

ABSTRAK

Perumdam Bayuangga Kota Probolinggo menghadapi berbagai permasalahan dalam sistem distribusi air minum, seperti tekanan air yang tidak merata, kebocoran jaringan, dan kualitas air yang terpengaruh oleh kondisi lingkungan sekitar sumber mata air Ronggojalu. Selain itu, efisiensi pengoperasian pompa belum optimal dan tingkat kehilangan air (NRW) masih tinggi. Penelitian ini bertujuan untuk mengevaluasi kondisi eksisting sistem distribusi air minum, menganalisis kualitas air dan operasional pompa, merancang strategi optimalisasi tekanan jaringan berbasis simulasi hidraulik dan analisis spasial, serta menyusun strategi penurunan kehilangan air untuk Perumdam Kota Probolinggo.

Penelitian ini menggunakan data sekunder dari Perumdam Bayuangga yang mencakup data tekanan air, kualitas air, peta jaringan distribusi, data operasional pompa, serta informasi kebocoran. Analisis spasial dilakukan menggunakan perangkat lunak QGIS untuk menentukan elevasi titik-titik *node* berdasarkan data Digital Elevation Model (DEM). Simulasi hidraulik pada kondisi eksisting maupun skenario optimasi dilakukan dengan menggunakan perangkat lunak EPANET. Evaluasi kualitas air didasarkan pada hasil uji laboratorium yang tersedia, sementara penyusunan strategi penurunan kehilangan air dilakukan melalui studi pustaka terhadap berbagai referensi ilmiah dan jurnal terkait.

Hasil simulasi menunjukkan adanya tekanan negatif di beberapa titik jaringan, yang menyebabkan gangguan distribusi. Strategi optimasi seperti penyesuaian diameter pipa, penyesuaian pompa, dan manajemen *valve* mampu meningkatkan tekanan ke arah yang lebih stabil dan sesuai standar teknis. Namun, peningkatan efisiensi hidraulik ini disertai dengan kenaikan biaya operasional pada pompa yaitu sebesar Rp 458.873,10 per bulan. Namun, peningkatan ini sebanding dengan peningkatan efisiensi distribusi dan pemerataan tekanan air, sehingga dianggap layak secara teknis dan ekonomis. Strategi yang disarankan untuk mengurangi kehilangan air (NRW) meliputi pembentukan *District Meter Area (DMA)*, manajemen tekanan, *active leakage control*, pemanfaatan teknologi seperti SCADA dan sensor tekanan, serta perbaikan sistem administrasi meterisasi dan sambungan ilegal.

ABSTRACT

Perumdam Bayuangga Probolinggo City faces various problems in the drinking water distribution system, such as uneven water pressure, network leaks, and water quality that is affected by environmental conditions around the Ronggojalu spring source. In addition, the pump's operating efficiency is not optimal and the water loss rate (NRW) is still high. This study aims to evaluate the existing condition of the drinking water distribution system, analyze water quality and pump operations, design a network pressure optimization strategy based on hydraulic simulation and spatial analysis, and develop a water loss reduction strategy for Perumdam Probolinggo City.

This study uses secondary data from Perumdam Bayuangga which includes water pressure data, water quality, distribution network maps, pump operational data, and leak information. Spatial analysis was performed using QGIS software to determine the elevation of node points based on Digital Elevation Model (DEM) data. Hydraulic simulation under existing conditions and optimization scenarios is carried out using EPANET software. The evaluation of water quality is based on the results of available laboratory tests, while the preparation of water loss reduction strategies is carried out through literature studies of various scientific references and related journals.

The simulation results show the presence of negative pressure at several points of the network, which causes distribution disruptions. Optimization strategies such as pipe diameter adjustment, pump adjustment, and valve management are able to increase pressure in a more stable direction and in accordance with technical standards. However, this increase in hydraulic efficiency is accompanied by an increase in operational costs at the pump, which is Rp 458,873.10 per month. However, this increase is proportional to the improvement in the efficiency of water pressure distribution and equalization, so it is considered technically and economically feasible. Suggested strategies to reduce water loss (NRW) include the establishment of District Meter Areas (DMAs), pressure management, active leakage control, the use of technologies such as SCADA and pressure sensors, as well as improvements to metering administration systems and illegal connections.