# MAXIMIZING ECONOMIC BENEFITS OF WATER TRANSMISSION SCHEMES BY OPTIMIZING PUMPING OPERATIONS

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Sri Lanka

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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).

Signature: Date: 01/08/2024

T. A. D De Silva

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:

# DEDICATION

Write your dedication here (if any)

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# ABSTRACT

Water transmission systems play a crucial role in ensuring efficient water distribution and management, with pumping systems constituting a significant portion of operational and maintenance costs. Efficient design and optimization of water transmission systems are paramount for sustainable water supply management. This abstract explores the complexities and challenges involved in the design phase of water treatment projects, emphasizing the importance of selecting an appropriate design horizon to align with project implementation stages.

This study presents a methodological approach for optimizing water transmission networks through cost-benefit analysis, aimed at reducing capital and operational expenses while enhancing system performance and it involves considering various parameters such as intake point locations, elevation differences, flow rates, transmission line lengths, and pump efficiencies. Specific speed calculations of pumps play a crucial role in determining system performance, with Variable Frequency Drive (VFD) utilization significantly impacting raw water transmission lines, particularly in regions with elevation discrepancies and seasonal variations in water extraction sources. According to the results output of the research VFD utilization must be carefully evaluated to ensure sustainable water supply management because according to the created model for treated water distribution line using VFD’s are not cost effective.

The model aims to select the most suitable system configuration by considering capital cost savings, energy optimization, and financial viability. Inputs such as capital cost estimates, operational parameters, and financial considerations are utilized to assess different scenarios and identify the optimum values of system components.

In conclusion, optimizing transmission systems requires a comprehensive understanding of the interplay between various parameters and careful consideration of project implementation stages. By addressing these complexities, water treatment projects can achieve optimal performance, minimize costs, and ensure long-term sustainability in water supply management.

**Keywords:** *optimization, cost-benefit analysis, water transmission network, pumping system, Variable Frequency Drives (VFDs), sustainability*.

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# LIST OF ABBREVIATIONS

| Abbreviation | | Description |
|---|---|---|
| NWSDB | – | National Water Supply and Drainage Board |
| WSS | – | Water Supply System |
| WSP | – | Water Supply Project |
| VFD | – | Variable Frequency Drive |
| SLR | – | Sri Lankan Rupees |
| USD | – | United State Dollars |
| O&M | – | Operation and Maintenance |
| GOSL | – | Government of Sri Lanka |
| ROI | – | Return on Investment |
| IRR | – | Internal Rate of Return |
| NPV | – | Net Present Value |

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