INTISARI

Waduk Jlantah merupakan Proyek Strategis Nasional yang dibangun untuk memenuhi kebutuhan air pada lahan irigasi potensial seluas 1.587,5 ha dan kebutuhan air baku sebesar 150 l/s di wilayah DAS Jlantah yang kritis dan rawan kekeringan. Penelitian ini bertujuan untuk mendapatkan pedoman operasi waduk yang optimal melalui proses optimasi *release* air dan menguji penerapannya secara komprehensif. Metode optimasi yang diterapkan menggunakan algoritma Program Linier dengan fungsi tujuan memaksimalkan intensitas tanam tahunan untuk pola tanam Padi-Padi-Palawija di Daerah Irigasi Jlantah. Oleh karena tidak tersedianya data debit terukur di DAS Jlantah, maka debit aliran sebagai *inflow* waduk historis diperkirakan menggunakan simulasi alihragam hujan-aliran metode F.J. Mock. Hasil optimasi menunjukkan intensitas tanam tahunan dapat mencapai rentang 228,7% hingga 268,4% untuk debit *inflow* pada kondisi aliran tahun kering hingga tahun basah, dengan reliabilitas layanan mencapai 100%. Keberhasilan penerapan pedoman operasi waduk yang telah disusun dianalisis dengan pendekatan stokastik implisit. Pendekatan ini menguji hasil simulasi operasi waduk selama lima tahun, dimana *release* setiap periode operasi ditetapkan dengan metode *Standard Operating Rules* (SOR). Simulasi operasi waduk dilakukan untuk 100 seri debit *inflow* sintetis yang dihitung menggunakan model Thomas-Fiering. Kinerja operasi waduk dievaluasi menggunakan indikator *reliability*, *resiliency*, dan *vulnerability* (RRV). Hasil pengujian menunjukkan bahwa sistem operasi Waduk Jlantah memiliki tingkat *reliability* dan *resiliency* yang sangat tinggi pada seluruh periode operasi. Hal penting yang perlu diperhatikan adalah pada periode awal operasi waduk (November–Maret), dimana *vulnerability* cenderung tinggi meskipun frekuensi kegagalan operasi cenderung kecil. Oleh karena itu, operasi Waduk Jlantah perlu dilakukan lebih adaptif pada periode tersebut dengan mempertimbangkan elevasi muka air waduk dan perkiraan debit *inflow*.

Kata Kunci : Optimasi Waduk, Program Linier, *Rule Curve*, Stokastik Implisit, Reliabilitas, Resiliensi, Kerentanan.

ABSTRACT

The Jlantah Reservoir is a National Strategic Project built to meet the water needs for a potential irrigation area of 1.587,471 ha and a raw water requirement of 150 l/s in the critical and drought-prone of Jlantah Watershed. This research aims to obtain optimal reservoir operation rules through the water release optimization process and assess its implementation comprehensively. The Linear Programming algorithm was applied for optimization to maximize the annual cropping intensity for the Paddy-Paddy-Secondary Crops pattern in the Jlantah Irrigation Area. Due to the unavailability of observed discharge data in the Jlantah watershed, the flow discharge as historical reservoir inflow was estimated using rainfall-runoff simulation with the F.J. Mock method. The optimization results show that the annual cropping intensity can reach a range of 228,7% to 268,4% for inflow under dry year to wet year flow conditions with service reliability reaching 100%. The effectiveness of implementing the reservoir operating rules that have been developed was analyzed using an implicit stochastic approach. This approach assessed the results of reservoir operation simulations over five years, where releases for each operating period were determined using the Standard Operating Rules (SOR) method. Reservoir operation simulations were conducted for 100 synthetic inflow discharge series generated using the Thomas-Fiering model. Reservoir operation performance was assessed using reliability, resilience, and vulnerability (RRV) indicators. The analysis revealed that the operating system of Jlantah Reservoir has a very high level of reliability and resiliency throughout the operating period. An important thing to note is in the early period of reservoir operation (November-March), where vulnerability tends to be high despite the low frequency of operational failures. Therefore, the Jlantah Reservoir needs to be operated more adaptively during this period by considering the reservoir water level and inflow forecast.

Keywords *: Reservoir Optimization, Linear Programming, Rule Curve, Implicit Stochastic, Reliability, Resiliency, Vulnerability.*