INTISARI

Danau Rawa Pening merupakan danau alami dengan luas 2.670 hektare yang menjadi hilir dari sembilan sungai di Kabupaten Semarang. Danau ini memiliki peran penting sebagai sumber air irigasi, air baku, pembangkit listrik, serta kawasan wisata. Namun, fungsi tersebut mengalami penurunan akibat tingginya laju sedimentasi yang mencapai 778,95 ton/tahun pada tahun 2024. Salah satu upaya untuk mengurangi laju sedimentasi adalah dengan membangun bangunan pengendali sedimen berupa gully plug pada parit di wilayah hulu. Gully plug berfungsi sebagai struktur pengendali erosi dan penahan sedimen agar partikel sedimen tidak langsung terbawa menuju danau.

Penelitian ini bertujuan untuk menganalisis debit banjir rancangan dan laju erosi di hulu Danau Rawa Pening, merencanakan desain dan metode pelaksanaan gully plug, menilai stabilitas struktur terhadap gaya guling dan geser, serta menyusun rencana anggaran biaya pembangunan. Metode penelitian meliputi analisis hidrologi dan erosi secara manual, perencanaan desain dan metode pelaksanaan berdasarkan hasil survei lapangan, analisis stabilitas menggunakan pendekatan manual dan simulasi Plaxis 2D, serta penyusunan RAB mengacu pada harga satuan Kabupaten Semarang.

Hasil penelitian menunjukkan bahwa debit banjir rancangan sebesar 0,141 m^3/s untuk kala ulang 5 tahun dan 0,172 m^3/s untuk kala ulang 10 tahun. Nilai rata-rata laju erosi selama periode 2015–2024 sebesar 5,012 ton/ha/tahun. Desain gully plug yang direncanakan memiliki dimensi lebar atas 5 meter, lebar bawah 4 meter, panjang 4 meter, dan tinggi 1,5 meter dengan bukaan pelimpah selebar 1 meter. Berdasarkan analisis stabilitas manual dan Plaxis 2D, struktur dinyatakan stabil karena memiliki nilai safety factor lebih dari 1,5 baik pada kondisi normal maupun banjir. Total estimasi biaya pembangunan gully plug sebesar Rp 20.400.000,00. Dengan demikian, penerapan gully plug di hulu Danau Rawa Pening dinilai efektif dalam mengendalikan erosi dan mengurangi laju sedimentasi yang masuk ke danau.

Kata kunci: *gully plug*, sedimentasi, Danau Rawa Pening.

ABSTRACT

Rawa Pening Lake is a natural lake covering an area of 2,670 hectares, located across the sub-districts of Bawen, Tuntang, Ambarawa, and Banyubiru in Semarang Regency. The lake serves important functions as a source of irrigation and raw water, hydroelectric power generation, and tourism. However, these functions have decreased due to high sedimentation rates, reaching 778.95 tons per year in 2024. One of the efforts to reduce sedimentation is through the construction of sediment control structures, such as gully plugs, in the upstream catchment areas. Gully plugs function as erosion control and sediment trapping structures that prevent soil particles from being transported directly into the lake.

This study aims to analyze the design flood discharge and erosion rate in the upstream area of Rawa Pening Lake, to design and determine the implementation method of the gully plug, to evaluate the structural stability against sliding and overturning forces, and to estimate the required construction cost. The research methods include hydrological and erosion analysis using manual calculations, design and implementation planning based on field surveys, stability analysis using both manual calculation and Plaxis 2D simulation, and cost estimation based on unit prices in Semarang Regency.

The analysis results show that the design flood discharge is 0.141 m^3/s for a 5-year return period and 0.172 m^3/s for a 10-year return period. The average erosion rate from 2015 to 2024 is 5.012 tons/ha/year. The designed gully plug has dimensions of 5 meters top width, 4 meters bottom width, 4 meters length, and 1.5 meters height, with a spillway opening of 1 meter width. Based on both manual and Plaxis 2D analyses, the structure is considered stable with a safety factor greater than 1.5 under normal and flood conditions. The total estimated construction cost of the gully plug is IDR 20,400,000. Therefore, the implementation of gully plugs in the upstream area of Rawa Pening Lake is considered effective in controlling erosion and reducing the sedimentation rate entering the lake.

Keywords: gully plug, sedimentation, Rawa Pening Lake.