SIMULATION OF WATER DISTRIBUTION NETWORK WITH AN INTERMITTENT WATER SUPPLY AND ANALYSING AVAILABILITY OF RESIDUAL CHLORINE

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Thesis/Dissertation submitted in partial fulfilment of the requirements for the degree

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DECLARATION

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement 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 acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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K.P.C Chathurika

The above candidate has carried out research for the PhD/MPhil/Masters thesis/dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

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Signature of the Supervisor: Date:

Name of Supervisor: Professor. Manatunge J.M.A

Signature of the Supervisor: Date:

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ABSTRACT

The intermittent nature of water supply in certain regions presents challenges in maintaining water quality and ensuring the appropriate level of disinfection. To address this issue, a simulation approach is utilized to model the dynamics of water flow, chlorine decay, and demand patterns within the distribution network. In modelling of intermittent water supply schemes (IWSSs) it is essential to consider partial/no flow condition and high water demand during initial filling stage to fill consumer storage tanks. The modified pressure dependent analysis was used to model the WDN. Through the development of a comprehensive simulation model, this study present variation of residual chlorine level within an IWS. By considering factors such as water demand variations, network topology, availability of storage facilities, the proposed simulation model provides a systematic framework for hydraulic modelling of an intermittent water supply systems. Modelling was carried out using the Bentley WaterGEMS software with the aid of ArcGIS platform and Ahangama water supply scheme in Sri Lanka where, intermittent water supply provided in alternate days used as the area for implementing the proposed methodology. The findings of this study are expected to contribute to the enhancement of water quality and quantity management practices in intermittent supply contexts, ultimately leading to improved public health outcomes and sustainable water distribution network operations.

Keywords: water distribution networks, chlorine injection, intermittent water supply, water quality management, WaterGEMS

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ABBREVIATIONS

ADD	Average Daily Demand
AHF	Average Hourly Flow
AHFR	Average Hourly Flow Rate
CWS	Continuous Water Supply
DEM	Digital Elevation Model
DI	Ductile Iron
dia.	Diameter
EPS	Extended Period Simulation
GIS	Geographic Information Systems
GR	Ground Reservoir
HDPE	High Density Polyethylene
HPC	Heterotrophic Plate Count
IWS	Intermittent Water Supply
IWSS	Intermittent Water Supply System
MSL	Mean Sea Level
N	North
NRW	Non-Revenue Water
NWSDB	National Water Supply & Drainage Board
PDNA	Pressure Deficient Network Algorithm
PVC	Polyvinyl Chloride

RCL	Residual Chlorine Level
WDN	Water Distribution Network
WSS	Water Supply Scheme
WTP	Water Treatment Plant