

Abstract of thesis presented to the senate of Infrastructure University Kuala Lumpur in partial fulfillment of the requirement for the degree of Master of Science in Water Resources

THE CAPACITY AND PERFORMANCE EVALUATION OF SANITARY SEWER SYSTEM USING (SSOAP) TOOLBOX IN GEORGETOWN, PENANG

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March 2017

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The town of Georgetown, Penang wastewater flows routinely exceeds the recorded water consumption values, which is a preliminary indication of the potential ground water infiltration and/or storm water inflow. The purpose of this research is to investigate and assess the integrity of the sanitary sewer collection system as means of identify The Capacity and Performance of existing sewer lines of for Hutton lane NPS (PEG 125), Macalister Lane NPS (PEG 127) and Medan Lim Cheng Teik NPS (PEG 129).

The research review the methodology used in the sanitary sewer collection system evaluation, the wastewater flow records provided from 9 sampling stations namely MH 1A and MH 19/3 for Hutton Lane (PEG 125); MH G12 and G14 for Macalister Lane NPS (PEG 127) and MH A6, MH CA4, MH D2, MH E2, MH F3 for Medan Lim Cheng Teik NPS (PEG 129). The date sampling period is started from July 2008 continued till May 2009 with date measurement gaps due to site constrains.

After conducting analysis, it is clear that, that MHC4A in dry weather flow has the highest maximum flow that is 3.6292 m³/s during the weekday and 3.6528 m³/s during the weekend, while in wet weather flow, MHC4A recorded flow of 7.789 m³/s; almost double the flow during dry season. It is also evident that there is pig

difference between dry weather flow and maximum recorded flow at the respective manholes, whereas the increasing of more than 100% during the wet weather flow within All manholes, since MHC4A recorded the highest maximum flow during wet weather flow. With respect to the results of capacity analyzes, only 2 out of 9 sewer sizing showed the acceptable design during dry weather flow.

ACKNOWLEDGEMENT

I would first like to thank my advisor **Assoc. Prof. Dr Manal Mohsen Abood** (Director Center for Postgraduate Studies). She was always open whenever I ran into a trouble spot or had a question about my thesis or writing. She consistently allowed this research to be my own work, but steered me in the right the direction whenever she thought I needed it.

Also would like to thank my co supervisor, **Dr. Mohd Sofiyan Sulaiman** of Technology Infrastructure at Engineering Faculty. Without his effort this thesis would not have been achieved. And I am gratefully indebted to him for his very valuable comments on this thesis, not only he helped me on my thesis, but also encouraged and trained me to be a good researcher.

Finally, I must express my very profound gratitude to my mother, sisters and brothers for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

APPROVAL

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I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at infrastructure University Kuala Lumpur or at any other institution.

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LIST OF ABBREVIATIONS

| Abbreviation | Description |
|--------------|---|
| BWF | Base Wastewater Flow |
| CMOM | Capacity, Management, Operation and Maintenance |
| CSO | Combined Sewer Overflow |
| DMT | Database Management Tool |
| DWF | Dry-Weather Flow |
| FDD | Footing Drain Disconnection |
| GIS | Geographical Information System |
| GW | Groundwater Infiltration |
| HGL | Hydraulic Grade Line |
| I/I | Infiltration and Inflow |
| MOM | Management, Operation and Maintenance |
| OF | Overflow |
| O&M | Operations and Maintenance |
| PSO | Pump Station Overflow |
| RDI | Rainfall-derived Infiltration |
| RDII | Rainfall-derived Infiltration and Inflow |
| R,T,K | Method for RDII prediction |
| R-value | Fraction of rainfall volume entering the sewer system |
| SSD | SSOAP System Database |
| SSES | Sewer System Evaluation Survey |
| SSOAP | Sanitary Sewer Overflow Analysis and Planning |
| SSO | Sanitary Sewer Overflow |
| SUH | Synthetic Unit Hydrograph |
| SWMM | Storm Water Management Model |
| SWMM5 | Storm Water Management Model Version 5 |
| UH | Unit Hydrograph |
| WERF | Water Environment Research Foundation |
| WWF | Wet-Weather Flow |
| WWTP | Wastewater Treatment Plant |

CHAPTER 1

INTRODUCTION

1.1 Research Background

Malaysia is a country that has abundant rainfall with varied seasonal rainfall (Sahabuddin & Longo, 2015). During the monsoon seasons, the exposed area of Peninsular Malaysia will experience heavy rain. Heavy rainfall will increase the probability of rainfall derived infiltration and inflow (RDII) into the sewer pipes accelerating sanitary sewer overflows (SSO) in the sewerage systems. Therefore, a good design and maintenance at sewerage systems is important to assist the collection and transportation of wastewater from residential and industrial areas to wastewater treatment plant.

Malaysia practices the separate sewerage system where the storm water drainage is separate from the sanitary sewerage system. This practice was formulated to ensure the safety of residences and the environment. Besides, the problem of combine sewer overflow (CSOs) can be avoided as what always happened in the combined sewer system. Nevertheless, some problems such as leakage of sewer pipe, joints and defect to manhole covers allows ground water to penetrate into the sewer or unwanted street water inflows into the sewer pipe. This phenomenon will result in excess sewage flow; hence causing poor performance of sewer system. The increased flow due to infiltration/inflow consume the capacity of the sewer pipe, damaging the environment and increasing the cost of operation at treatment plant.

Sanitary sewer lines serve a vital role in the health and safety of the public. Beneath our streets exists a network of sanitary sewer lines that are essential in the efficient conveyance of wastewater. These systems are designed to convey the wastewater from the residential area or factory to the wastewater treatment plants. Typical sources of wastewater include toilets, sinks and showers, as well as industrial and commercial wastes. Without the existence of these sewage collection systems, the safety aspects of community are compromised due to pathogens and bacteria. This

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