

Mitigasi bencana hidrometeorologi sangat penting untuk menjamin keselamatan infrastruktur Pembangkit Listrik Tenaga Nuklir (PLTN) selama tahap konstruksi dan operasional dari ancaman bahaya eksternal seperti bencana hidro-meteorologi. Perairan di sekitar PLTN Pantai Gosong saat ini mengalami sedimentasi akibat aktivitas antropogenik di Daerah Aliran Sungai (DAS) Raya. Sedimentasi yang tinggi dapat menyebabkan kapasitas daya tampung sungai menurun dan menyebabkan banjir. Selain itu, kualitas air di sekitar Pantai Gosong yang digunakan sebagai sumber pendingin reaktor dapat menurun akibat tingginya kandungan suspensi sehingga mempengaruhi kinerja PLTN. Kedua hal tersebut dapat mengancam keselamatan infrastruktur PLTN Pantai Gosong. Penelitian ini bertujuan menentukan model pengelolaan lahan untuk mengurangi laju sedimen yang dihasilkan di DAS Raya. Model SWAT digunakan untuk menilai hasil sedimen di DAS Raya, sementara validasi model dilakukan dengan pendekatan spasial berdasarkan bukti erosi di lapangan. Model pengelolaan lahan yang diusulkan adalah berdasarkan Sumber Hasil Sedimen, RTRW dan Kawasan Fungsi Hutan. Model yang dihasilkan menunjukkan bahwa rata-rata hasil sedimen dari masukan setiap sub-DAS di DAS Raya mencapai 162,88 ton/ha/tahun. Sumber hasil sedimen tertinggi terdistribusi di bagian hulu, khususnya sub-DAS 25 (620,80 ton/ha/tahun). Distribusi hasil sedimen tinggi diketahui pada bagian hulu hingga tengah DAS Raya, sedangkan hasil sedimen sedang terdistribusi di bagian tengah DAS dan bagian hilir DAS Raya sebagian besar berkategori hasil sedimen rendah. Variasi data hasil sedimen diketahui sangat kontras dengan simpangan baku 152,07 ton/ha/tahun. Akibat adanya nilai ekstrim terutama di bagian hulu DAS yang disebabkan faktor lingkungan dan aktivitas manusia. Skenario pengelolaan lahan berdasarkan Sumber Hasil Sedimen adalah yang paling efektif untuk menurunkan laju sedimen yang dihasilkan DAS Raya dibandingkan skenario RTRW dan Kawasan Fungsi Hutan. Dengan dilakukan pemulihan kawasan sebesar 63,28%, hasil sedimen dapat diturunkan menjadi 90,74 ton/ha/tahun. Intervensi pengelolaan lahan perlu segera dilakukan di DAS Raya, tidak hanya berkontribusi pada pemulihan fungsi ekologis tetapi juga untuk meningkatkan kualitas air sungai sebagai upaya menjamin keselamatan infrastruktur PLTN Pantai Gosong dalam mengurangi risiko bencana hidrologi.

**Kata Kunci:** mitigasi bencana hidrometeorologi, model SWAT, pengelolaan lahan, hasil sedimen, DAS Raya, tapak PLTN Pantai Gosong.

*Hydrometeorological disaster mitigation is essential to ensure the safety of Nuclear Power Plant (NPP) infrastructure during the construction and operational stages from external hazards such as hydro-meteorological disasters. The waters around the Pantai Gosong NPP are currently experiencing sedimentation due to anthropogenic activities in the Raya Watershed (DAS). High sedimentation can decrease the river's capacity and cause flooding. In addition, the quality of water around Pantai Gosong, which is used as a source of reactor coolant, can decrease due to the high suspension content, thus affecting the performance of the NPP. Both of these things can threaten the safety of the Pantai Gosong NPP infrastructure. This study aims to determine a land management model to reduce the rate of sediment yield in the Raya Watershed. The SWAT model is used to assess sediment yields in the Raya Watershed, while model validation uses a spatial approach based on evidence of erosion in the field. The proposed land management model is based on Sediment Yield Sources, Regional Spatial Planning, and Forest Function Areas. The resulting model shows that the average sediment yield from each sub-watershed input in the Raya Watershed reaches 162.88 tons/ha/year. The highest sediment yield source is distributed upstream, especially sub-watershed 25 (620.80 tons/ha/year). The distribution of high sediment yields is known in the upstream to middle parts of the Raya Watershed, while moderate sediment yields are distributed in the middle part of the watershed and the downstream part of the Raya Watershed is mostly categorized as low sediment yield. The variation in sediment yield data is very contrasting with the standard deviation of 152.07 tons/ha/year. This is due to the presence of extreme values, especially in the upstream part of the watershed, which are caused by environmental factors and human activities. The land management scenario based on Sediment Yield Sources is the most effective in reducing the sediment yield rate by the Raya Watershed compared to the Regional Spatial Planning and Forest Function Area scenarios. By restoring the area by 63.28%, sediment yields can be reduced to 90.74 tons/ha/year. Land management interventions need to be carried out immediately in the Raya Watershed, contributing to the restoration of ecological functions and improving river water quality to ensure the safety of the Pantai Gosong NPP infrastructure in reducing the risk of hydrological disasters.*

*Keywords: hydrometeorological disaster mitigation, SWAT model, land management, sediment yield, Raya Watershed, Pantai Gosong NPP site.*