

Limpasan permukaan yang tinggi menjadi indikator pencemaran *non-point source* (NPS) di perairan, sehingga kajiannya penting sebagai dasar perencanaan strategi pengendalian pencemaran. *Bioswale* merupakan salah satu *Best Management Practices* (BMPs) dengan konsep saluran drainase alami untuk mengurangi polutan NPS sebelum mencapai badan air. Penelitian ini bertujuan untuk mengkuantifikasi limpasan permukaan di DAS Progo guna menentukan wilayah prioritas penerapan *bioswale* serta menyusun perancangan teknisnya. Perancangan difokuskan pada lahan pertanian di bantaran sungai untuk memperbaiki kualitas limpasan pertanian sebelum bermuara ke Sungai Progo.

Pemodelan hujan – limpasan dilakukan dengan HEC-HMS menggunakan model *Deficit and Constant*, *Dynamic Canopy*, *Simple Surface*, *ModClark*, *Recession*, dan *Muskingum-Cunge*. Model dikalibrasi dan divalidasi dengan data debit pengukuran di Sungai Progo. Lokasi intervensi *bioswale* diprioritaskan pada Sub-DAS dengan limpasan tertinggi dan indikasi pencemaran air sungai. Tahap perancangan *bioswale* mencakup analisis lokasi intervensi, perhitungan debit banjir rancangan, perhitungan dimensi, penyusunan rencana anggaran biaya, dan gambar teknik.

Hasil pemodelan menggunakan data tahun 2024 menunjukkan Sub-DAS 8 (Kabupaten Magelang) dan Sub-DAS 6 (Kabupaten Temanggung, Kabupaten Magelang, dan Kota Magelang) menghasilkan limpasan tertinggi akibat curah hujan dan luas lahan kedap air. Lokasi intervensi difokuskan di Sub-DAS 6, dekat inlet Bendung Bantar yang terintegrasi dengan jaringan irigasi dan dilengkapi alat pemantau kualitas air otomatis (ONLIMO). *Bioswale* dirancang untuk mengolah limpasan dari lahan pertanian seluas 4,3 ha dengan dimensi panjang 30 m, lebar permukaan 2 m, lebar dasar 0,6 m, dan kedalaman total 1,55 m. Komponen *bioswale* meliputi tanaman *Vetiveria zizanioides*, *check dam*, lapisan filter, lapisan permeabel, lapisan drainase, pipa perforasi, dan pelindung outlet. *Bioswale* rancangan diperkirakan mampu menurunkan potensi beban pencemar TN dari 8,6 menjadi 3,2 kg/ha/musim tanam, TP dari 4,3 menjadi 0,1 kg/ha/musim tanam, serta TSS dari 0,2 menjadi 0,0002 kg/ha/musim tanam. Penelitian ini menunjukkan bahwa pemodelan hujan-limpasan menggunakan HEC-HMS dapat menjadi dasar penting dalam merancang *bioswale* untuk pengendalian pencemaran NPS di Sungai Progo.

Kata kunci: *Bioswale*, Pencemaran *Non-Point Source*, HEC-HMS, Limpasan Permukaan, Limpasan Pertanian

High surface runoff is an indicator of non-point source (NPS) pollution in water bodies, making its study important as a basis for planning pollution control strategies. Bioswales are one of the Best Management Practices (BMPs) with the concept of natural drainage channels to reduce NPS pollutants before they reach water bodies. This study aims to quantify surface runoff in the Progo watershed to determine priority areas for bioswale implementation and develop technical designs. The bioswale design focuses on agricultural land along the riverbanks to improve the quality of agricultural runoff before it flows into the Progo River.

Rainfall-runoff modeling was performed using HEC-HMS with the Deficit and Constant, Dynamic Canopy, Simple Surface, ModClark, Recession, and Muskingum-Cunge models. The models were calibrated and validated using discharge measurement data from the Progo River. Bioswale intervention location was prioritized in sub-watershed with the highest runoff and indication of river water pollution. The bioswale design stage included intervention location analysis, design flood discharge calculations, dimension calculations, budget planning, and technical drawings.

Modeling results using 2024 data show that Sub-DAS 8 (Magelang Regency) and Sub-DAS 6 (Temanggung Regency, Magelang Regency, and Magelang City) produce the highest runoff due to rainfall and impervious area. The intervention location is focused on Sub-DAS 6, near the Bantar Dam inlet, which is integrated with the irrigation network and equipped with automatic water quality monitoring devices (ONLIMO). The bioswale is designed to treat runoff from 4.3 ha of agricultural land with dimensions of 30 m in length, 2 m in surface width, 0.6 m in base width, and 1.55 m in total depth. The bioswale components include *Vetiveria zizanioides* plants, check dams, a filter layer, permeable layers, a drainage layer, perforated pipes, and an outlet protector. The designed bioswale is estimated to reduce the potential pollutant load of TN from 8.6 to 3.2 kg/ha/crop season, TP from 4.3 to 0.1 kg/ha/crop season, and TSS from 0.2 to 0.0002 kg/ha/crop season. This study shows that rainfall-runoff modeling using HEC-HMS can be an important basis for designing bioswales for NPS pollution control in the Progo River.

Keywords: Bioswale, Non-Point Source Pollution, HEC-HMS, Surface runoff, Agricultural Runoff