresan Street	A2-4	A2-4A	225	42.2	< 0.1209	3.195
Andival Street	A19-3	A19-2	225	27.5	< 0.1209	1.781
Andival St.	A19-2	A19-1	225	2.3	< 0.1209	3.496
Andival St.	A19-1	A17-3	225	71.2	< 0.1209	3.855
Brass Founder Street	A20-1	A20-1A	225	17.1	< 0.1209	3.088
Wolfendhal Lane	A23-1	A16-10	225	49.3	< 0.1209	2.408
Wolfendhal Lane	C11-7	A23-1	225	50	< 0.1209	2.489
New Moor Street	A25-1	A25-1A	225	31.5	<0.0101	3.071
New Moor Street	A25-2	A25-1	225	67	<0.0101	3.537
New Moor Street	A29-1	A25-2	225	121	<0.0101	1.558
Mohamed Zain Mw	A26-4	A26-3	225	29.8	<0.0436	12.23
Mohamed Zain Mw	A26-3	A26-2	225	52.4	<0.0436	12.10
Mohamed Zain Mw	A26-2	A26-1	225	40	<0.0436	10.98
Mohamed Zain Mw	A26-1	A26-1A	225	25.9	<0.0436	8.909
Old Moor Street	A27-1	A14-6	225	90	<0.0436	3.764
Old Moor Street	A27-3	A27-2A	225	31.7	<0.0436	2.925
Old Moor Street	A27-4	A27-3	225	45.5	<0.0436	2.740
Old Moor Street	A27-5	A27-5A	225	31.4	<0.0436	2.840
Hulftsdorp Street	A27-6	A27-5	225	42	<0.0436	2.761
Hulftsdorp Street	A27-7	A27-6	225	42	<0.0436	3.534
Hussainiya Street	A27-8	A27-7	225	59.6	<0.0436	3.322
Hussainiya Street	A27-9	A27-8	225	57.6	<0.0436	2.820
Hussainiya Street	A26-4	A27-9	225	57	<0.0436	3.300
Old Moor Street	A27A-1	A27A-1A	150	11.6	<0.0436	2.508
New Moor Street	A29-2	A28-1	225	21	<0.0436	2.633
New Moor Street	A28-1	A27-7	225	60.1	<0.0436	3.650
New Moor Street	A29-1	A29-2	225	86	<0.0436	1.838

Rifai Thangal Lane	A30-4	A30-3	225	1.7	<0.0436	2.199
1st Mosque Lane	A30-3	A30-2	225	47.4	<0.0436	2.853
1st Mosque Lane	A30-2	A30-1	225	21.3	<0.0436	2.422
1st Mosque Lane	A30-1	A29-2	225	7.5	<0.0436	2.176
Peer Saibo Street	A33-1	A27-3	225	78	<0.0436	2.538
Hulftsdorp Street	A32-4	A32-3	225	29.4	<0.0436	2.528
Hulftsdorp Street	A32-3	A32-2	225	47.1	<0.0436	3.000
Hulftsdorp Street	A32-2	A32-1	225	64	<0.0436	3.486
Hulftsdrop Street	A32-1	A27-5	225	10.5	< 0.1209	3.339
Peer Saibo Street	A33-3	A14-10	225	59.3	< 0.1209	2.722
Peer Saibo Street	A33-2	A33-3	225	32.6	< 0.1209	2.413
Peer Saibo Street	A33-1	A33-2	225	35	< 0.1209	2.184
St Sebastian Street	A71-3	A34-5	225	47.9	< 0.1209	3.397
St Sebastian Street	A34-5	A34-4	225	42.5	< 0.1209	3.568
St Sebastian Street	A34-4	A34-3	225	35.5	< 0.1209	2.698
St.Sebastian Street	A34-3	A34-2	225	61.9	< 0.1209	2.449
San Sebastian Street	A34-2	A34-1	225	70.3	< 0.1209	4.667
St.Sebastian Street	A34-1	A34-1A	225	19.5	< 0.1209	2.449
St. Sebastian Street	A34-1A	A34-1B	225	20.4	< 0.1209	3.041
St.Sebastian Street	A34-1B	A14-10	225	60	< 0.1209	2.449
Sebastian Street	A34A-2	A34A-1	150	22.3	< 0.1209	4.533
Sebastian Street	A34A-1	A34-1A	150	23.8	< 0.1209	5.011
Hulftsdorp Street	A35-1	A14-13	225	45.9	< 0.1209	3.823
Hulftsdorp Street	A35-2	A35-1	225	19.1	< 0.1209	3.275
Main Street	A36-4	A36-3	225	50.2	<0.0101	1.895
Main Street	A36-3	A36-3A	225	19.8	<0.0101	2.276
Main Street	A36-2	A36-1	225	32	<0.0101	3.716
Saunders Place	A39-9	A39-9A	225	41.7	0.00	2.781
Saunders Place	A39-8	A39-7	225	39.6	0.0303	2.920
Saunders Place	A39-7	A39-7A	225	23.8	0.0305	2.878
Sounders Place	CS4A-1A	A39-5	225	1.6	0.0336	3.000
Saunders Place	A39-6	CS4A-1A	225	16.5	0.0342	2.663
5th Cross Street	A39-1	A7-6	225	21.9	0.0405	4.916
Akbar Lane	A40-6	A40-5	225	46.1	<0.0406	2.503
Akbar Lane	A40-5	A40-4	225	11.2	<0.0406	2.230
Beira Road	A40-4	A40-3	225	43.1	<0.0406	2.381
Beira Road	A40-3	A40-2	225	49.2	<0.0406	2.449
Beira Road	A40-2	A40-1	225	6.5	<0.0406	2.503
Beira Road	A40-1	A39-7	225	39.5	<0.0406	2.775
Akbar Lane	A40A-4	A40A-3	225	25.8	<0.0406	2.933
Akbar Lane	A40A-2	A40A-1	225	21.1	<0.0406	3.113
Akbar Lane	A40A-1	A40-5	225	37.6	<0.0406	2.455
Muhandiram Road	A40B-2	A40B-1	225	68	<0.0406	2.659
Muhandiram Road	A40B-1	A39-8	225	54.8	<0.0406	3.241
Saunders Place	A14-7	A41-2	225	74.1	<0.0046	3.382
Dias Place	A42-3	A42-2	225	103	<0.0406	3.055
Dias Place	A42-2	A42-2A	225	56.5	<0.0406	2.045
Dias Place	A42-1	A39-6	225	30.3	<0.0406	2.920
Olcott Mawatha	A48-1	A7-9	300	24	<0.0841	4.362

Olcott Mawatha	A48-2	A48-1	300	57.5	<0.0841	4.249
Olcott Mawatha	A48-3	A48-2	300	45	<0.0841	4.076
Olcott Mawatha	A48-4	A48-3	225	15.1	<0.0841	3.456
Olcott Mawatha	A48-5	A48-4	225	60.8	<0.0841	3.019
Olcott Mawatha	A48-6	A48-5	225	30	<0.0841	2.960
Olcott Mawatha	A48-7	A48-6	225	58.1	<0.0841	2.738
Olcott Mawatha	A48-8	A48-7	225	50.7	<0.0841	2.573
Keyzer Street	A48-15	A48-14	225	70	<0.0841	1.495
Keyzer Street	A60-4	A48-15	225	70.8	<0.0841	1.399
Olcott MW (4th Cross	A49-4	A49-3	225	57.2	<0.0841	2.725
Olcott MW (4th Cross	A49-3	A49-2	225	13.5	<0.0841	2.410
Olcott MW (4th Cross	A36-2	A36-2A	225	48.2	<0.0841	2.637
Olcott MW (4th Cross	A49-2	A49-1	225	82.1	<0.0841	2.457
4th Cross Street	A49-1	A48-1	225	66.5	<0.0841	2.606
Maliban Street	A54-1	A49-1	225	49.8	<0.0841	1.982
Keyzer Street	A51-4	A51-3	225	33.1	<0.0841	2.115
3rd Cross Street	A51-3	A51-2	225	70.3	<0.0841	2.219
3rd Cross Street	A51-2	A51-1	225	68.8	<0.0841	1.664
Prince Street	A51-1	A49-2	225	41.9	<0.0841	1.581
3rd Cross Street	A36-3	A51-3	225	92.5	<0.0841	2.230
Keyzer Street	A51-3	A51-3A	225	24.5	<0.0841	2.511
Main Street	A36-4	A11-7	225	1.1	<0.0841	1.775
2nd Cross Street	A11-7	A11-7A	225	44.2	<0.0841	2.270
2 nd Cross Street	A53-3	A53-2	225	19	<0.0841	2.232
2nd Cross Street	A53-2	A53-1	225	79.4	<0.0841	2.279
2nd Cross Street	A53-1	A48-3	225	53.8	<0.0841	2.339
Maliban Street	A61-1	A53-1	225	84.2	<0.0841	1.914
Prince Street	A51-1	A56-1	225	15	<0.0841	1.921
Prince Street	A63-1	A53-2	225	43.2	<0.0841	1.917
Keyzer Street	A51-4	A53-3	225	48.8	<0.0841	2.235
Keyzer Street	A60-4	A59-1	225	11.6	<0.0841	1.793
1st Cross Street	A60-4	A60-4A	225	59	<0.0841	2.197
1st Cross Street	A60-3	A60-2	225	84	<0.0841	2.054
1st Cross Street	A60-2	A60-1	225	51.5	<0.0841	2.144
1st Cross Street	A75-1	A75-1B	225	25	<0.0841	2.003
Main Street	A11-8	A75-1	225	62.4	<0.0841	1.600
Maliban Street	A60-2	A61-1	225	77	<0.0841	1.707
Prince St	A63-1	A60-3	225	107	<0.0841	1.814
Prince St	A68-1	A60-3	225	35	<0.0841	1.821
Kosala Lane	A65-1	A68-1	225	38.3	<0.0841	1.547
Kosala Lane	A68-1	A67-1	225	43.6	<0.0841	1.369
Maliban Street	A62-1	A48-9	225	31.4	<0.0841	1.701
Mayuri Lane	A67-1	A67-1A	225	5.8	<0.0841	1.547
Prince Street	A68-1	A68-1A	225	50	<0.0841	1.669
2nd Rohini St	A65-1	A65-1A	225	49.2	<0.0841	1.659
Mihindu Mawatha	A71-5	A71-4	225	48	<0.0207	3.158
Mihindu Mawatha	A71-4	A71-3	225	48	<0.0207	3.014
Mihindu Mawatha	A71-3	A71-2	225	123	<0.0207	2.726
Mihindu Mawatha	A71-2	A71-1	225	78.3	<0.0207	2.563

Mihindu Mawatha	A71-1	A39-9	225	76.7	<0.0207	2.584
Main Street	A75-3	A75-2	225	16.3	<0.0478	1.595
Main Street	A75-2	A75-2A	225	59.1	<0.0478	2.240
1st Cross Street	A75-1A	A76-1	225	33	<0.0478	2.507
Bank shall Street	A11-6	A11-6A	225	34.9	<0.0478	1.033
Bank shall Street	A77-2	A77-1	225	68.8	<0.0478	2.177
Bank shall Street	A77-1A	A76-1	225	31.2	<0.0478	2.244
Janadhipathi Mawatha	A78-19	A78-18A	225	49.6	0.0003	5.001
Janadhipathi Mawatha	A78-18A	A78-18	225	48.1	0.0008	5.115
Janadhipathi Mawatha	A78-18	A78-17	225	64.8	0.0017	1.359
Janadhipathi Mawatha	A78-17	A78-16	225	70.2	0.0028	1.152
Janadhipathi Mawatha	A78-16	A78-15	225	38.4	0.0065	1.702
Janadhipathi Mawatha	A78-15	A78-15A	225	18.1	0.0321	3.741
Janadhipathi Mawatha	A78-14A	A78-14	225	24.8	0.0333	3.563
Janadhipathi Mawatha	A78-14	A78-13A	225	55	0.0357	3.131
Janadhipathi Mawatha	A78-13A	A78-13	225	55.4	0.0369	2.352
Lotus Road	A78-12	A78-11	225	51.3	0.0458	0.150
Lotus Road	A78-11	A78-10A	225	67.3	0.0470	0.673
Lotus Road	A78-5	A78-4	225	64	0.2288	4.225
Lotus Road	A78-4	A78-3	225	62	0.2370	2.850
Lotus Road	A78-3	A78-2	225	111	0.2386	2.048
Lotus Road	A78-2	A78-1	225	97	0.2397	2.671
Main Street	A78-1	A1-23	450	50	0.2399	3.210
Chatham Street	A78-18	A79-5	225	79.2	0.0017	1.909
Chatham Street	A79-5	A79-4	225	51.6	0.0007	2.551
Chatham Street	A79-4	A79-3A	225	94.8	0.0017	4.871
Chatham Street	A79-3	A79-2	225	56.3	0.0129	1.847
Chatham Street	A79-2	A79-1	225	74.2	0.0135	1.219
Chatham Street	A79-1	A78-4	225	108	0.0142	1.798
York Street	A79-3	A80-4	225	65.5	0.0004	1.427
York Street	A80-4	A80-3	225	53.4	0.0015	1.875
York Street	A80-3	A80-2	225	38	0.0167	2.515
York Street	A80-2	A80-1	225	56.5	0.0172	3.245
Canal Road	A82-2	A81-1	225	53.4	0.0121	1.247
Canal Road	A81-1	A80-3	225	83	0.0145	1.783
Hospital Street	A82-1	A82-2	225	67	0.0026	1.157
Flag Staff Street	A83-3	A83-2	225	54.3	0.0094	0.391
Upper Chatham Street	A78-18	A84-1	225	67.8	< 0.0094	1.440
Upper Chatham Street	A84-1	A83-3	225	69.6	< 0.0094	1.048
Hospital Lane	A79-5	A82-1	225	64.3	0.0024	1.729
Sir Baron Jayathilaka Mw	A78-19	A86-5	225	105	0.0010	1.171
Sir Baron Jayathilaka Mw	A86-5	A86-4	225	97.4	0.0031	2.182
Sir Baron Jayathilaka Mw	A86-4	A86-3	225	81.5	0.0044	2.351
Sir Baron Jayathilaka Mw	A86-3	A86-2	225	45.4	0.0426	3.330
Sir Baron Jayathilaka Mw	A86-2	A86-2A	225	41.9	0.0433	3.123
Sir Baron Jayathilaka Mw	A86-2A	A86-1A	225	49	0.0435	2.943
Sir Baron Jayathilaka Mw	A86-1A	A86-1	225	21.3	0.0483	2.955
Sir Baron Jayathilaka Mw	A86-1	A1-23	225	106	0.0489	2.889
Duke Street	A79-1	A86A-2	225	80.3	0.0014	1.131

Duke Street	A86A-2	A86A-1	225	87.5	0.0035	1.328
Duke Street	A86A-1	A86-1A	225	86.7	0.0048	1.931
Mudalige mawatha	A78-19	A78-19A	225	52.5	0.0007	1.380
Mudalige Mawatha	A87-3	A87-2	225	52.8	0.0018	2.099
Mudalige Mawatha	A87-2	A87-1	225	94.9	0.0029	2.281
Church Street	A89-2	A89-1	225	56.8	0.0152	2.352
York Street	A90-3	A90-2	225	68.8	0.0004	1.518
York St	A90-2	A90-1	225	71.4	0.0011	1.494
D. R. Wijewardena Mawatha	A92-13	A92-11	225	73.7	<0.0246	1.759
D. R. Wijewardena Mawatha	A92-11	A92-10	225	73.6	<0.0246	1.768
D. R. Wijewardena Mawatha	A92-9	A92-8	225	85.3	<0.0246	2.277
D. R. Wijewardena Mawatha	A92-8	A92-7	225	94.2	<0.0246	2.864
Mohamed Zain Mawatha	A100-12	A100-11	225	29	<0.0478	22.00
Mohamed Zain Mawatha	A100-11	A100-11A1	225	30	<0.0478	20.55
Mohamed Zain Mawatha	A100-10	A100-9	225	29.6	<0.0478	18.28
Mohamed Zain Mawatha	A100-9	A100-8	225	31.6	<0.0478	16.70
Mohamed Zain Mawatha	A100-8	A100-7	225	29.2	<0.0478	15.11
Mohamed Zain Mawatha	A100-7	A100-7A	225	7.8	<0.0478	13.74
Mohamed Zain Mawatha	A100-6	A100-5	225	30	<0.0478	12.53
Mohamed Zain Mawatha	A100-5	A100-5A	225	30	<0.0478	8.937
Mohamed Zain Mawatha	A100-4	A100-3	225	28.8	<0.0478	5.757
Mohamed Zain Mawatha	A100-3	A100-2	225	30.4	<0.0478	5.210
Mohamed Zain Mawatha	A100-2	A100-1A	225	28.5	<0.0478	4.813
Mohamed Zain Mawatha	A100-1	A16-2	225	52.1	<0.0478	4.753
2nd Mosque Lane	A101-1	A16-9	225	3.4	<0.0478	16.623
Beach Road	A1RS1-2	A1RS1-2A	225	49	<0.0478	3.496
Beach Road	A1RS1-1	A1-7	225	10.5	<0.0478	3.453
Vivekananda Hill	A16-11	C11-7	225	69.3	<0.00226	2.433
Vivekananda Hill	C11-7	C11-6	225	64.6	<0.00226	2.227
Vivekananda Hill	C11-6	C11-5	225	18.3	<0.00226	2.329
Vivekananda Hill	C11-5	C11-4	225	32.4	<0.00226	2.201
Vivekananda Hill	C11-4	C11-4A	225	68.9	<0.00226	1.674
Vivekananda Hill	C11-3	C11-3A	225	28.1	<0.00226	1.544
Vivekananda Hill	C11-2	C11-1	225	86	<0.00226	1.273
Vivekananda Hill	C11-1	C11-1A	225	32.1	<0.00226	1.897
Maha Vidyalaya Mawatha	C3A-11A	C3A-10	225	23.7	<0.0300	2.612
Maha Vidyalaya Mawatha	C3A-10	C3A-9	225	52.5	<0.0371	1.697
Maha Vidyalaya Mawatha	C3A-9	C3A-8	225	87.9	<0.0371	2.167
Sangamitta Mawatha	C3A-8	C3A-7	225	91.9	<0.0371	2.296
Sangamitta Mw	C3A-6	C3A-6A	225	64.3	<0.0371	2.453
Sangamitta Mw	C3A-5	C3A-4	225	90.8	<0.0371	3.710
K.B Christie Perera Mw	C3A-4	C3A-2	225	123	<0.0371	3.129
K.B Christie Perera Mw	C3A-2	C3A-1	225	124	<0.0371	2.808
K.B Christie Perera Mw	C3A-1	C1-3	225	36.8	<0.0371	2.623
Old Moor Street	K4A-2	K4A-1	225	57.8	<0.0301	2.257
Old Moor Street	K4A-1	A27-5	225	58	<0.0301	2.511
Hultdort Street	K5A-8	A32-3	225	39	<0.0301	2.328

Annex 13 Consequences of Failure Analysis - (COF) @CS3 Catchment

Location Reference	US MH ID	DS MH ID	Cat	Flow (m3/s)	Invert	Soil Type	Flow con.	Proximity to surface	WT	Pipeline Depth	Pipe length	Pipe Dia.	Accessibility		Road Type	Land use	Location	COF
1st Cross Street	A75-1B	A60-4	4	0.023	0.14	3	1	2	5	1	2	2	1	1	2	5	3	61.618
1st Cross Street	A60-4	A60-4A	2	0.024	0.14	3	1	2	5	1	2	2	1	1	2	5	3	63.658
1st Cross Street	A60-4A	A60-3	4	0.035	-	3	1	1	5	5	2	2	1	1	2	5	3	64.558
1st Cross Street	A60-3	A60-2	1	0.372	3.00	3	2	1	5	2	3	2	1	1	2	5	3	69.428
1st Cross Street	A60-2	A60-1	7	< 0.1209	2.75	3	5	1	5	2	2	2	1	1	2	5	3	66.902
1st Cross Street	A75-1	A75-1B	7	< 0.1209		3	5	5	5	1	1	2	1	1	2	5	3	67.178
1st Cross Street	A75-1	A75-1A	7	< 0.1209	2.20	3	5	1	5	2	2	2	1	1	2	5	3	66.902
1st Cross Street	A75-1A	A76-1	7	< 0.1209		3	5	5	5	1	2	2	1	1	2	5	3	74.012
1st Mosque Lane	A30-3	A30-2	8	< 0.1209	3.26	3	5	1	5	3	2	2	1	1	2	5	3	70.472
1st Mosque Lane	A30-2	A30-1	8	< 0.1209	3.17	3	5	1	5	3	1	2	1	1	2	5	3	64.148
1st Mosque Lane	A30-1	A29-2	8	< 0.1209	3.17	3	5	1	5	3	1	2	1	1	2	5	3	64.148
2 nd Cross Street	A53-3	A53-2	2	< 0.1209	3.47	3	5	1	5	3	1	2	1	1	2	5	3	67.208
2nd Cross Street	A11-7	A11-6	6	< 0.1209	5.95	3	5	1	5	5	3	2	1	1	2	5	3	77.306
2nd Cross Street	A11-7	A11-7A	4	< 0.1209	2.73	3	5	1	5	2	2	2	1	1	2	5	3	70.982
2nd Cross Street	A11-7A	A53-3	4	0.0207	4.37	3	1	1	5	5	2	2	1	1	3	5	3	74.314
2nd Cross Street	A53-2	A53-1	2	0.0230	4.45	3	1	1	5	5	3	2	1	1	3	5	3	80.638

2nd Cross Street	A53-1	A48-3	7	0.0257	4.95	3	1	1	5	5	2	2	1	1	3	5	3	74.314
2nd Mosque Lane	A101-1	A16-9	7	0.0266	4.81	3	1	1	5	5	1	2	1	1	3	5	3	67.99
2nd Rohini St	A65-1	A65-1A	3	0.0519	5.27	3	1	1	5	5	2	2	1	1	3	5	3	74.314
2nd Rohini St	A65-1A	A48-12	7	<0.1710	5.80	3	5	1	5	5	2	2	1	1	2	5	3	78.632
3rd Cross Street	A51-3	A51-2	3	<0.1710	4.12	3	5	1	5	5	2	2	1	1	1	5	3	66.326
3rd Cross Street	A51-2	A51-1	2	<0.1710	1.65	3	5	1	5	1	2	2	1	1	2	5	3	66.392
3rd Cross Street	A36-3	A51-3	1	<0.1710	1.60	3	5	1	5	1	3	2	1	1	3	5	3	74.822
4th Cross Street	A49-1	A48-1	7	<0.1710	0.99	3	5	1	5	1	2	2	1	1	2	5	3	66.902
5th Cross Street	A39-1	A7-6	8	<0.1710	2.36	3	5	1	5	2	1	2	1	1	2	5	3	60.578
Akbar Lane	A40-7	A40-6	5	<0.1710	1.80	3	5	1	5	1	1	2	1	1	2	5	3	60.578
Akbar Lane	A40-6	A40-5	6	<0.1710	2.00	3	5	1	5	2	2	2	1	1	2	5	3	70.982
Akbar Lane	A40-5	A40-4	7	<0.1710	4.22	3	5	1	5	5	1	2	1	1	2	5	3	62.108
Akbar Lane	A40A-4	A40A-3	7	<0.1710	1.22	3	5	1	5	1	1	2	1	1	2	5	3	60.068
Akbar Lane	A40A-3	A40A-2	7	<0.1710	1.93	3	5	1	5	1	1	2	1	1	2	5	3	60.578
Akbar Lane	A40A-2	A40A-1	8	<0.1710	2.15	3	5	1	5	2	1	2	1	1	2	5	3	64.658
Akbar Lane	A40A-1	A40-5	8	< 0.1209	4.88	3	5	1	5	5	2	2	1	1	3	5	3	80.738
Andival St.	A19-2	A19-1	1	< 0.1209	4.26	3	5	1	5	5	1	2	1	1	2	5	3	72.308
Andival St.	A19-1	A17-3	8	< 0.1209	4.11	3	5	1	5	5	2	2	1	1	2	5	3	76.082
Andival Street	A19-3	A19-2	8	< 0.1209	3.96	3	5	1	5	4	1	2	1	1	2	5	3	67.718
Bank shall Street	A11-2	A11-1	5	< 0.1209	3.96	3	5	1	5	4	1	2	1	1	2	5	3	67.718
Bank shall Street	A11-6	A11-5	4	< 0.1209	3.93	3	5	1	5	4	2	2	1	1	2	5	3	76.082
Bank shall Street	A11-5	A11-4	3	< 0.1209	4.02	3	5	1	5	5	1	2	1	1	2	5	3	69.758
Bank shall Street	A11-3	A11-2	4	< 0.1209	3.91	3	5	1	5	4	1	2	1	1	2	5	3	65.678
Bank shall Street	A11-1	A7-2	3	< 0.1209	3.29	3	5	1	5	3	1	2	1	1	2	5	3	62.618
Bank shall Street	A11-6	A11-6A	2	< 0.1209	2.61	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Bank shall Street	A11-6A	A76-1	6	< 0.1209	2.73	3	5	1	5	2	2	2	1	1	2	5	3	67.922

Bank shall Street	A77-2	A77-1	7	< 0.1209	2.73	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Bank shall Street	A77-1A	A76-1	7	< 0.1209	2.73	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Bank shall Street	A77-1	A77-1A	8	< 0.1209	2.73	3	5	1	5	2	2	2	1	1	2	5	3	68.942
Beach Road	A1RS1-3	A1RS1-2	2	< 0.1209	3.25	3	5	1	5	3	3	2	1	1	2	5	3	76.796
Beach Road	A1RS1-2	A1RS1-2A	3	< 0.1209	3.10	3	5	1	5	3	2	2	1	1	2	5	3	68.942
Beach Road	A1RS1-2A	A1RS1-1	5	< 0.1209	2.49	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Beach Road	A1RS1-1	A1-7	7	< 0.1209	2.49	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Beira Road	A40-4	A40-3	4	< 0.1209	2.61	3	5	1	5	2	2	2	1	1	2	5	3	66.902
Beira Road	A40-3	A40-2	7	<0.1710	1.53	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Beira Road	A40-2	A40-1	7	<0.1710	1.67	3	5	1	5	1	1	2	1	1	2	5	3	60.068
Beira Road	A40-1	A39-7	8	<0.1710	1.28	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Brass Founder St	A20-1	A20-1A	3	<0.1710	1.39	3	5	1	5	1	1	2	1	1	2	5	3	60.578
Brass Founder St	A20-1A	A19-1	2	<0.1710	2.80	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Brass Founder St	A2-6	A20-1	7	< 0.1209	2.47	3	5	1	5	2	5	2	1	1	2	5	3	86.894
Canal Road	A82-2	A81-1	3	< 0.1209	2.02	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Canal Road	A81-1	A80-3	3	< 0.1209	2.17	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Chatham Street	A78-18	A79-5	5	< 0.1209	2.17	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Chatham Street	A79-5	A79-4	5	< 0.1209	2.28	3	5	1	5	2	2	2	1	1	2	5	3	66.902
Chatham Street	A79-4	A79-3A	5	< 0.1209	1.96	3	5	1	5	1	3	2	1	1	2	5	3	72.716
Chatham Street	A79-3	A79-2	4	< 0.1209	1.96	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Chatham Street	A79-2	A79-1	3	< 0.1209	1.96	3	5	1	5	1	2	2	1	1	2	5	3	67.412
Chatham Street	A79-1	A78-4	7	< 0.1209	3.04	3	5	1	5	3	3	2	1	1	2	5	3	75.266
China Lane	A13-1	A12-1	4	< 0.1209	2.25	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Church Street	A89-2	A89-1	1	< 0.1209	2.91	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Church St	A90-1	A89-1	2	< 0.1209	2.91	3	5	1	5	2	2	2	1	1	2	5	3	67.922
D. R. Wijewardena Mw	A92-13	A92-11	6	< 0.1209	.63	3	5	1	5	2	2	2	1	1	2	5	3	69.962

D. R. Wijewardena Mw	A92-11	A92-10	8	< 0.1209	.66	3	5	1	5	4	2	2	1	1	2	5	3	72.002
D. R. Wijewardena Mw	A92-10	A92-10A	8	< 0.1209	.20	3	5	1	5	3	2	2	1	1	2	5	3	72.002
D. R. Wijewardena Mw	A92-10A	A92-9	8	< 0.1209	.65	3	5	1	5	4	1	2	1	1	2	5	3	69.758
D. R. Wijewardena Mw	A92-9	A92-8	8	< 0.1209	.38	3	5	1	5	5	3	2	1	1	2	5	3	84.956
D. R. Wijewardena Mw	A92-8	A92-7	8	< 0.1209	.45	3	5	1	5	5	3	2	1	1	2	5	3	84.956
Dam Street	A14-2	A14-1	4	< 0.1209	.45	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Dam Street	A14-3	A14-2	4	< 0.1209	.45	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Dam Street	A14-4	A14-3	5	< 0.1209	.45	3	5	1	5	5	2	2	1	1	2	5	3	73.532
Dam Street	A14-5A	A14-4	5	< 0.1209	.20	3	5	1	5	3	2	2	1	1	2	5	3	67.412
Dam Street	A14-5	A14-5A	5	< 0.1209	.78	3	5	1	5	1	2	2	1	1	2	5	3	67.412
Dam Street	A14-6	A14-5	5	< 0.1209	.50	3	5	1	5	3	2	2	1	1	2	5	3	72.002
Dam Street	A14-7	A14-6	2	< 0.1209	.86	3	5	1	5	4	1	2	1	1	2	5	3	65.678
Dam Street	A14-8	A14-7	1	< 0.1209	.09	3	5	1	5	3	3	2	1	1	2	5	3	76.796
Dam Street	A14-9	A14-8	7	< 0.1209	.09	3	5	1	5	3	3	2	1	1	2	5	3	76.796
Dam Street	A14-10	A14-10A	7	< 0.1209	.09	3	5	1	5	3	1	2	1	1	2	5	3	62.618
Dam Street	A14-10A	A14-10B-1	7	< 0.1209	.41	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Dam Street	A14-10B-1	A14-10B	7	< 0.1209	.49	3	5	1	5	2	1	2	1	1	2	5	3	62.618
Dam Street	A14-10B	A14-9	7	<0.0101	.07	3	5	1	5	3	2	2	1	1	2	5	3	70.472
Dam Street	A14-13	A14-12	8	<0.0101	.07	3	5	1	5	3	2	2	1	1	2	5	3	72.002
Dam Street	A14-12	A14-12A	8	<0.0101	.54	3	5	1	5	4	1	2	1	1	2	5	3	61.598
Dam Street	A14-12A	A14-11	8	<0.0101	.56	3	5	1	5	1	2	2	1	1	2	5	3	68.432

Dam Street	A14-11	A14-10	8	<0.0436	2.23	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Dias Place	A42-3	A42-2	5	<0.0436	2.10	3	5	1	5	5	3	2	1	1	2	5	3	84.956
Dias Place	A42-2	A42-2A	5	<0.0436	0.98	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Dias Place	A42-2A	A42-2B	4	<0.0436	.91	3	5	1	5	5	1	2	1	1	2	5	3	72.308
Dias Place	A42-2B	A42-1	7	<0.0436	.91	3	5	1	5	5	2	2	1	1	2	5	3	76.082
Dias Place	A42-1	A39-6	7	<0.0436	.76	3	5	1	5	4	2	2	1	1	2	5	3	74.042
Duke Street	A79-1	A86A-2	5	<0.0436	.76	3	5	1	5	4	3	2	1	1	2	5	3	80.366
Duke Street	A86A-2	A86A-1	3	<0.0436	.76	3	5	1	5	4	3	2	1	1	2	5	3	80.366
Duke Street	A86A-1	A86-1A	2	<0.0436	.76	3	5	1	5	4	3	2	1	1	2	5	3	76.286
Flag Staff Street	A83-3	A83-2	1	<0.0436	.92	3	5	1	5	2	2	2	1	1	2	5	3	67.922
FRONT STREET	A48-9	A48-8	5	<0.0436	.74	3	5	1	5	2	2	2	1	1	2	5	3	67.922
FRONT STREET	A48-10	A48-9	4	<0.0436	.74	3	5	1	5	2	2	2	1	1	2	5	3	67.922
FRONT STREET	A48-11	A48-10	5	<0.0436	.84	3	5	1	5	2	2	2	1	1	2	5	3	67.922
FRONT STREET	A48-12	A48-11	7	<0.0436	.76	3	5	1	5	2	2	2	1	1	2	5	3	69.962
FRONT STREET	A48-13	A48-12	7	<0.0436	.53	3	5	1	5	4	1	2	1	1	2	5	3	65.678
FRONT STREET	A48-14	A48-13	8	<0.0436	.32	3	5	1	5	3	1	2	1	1	2	5	3	62.618
Gabos' Lane	A15-2	A10-1	5	<0.0436	.82	3	5	1	5	2	1	2	1	1	2	5	3	62.618
Gabos' Lane	A10-1	A10-2	1	<0.0436	.30	3	5	1	5	3	2	2	1	1	2	5	3	70.472
Gintupiiya Street	A2-8	A2-8A	6	<0.0436	.30	3	5	1	5	3	2	2	1	1	2	5	3	70.472
Gintupiiya Street	A2-8A	A2-7	5	<0.0436	.30	3	5	1	5	3	1	2	1	1	2	5	3	64.148
Gintupiiya Street	A2-7	A2-6	5	<0.0436	.30	3	5	1	5	3	3	2	1	1	2	5	3	75.266

Gintupiiya Street	A2-6	A2-5	1	<0.0436	.51	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Gintupiiya Street	A2-5	A2-4	4	<0.0436	.63	3	5	1	5	2	2	2	1	1	2	5	3	69.962
Gintupiiya Street	A2-4	A2-3	2	<0.0436	.65	3	5	1	5	4	2	2	1	1	2	5	3	67.922
Gintupiiya Street	A2-3	A4-2	7	<0.0436	.84	3	5	1	5	1	2	2	1	1	2	5	3	66.902
Gintupiiya Street	C11-6	A2-8	7	<0.0436	.20	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Hospital Lane	A79-5	A82-1	3	<0.0436	.85	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Hospital Street	A82-1	A82-2	5	<0.0436	.42	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Hospital Street	A82-2	A82-4	2	<0.0436	.18	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Hulftsdorp Street	A14-14	A14-13	6	<0.0436	.54	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Hulftsdorp Street	A27-6	A27-5	3	<0.0436	.53	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Hulftsdorp Street	A27-7	A27-6	4	<0.0436	.00	3	5	1	5	2	2	2	1	1	2	5	3	68.942
Hulftsdorp Street	A32-4	A32-3	3	<0.0436	.49	3	5	1	5	3	1	2	1	1	2	5	3	64.148
Hulftsdorp Street	A32-3	A32-2	4	< 0.1209	.34	3	5	1	5	3	2	2	1	1	2	5	3	68.942
Hulftsdorp Street	A32-2	A32-1	5	< 0.1209	.72	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Hulftsdorp Street	A35-1	A14-13	4	< 0.1209	.41	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Hulftsdorp Street	A35-2	A35-1	8	< 0.1209	.18	3	5	1	5	2	1	2	1	1	2	5	3	62.618
Hulftsdrop Street	A32-1	A27-5	5	< 0.1209	.40	3	5	1	5	3	1	2	1	1	2	5	3	65.678
Hultdort Street	K5A-8	A32-3	6	< 0.1209	.57	3	5	1	5	4	2	2	1	1	2	5	3	69.962
Hussainiya Street	A27-8	A27-7	4	< 0.1209	.70	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Hussainiya Street	A27-9	A27-8	4	< 0.1209	.45	3	5	1	5	2	2	2	1	1	2	5	3	70.982
Hussainiya Street	A26-4	A27-9	8	< 0.1209	.67	3	5	1	5	5	2	2	1	1	2	5	3	70.982

I.X.Perera Mawatha	A36-2	A12-1	3	< 0.1209	.45	3	5	1	5	2	1	2	1	1	2	5	3	62.618
I.X.Perera Mawatha	A12-1	A11-3	7	< 0.1209	.04	3	5	1	5	3	2	2	1	1	2	5	3	68.942
Janadhipathi Mawatha	A78-19	A78-18A	6	< 0.1209	.45	3	5	1	5	2	2	2	1	1	2	5	3	70.982
Janadhipathi Mawatha	A78-18A	A78-18	4	< 0.1209	.53	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Janadhipathi Mawatha	A78-18	A78-17	5	< 0.1209	.01	3	5	1	5	5	2	2	1	1	2	5	3	76.082
Janadhipathi Mawatha	A78-17	A78-16	5	< 0.1209	.82	3	5	1	5	4	2	2	1	1	2	5	3	72.002
Janadhipathi Mawatha	A78-16	A78-15	3	< 0.1209	.27	3	5	1	5	3	2	2	1	1	2	5	3	67.412
Janadhipathi Mawatha	A78-15	A78-15A	3	<0.0101	.90	3	5	1	5	1	1	2	1	1	3	5	3	62.684
Janadhipathi Mawatha	A78-15A	A78-14A	3	<0.0101	.28	3	5	1	5	2	1	2	1	1	3	5	3	63.704
Janadhipathi Mawatha	A78-14A	A78-14	3	<0.0101	.28	3	5	1	5	2	1	2	1	1	3	5	3	65.744
Janadhipathi Mawatha	A78-14	A78-13A	3	<0.0101	.72	3	5	1	5	4	2	2	1	1	3	5	3	76.148
Janadhipathi Mawatha	A78-13A	A78-13	7	<0.0101	.72	3	5	1	5	4	2	2	1	1	3	5	3	72.068
K.B Christie Perera Mw	C3A-4	C3A-2	4	0.00	.78	3	1	1	5	2	4	2	1	1	2	5	3	74.146
K.B Christie Perera Mw	C3A-2	C3A-1	1	0.0074	.78	3	1	1	5	2	4	2	1	1	2	5	3	74.146
K.B Christie Perera Mw	C3A-1	C1-3	8	0.0247	.78	3	1	1	5	2	2	2	1	1	2	5	3	61.498
Keyzer Street	A48-15	A48-14	2	0.0303	.92	3	1	1	5	2	2	2	1	1	2	5	3	61.498
Keyzer Street	A60-4	A48-15	2	0.0305	.88	3	1	1	5	2	2	2	1	1	2	5	3	61.498
Keyzer Street	A51-4	A51-3	3	0.0321	.88	3	1	1	5	2	2	2	1	1	2	5	3	62.518
Keyzer Street	A51-3	A51-3A	3	0.0336	.00	3	1	1	5	3	1	2	1	1	2	5	3	56.194
Keyzer Street	A51-3A	A49-4	2	0.0342	.66	3	1	1	5	2	2	2	1	1	2	5	3	64.558
Keyzer Street	A51-4	A53-3	2	0.0405	.92	3	1	1	5	5	2	2	1	1	2	5	3	72.208

Keyzer Street	A60-4	A59-1	2	<0.0406	.92	3	5	1	5	5	1	2	1	1	2	5	3	64.658
Keyzer Street	A59-1	A53-3	3	<0.0406	.50	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Kosala Lane	A65-1	A68-1	3	<0.0406	.23	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Kosala Lane	A68-1	A67-1	3	<0.0406	.38	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Lotus Road	A78-13	A78-12	4	<0.0406	.45	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Lotus Road	A78-12	A78-11	5	<0.0406	.50	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Lotus Road	A78-11	A78-10A	2	<0.0406	.78	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Lotus Road	A78-5	A78-4	2	<0.0406	.93	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Lotus Road	A78-4	A78-3	5	<0.0406	.93	3	5	1	5	2	2	2	1	1	2	5	3	68.942
Lotus Road	A78-3	A78-2	7	<0.0406	.11	3	5	1	5	3	3	2	1	1	2	5	3	75.266
Lotus Road	A78-2	A78-1	7	<0.0406	.46	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Maha Vidyalaya mawatha	A26-4A	A26-4	4	<0.0406	.66	3	5	1	5	2	1	2	1	1	2	5	3	62.618
Maha Vidyalaya mawatha	A26-4B	C3A-11	3	<0.0406	.24	3	5	1	5	3	1	2	1	1	2	5	3	64.148
Maha vidyala Mawatha	A26-4A	A26-4	7	<0.0046	.38	3	5	1	5	3	1	2	1	1	2	5	3	64.148
Maha Vidyalaya Mawatha	C3A-11	C3A-11A	4	<0.0406	.06	3	5	1	5	3	1	2	1	1	2	5	3	62.618
Maha Vidyalaya Mawatha	C3A-11A	C3A-10	4	<0.0406	.05	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Maha Vidyalaya Mawatha	C3A-10	C3A-9	4	<0.0406	.05	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Maha Vidyalaya Mawatha	C3A-9	C3A-8	3	<0.0406	.05	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Main Street	A1-23	A1-22A	5	<0.0406	.92	3	5	1	5	2	3	2	1	1	2	5	3	77.306
Main Street	A11-8	A11-7	5	<0.0841	.36	3	5	1	5	5	1	2	1	1	3	5	3	74.414
Main Street	A14-1	A7-4	3	<0.0841	.25	3	5	1	5	5	2	3	1	1	3	5	3	85.991

Main Street	A36-4	A36-3	4	<0.0841	.08	3	5	1	5	5	2	2	1	1	3	5	3	75.638
Main Street	A36-3	A36-3A	3	<0.0841	.46	3	5	1	5	3	1	2	1	1	3	5	3	66.254
Main Street	A36-3A	A36-2	4	<0.0841	.02	3	5	1	5	3	2	2	1	1	3	5	3	71.048
Main Street	A36-2	A36-1	5	<0.0841	.96	3	5	1	5	2	2	2	1	1	3	5	3	70.028
Main Street	A36-1	A7-3	1	<0.0841	.74	3	5	1	5	2	1	2	1	1	3	5	3	63.704
Main Street	A36-4	A11-7	7	<0.0841	.57	3	5	1	5	2	1	2	1	1	3	5	3	63.704
Main Street	A11-8	A75-1	7	<0.0841	.57	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Main Street	A75-3	A75-2	7	<0.0841	.57	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Main Street	A75-2	A75-2A	8	<0.0841	.57	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Main Street	A75-2A	A75-1	8	<0.0841	.57	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Main Street	A78-1	A1-23	8	<0.0841	.57	3	5	1	5	2	2	3	1	1	2	5	3	72.155
Main Street (4 th Cross St)	A36-2	A36-2A	3	<0.0841	.50	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Main Street (4 th Cross St)	A36-2A	A49-4	2	<0.0841	.40	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Maliban Street	A61-1	A53-1	3	<0.0841	.40	3	5	1	5	1	3	2	1	1	2	5	3	73.226
Maliban Street	A60-2	A61-1	3	<0.0841	.73	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Maliban Street	A62-1	A60-2	1	<0.0841	.41	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Maliban Street	A62-1	A48-9	7	<0.0841	.64	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Maliban Street	A54-1	A49-1	3	<0.0841	.64	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Mayuri Lane	A67-1	A67-1A	2	<0.0841	.46	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Mayuri Lane	A67-1A	A48-10	7	<0.0841	.61	3	5	1	5	2	2	2	1	1	2	5	3	66.902
Mihindu Mawatha	A71-5	A71-4	4	<0.0841	.98	3	5	1	5	1	2	2	1	1	2	5	3	66.902

Mihindu Mawatha	A71-4	A71-3	3	<0.0841	.12	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Mihindu Mawatha	A71-3	A71-2	3	<0.0841	.22	3	5	1	5	2	4	2	1	1	2	5	3	79.55
Mihindu Mawatha	A71-2	A71-1	2	<0.0841	.66	3	5	1	5	1	3	2	1	1	2	5	3	72.716
Mihindu Mawatha	A71-1	A39-9	7	<0.0841	.58	3	5	1	5	1	3	2	1	1	2	5	3	73.226
Mohamed Zain Mawatha	A26-3	A26-2	6	<0.0841	.23	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Mohamed Zain Mawatha	A26-2	A26-1	2	<0.0841	.51	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Mohamed Zain Mawatha	A26-1	A26-1A	5	<0.0841	.51	3	5	1	5	2	1	2	1	1	2	5	3	60.578
Mohamed Zain Mawatha	A26-1A	A30-4	5	<0.0841	.78	3	5	1	5	1	1	2	1	1	2	5	3	60.578
Mohamed Zain Mawatha	A100-12	A100-11	6	<0.0841	.27	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Mohamed Zain Mawatha	A100-11	A100-11A1	4	<0.0841	.27	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Mohamed Zain Mawatha	A100-11A1	A100-11A	2	<0.0841	.23	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Mohamed Zain Mawatha	A100-11A	A100-10	5	<0.0841	.28	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Mohamed Zain Mawatha	A100-10	A100-9	2	<0.0841	.34	3	5	1	5	2	1	2	1	1	2	5	3	60.578
Mohamed Zain Mawatha	A100-9	A100-8	2	<0.0841	.91	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Mohamed Zain Mawatha	A100-8	A100-7	6	<0.0841	.92	3	5	1	5	1	1	2	1	1	2	5	3	60.068
Mohamed Zain Mawatha	A100-7	A100-7A	7	<0.0841	.92	3	5	1	5	1	1	2	1	1	2	5	3	60.578
Mohamed Zain Mawatha	A100-7A	A100-6	7	<0.0841	.24	3	5	1	5	2	1	2	1	1	2	5	3	60.578
Mohamed Zain Mawatha	A100-6	A100-5	7	<0.0841	.79	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Mohamed Zain Mawatha	A100-5	A100-5A	8	<0.0841	.79	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Mohamed Zain Mawatha	A100-4	A100-3	8	<0.0841	.79	3	5	1	5	1	1	2	1	1	2	5	3	60.578
Mohamed Zain Mawatha	A100-3	A100-2	8	<0.0841	.20	3	5	1	5	2	2	2	1	1	2	5	3	67.922

Mohamed Zain Mawatha	A100-2	A100-1A	8	<0.0841	.20	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Mohamed Zain Mawatha	A100-1A	A100-1	8	<0.0841	.05	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Mohamed Zain Mawatha	A100-1	A16-2	8	<0.0841	.14	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Mohamed Zain Mw	A26-4	A26-3	5	<0.0841	.00	3	5	1	5	2	1	2	1	1	2	5	3	60.578
Mudalige Mawatha	A78-19	A78-19A	4	<0.0841	.60	3	5	1	5	1	2	2	1	1	3	5	3	68.498
Mudalige Mawatha	A78-19A	A87-3	7	<0.0841	.71	3	5	1	5	1	1	2	1	1	2	5	3	60.068
Mudalige Mawatha	A87-3	A87-2	7	<0.0841	.71	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Mudalige Mawatha	A87-2	A87-1	8	<0.0841	.81	3	5	1	5	1	3	2	1	1	2	5	3	72.716
Muhandiram Road	A40B-2	A40B-1	4	<0.0841	.82	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Muhandiram Road	A40B-1	A39-8	7	<0.0841	.55	3	5	1	5	1	2	2	1	1	2	5	3	66.392
New Moor Street	A25-1	A25-1A	5	<0.0841	.37	3	5	1	5	1	2	2	1	1	2	5	3	66.392
New Moor Street	A25-1A	A14-4	4	<0.0841	.70	3	5	1	5	1	3	2	1	1	2	5	3	72.716
New Moor Street	A25-2	A25-1	1	<0.0841	.55	3	5	1	5	1	2	2	1	1	2	5	3	66.392
New Moor Street	A29-1	A25-2	6	<0.0841	.60	3	5	1	5	1	4	2	1	1	2	5	3	79.04
New Moor Street	A29-2	A28-1	1	<0.0841	.67	3	5	1	5	1	1	2	1	1	2	5	3	60.068
New Moor Street	A28-1	A27-7	7	<0.0841	.60	3	5	1	5	1	2	2	1	1	2	5	3	66.392
New Moor Street	A29-1	A29-2	8	<0.0841	.66	3	5	1	5	1	3	2	1	1	2	5	3	72.716
Olcott (4th Cross Street)	A49-2	A49-1	4	<0.0841	.78	3	5	1	5	1	3	2	1	1	2	5	3	73.736
Olcott Mawatha	A48-1	A7-9	5	<0.0207	.16	3	5	1	5	3	1	2	1	1	2	5	3	64.148
Olcott Mawatha	A48-2	A48-1	5	<0.0207	.01	3	5	1	5	3	2	2	1	1	2	5	3	68.942
Olcott Mawatha	A48-3	A48-2	5	<0.0207	.73	3	5	1	5	2	2	2	1	1	2	5	3	67.922

Olcott Mawatha	A48-4	A48-3	5	<0.0207	.56	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Olcott Mawatha	A48-5	A48-4	5	<0.0207	.58	3	5	1	5	2	2	2	1	1	2	5	3	66.902
Olcott Mawatha	A48-6	A48-5	1	<0.0478	.59	3	5	1	5	1	2	2	1	1	3	5	3	69.008
Olcott Mawatha	A48-7	A48-6	8	<0.0478	.24	3	5	1	5	2	2	2	1	1	3	5	3	70.028
Olcott Mawatha	A48-8	A48-7	8	<0.0478	.30	3	5	1	5	2	2	2	1	1	3	5	3	70.028
Olcott MW (4th Cross St)	A49-4	A49-3	3	<0.0478	.40	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Olcott MW (4th Cross St)	A49-3	A49-2	1	<0.0478	.51	3	5	1	5	2	1	2	1	1	2	5	3	60.578
Olcott Mw.	A7-14	A7-13	5	<0.0478	.03	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Olcott Mw.	A7-13	A7-12	8	<0.0478	.80	3	5	1	5	1	2	2	1	1	2	5	3	66.902
Olcott Mw.	A7-12	A7-11	8	<0.0478	.18	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Olcott Mw.	A7-11	A7-10	8	<0.0478	.24	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Olcott Mw.	A7-10	A7-9	8	<0.0478	.30	3	5	1	5	2	1	2	1	1	2	5	3	64.658
Old Moor Street	A27-1	A14-6	5	0.0003	.00	3	1	1	5	5	3	2	1	1	3	5	3	80.638
Old Moor Street	A27-2	A27-1	5	0.0008	.11	3	1	1	5	5	3	2	1	1	3	5	3	70.438
Old Moor Street	A27-2B	A27-2	5	0.0017	.36	3	1	1	5	1	2	2	1	1	3	5	3	62.074
Old Moor Street	A27-2A	A27-2B	5	0.0028	.15	3	1	1	5	1	1	2	1	1	3	5	3	55.75
Old Moor Street	A27-3	A27-2A	4	0.0065	.70	3	1	1	5	1	2	2	1	1	3	5	3	63.604
Old Moor Street	A27-4	A27-3	4	0.0321	.74	3	1	1	5	4	2	2	1	1	3	5	3	69.724
Old Moor Street	A27-5A	A27-4	3		.64	3	1	1	5	4	2	2	1	1	3	5	3	69.724
Old Moor Street	A27-5	A27-5A	7	0.0333	.56	3	1	1	5	4	2	2	1	1	3	5	3	67.684
Old Moor Street	A27A-1C	A27-2A	7	0.0357	.13	3	1	1	5	3	1	1	1	1	3	5	3	53.047

Old Moor Street	A27A-1B	A27A-1C	7	0.0369	.35	3	1	1	5	2	1	1	1	1	3	5	3	51.007
Old Moor Street	A27A-1A	A27A-1B	7	0.0396	.15	3	1	1	5	1	1	1	1	1	3	5	3	50.497
Old Moor Street	A27A-1	A27A-1A	7	0.0458	.15	3	1	1	5	1	1	1	1	1	3	5	3	50.497
Old Moor Street	K4A-2	K4A-1	8	0.0470	.67	3	1	1	5	1	2	2	1	1	3	5	3	64.114
Old Moor Street	K4A-1	A27-5	8	0.2288	.22	3	2	1	5	5	2	2	1	1	3	5	3	68.27
Peer Saibo Street	A33-1	A27-3	4	0.2370	.85	3	2	1	5	2	3	2	1	1	3	5	3	71.534
Peer Saibo Street	A33-3	A14-10	5	0.2386	.05	3	2	1	5	2	2	2	1	1	3	5	3	65.21
Peer Saibo Street	A33-2	A33-3	5	0.2397	.67	3	2	1	5	2	2	2	1	1	3	5	3	66.23
Peer Saibo Street	A33-1	A33-2	8	0.2399	.21	3	2	1	5	3	2	2	1	1	3	5	3	64.7
Prince St	A63-1	A60-3	2	0.0017	.91	3	1	1	5	1	3	2	1	1	3	5	3	68.908
Prince St	A68-1	A60-3	7	0.0007	.55	3	1	1	5	2	2	2	1	1	3	5	3	66.664
Prince Street	A51-1	A49-2	3	0.0017	.87	3	1	1	5	5	2	2	1	1	3	5	3	64.114
Prince Street	A51-1	A56-1	3	0.0129	.85	3	1	1	5	1	1	2	1	1	3	5	3	55.75
Prince Street	A63-1	A53-2	3	0.0135	.22	3	1	1	5	1	2	2	1	1	3	5	3	62.074
Prince Street	A68-1	A68-1A	2	0.0142	.80	3	1	1	5	1	2	2	1	1	3	5	3	62.074
Prince Street	A68-1A	A48-11	7	0.0004	.43	3	1	1	5	1	2	2	1	1	3	5	3	62.074
Rifai Thangal Lane	A30-4	A30-3	3	0.0015	.88	3	1	1	5	1	1	2	1	1	3	5	3	56.26
San Sebastian Street	A34-2	A34-1	2	0.0167	.52	3	1	1	5	2	2	2	1	1	3	5	3	64.624
Sangamitta Mawatha	C3A-8	C3A-7	2	0.0172	.25	3	1	1	5	3	3	2	1	1	3	5	3	69.418
Sangamitta Mawatha	C3A-7	C3A-6	1	0.0121	.25	3	1	1	5	1	3	2	1	1	2	5	3	66.292
Sangamitta Mw	C3A-6	C3A-6A	3	0.0145	.78	3	1	1	5	1	2	2	1	1	2	5	3	59.968

Sangamitta Mw	C3A-6A	C3A-5	2	0.0026	.16	3	1	1	5	1	1	2	1	1	2	5	3	53.644
Sangamitta Mw	C3A-5	C3A-4	2	-	.23	3	5	1	5	1	3	2	1	1	2	5	3	72.716
Saunders Place	A39-9	A39-9A	5	0.0094	.39	3	1	1	5	1	2	2	1	1	2	5	3	59.968
Saunders Place	A39-9A	A39-9B	4	< 0.0094	.44	3	5	1	5	1	2	2	1	1	3	5	3	68.498
Saunders Place	A39-9B	A39-8	4	< 0.0094	.05	3	5	1	5	1	1	2	1	1	3	5	3	62.174
Saunders Place	A39-8	A39-7	4	0.0024	.73	3	1	1	5	1	2	2	1	1	2	5	3	59.968
Saunders Place	A39-7	A39-7A	6	0.0010	.17	3	1	1	5	1	1	2	1	1	3	5	3	56.26
Saunders Place	A39-7A	A39-6	7	0.0031	.18	3	1	1	5	2	2	2	1	1	3	5	3	63.604
Saunders Place	A39-6	CS4A-1A	7	0.0044	.35	3	1	1	5	2	1	2	1	1	3	5	3	58.3
Saunders Place	A14-7	A41-2	8	0.0426	.33	3	1	1	5	3	2	2	1	1	3	5	3	66.154
Sea Beach Road	A2-2	A2-1	6	0.0433	.12	3	1	1	5	3	1	2	1	1	3	5	3	58.3
Sea Beach Road	A2-1	A1-7	8	0.0435	.94	3	1	1	5	2	1	2	1	1	3	5	3	57.28
Sea Street	A3-4	A15-4	3	0.0483	.96	3	1	1	5	2	2	2	1	1	3	5	3	63.604
Sea Street	A15-4	A15-3	1	0.0489	.89	3	1	1	5	2	2	2	1	1	3	5	3	62.584
Sea Street	A15-3	A15-2	1	0.0014	.13	3	1	1	5	1	2	2	1	1	2	5	3	59.968
Sea Street	A15-2	A15-1	8	0.0035	.33	3	1	1	5	1	2	2	1	1	2	5	3	59.968
Sebastian Street	A34A-2	A34A-1	8	0.0048	.93	3	1	1	5	1	1	1	1	1	2	5	3	48.391
Sebastian Street	A34A-1	A34-1A	8	0.0007	.38	3	1	1	5	1	1	1	1	1	2	5	3	48.391
Sir Baron Jayathilaka Mw	A86-2	A86-2A	4			3	1	5	5	1	2	2	1	1	2	5	3	67.078
Sir Baron Jayathilaka Mw	A86-2A	A86-1A	1	0.0018	.10	3	1	1	5	2	2	2	1	1	2	5	3	61.498
Sir Baron Jayathilaka Mw	A86-1A	A86-1	8	0.0029	.28	3	1	1	5	2	1	2	1	1	2	5	3	54.154
Sir Baron Jayathilaka Mw	A78-19	A86-5	5	0.0375		3	1	5	5	1	3	2	1	1	3	5	3	75.508

Sir Baron Jayathilaka Mw	A86-5	A86-4	4	-	.80	3	5	1	5	2	3	2	1	1	3	5	3	76.352
Sir Baron Jayathilaka Mw	A86-4	A86-3	2	0.0152	.35	3	1	1	5	2	3	2	1	1	2	5	3	66.802
Sir Baron Jayathilaka Mw	A86-3	A86-2	1	0.0004	.52	3	1	1	5	1	2	2	1	1	3	5	3	62.074
Sir Baron Jayathilaka Mw	A86-1	A1-23	5	0.0011	.49	3	1	1	5	1	3	2	1	1	3	5	3	68.398
Sounders Place	CS4A-1A	A39-5	7	0.0125		3	1	5	5	1	1	2	1	1	2	5	3	60.244
Sri Kathiresan Street	A2-4A	A17-4	5	<0.0246	.76	3	5	1	5	1	2	2	1	1	3	5	3	68.498
Sri Kathiresan Street	A17-4	A17-3	2	<0.0246	.77	3	5	1	5	1	3	2	1	1	3	5	3	74.822
Sri Kathiresan Street	A17-3	A17-3A	1	<0.0246		3	5	5	5	1	2	2	1	1	3	5	3	75.098
Sri Kathiresan Street	A17-3A	A17-2	1	<0.0246		3	5	5	5	1	2	2	1	1	3	5	3	75.608
Sri Kathiresan Street	A17-2	A17-2A	8	<0.0246	.28	3	5	1	5	2	2	2	1	1	3	5	3	70.028
Sri Kathiresan Street	A17-2A	A17-2B	8	<0.0246	.86	3	5	1	5	2	1	2	1	1	3	5	3	66.764
Sri Kathiresan Street	A17-2B	A17-1	8	<0.0478	2.00	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Sri Kathiresan Street	A2-4	A2-4A	8	<0.0478	0.55	3	5	1	5	5	2	2	1	1	2	5	3	68.432
St Sebastian Street	A71-3	A34-5	3	<0.0478		3	5	5	5	1	2	2	1	1	2	5	3	72.992
St Sebastian Street	A34-5	A34-4	7	<0.0478		3	5	5	5	1	2	2	1	1	2	5	3	75.032
St Sebastian Street	A34-4	A34-3	7	<0.0478	8.28	3	5	1	5	5	2	2	1	1	2	5	3	78.632
St. Sebastian Street	A34-1A	A34-1B	2	<0.0478	6.70	3	5	1	5	5	1	2	1	1	2	5	3	72.308
St.Sebastian Street	A34-3	A34-2	3	<0.0478	5.11	3	5	1	5	5	2	2	1	1	2	5	3	78.632
St.Sebastian Street	A34-1	A34-1A	2	<0.0478	3.74	3	5	1	5	5	1	2	1	1	2	5	3	62.108
St.Sebastian Street	A34-1B	A14-10	7	<0.0478		3	5	5	5	1	2	2	1	1	2	5	3	75.032
Upper Chatham Street	A78-18	A84-1	3	<0.0478	2.53	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Upper Chatham Street	A84-1	A83-3	3	<0.0478	.94	3	5	1	5	5	2	2	1	1	2	5	3	78.632

Vivekananda Hill	A16-11	C11-7	3	<0.0478	.76	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Vivekananda Hill	C11-7	C11-6	4	<0.0478	.21	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Vivekananda Hill	C11-6	C11-5	3	<0.0478	.81	3	5	1	5	5	1	2	1	1	2	5	3	62.108
Vivekananda Hill	C11-5	C11-4	4	<0.0478		3	5	5	5	1	2	2	1	1	2	5	3	75.032
Vivekananda Hill	C11-4	C11-4A	7	<0.0478	.75	3	5	1	5	5	2	2	1	1	2	5	3	78.632
Vivekananda Hill	C11-4A	C11-3	7	<0.0478	6.62	3	5	1	5	5	1	2	1	1	2	5	3	62.108
Vivekananda Hill	C11-3	C11-3A	7	<0.0478		3	5	5	5	1	1	2	1	1	2	5	3	67.688
Vivekananda Hill	C11-3A	C11-2	7	<0.0478	.50	3	5	1	5	3	2	2	1	1	2	5	3	67.412
Vivekananda Hill	C11-2	C11-1	8	<0.0478		3	5	5	5	1	3	2	1	1	2	5	3	80.336
Vivekananda Hill	C11-1	C11-1A	8	<0.0478	.45	3	5	1	5	3	2	2	1	1	2	5	3	68.942
Vivekananda Hill	C11-1A	C10-1	8	<0.00226	.43	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Wharf Road	A1-30	A1-29	4	<0.00226	.23	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Wharf Road	A1-29	A1-28	4	<0.00226	.33	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Wharf Road	A1-28	A1-28A	8	<0.00226	.20	3	5	1	5	2	1	2	1	1	2	5	3	60.578
Wholfendhal Street	A15-1	A14-1	1	<0.00226	.67	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Wolfendhal Lane	A23-1	A16-10	2	<0.00226		3	5	5	5	1	2	2	1	1	2	5	3	72.992
Wolfendhal Lane	C11-7	A23-1	3	<0.00226	.54	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Wolfendhal Street	A16-11	A16-10	4	<0.00226		3	5	5	5	1	3	2	1	1	2	5	3	79.316
Wolfendhal Street	A16-10	A16-9	3	<0.00226	.27	3	5	1	5	1	2	2	1	1	2	5	3	66.392
Wolfendhal Street	A16-9	A16-9A	2	<0.00226	.90	3	5	1	5	1	1	2	1	1	2	5	3	60.068
Wolfendhal Street	A16-9A	A16-8	3	<0.00226		3	5	5	5	1	2	2	1	1	2	5	3	72.992
Wolfendhal Street	A16-7	A16-7A	3	<0.0300		3	5	5	5	1	2	2	1	1	2	5	3	73.502
Wolfendhal Street	A16-8	A16-7	3			3	1	1	5	2	2	2	1	1	2	5	3	60.478

Wolfendhal Street	A16-7A	A16-6	6	<0.0371	.70	3	5	1	5	1	1	2	1	1	2	5	3	60.578
Wolfendhal Street	A16-6	A16-6A	7	<0.0371	.17	3	5	1	5	2	1	2	1	1	2	5	3	61.598
Wolfendhal Street	A16-6A	A16-5	7	<0.0371	.30	3	5	1	5	2	2	2	1	1	2	5	3	67.922
Wolfendhal Street	A16-5	A16-5A	7	<0.0371	.37	3	5	1	5	2	3	2	1	1	2	5	3	74.246
Wolfendhal Street	A16-2	A16-1	7	<0.0371	.45	3	5	1	5	2	2	2	1	1	2	5	3	68.942
Wolfendhal Street	A16-5A	A16-4	8	<0.0371	.08	3	5	1	5	3	1	2	1	1	2	5	3	65.678
Wolfendhal Street	A16-4	A16-3	8	<0.0371	.71	3	5	1	5	4	2	2	1	1	2	5	3	72.002
Wolfendhal Street	A16-1	A15-1	8	<0.0371	.13	3	5	1	5	3	1	2	1	1	2	5	3	62.618
York St	A90-2	A90-1	1	<0.0371	.81	3	5	1	5	2	2	2	1	1	2	5	3	67.922
York Street	A79-3	A80-4	5	<0.0371	.62	3	5	1	5	2	2	2	1	1	2	5	3	66.902
York Street	A80-4	A80-3	4	<0.0300		3	5	5	5	1	2	2	1	1	2	5	3	72.992
York Street	A80-3	A80-2	5	<0.0300		3	5	5	5	1	2	2	1	1	2	5	3	72.992
York Street	A80-2	A80-1	2	<0.0300		3	5	5	5	1	2	2	1	1	2	5	3	73.502
York Street	A87-1	A86-3	4	<0.0301	.26	3	5	1	5	2	3	2	1	1	2	5	3	74.246
York Street	A79-3	A87-1	2	<0.0301	.51	3	5	1	5	2	3	2	1	1	2	5	3	74.246
York Street	A90-3	A90-2	9	<0.0301	.33	3	5	1	5	2	2	2	1	1	2	5	3	81.692

Annex 14 Priority Rehabilitation List-Category 1 - CS3 Catchment

Location Reference	US MH ID	DS MH ID	Dia (mm)	Length (m)	Maxi Grade	Cat.	3	4	5	COF	Rank
1st Cross Street	A60-3	A60-2	225	84	5	1	58	28	16	69.428	1
3rd Cross Street	A36-3	A51-3	225	92.5	5	1	51	51	11	74.822	2
Andival St.	A19-2	A19-1	225	2.3	5	1	30	44	18	72.308	3
Church Street	A89-2	A89-1	225	56.8	5	1	114	42	14	67.922	4
Dam Street	A14-8	A14-7	225	96.7	5	1	5	3	16	76.796	5
Flag Staff Street	A83-3	A83-2	225	54.3	5	1	182	54	13	67.922	6
Gabos' Lane	A10-1	A10-2	225	44.4	5	1	35	14	15	70.472	7
Gintupiiya Street	A2-6	A2-5	225	14.1	5	1	127	13	19	61.598	8
K.B Christie Per.	C3A-2	C3A-1	225	123.5	5	1	94	67	11	74.146	9
Main Street	A36-1	A7-3	225	3.5	5	1	49	32	11	63.704	10
Maliban Street	A62-1	A60-2	225	60.3	5	1	75	34	16	67.922	11
New Moor Street	A25-2	A25-1	225	67	5	1	93	32	17	66.392	12
New Moor Street	A29-2	A28-1	225	21	5	1	99	45	21	60.068	13
Olcott Mawatha	A48-6	A48-5	225	30	5	1	7	0	11	69.008	14
Olcott Mw(4th Cross	A49-3	A49-2	225	13.5	5	1	239	92	12	60.578	15
Sangamitta Mawatha	C3A-7	C3A-6	225	90.7	5	1	63	86	12	66.292	16
Sea Street	A15-4	A15-3	225	59	5	1	32	11	14	62.584	17
Sea Street	A15-3	A15-2	225	32.6	5	1	27	2	14	59.968	18
Sir Baron Jayathilaka Mw	A86-2A	A86-1A	225	49	5	1	32	5	13	61.498	19
Sir Baron Jayathilaka Mw	A86-3	A86-2	225	45.4	5	1	66	20	14	62.074	20
Sri Kathiresan Street	A17-3	A17-3A	225	42	5	1	43	15	19	75.098	21
Sri Kathiresan Street	A17-3A	A17-2	225	41.8	5	1	45	33	27	75.608	22
Wholfendhal Street	A15-1	A14-1	225	43	5	1	7	1	26	66.392	23
York St	A90-2	A90-1	225	71.4	5	1	56	13	19	67.922	24

Annex 15 Priority Rehabilitation List Category 2 - CS3 Catchment

Location Reference	US MH ID	DS MH ID	Dia. (mm)	Chainage (m)	Grade	Cat	3	4	5	Rank	Rank COF)
2nd Cross Street	A53-2	A53-1	225	79.4	5	2	58	3	7	80.638	1
St. Sebastian Street	A34-1A	A34-1B	225	20.4	5	2	18	15	7	78.632	2
Beach Road	A1RS1-3	A1RS1-2	225	96.5	5	2	175	8	7	76.796	3
Duke Street	A86-A1	A86-1A	225	86.7	5	2	136	60	9	76.286	4
Sri Kathiresan St	A17-4	A17-3	225	100.6	5	2	27	8	9	74.822	5
Brass Founder St	A20-1A	A19-1	225	77.9	5	2	53	37	8	74.246	6
Hospital Street	A82-2	A82-4	225	84.4	5	2	19	64	8	74.246	7
York Street	A79-3	A87-1	225	91.7	5	2	61	31	9	74.246	8
2 nd Cross Street	A53-3	A53-2	225	19	5	2	27	15	9	73.532	9
York Street	A80-2	A80-1	225	56.5	5	2	124	60	6	73.502	10
Wolfendhal Lane	A23-1	A16-10	225	49.3	5	2	56	11	6	72.992	11
Mihindu Mawatha	A71-2	A71-1	225	78.3	5	2	56	25	6	72.716	12
Sangamitta Mw	C3A-5	C3A-4	225	90.8	5	2	57	45	6	72.716	13
Keyzer Street	A51-4	A53-3	225	48.8	5	2	45	59	7	72.208	14
Dam Street	A14-7	A14-6	225	19.1	5	2	13	10	6	72.002	15
Keyzer Street	A60-4	A59-1	225	11.6	5	2	28	33	6	70.982	16
Sangamitta Mawatha	C3A-8	C3A-7	225	91.9	5	2	83	73	7	69.418	17
Prince St	A63-1	A60-3	225	107	5	2	115	25	6	68.908	18
St.Sebastian Street	A34-1	A34-1A	225	19.5	5	2	16	12	7	68.432	19
Bank shall Street	A11-6	A11-6A	225	34.9	5	2	14	6	6	67.922	20
Church St	A90-1	A89-1	225	55.2	5	2	42	6	6	67.922	21
Gintupiiya Street	A2-4	A2-3	225	36.1	5	2	36	13	9	67.922	22
Lotus Road	A78-11	A78-10A	225	67.3	5	2	70	13	6	67.922	23
Lotus Road	A78-5	A78-4	225	64	5	2	43	10	9	67.922	24
Mayuri Lane	A67-1	A67-1A	225	5.8	5	2	38	6	6	67.922	25
Mohamed Zain	A26-2	A26-1	225	40	5	2	43	8	6	67.922	26
Mohamed Zain	A100-11A1	A100-11A	225	5.2	5	2	23	5	9	67.922	27
Mohamed Zain	A100-10	A100-9	225	29.6	5	2	3	0	6	66.902	28
Sir Baron Jayathilaka	A86-4	A86-3	225	81.5	5	2	68	8	9	66.802	29
3rd Cross Street	A51-2	A51-1	225	68.8	5	2	58	49	6	66.392	30
Main St(4 th Cross St)	A36-2A	A49-4	225	47.3	5	2	55	21	6	66.392	31
Mohamed Zain Mw	A100-9	A100-8	225	31.6	5	2	1	3	7	66.392	32
Wolfendhal Street	A16-9	A16-9A	225	10.3	5	2	39	51	6	66.392	33
San Sebastian Street	A34-2	A34-1	225	70.3	5	2	66	53	8	64.624	34
Keyzer Street	A51-3A	A49-4	225	47.7	5	2	44	49	8	64.558	35
1st Cross Street	A60-4	A60-4A	225	59	5	2	84	5	7	63.658	36

Prince Street	A68-1	A68-1A	225	50	5	2	21	6	6	62.074	37
Keyzer Street	A48-15	A48-14	225	70	5	2	84	39	8	61.498	38
Keyzer Street	A60-4	A48-15	225	70.8	5	2	63	30	6	61.498	39
Sangamitta Mw	C3A-6A	C3A-5	225	25.8	5	2	100	70	10	59.968	40

Annex 16 Priority Rehabilitation List - Category 3 - CS3 Catchment

Location Reference	US MH ID	DS MH ID	Sewer Diameter (mm)	length(m)	Max Grade	Cat.	3	4	5	COF	Priority
Main Street	A14-1	A7-4	450	53.1	5	3	77	19	3	85.991	1
Duke Street	A86A-2	A86A-1	225	87.5	5	3	81	20	3	80.366	2
Mihindu Mawatha	A71-3	A71-2	225	122.6	5	3	69	26	3	79.55	3
St.Sebastian Street	A34-3	A34-2	225	61.9	5	3	53	71	3	78.632	4
Upper Chatham Street	A78-18	A84-1	225	67.8	5	3	70	16	1	78.632	5
Upper Chatham Street	A84-1	A83-3	225	69.6	5	3	63	69	4	78.632	6
Vivekananda Hill	A16-11	C11-7	225	69.3	5	3	102	19	2	78.632	7
Janadhipathi Mawatha	A78-14	A78-13A	225	55	5	3	3	24	4	76.148	8
Bank shall Street	A11-5	A11-4	225	24.3	5	3	66	20	1	76.082	9
2nd Rohini St	A65-1	A65-1A	225	49.2	5	3	31	24	4	74.314	10
Canal Road	A81-1	A80-3	225	83	5	3	34	44	5	74.246	11
Maha Vidyalaya Mw	C3A-9	C3A-8	225	87.9	5	3	49	35	3	74.246	12
Maliban Street	A60-2	A61-1	225	77	5	3	43	54	1	74.246	13
Wolfendhal Street	A16-7	A16-7A	225	36.4	5	3	14	17	5	73.502	14
Maliban Street	A61-1	A53-1	225	84.2	5	3	50	41	1	73.226	15
St Sebastian Street	A71-3	A34-5	225	47.9	5	3	14	26	2	72.992	16
Wolfendhal Street	A16-9A	A16-8	225	47.7	5	3	11	27	1	72.992	17
Main Street	A36-3	A36-3A	225	19.8	5	3	68	58	4	72.578	18
Janadhipathi Mawatha	A78-14A	A78-14	225	24.8	5	3	5	57	2	72.068	19
Hulftsdorp Street	A32-4	A32-3	225	29.4	5	3	30	16	1	70.472	20
Maha Vidyalaya mw	A26-4B	C3A-11	225	21	5	3	37	35	5	70.472	21
Janadhipathi Mawatha	A78-15A	A78-14A	225	17	5	3	10	30	3	70.028	22
Old Moor Street	A27-5A	A27-4	225	33.1	5	3	35	16	2	69.724	23
Janadhipathi Mawatha	A78-15	A78-15A	225	18.1	5	3	27	41	3	69.008	24
Bank shall Street	A11-1	A7-2	225	2	5	3	68	25	4	68.942	25
Beach Road	A1RS1-2	A1RS1-2A	225	49	5	3	76	16	4	68.942	26
I.X.Perera Mawatha	A36-2	A12-1	225	24.6	5	3	46	36	1	68.942	27
Vivekananda Hill	C11-6	C11-5	225	18.3	5	3	60	16	1	68.432	28
Canal Road	A82-2	A81-1	225	53.4	5	3	86	36	2	67.922	29
Hospital Lane	A79-5	A82-1	225	64.3	5	3	60	18	5	67.922	30
Hulftsdorp Street	A27-6	A27-5	225	42	5	3	84	23	5	67.922	31
Keyzer Street	A59-1	A53-3	225	41.2	5	3	18	40	1	67.922	32
Kosala Lane	A65-1	A68-1	225	38.3	5	3	38	24	4	67.922	33
Kosala Lane	A68-1	A67-1	225	43.6	5	3	21	33	2	67.922	34
Maliban Street	A54-1	A49-1	225	49.8	5	3	35	31	2	67.922	35

Mihindu Mawatha	A71-4	A71-3	225	48	5	3	153	57	2	67.922	36
Olcott MW (4th Cross St)	A49-4	A49-3	225	57.2	5	3	68	17	5	67.922	37
Chatham Street	A79-2	A79-1	225	74.2	5	3	100	34	4	67.412	38
Janadhipathi Mawatha	A78-16	A78-15	225	38.4	5	3	34	42	3	67.412	39
Brass Founder Street	A20-1	A20-1A	225	17.1	5	3	150	29	3	66.902	40
Main Street (4 th Cross St)	A36-2	A36-2A	225	48.2	5	3	52	21	1	66.392	41
Wolfendhal Lane	C11-7	A23-1	225	50	5	3	28	25	1	66.392	42
Wolfendhal Street	A16-10	A16-9	225	53.7	5	3	54	73	4	66.392	43
3rd Cross Street	A51-3	A51-2	225	70.3	5	3	46	38	3	66.326	44
Prince Street	A51-1	A49-2	225	41.9	5	3	44	24	2	64.114	45
Sea Street	A3-4	A15-4	225	74.5	5	3	65	19	5	63.604	46
Rifai Thangal Lane	A30-4	A30-3	225	1.7	5	3	79	17	4	62.584	47
Keyzer Street	A51-4	A51-3	225	33.1	5	3	44	33	4	62.518	48
Keyzer Street	A51-3	A51-3A	225	24.5	5	3	15	16	1	62.518	49
Prince Street	A51-1	A56-1	225	15	5	3	39	42	3	62.074	50
Prince Street	A63-1	A53-2	225	43.2	5	3	30	35	2	62.074	51
Wolfendhal Street	A16-8	A16-7	225	58.4	5	3	7	20	2	60.478	52
Sangamitta Mw	C3A-6	C3A-6A	225	64.3	5	3	29	20	1	59.968	53

Annex 17 Priority List Category 4 - CS3 Catchment

Location Reference	US MH ID	DS MH ID	Dia (mm)	length(m	Grade	Cat.	3	4	5	COF	Priority
Wolfendhal Street	A16-11	A16-10	225	107.1	5	4	17	6	3	79.32	1
Dam Street	A14-2	A14-1	375	33.5	5	4	68	6	1	78.63	2
Dam Street	A14-3	A14-2	375	55	5	4	113	13	1	78.63	3
Dias Place	A42-2A	A42-2B	225	13.2	5	4	13	10	1	78.63	4
Janadhipathi Mawatha	A78-18A	A78-18	225	48.1	5	4	23	6	3	78.63	5
Vivekananda Hill	C11-7	C11-6	225	64.6	5	4	38	7	1	78.63	6
Sir Baron Jayathilaka	A86-5	A86-4	225	97.4	5	4	129	6	3	76.35	7
Bank shall Street	A11-6	A11-5	225	60.1	5	4	64	12	3	76.08	8
Main Street	A36-4	A36-3	225	50.2	5	4	20	9	1	75.64	9
Vivekananda Hill	C11-5	C11-4	225	32.4	5	4	43	9	3	75.03	10
2nd Cross Street	A11-7A	A53-3	225	42.4	5	4	60	9	2	74.31	11
York Street	A87-1	A86-3	225	115.3	5	4	18	6	3	74.25	12
K.B Christie Perera Mw	C3A-4	C3A-2	225	123.2	5	4	20	7	1	74.15	13
Olcott (4th Cross Street)	A49-2	A49-1	225	82.1	5	4	56	13	5	73.74	14
York Street	A80-4	A80-3	225	53.4	5	4	118	8	5	72.99	15
New Moor Street	A25-1A	A14-4	225	81.8	5	4	51	12	1	72.72	16
Bank shall Street	A11-3	A11-2	225	17	5	4	35	13	1	72	17
Peer Saibo Street	A33-1	A27-3	225	78	5	4	50	6	1	71.53	18
Main Street	A36-3A	A36-2	225	65.6	5	4	16	10	2	71.05	19
2nd Cross Street	A11-7	A11-7A	225	44.2	5	4	98	7	1	70.98	20
Hussainiya Street	A27-9	A27-8	225	57.6	5	4	37	11	1	70.98	21
Gintupiiya Street	A2-5	A2-4	225	64.4	5	4	34	10	4	69.96	22
Old Moor Street	A27-4	A27-3	225	45.5	5	4	20	9	1	69.72	23
Hulftsdorp Street	A27-7	A27-6	225	42	5	4	42	12	4	68.94	24
Hulftsdorp Street	A32-3	A32-2	225	47.1	5	4	38	13	5	68.94	25
Maha Vidyalay Mw	A26-4A	A26-4	225	23.3	5	4	25	14	3	68.94	26
Maha Vidyalaya Mw	C3A-11	C3A-11A	225	28.2	5	4	60	10	2	68.94	27
Mudalige Mawatha	A78-19	A78-19A	225	52.5	5	4	40	6	3	68.5	28
Saunders Place	A39-9A	A39-9B	225	30.6	5	4	21	8	2	68.5	29
Saunders Place	A39-9B	A39-8	225	7	5	4	19	7	2	68.5	30
China Lane	A13-1	A12-1	225	20.8	5	4	24	15	1	67.92	31
FRONT STREET	A48-10	A48-9	225	41	5	4	4	6	1	67.92	32
Hulftsdorp Street	A35-1	A14-13	225	45.9	5	4	11	9	3	67.92	33
Hussainiya Street	A27-8	A27-7	225	59.6	5	4	52	9	1	67.92	34
Lotus Road	A78-13	A78-12	225	8.6	5	4	72	6	1	67.92	35
Maha Vidyalaya Mw	C3A-11A	C3A-10	225	23.7	5	4	32	8	4	67.92	36
Maha Vidyalaya Mw	C3A-10	C3A-9	225	52.5	5	4	19	10	1	67.92	37
Mohamed Zain Mw	A100-11	A100-11A1	225	30	5	4	20	13	5	67.92	38
Wharf Road	A1-30	A1-29	225	74	5	4	45	7	2	67.92	39
Wharf Road	A1-29	A1-28	225	45.1	5	4	28	10	3	67.92	40
Sir Baron Jayathilaka M	A86-2	A86-2A	225	41.9	5	4	75	9	4	67.08	41
Beira Road	A40-4	A40-3	225	43.1	5	4	29	11	2	66.9	42
Mihindu Mawatha	A71-5	A71-4	225	48	5	4	49	7	1	66.9	43
Chatham Street	A79-3	A79-2	225	56.3	5	4	60	10	4	66.39	44
Muhandiram Road	A40B-2	A40B-1	225	68	5	4	51	11	1	66.39	45

1st Cross Street	A60-4A	A60-3	225	56.3	5	4	25	8	4	64.56	46
Old Moor Street	A27-3	A27-2A	225	31.7	5	4	50	13	3	63.6	47
1st Cross Street	A75-1B	A60-4	225	62.6	5	4	83	15	3	61.62	48
Saunders Place	A39-8	A39-7	225	39.6	5	4	14	8	1	59.97	49

Annex 18 Priority List of Category 5 - CS3 Catchment

Location Reference	US MH ID	DS MH ID	Dia (mm)	length(m)	Max Grade	Cat.	3	4	5	COF	Priority
Dias Place	A42-3	A42-2	225	103	5	5	8	1	1	84.956	1
Main Street	A11-8	A11-7	225	11.6	5	5	75	1	4	80.738	2
Old Moor Street	A27-1	A14-6	225	90	5	5	102	5	3	80.638	3
Duke Street	A79-1	A86A-2	225	80.3	5	5	115	5	2	80.366	4
Dias Place	A42-2	A42-2A	225	56.5	5	5	10	5	1	78.632	5
Main Street	A1-23	A1-22A	300	100	5	5	66	1	2	77.306	6
Janadhipathi Mw	A78-18	A78-17	225	64.8	5	5	17	3	3	76.082	7
Sir Baron Jayathilaka	A78-19	A86-5	225	105	5	5	87	5	1	75.508	8
Gintupiiya Street	A2-7	A2-6	225	106	5	5	32	5	1	75.266	9
Chatham Street	A78-18	A79-5	225	79.2	5	5	110	4	1	74.246	10
Bank shall Street	A11-2	A11-1	225	20.4	5	5	3	4	5	74.042	11
Dam Street	A14-4	A14-3	375	53.5	5	5	53	5	1	73.532	12
York Street	A80-3	A80-2	225	38	5	5	34	4	2	72.992	13
Chatham Street	A79-4	A79-3A	225	94.8	5	5	62	3	2	72.716	14
Dam Street	A14-6	A14-5	225	43.5	5	5	10	5	1	72.002	15
Hulftsdrop Street	A32-1	A27-5	225	10.5	5	5	3	1	3	72.002	16
Janadhipathi Mawatha	A78-17	A78-16	225	70.2	5	5	19	2	5	72.002	17
Gintupiiya Street	A2-8A	A2-7	225	21.4	5	5	36	5	1	70.472	18
Olcott Mawatha	A48-1	A7-9	300	24	5	5	22	4	1	70.472	19
Old Moor Street	A27-2	A27-1	225	109	5	5	45	2	2	70.438	20
Main Street	A36-2	A36-1	225	32	5	5	13	4	3	70.028	21
Gabos' Lane	A15-2	A10-1	225	11.4	5	5	7	3	2	68.942	22
Lotus Road	A78-4	A78-3	225	62	5	5	7	2	2	68.942	23
Olcott Mawatha	A48-2	A48-1	300	57.5	5	5	10	1	1	68.942	24
Sri Kathiresan Street	A2-4A	A17-4	225	60	5	5	5	3	1	68.498	25
Sir Baron Jayatilaka	A86-1	A1-23	225	106	5	5	5	1	5	68.398	26
Beach Road	A1RS1-2A	A1RS1-1	225	44	5	5	5	2	1	67.922	27
FRONT STREET	A48-9	A48-8	225	45	5	5	13	5	1	67.922	28
FRONT STREET	A48-11	A48-10	225	38	5	5	3	1	2	67.922	29
Hospital Street	A82-1	A82-2	225	67	5	5	13	2	1	67.922	30
Hulftsdorp Street	A32-2	A32-1	225	64	5	5	9	3	3	67.922	31
Lotus Road	A78-12	A78-11	225	51.3	5	5	14	1	1	67.922	32
Mohamed Zain Mawatha	A100-11A	A100-10	225	29	5	5	2	1	1	67.922	33
Olcott Mawatha	A48-3	A48-2	300	45	5	5	18	1	5	67.922	34
Olcott Mawatha	A48-4	A48-3	225	15.1	5	5	18	1	5	67.922	35
Dam Street	A14-5A	A14-4	300	45.7	5	5	42	5	3	67.412	36
Dam Street	A14-5	A14-5A	300	43.3	5	5	23	5	2	67.412	37
Akbar Lane	A40-7	A40-6	225	29.9	5	5	5	5	1	66.902	38
Chatham Street	A79-5	A79-4	225	51.6	5	5	95	4	2	66.902	39
Mohamed Zain Mw	A26-1	A26-1A	225	25.9	5	5	7	3	1	66.902	40
Mohamed Zain Mw	A26-1A	A30-4	225	16.9	5	5	4	1	1	66.902	41
Mohamed Zain Mw	A26-4	A26-3	225	29.8	5	5	25	5	3	66.902	42

Olcott Mawatha	A48-5	A48-4	225	60.8	5	5	4	1	1	66.902	43
York Street	A79-3	A80-4	225	65.5	5	5	48	1	2	66.902	44
New Moor Street	A25-1	A25-1A	225	31.5	5	5	41	4	1	66.392	45
Olcott Mw.	A7-14	A7-13	225	56.1	5	5	3	1	4	66.392	46
Peer Saibo Street	A33-2	A33-3	225	32.6	5	5	16	1	2	66.23	47
Peer Saibo Street	A33-3	A14-10	225	59.3	5	5	18	1	1	65.21	48
Old Moor Street	A27-2B	A27-2	225	65.6	5	5	44	5	1	62.074	49
Old Moor Street	A27-2A	A27-2B	225	10	5	5	17	2	1	62.074	50
Saunders Place	A39-9	A39-9A	225	41.7	5	5	17	4	1	59.968	51

Annex 19 Priority Rehabilitation List Category 6 - CS3 Catchment

Location Reference	US MH ID	DS MH ID	Dia(mm)	length(m)	Max Grade	Cat.	3	4	5	COF	Priority
New Moor Street	A29-1	A25-2	225	120.5	5	6	13	0	4	79.04	1
2nd Cross Street	A11-7	A11-6	225	77.5	5	6	32	0	1	77.306	2
Akbar Lane	A40-6	A40-5	225	46.1	5	6	0	0	1	70.982	3
Janadhipathi Mw	A78-19	A78-18A	225	49.6	5	6	37	0	3	70.982	4
Gintupiiya Street	A2-8	A2-8A	225	65.9	5	6	15	0	1	70.472	5
D. R. Wijewardena	A92-13	A92-11	225	73.7	5	6	2	0	1	69.962	6
Hultdort Street	K5A-8	A32-3	225	39	5	6	8	0	1	69.962	7
Bank shall Street	A11-6A	A76-1	225	35.7	5	6	0	0	1	67.922	8
Hulftsdorp Street	A14-14	A14-13	225	59.5	5	6	8	0	1	67.922	9
Mohamed Zain Mw	A26-3	A26-2	225	52.4	5	6	21	0	2	67.922	10
Mohamed Zain Mw	A100-12	A100-11	225	29	5	6	13	0	4	67.922	11
Wolfendhal Street	A16-7A	A16-6	225	1	5	6	1	0	1	66.902	12
Mohamed Zain Mw	A100-8	A100-7	225	29.2	5	6	0	0	1	66.392	13
Sea Beach Road	A2-2	A2-1	225	27.7	5	6	28	0	1	64.624	14
Saunders Place	A39-7	A39-7A	225	23.8	5	6	4	0	1	62.584	15

Annex 20 Priority Rehabilitation List - Category 7

Location Reference	US MH ID	DS MH ID	Dia. (mm)	length (m)	Max Grade	Cat.	3	4	5	COF	Priority
Brass Founder Street	A2-6	A20-1	225	48,5	4	7	30	4	0	86.894	1
2nd Rohini St	A65-1A	A48-12	225	48.3	4	7	29	36	0	78.632	2
St Sebastian Street	A34-4	A34-3	225	35.5	4	7	11	32	0	78.632	3
Vivekananda Hill	C11-4	C11-4A	225	68.9	4	7	20	1	0	78.632	4
Dam Street	A14-9	A14-8	225	96.2	4	7	15	2	0	76.796	5
Dias Place	A42-2B	A42-1	225	31.3	4	7	79	34	0	76.082	6
Chatham Street	A79-1	A78-4	225	107.7	4	7	64	4	0	75.266	7
Lotus Road	A78-3	A78-2	225	111.2	4	7	106	8	0	75.266	8
St Sebastian Street	A34-5	A34-4	225	42.5	4	7	24	3	0	75.032	9
St.Sebastian Street	A34-1B	A14-10	225	60	4	7	34	5	0	75.032	10
2nd Cross Street	A53-1	A48-3	225	53.8	4	7	127	5	0	74.314	11
2nd Mosque Lane	A101-1	A16-9	225	3.4	4	7	0	2	0	74.314	12
Gintupiiya Street	C11-6	A2-8	225	111.5	4	7	16	2	0	74.246	13
Lotus Road	A78-2	A78-1	225	97	4	7	15	2	0	74.246	14
Wolfendhal Street	A16-5	A16-5A	225	84.4	4	7	33	22	0	74.246	15
Dias Place	A42-1	A39-6	225	30.3	4	7	1	2	0	74.042	16
1st Cross Street	A75-1A	A76-1	225	33	4	7	41	8	0	74.012	17
Vivekananda Hill	C11-3	C11-3A	225	28.1	4	7	36	5	0	74.012	18
1st Cross Street	A75-1	A75-1B	225	25	4	7	27	1	0	73.502	19
Mihindu Mawatha	A71-1	A39-9	225	76.7	4	7	30	16	0	73.226	20
Janadhipathi Mawatha	A78-13A	A78-13	225	55.4	4	7	5	62	0	72.068	21
FRONT STREET	A48-13	A48-12	225	29	4	7	2	11	0	72.002	22
Dam Street	A14-10B	A14-9	225	35.6	4	7	3	1	0	70.472	23
Maha VidyalayMw	A26-4A	A26-4	225	23.3	4	7	12	5	0	70.472	24
Main Street	A36-4	A11-7	225	1.1	4	7	19	3	0	70.028	25
FRONT STREET	A48-12	A48-11	225	37	4	7	6	13	0	69.962	26
Dam Street	A14-10	A14-10A	225	15.2	4	7	37	5	0	68.942	27
Dam Street	A14-10B-1	A14-10B	225	2.5	4	7	19	6	0	68.942	28
I.X.Perera Mawatha	A12-1	A11-3	225	65	4	7	18	6	0	68.942	29
Wolfendhal Street	A16-2	A16-1	225	32.1	4	7	17	22	0	68.942	30
Akbar Lane	A40-5	A40-4	225	11.2	4	7	3	1	0	68.432	31
Vivekananda Hill	C11-4A	C11-3	225	18.4	4	7	10	1	0	68.432	32
Bank shall Street	A77-2	A77-1	225	68.8	4	7	7	2	0	67.922	33
Bank shall Street	A77-1A	A76-1	225	31.2	4	7	30	9	0	67.922	34
Beach Road	A1RS1-1	A1-7	225	10.5	4	7	62	4	0	67.922	35
Dam Street	A14-10A	A14-10B-1	225	11	4	7	14	3	0	67.922	36
Main Street	A11-8	A75-1	225	62.4	4	7	18	6	0	67.922	37
Main Street	A75-3	A75-2	225	16.3	4	7	65	22	0	67.922	38
Maliban Street	A62-1	A48-9	225	31.4	4	7	191	3	0	67.922	39
Wolfendhal Street	A16-6	A16-6A	225	24.2	4	7	14	1	0	67.922	40
Wolfendhal Street	A16-6A	A16-5	225	30.2	4	7	12	3	0	67.922	41
Old Moor Street	A27-5	A27-5A	225	31.4	4	7	13	1	0	67.684	42
Vivekananda Hill	C11-3A	C11-2	225	64.7	4	7	1	2	0	67.412	43
1st Cross Street	A60-2	A60-1	225	51.5	4	7	31	1	0	66.902	44
1st Cross Street	A75-1	A75-1A	225	35.5	4	7	21	3	0	66.902	45

4th Cross Street	A49-1	A48-1	225	66.5	4	7	14	3	0	66.902	46
Akbar Lane	A40A-3	A40A-2	225	10.9	4	7	1	4	0	66.902	47
Gintupiiya Street	A2-3	A4-2	225	38.6	4	7	91	7	0	66.902	48
Mayuri Lane	A67-1A	A48-10	225	50.2	4	7	37	28	0	66.902	49
Mohamed Zain Mw	A100-7	A100-7A	225	7.8	4	7	10	1	0	66.902	50
Mohamed Zain Mw	A100-7A	A100-6	225	20.2	4	7	2	1	0	66.902	51
Prince St	A68-1	A60-3	225	35	4	7	22	8	0	66.664	52
Sounders Place	CS4A-1A	A39-5	225	1.6	4	7	3	1	0	66.568	53
Akbar Lane	A40A-4	A40A-3	225	25.8	4	7	10	15	0	66.392	54
Beira Road	A40-3	A40-2	225	49.2	4	7	10	1	0	66.392	55
Beira Road	A40-2	A40-1	225	6.5	4	7	46	9	0	66.392	56
Mohamed Zain Mw	A100-6	A100-5	225	30	4	7	1	1	0	66.392	57
Mudalige Mawatha	A78-19A	A87-3	225	5.5	4	7	33	3	0	66.392	58
Mudalige Mawatha	A87-3	A87-2	225	52.8	4	7	62	11	0	66.392	59
Muhandiram Road	A40B-1	A39-8	225	54.8	4	7	13	1	0	66.392	60
New Moor Street	A28-1	A27-7	225	60.1	4	7	28	1	0	66.392	61
Saunders Place	A39-6	CS4A-1A	225	16.5	4	7	5	3	0	64.624	62
Saunders Place	A39-7A	A39-6	225	65.1	4	7	14	3	0	63.604	63
Prince Street	A68-1A	A48-11	225	55	4	7	35	28	0	62.074	64
Old Moor Street	A27A-1C	A27-2A	150	19.3	4	7	43	4	0	59.371	65
Old Moor Street	A27A-1B	A27A-1C	150	13.5	4	7	10	1	0	57.331	66
Old Moor Street	A27A-1A	A27A-1B	150	5	4	7	63	16	0	56.821	67
Old Moor Street	A27A-1	A27A-1A	150	11.6	4	7	6	5	0	56.821	68

Annex 21 Priority Rehabilitation List Category 8 CS3 Catchment

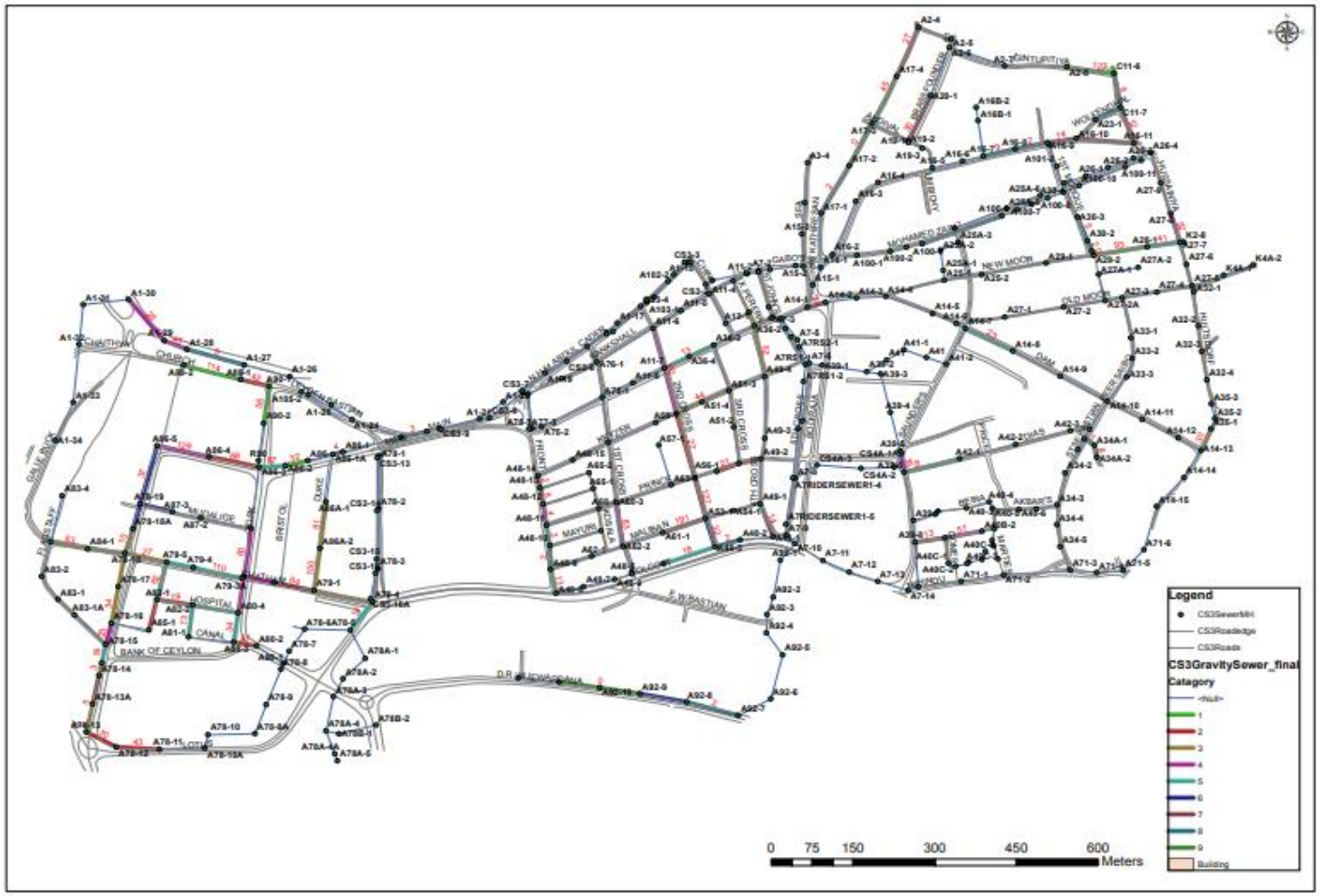
Location Reference	US MH ID	DS MH ID	Dia (mm)	length(m)	Max Grade	Cat.	3	4	5	COF	Priority
York Street	A90-3	A90-2	225	68.8	3	9	3	0	0	81.692	1
Akbar Lane	A40A-1	A40-5	225	37.6	3	8	1	0	0	80.738	2
Vivekananda Hill	C11-2	C11-1	225	86	3	8	9	0	0	80.336	3
Dam Street	A14-11	A14-10	225	70.5	3	8	9	0	0	78.632	4
Andival St.	A19-1	A17-3	225	71.2	3	8	2	0	0	76.082	5
Andival Street	A19-3	A19-2	225	27.5	3	8	13	0	0	74.042	6
Sri Kathiresan St	A17-2A	A17-2B	225	3.3	3	8	2	0	0	73.088	7
Mudalige Mawatha	A87-2	A87-1	225	94.9	3	8	4	0	0	72.716	8
New Moor Street	A29-1	A29-2	225	86	3	8	15	0	0	72.716	9
D. R. Wijewardena	A92-11	A92-10	225	73.6	3	8	4	0	0	72.002	10
D. R. Wijewardena M	A92-10	A92-10A	225	43.9	3	8	2	0	0	72.002	11
Dam Street	A14-13	A14-12	225	47.3	3	8	33	0	0	72.002	12
Wolfendhal Street	A16-5A	A16-4	225	15.9	3	8	2	0	0	72.002	13
Wolfendhal Street	A16-4	A16-3	225	52.2	3	8	2	0	0	72.002	14
Akbar Lane	A40A-2	A40A-1	225	21.1	3	8	2	0	0	70.982	15
1st Mosque Lane	A30-3	A30-2	225	47.4	3	8	5	0	0	70.472	16
1st Mosque Lane	A30-2	A30-1	225	21.3	3	8	2	0	0	70.472	17
Olcott Mawatha	A48-7	A48-6	225	58.1	3	8	2	0	0	70.028	18
Olcott Mawatha	A48-8	A48-7	225	50.701	3	8	2	0	0	70.028	19
Sri Kathiresan Street	A17-2	A17-2A	225	48.2	3	8	2	0	0	70.028	20
Bank shall Street	A77-1	A77-1A	225	38.2	3	8	16	0	0	68.942	21
FRONT STREET	A48-14	A48-13	225	23	3	8	2	0	0	68.942	22
Hulftsdorp Street	A35-2	A35-1	225	19.1	3	8	11	0	0	68.942	23
Vivekananda Hill	C11-1	C11-1A	225	32.1	3	8	6	0	0	68.942	24
Wolfendhal Street	A16-1	A15-1	225	10.4	3	8	9	0	0	68.942	25
Dam Street	A14-12A	A14-11	225	66.3	3	8	13	0	0	68.432	26
Old Moor Street	K4A-1	A27-5	225	58	3	8	5	0	0	68.27	27
Dam Street	A14-12	A14-12A	225	7.7	3	8	25	0	0	67.922	28
Main Street	A75-2	A75-2A	225	59.1	3	8	3	0	0	67.922	29
Main Street	A75-2A	A75-1	225	63.5	3	8	1	0	0	67.922	30
Mohamed Zain Mw	A100-3	A100-2	225	30.4	3	8	3	0	0	67.922	31
Mohamed Zain Mw	A100-2	A100-1A	225	28.5	3	8	2	0	0	67.922	32
Mohamed Zain Mw	A100-1A	A100-1	225	28.4	3	8	2	0	0	67.922	33
Mohamed Zain Mw	A100-1	A16-2	225	52.1	3	8	7	0	0	67.922	34
Olcott Mw.	A7-12	A7-11	225	50.3	3	8	2	0	0	67.922	35
Olcott Mw.	A7-11	A7-10	225	58.5	3	8	1	0	0	67.922	36
Vivekananda Hill	C11-1A	C10-1	225	34.2	3	8	9	0	0	67.922	37
5th Cross Street	A39-1	A7-6	225	21.9	3	8	7	0	0	66.902	38

Mohamed Zain Mw	A100-4	A100-3	225	28.8	3	8	3	0	0	66.902	39
Olcott Mw.	A7-13	A7-12	225	55	3	8	3	0	0	66.902	40
Wharf Road	A1-28	A1-28A	225	29.1	3	8	5	0	0	66.902	41
Beira Road	A40-1	A39-7	225	39.5	3	8	2	0	0	66.392	42
Mohamed Zain Mw	A100-5	A100-5A	225	30	3	8	1	0	0	66.392	43
Saunders Place	A14-7	A41-2	225	74.1	3	8	16	0	0	66.154	44
Peer Saibo Street	A33-1	A33-2	225	35	3	8	38	0	0	64.7	45
Old Moor Street	K4A-2	K4A-1	225	57.8	3	8	8	0	0	64.114	46
Sea Beach Road	A2-1	A1-7	225	7.8	3	8	2	0	0	63.604	47
K.B Christie Perera M	C3A-1	C1-3	225	36.8	3	8	4	0	0	61.498	48
Sir Baron Jayathilaka	A86-1A	A86-1	225	21.3	3	8	4	0	0	60.478	49
Sea Street	A15-2	A15-1	225	38	3	8	5	0	0	59.968	50
Sebastian Street	A34A-2	A34A-1	150	22.3	3	8	8	0	0	54.715	51
Sebastian Street	A34A-1	A34-1A	150	23.8	3	8	1	0	0	54.715	52

Annex 22 Priority List Category 9 - CS3 Catchment

Location Reference	US MH ID	DS MH ID	Dia (mm)	Chainage Total (m)	Max Grade	Category	3	4	5	Rank	Rank
D. R. Wijewardena Mw	A92-9	A92-8	225	85.3	2	9	0	0	0	84.956	1
D. R. Wijewardena Mw	A92-8	A92-7	225	94.2	2	9	0	0	0	84.956	2
Sri Kathiresan St	A17-2B	7-1	225	34.5	2	9	0	0	0	78.632	3
D. R. Wijewardena	A92-10A	A92-9	225	29	2	9	0	0	0	76.082	4
Main Street	A78-1	A1-23	450	50	2	9	0	0	0	72.155	5
Hussainiya Street	A26-4	A27-9	225	57	2	9	0	0	0	70.982	6
Olcott Mw.	A7-10	A7-9	225	20.2	2	9	0	0	0	70.982	7
1st Mosque Lane	A30-1	A29-2	225	7.5	2	9	0	0	0	70.472	8
Sri Kathiresan St	A2-4	A2-4A	225	42.2	0	9	0	0	0	68.432	9

Annex 23 Category List - CS3 Catchment



Annex 24 Sample CCTV

TEC/GCWMP-17/02097

TEACLY (S) PTE LTD

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5633
28 SEP 2017

CCTV INSPECTION REPORTS

Ministry of Local Government and Provincial council

Report No:

CCTV/Sewer/D2A/0226-F

Content :

A49-3-A49-2~021116~4TH Cross St-C

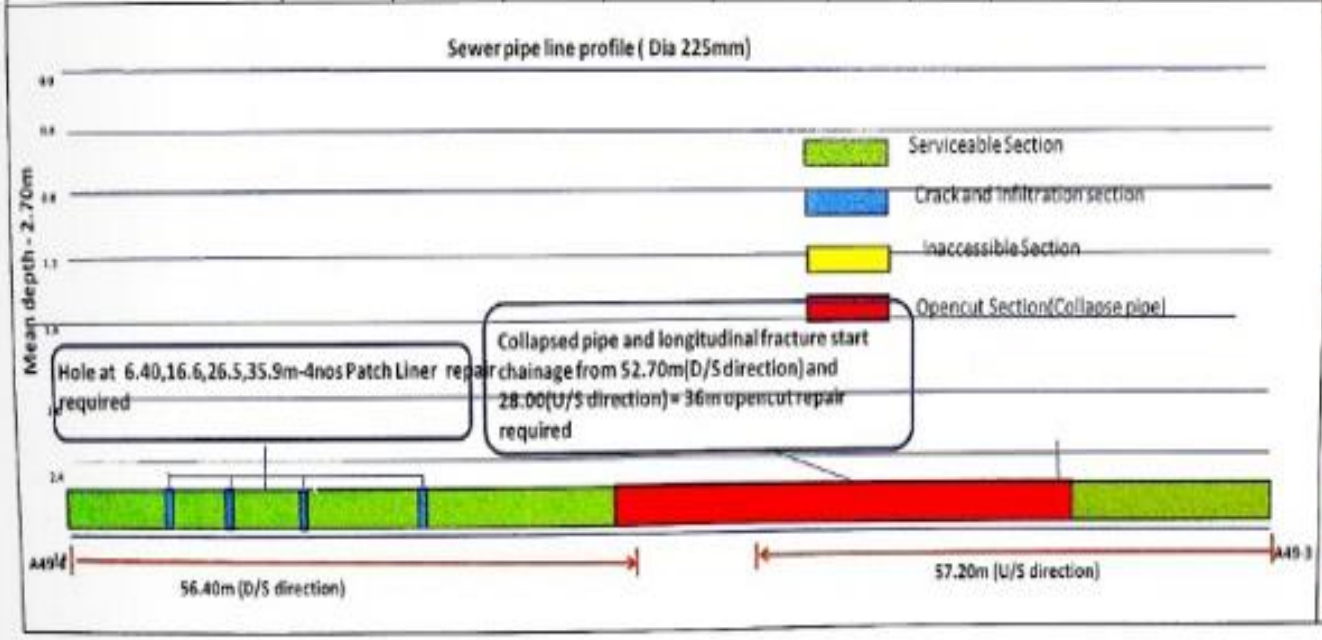
A49-4-A49-3~041116~4TH Cross St-C

Certified By
Amila Handagiri
QA/QC Manager

21/9/17

Approved By
Karuppaiah Azhagar
SCAE

Report No	Date	SEWER ID	US_MH No	DS_MH No	Location	District	Given Length	CCTV length	Description	Priority	Estimated open cut Repair length/m	Preferred repair method	Remarks
CCTV/Sewer/D2A/0226	04-11-2016	A49(US)	A49-4	A49-3	Olcott Mw(4th Cross street)	2A	116.50	57.20	Collapsed pipe and longitudinal fracture start from 52.70m(D/S direction)	Urgent	38	Open cut	Its recommend to repair by opencut method immediately
	05-11-2016	A49(DS)						56.40	Fracture longitudinal at 20.0m to 22.0m(U/S direction) and 28.00m start fracture longitudinal				



Contractor	Teachy(s) pte Ltd.
Date	30/09/2016

S/No	District	Location / Street	Sewer ID	US MH ID	DS MH ID	Dia (mm)	Mean Depth(m)	Given Length (m)	Cleaning Length (m)	CCTV Survey Length (m)	CCTV Survey Date	CCTV Survey Report No	Lateral(nos)	Remarks (state the defects etc.)
1	2A	Olcott mw (4th Cross St)	A49(DS)	A49-3	A49-2	225	2.90	39.40	13.50	13.50	02-11-2016	CCTVID2A/0226	4	found cracks, spalling, infiltration, broken, deformed, junction defective, hole, collapsed and fracture.SA due to Collapsed pipe
2	2A	Olcott mw (4th Cross St)	A49(US)	A49-3	A49-2	225	2.90	30.00	21.00	21.00	02-11-2016	CCTVID2A/0226	6	found cracks, spalling, infiltration, broken, deformed, connectio defective, collapsed and fracture.SA due to Collapsed pipe
3	2A	Olcott mw (4th Cross St)	A49(DS)	A49-4	A49-3	225	2.73	116.50	56.4	56.4	03-11-2016	CCTVID2A/0226	15	found cracks, spalling, broken, hole, deformed, junction defective, obstacles and fracture. SA due to obstruction stone
4	2A	Olcott mw (4th Cross St)	A49(US)	A49-4	A49-3	225	2.73	116.50	57.2	57.2	04-11-2016	CCTVID2A/0226	12	found cracks, spalling, broken, hole, deformed, junction defective, obstacles and fracture. SA due to obstruction stone
							Total Length (m)		148.10	148.10				

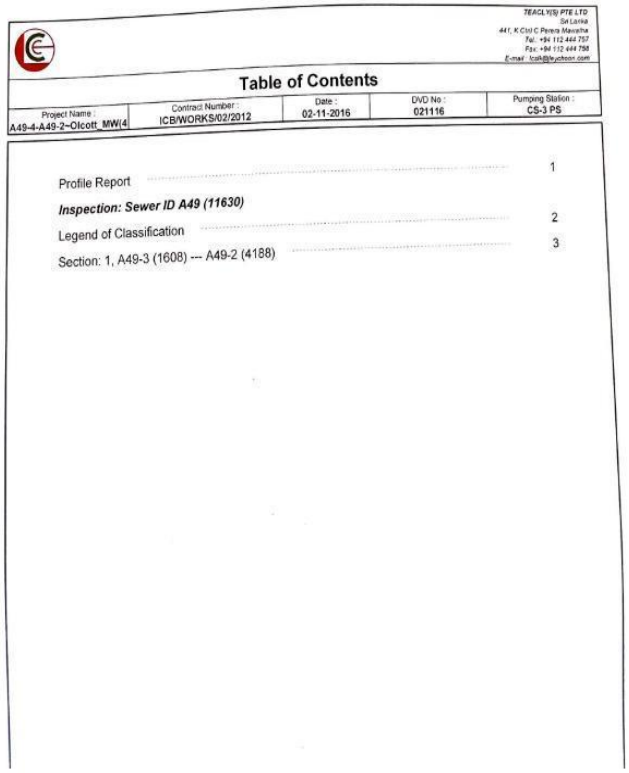
Contractor /Signature		Engineer's Signature	
Name	Michel Martin	Name	
Designation	Sewer Condition Assessment Expert	Designation	
Date	5-Dec-16	Date	

Report No	Survey Date	Location	Start Manhole	End Manhole	Sewer ID	CCTV Length (M)	Recommendation: Defects with Grade Classification					Total No of Defects	Pre Relining Repairs					Remarks
							Grade 1	Grade 2	Grade 3	Grade 4	Grade 5		Relining	Internal Trenchless Spot Repairs	Chainage of Internal Sport Repair	Open Cut Spot Repairs	Chainage of Open Cut Spot Repair	
CCTV/Sewer/D2A/0226	02-11-2016	Olcott_MW(4TH Cross St)	A49-3	A49-2	A49(DS)	13.50	0	28	45	12	1	87	Yes	Yes	4.30,6.60,7.20,90, 12.80,13.50	Yes	13.50	
	02-11-2016				A49(US)	21.00	0	37	23	5	3	68	Yes	Yes	17.70,20.30,21.00	Yes	21.00	
CCTV/Sewer/D2A/0226	04-11-2016	Olcott_MW(4TH Cross St)	A49-4	A49-3	A49(DS)	57.20	1	87	125	32	5	250	Yes	Yes	16.60,29.10,30.90 ,32.20,55.80,57.1 0	Yes	57.10	
	05-11-2016				A49(US)	56.40	1	68	114	60	7	250	Yes	Yes	2.10,4.10,7.00,8.9 0,16.60,26.50,54. 10,54.70	Yes	54.70	

Legend	Description	Defects commonly identified
Grade I	Acceptable Structural Condition	Deposits
Grade 2	Minor Collapse risk in short term but potential for further deterioration	Infiltration Cracks
Grade 3	Collapse unlikely in near future but future deterioration likely	Fractures,Infiltration
Grade 4	Collapse likely in foreseeable future	Broken pipe
Grade 5	Collapse or collapse imminent	Hole,Collapse

Summary of property connections protruding into sewer

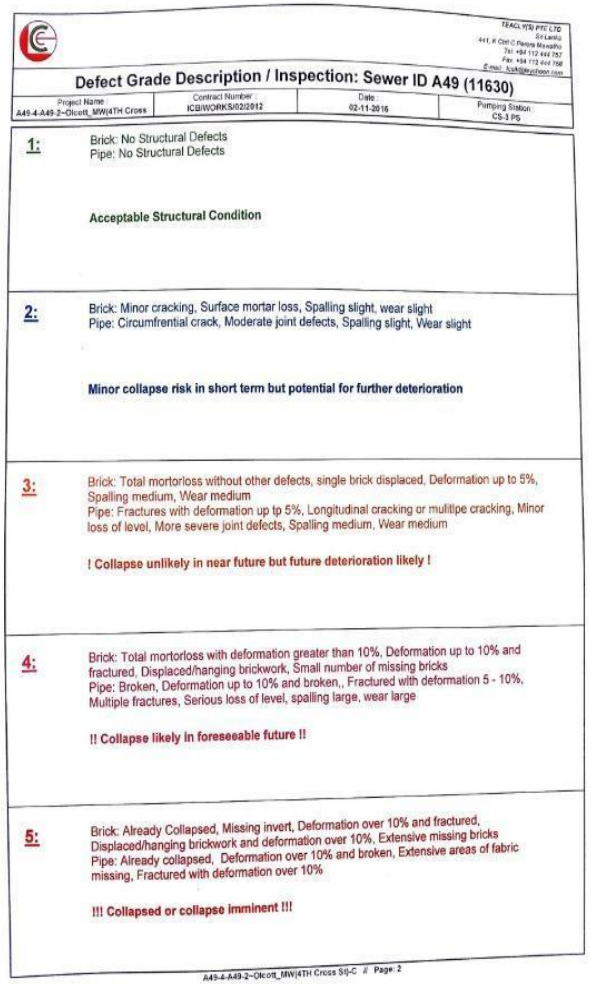
Report No	Survey Date	Location	Sewer ID	U/S MH	D/S MH	CCTV Length	Chainage	Remarks	Protruding property connections found
CCTV/Sewer/D2A/0226	02-11-2016	Olcott_MW(4TH Cross St)	A49(DS)	A49-3	A49-2	13.50	NA	NA	NA
	02-11-2016		A49(US)			21.00			
CCTV/Sewer/D2A/0226	04-11-2016	Olcott_MW(4TH Cross St)	A49(DS)	A49-4	A49-3	57.20	NA	NA	NA
	05-11-2016		A49(US)			56.40			



TEACLY(S) PTE LTD
Sri Lanka
441, K.Cmt C.Perera Mawatha
Tel: +94 112 444 757
Fax: +94 112 444 758
E-mail: tcsk@teacloon.com

Table of Contents

Project Name :	Contract Number :	Date :	DVD No :	Pumping Station :
A49-4-A49-2~Olcott_MW(4	ICB/WORKS/02/2012	02-11-2016	021116	CS-3 PS



TEACLY(S) PTE LTD
Sri Lanka
441, K.Cmt C.Perera Mawatha
Tel: +94 112 444 757
Fax: +94 112 444 758
E-mail: tcsk@teacloon.com

Defect Grade Description / Inspection: Sewer ID A49 (11630)

Project Name :	Contract Number :	Date :	Pumping Station :
A49-4-A49-2~Olcott_MW(4TH Cross	ICB/WORKS/02/2012	02-11-2016	CS-3 PS

1: Brick: No Structural Defects
Pipe: No Structural Defects

Acceptable Structural Condition

2: Brick: Minor cracking, Surface mortar loss, Spalling slight, wear slight
Pipe: Circumfrential crack, Moderate joint defects, Spalling slight, Wear slight

Minor collapse risk in short term but potential for further deterioration

3: Brick: Total mortorloss without other defects, single brick displaced, Deformation up to 5%, Spalling medium, Wear medium
Pipe: Fractures with deformation up tp 5%, Longitudinal cracking or mulitipe cracking, Minor loss of level, More severe joint defects, Spalling medium, Wear medium

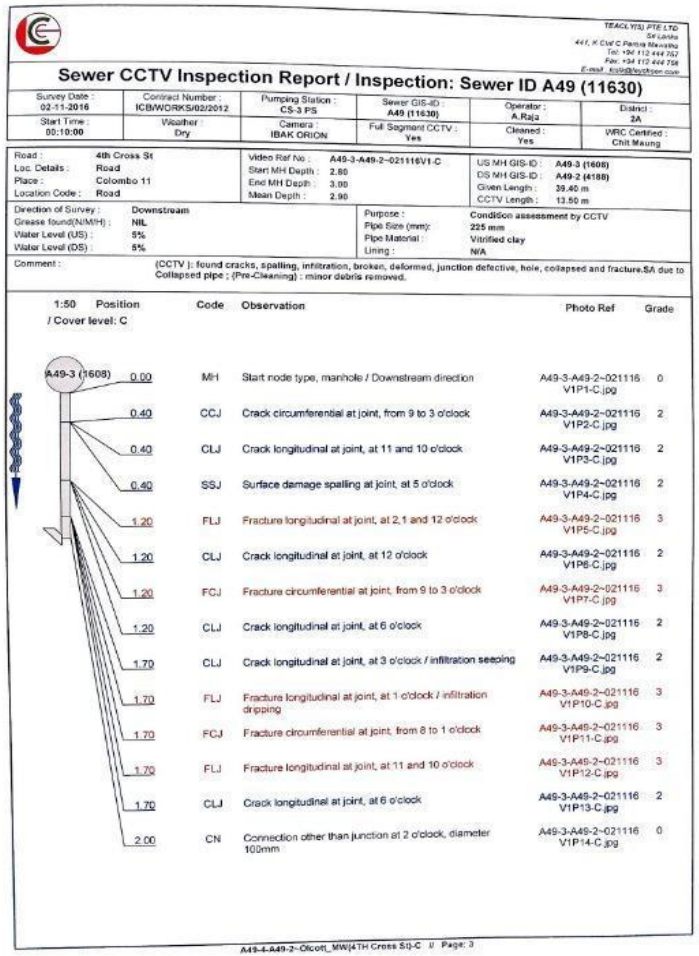
! Collapse unlikely in near future but future deterioration likely !

4: Brick: Total mortorloss with deformation greater than 10%, Deformation up to 10% and fractured, Displaced/hanging brickwork, Small number of missing bricks
Pipe: Broken, Deformation up to 10% and broken,, Fractured with deformation 5 - 10%, Multiple fractures, Serious loss of level, spalling large, wear large

!! Collapse likely in foreseeable future !!

5: Brick: Already Collapsed, Missing invert, Deformation over 10% and fractured, Displaced/hanging brickwork and deformation over 10%, Extensive missing bricks
Pipe: Already collapsed, Deformation over 10% and broken, Extensive areas of fabric missing, Fractured with deformation over 10%

!!! Collapsed or collapse imminent !!!



TEACLYSI PTE LTD
Sri Lanka
441, K Col C Perera Mawatha
Tel: +94 112 444 757
Fax: +94 112 444 758
E-mail: icdb@sltnet.com

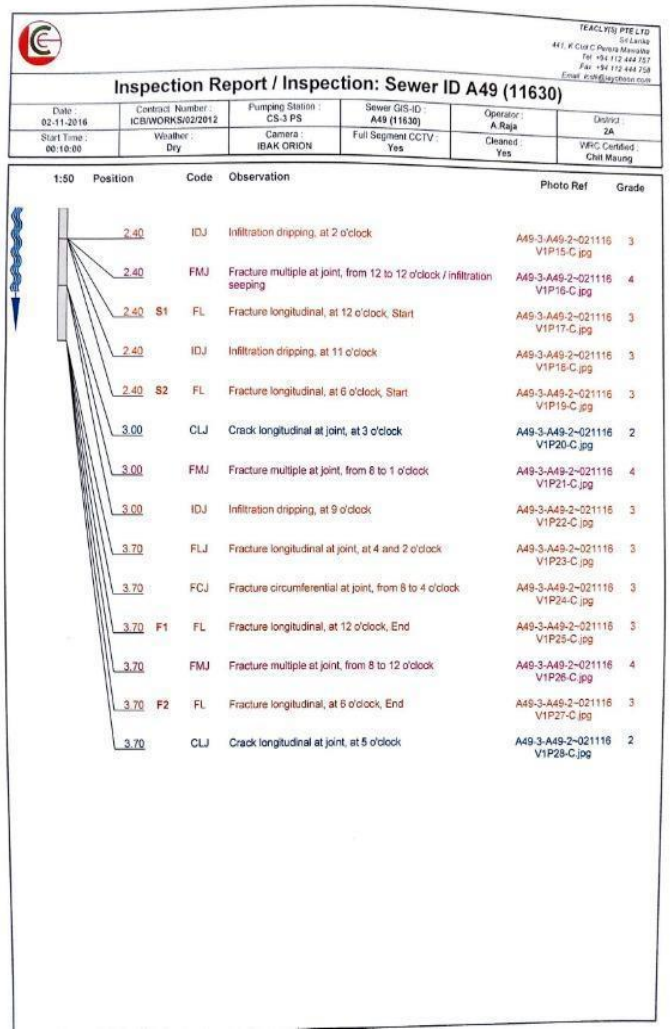
Sewer CCTV Inspection Report / Inspection: Sewer ID A49 (11630)

Survey Date : 02-11-2016	Contract Number : ICB/WORKS/02/2012	Pumping Station : CS-3 PS	Sewer GIS-ID : A49 (11630)	Operator : A.Raja	District : 2A
Start Time : 00:10:00	Weather : Dry	Camera : IBAK ORION	Full Segment CCTV : Yes	Cleaned : Yes	WRC Certified : Chit Maung

Road :	4th Cross St	Video Ref No :	A49-3-A49-2~021116V1-C	US MH GIS-ID :	A49-3 (1608)
Loc Details :	Road	Start MH Depth :	2.80	DS MH GIS-ID :	A49-2 (4188)
Place :	Colombo 11	End MH Depth :	3.00	Given Length :	39.40 m
Location Code :	Road	Mean Depth :	2.90	CCTV Length :	13.50 m
Direction of Survey :	Downstream			Purpose :	Condition assessment by CCTV
Grease found(N/M/H) :	NIL			Pipe Size (mm):	225 mm
Water Level (US) :	5%			Pipe Material :	Vitrified clay
Water Level (DS) :	5%			Lining :	N/A

Comment : (CCTV): found cracks, spalling, infiltration, broken, deformed, junction defective, hole, collapsed and fracture.SA due to Collapsed pipe ; (Pre-Cleaning) : minor debris removed.

1:50 Position / Cover level: C		Code	Observation	Photo Ref	Grade
A49-3 (1608)	0.00	MH	Start node type, manhole / Downstream direction	A49-3-A49-2~021116 V1P1-C.jpg	0
	0.40	CCJ	Crack circumferential at joint, from 9 to 3 o'clock	A49-3-A49-2~021116 V1P2-C.jpg	2
	0.40	CLJ	Crack longitudinal at joint, at 11 and 10 o'clock	A49-3-A49-2~021116 V1P3-C.jpg	2
	0.40	SSJ	Surface damage spalling at joint, at 5 o'clock	A49-3-A49-2~021116 V1P4-C.jpg	2
	1.20	FLJ	Fracture longitudinal at joint, at 2,1 and 12 o'clock	A49-3-A49-2~021116 V1P5-C.jpg	3
	1.20	CLJ	Crack longitudinal at joint, at 12 o'clock	A49-3-A49-2~021116 V1P6-C.jpg	2
	1.20	FCJ	Fracture circumferential at joint, from 9 to 3 o'clock	A49-3-A49-2~021116 V1P7-C.jpg	3
	1.20	CLJ	Crack longitudinal at joint, at 6 o'clock	A49-3-A49-2~021116 V1P8-C.jpg	2
	1.70	CLJ	Crack longitudinal at joint, at 3 o'clock / infiltration seeping	A49-3-A49-2~021116 V1P9-C.jpg	2
	1.70	FLJ	Fracture longitudinal at joint, at 1 o'clock / infiltration dripping	A49-3-A49-2~021116 V1P10-C.jpg	3
	1.70	FCJ	Fracture circumferential at joint, from 8 to 1 o'clock	A49-3-A49-2~021116 V1P11-C.jpg	3
	1.70	FLJ	Fracture longitudinal at joint, at 11 and 10 o'clock	A49-3-A49-2~021116 V1P12-C.jpg	3
	1.70	CLJ	Crack longitudinal at joint, at 6 o'clock	A49-3-A49-2~021116 V1P13-C.jpg	2
	2.00	CN	Connection other than junction at 2 o'clock, diameter 100mm	A49-3-A49-2~021116 V1P14-C.jpg	0

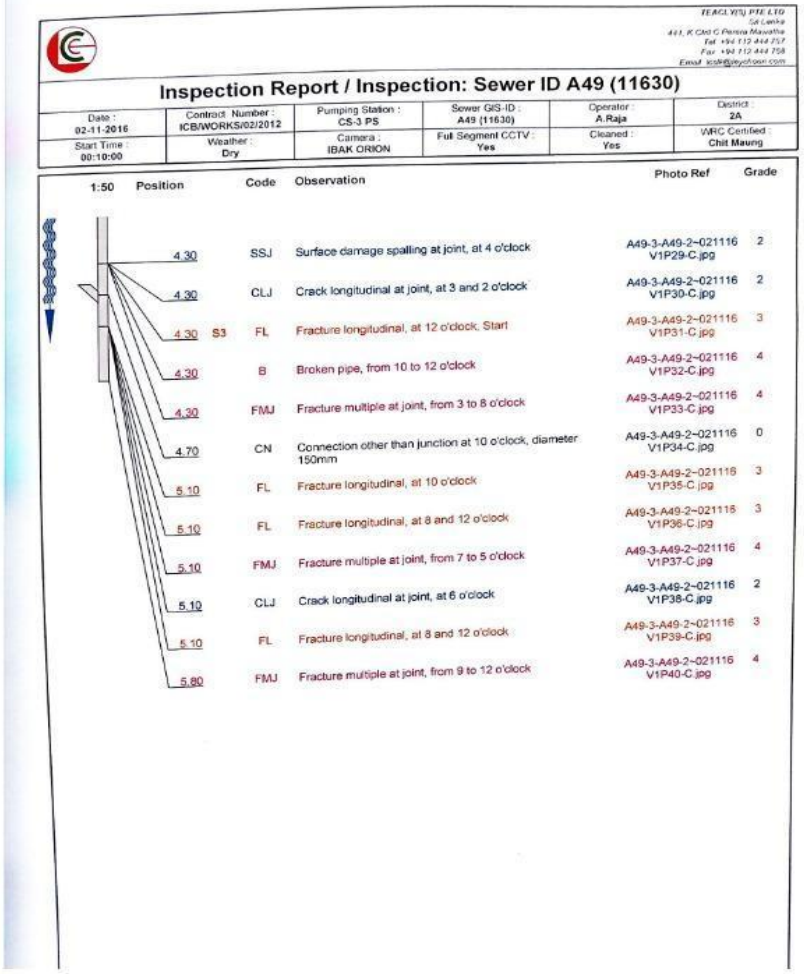


TEACLYSI PTE LTD
Sri Lanka
441, K Col C Perera Mawatha
Tel: +94 112 444 757
Fax: +94 112 444 758
E-mail: icdb@sltnet.com

Inspection Report / Inspection: Sewer ID A49 (11630)

Date : 02-11-2016	Contract Number : ICB/WORKS/02/2012	Pumping Station : CS-3 PS	Sewer GIS-ID : A49 (11630)	Operator : A.Raja	District : 2A
Start Time : 00:10:00	Weather : Dry	Camera : IBAK ORION	Full Segment CCTV : Yes	Cleaned : Yes	WRC Certified : Chit Maung

1:50 Position		Code	Observation	Photo Ref	Grade
	2.40	IDJ	Infiltration dripping, at 2 o'clock	A49-3-A49-2~021116 V1P15-C.jpg	3
	2.40	FMJ	Fracture multiple at joint, from 12 to 12 o'clock / infiltration seeping	A49-3-A49-2~021116 V1P16-C.jpg	4
	2.40 S1	FL	Fracture longitudinal, at 12 o'clock, Start	A49-3-A49-2~021116 V1P17-C.jpg	3
	2.40	IDJ	Infiltration dripping, at 11 o'clock	A49-3-A49-2~021116 V1P18-C.jpg	3
	2.40 S2	FL	Fracture longitudinal, at 6 o'clock, Start	A49-3-A49-2~021116 V1P19-C.jpg	3
	3.00	CLJ	Crack longitudinal at joint, at 3 o'clock	A49-3-A49-2~021116 V1P20-C.jpg	2
	3.00	FMJ	Fracture multiple at joint, from 8 to 1 o'clock	A49-3-A49-2~021116 V1P21-C.jpg	4
	3.00	IDJ	Infiltration dripping, at 9 o'clock	A49-3-A49-2~021116 V1P22-C.jpg	3
	3.70	FLJ	Fracture longitudinal at joint, at 4 and 2 o'clock	A49-3-A49-2~021116 V1P23-C.jpg	3
	3.70	FCJ	Fracture circumferential at joint, from 8 to 4 o'clock	A49-3-A49-2~021116 V1P24-C.jpg	3
	3.70 F1	FL	Fracture longitudinal, at 12 o'clock, End	A49-3-A49-2~021116 V1P25-C.jpg	3
	3.70	FMJ	Fracture multiple at joint, from 8 to 12 o'clock	A49-3-A49-2~021116 V1P26-C.jpg	4
	3.70 F2	FL	Fracture longitudinal, at 6 o'clock, End	A49-3-A49-2~021116 V1P27-C.jpg	3
	3.70	CLJ	Crack longitudinal at joint, at 5 o'clock	A49-3-A49-2~021116 V1P28-C.jpg	2

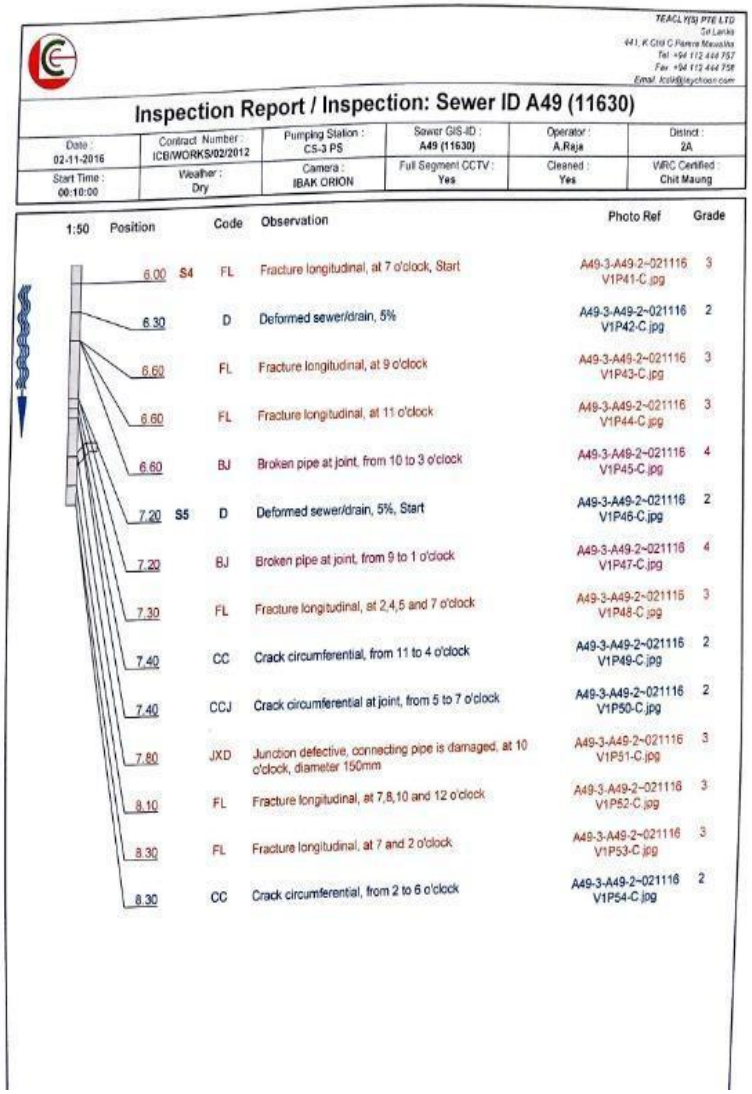


TEACLY(S) PTE LTD
Sri Lanka
441, K Gnl C Perera Mawatha
Tel +94 112 444 757
Fax +94 112 444 758
Email icdl@leychoon.com

Inspection Report / Inspection: Sewer ID A49 (11630)

Date :	Contract Number :	Pumping Station :	Sewer GIS-ID :	Operator :	District :
02-11-2016	ICB/WORKS/02/2012	CS-3 PS	A49 (11630)	A.Raja	2A
Start Time :	**Weather :**	**Camera :**	**Full Segment CCTV :**	**Cleaned :**	**WRC Certified :**
00:10:00	Dry	IBAK ORION	Yes	Yes	Chit Maung

1:50 Position		Code	Observation	Photo Ref	Grade
4.30		SSJ	Surface damage spalling at joint, at 4 o'clock	A49-3-A49-2~021116 V1P29-C.jpg	2
4.30		CLJ	Crack longitudinal at joint, at 3 and 2 o'clock	A49-3-A49-2~021116 V1P30-C.jpg	2
4.30	S3	FL	Fracture longitudinal, at 12 o'clock, Start	A49-3-A49-2~021116 V1P31-C.jpg	3
4.30		B	Broken pipe, from 10 to 12 o'clock	A49-3-A49-2~021116 V1P32-C.jpg	4
4.30		FMJ	Fracture multiple at joint, from 3 to 8 o'clock	A49-3-A49-2~021116 V1P33-C.jpg	4
4.70		CN	Connection other than junction at 10 o'clock, diameter 150mm	A49-3-A49-2~021116 V1P34-C.jpg	0
5.10		FL	Fracture longitudinal, at 10 o'clock	A49-3-A49-2~021116 V1P35-C.jpg	3
5.10		FL	Fracture longitudinal, at 8 and 12 o'clock	A49-3-A49-2~021116 V1P36-C.jpg	3
5.10		FMJ	Fracture multiple at joint, from 7 to 5 o'clock	A49-3-A49-2~021116 V1P37-C.jpg	4
5.10		CLJ	Crack longitudinal at joint, at 6 o'clock	A49-3-A49-2~021116 V1P38-C.jpg	2
5.10		FL	Fracture longitudinal, at 8 and 12 o'clock	A49-3-A49-2~021116 V1P39-C.jpg	3
5.80		FMJ	Fracture multiple at joint, from 9 to 12 o'clock	A49-3-A49-2~021116 V1P40-C.jpg	4



TEACLY(S) PTE LTD
Sri Lanka
441, K Gnl C Perera Mawatha
Tel +94 112 444 757
Fax +94 112 444 758
Email icdl@leychoon.com

Inspection Report / Inspection: Sewer ID A49 (11630)

Date :	Contract Number :	Pumping Station :	Sewer GIS-ID :	Operator :	District :
02-11-2016	ICB/WORKS/02/2012	CS-3 PS	A49 (11630)	A.Raja	2A
Start Time :	**Weather :**	**Camera :**	**Full Segment CCTV :**	**Cleaned :**	**WRC Certified :**
00:10:00	Dry	IBAK ORION	Yes	Yes	Chit Maung

1:50 Position		Code	Observation	Photo Ref	Grade
6.00	S4	FL	Fracture longitudinal, at 7 o'clock, Start	A49-3-A49-2~021116 V1P41-C.jpg	3
6.30		D	Deformed sewer/drain, 5%	A49-3-A49-2~021116 V1P42-C.jpg	2
6.60		FL	Fracture longitudinal, at 9 o'clock	A49-3-A49-2~021116 V1P43-C.jpg	3
6.60		FL	Fracture longitudinal, at 11 o'clock	A49-3-A49-2~021116 V1P44-C.jpg	3
6.60		BJ	Broken pipe at joint, from 10 to 3 o'clock	A49-3-A49-2~021116 V1P45-C.jpg	4
7.20	S5	D	Deformed sewer/drain, 5%, Start	A49-3-A49-2~021116 V1P46-C.jpg	2
7.20		BJ	Broken pipe at joint, from 9 to 1 o'clock	A49-3-A49-2~021116 V1P47-C.jpg	4
7.30		FL	Fracture longitudinal, at 2,4,5 and 7 o'clock	A49-3-A49-2~021116 V1P48-C.jpg	3
7.40		CC	Crack circumferential, from 11 to 4 o'clock	A49-3-A49-2~021116 V1P49-C.jpg	2
7.40		CCJ	Crack circumferential at joint, from 5 to 7 o'clock	A49-3-A49-2~021116 V1P50-C.jpg	2
7.80		JXD	Junction defective, connecting pipe is damaged, at 10 o'clock, diameter 150mm	A49-3-A49-2~021116 V1P51-C.jpg	3
8.10		FL	Fracture longitudinal, at 7,8,10 and 12 o'clock	A49-3-A49-2~021116 V1P52-C.jpg	3
8.30		FL	Fracture longitudinal, at 7 and 2 o'clock	A49-3-A49-2~021116 V1P53-C.jpg	3
8.30		CC	Crack circumferential, from 2 to 6 o'clock	A49-3-A49-2~021116 V1P54-C.jpg	2

TEAM LYNX PTE LTD
Sri Lanka
441, K Old C Perera Mawatha
Tel: +94 112 444 757
Fax: +94 112 444 758
Email: tcsl@teamlynx.com

Inspection Report / Inspection: Sewer ID A49 (11630)

Date :	Contract Number :	Pumping Station :	Sewer GIS-ID :	Operator :	District :
02-11-2016	ICB/WORKS/02/2012	CS-3 PS	A49 (11630)	A.Raja	2A
Start Time :	**Weather :**	**Camera :**	**Full Segment CCTV :**	**Cleaned :**	**WRC Certified :**
00:10:00	Dry	IBAK ORION	Yes	Yes	Chit Maung

1:50 Position		Code	Observation	Photo Ref	Grade
8.50		JN	Junction, at 2 o'clock, diameter 150mm	A49-3-A49-2~021116 V1P55-C.jpg	0
8.50		REM	General remark / Close view of junction	A49-3-A49-2~021116 V1P56-C.jpg	0
8.50	E3	FL	Fracture longitudinal, at 12 o'clock, End	A49-3-A49-2~021116 V1P57-C.jpg	3
8.50	E4	FL	Fracture longitudinal, at 7 o'clock, End	A49-3-A49-2~021116 V1P58-C.jpg	3
8.60	E5	D	Deformed sewer/drain, 5%, End	A49-3-A49-2~021116 V1P59-C.jpg	2
8.80		FL	Fracture longitudinal, at 8 and 10 o'clock	A49-3-A49-2~021116 V1P60-C.jpg	3
8.90		BJ	Broken pipe at joint, from 11 to 2 o'clock	A49-3-A49-2~021116 V1P61-C.jpg	4
8.90	S6	FL	Fracture longitudinal, at 12.9 and 6 o'clock, Start	A49-3-A49-2~021116 V1P62-C.jpg	3
8.90		FC	Fracture circumferential, from 3 to 5 o'clock	A49-3-A49-2~021116 V1P63-C.jpg	3
9.40	S7	D	Deformed sewer/drain, 5%, Start	A49-3-A49-2~021116 V1P64-C.jpg	2
9.70		FC	Fracture circumferential, from 6 to 12 o'clock	A49-3-A49-2~021116 V1P65-C.jpg	3
10.00		CL	Crack longitudinal, at 3 o'clock / infiltration seeping	A49-3-A49-2~021116 V1P66-C.jpg	2
10.80	E6	FL	Fracture longitudinal, at 12 o'clock, End	A49-3-A49-2~021116 V1P67-C.jpg	3
11.00		CLJ	Crack longitudinal at joint, at 4 and 2 o'clock	A49-3-A49-2~021116 V1P68-C.jpg	2