

Table 1 Fit statistics of simulated data by WEAP and observed stream flow data for calibration

Fit Statistic	Range	Acceptable Range	Value
Mean Observed Flow (m ³ /s)			9.009
Mean Simulated Flow (m ³ /s)			7.760
Median Observed Flow (m ³ /s)			8.998
Median Simulated Flow (m ³ /s)			6.984
Standard Deviation (Observed) (m ³ /s)			3.764
Standard Deviation (Simulated) (m ³ /s)			5.001
Mean Absolute Error (MAE) (m ³ /s)	0 to ∞	Lower is better	5.552
Root Mean Square Error (RMSE) (m ³ /s)	0 to ∞	Lower is better	11.921
Nash-Sutcliffe Efficiency (NSE)	−∞ to 1	> 0.5	0.712
Index of Agreement (IA)	0 to 1	Closer to 1	0.913
Coefficient of Determination (R ²)	0 to 1	> 0.6	0.757

Source: Researcher (2025)

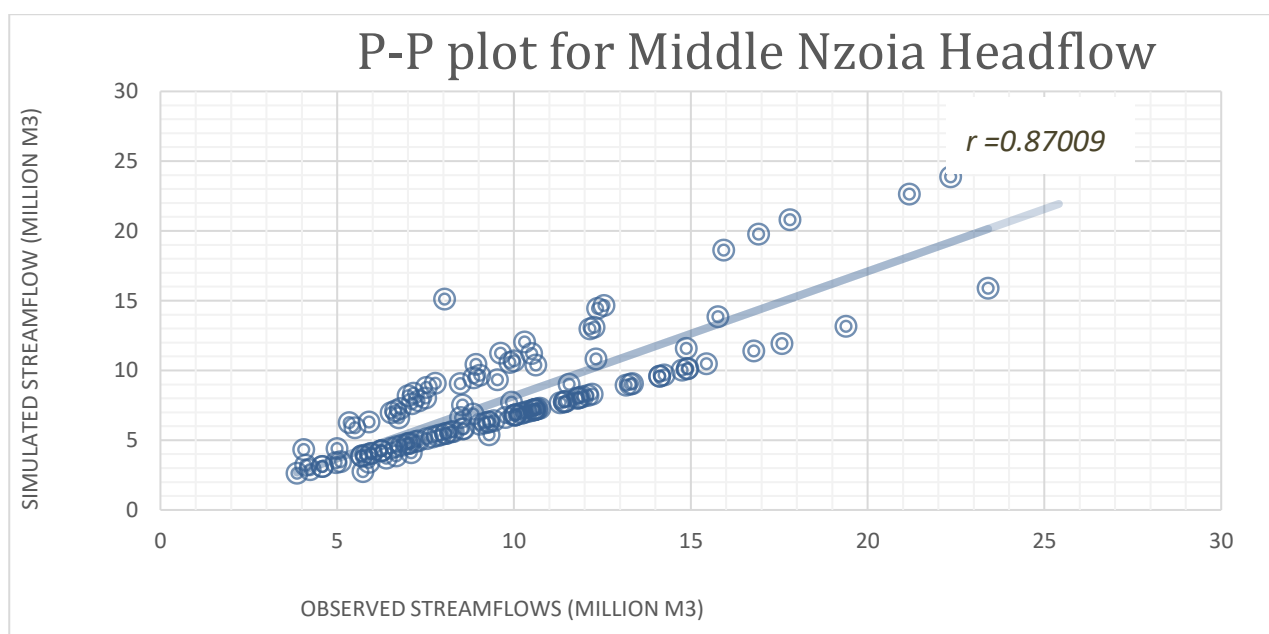


Figure 4 Calibration results showing Relationship between monthly observed and simulated streamflow in the Middle Nzoia Catchment (2001-2010) (Source: Researcher (2025))

Based on the performance metrics, the WEAP model demonstrates strong capability in simulating streamflow at Nzoia (IDD1) station during the 2001-2010 calibration period. The Nash-Sutcliffe Efficiency (0.712) which is above the acceptable range by 21%, R² (0.757) which is above the acceptable range by 16%, and IA (0.913) all reflect good agreement between simulated and observed values, confirming the model's reliability for use in future scenario analysis and water resource planning.

4.2 Validation

To assess the reliability and robustness of the calibrated hydrological model, a validation exercise was conducted using an independent dataset from Nabuyole gauge station covering the period 2011 to 2020. This period was selected to test the model's performance under different hydrological conditions from those used in calibration (which covered 2001-2010). The validation ensures that the model is not over fitted and can reliably simulate flows in varying conditions (Figure 5).