Supplementary Table S1: List of various parameters are changed during the SWAT model Flow, Sediment, Phosphorus calibration with existing BMPs.

Parameter Type	Parameter	File Type	Description	Default Value	Model Range	Wigle Creek
Snow	SMTMP	.bsn	Snow melt base temperature (°C)	0.5	-5 to 5	0.97
Snow	SFTMP	.bsn	Snowfall temperature (°C)	1	-5 to 5	-1.93
Snow	SMFMX	.bsn	Maximum melt factor for snow on June 21 (mm H2O $°C^{-1}$ day^{-1})	4.5	1.4 to 6.9	4.14
Snow	SMFMN	.bsn	Minimum melt factor for snow on December 21 (mm H_2O $°C^{-1}$ day^{-1})	4.5	1.4 to 6.9	2.61
Snow	SNOCOVMX	.bsn	Minimum snow water content that corresponds to 100% snow cover (mm H_2O)	1	0 to 500	4.85
Snow	SNO50COV	.bsn	Fraction of snow volume that corresponds to 50% snow cover	0.5	0.01 to 0.99	0.18
Snow	TIMP	.bsn	Snow pack temperature lag factor	1	0.01 to 1	0.91
Hydrology	ESCO	.hru	Soil Evaporation compensation factor	0.95	0 to 1	0.66
Hydrology	EPCO	.hru	Plant uptake compensation factor	1	0 to 1	0.76
Hydrology	CH_N2	.rte	Manning's coefficient for the main channel	0.014	-0.01 to 0.3	0.083
Hydrology	CH_K2	.rte	Effective hydraulic conductivity in main channel alluvium (mm/hr)	0	-0.01 to 500	1.6
Hydrology	SURLAG	.hru	Surface runoff lag coefficient	2	0 to 24	2.6
Hydrology	GWQMN	.gw	Threshold depth of water in the shallow aquifer required for return flow to occur (mm H_2O)	1000	0 to 5000	859
Hydrology	RCHRG_DP	.gw	Deep aquifer percolation fraction	0	0 to 1	0.24
Hydrology	GW_DELAY	.gw	Groundwater delay time (days)	31	0 to 2000	31.5
Hydrology	GW_REVAP	.gw	Groundwater "revap" coefficient	0.02	0.02 to 0.2	0.084
Hydrology	ALPHA_BF	.gw	Baseflow alpha factor	0.048	0 to 1	0.041
Hydrology	REVAPMN	.gw	Threshold depth of water in the shallow aquifer for “revap” or percolation to the deep aquifer to occur (mm H_2O)	750	200 to 500	416.75

Supplementary Table S1: List of various parameters are changed during the SWAT model Flow, Sediment, Phosphorus calibration with existing BMPs.

Hydrology	SOL_AWC	.sol	Available water capacity of the soil layer (mm H_2O/mm soil)	Varies	-0.1 to 0.1*	0.09*
Hydrology	SOL_K	.sol	Saturated hydraulic conductivity (mm/hr)	varies	-0.1 to 0.1*	-0.06*
Tile Drainage	DEP_IMP	.hru	Depth to impervious layer in agricultural fields (mm)	6000	0 to 6000	2100
Tile Drainage	DEP_IMP	.hru	Depth to impervious layer in non-agricultural fields (mm)	6000	0 to 6000	6000
Tile Drainage	DDRAIN	.mgt	Depth to drains (mm); must be >0 to initiate tile drainage	0	0 to 2000	900
Tile Drainage	TDRAIN	.mgt	Time to drain soil to field capacity (hours)	0	0 to 2000	48
Tile Drainage	GDRAIN	.mgt	Drain tile lag time (hours)	0	0 to 2000	24
Sediment	SPCON	.bsn	Linear parameter for calculating the maximum amount of sediment that can be reentrained during channel sediment routing	0.0001	0.0001 to 0.01	0.003
Sediment	SPEXP	.bsn	Exponent parameter for calculating sediment reentrained in channel sediment routing	1	1.0 to 1.5	1.1
Sediment	ADJ_PKR	.bsn	Peak rate adjustment factor for sediment routing in the subbasin (tributary channels)	1	0.5 to 2	0.97
Sediment	PRF_BSN	.bsn	Peak rate adjustment factor for sediment routing in the main channel	1	0 to 2	1.54
Sediment	CH_COV1	.rte	Channel erodibility factor	0	-0.05 to 0.6	0.41
Sediment	CH_COV2	.rte	Channel cover factor	0	-0.001 to 1	0.51
Sediment	CH_ERODMO (1-12)	.rte	Monthly channel erodibility factor	0	0 to 1	Varies
Sediment	USLE_K	.sol	USLE equation soil erodibility (K) factor	Varies	-0.1 to 0.1*	0.028*
Sediment	USLE_C	.plant.dat	Minimum value of USLE C factor for water erosion applicable to the land cover/plant	Varies	-0.1 to 0.1*	-0.04*
Phosphorus	SOL_P_MODEL	.bsn	Soil Phosphorus Model (0=original; 1 = new soil P model)	0	0 or 1	1

Supplementary Table S1: List of various parameters are changed during the SWAT model Flow, Sediment, Phosphorus calibration with existing BMPs.

*Relative changes based on % (-0.1 to 0.1 is a relative change of -10% to +10% of the parameter value)