

Estimating Attenuation of Nutrients from Septic Systems & Nutrient Trading (DEQ-13)

Presented to WPCAC


May 13, 2022

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METHOD FOR ESTIMATING ATTENUATION OF NUTRIENTS FROM SEPTIC SYSTEMS (MEANSS)

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 - ▶ Data Needs
 - ▶ Scoring Tables
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MEANSS DESCRIPTION

- ▶ Estimate nitrogen and phosphorus (nutrients) reductions as septic system wastewater migrates to surface water.
- ▶ Used to estimate septic loading for TMDLs & Nutrient Trading (DEQ-13). Large dataset over watershed scale.
- ▶ Needed a simple method that uses site-specific information known to control nitrogen (N) and phosphorus (P) attenuation.
- ▶ Lack of other simple available tools for estimating septic contributions to surface water.

MEANSS PARAMETERS (3)

- ▶ Denitrification (natural nitrogen reduction) and phosphorus adsorption occurs more in soils with high organic content (clay soils). **Hydrologic Soil Group (HSG)** used to estimate those soils.
- ▶ Low **CaCO₃** content correlated to higher P adsorption (except at less common high soil pH (>~8), where P adsorption increases again at higher CaCO₃ concentrations).
- ▶ Wastewater travel time is correlated to nutrient reduction. **Distance to surface water** used as proxy to travel time which is more difficult to measure.

DATA SOURCES

- ▶ Drainfield location from GIS: Montana Structures Framework (drainfield location ~ house) OR actual location when available
- ▶ HSG and soil CaCO₃ from NRCS Soil Survey Geographic Database (SSURGO)
 - ▶ 4 HSGs – A,B,C,D: low to high clay content [$<10\%$ (A), $10-20\%$ (B), $20-40\%$ (C), $>40\%$ (D)].
- ▶ Distance to receiving/perennial SW is from GIS and USGS surface water dataset (NHD).

NITROGEN TABLE

Percent Nitrogen Load Reduction	HSG Soil Type @ Drainfield	HSG Soil Type within 100' of surface water	Distance to surface water (ft)
0	A	A	0 – 100
10	B	B	101 – 500
20	C	B	501 – 5,000
30	D	C	5,001 – 20,000
50	D	D	>20,000

PHOSPHORUS TABLE

(* = Can be modified for soil pH >~8)

Percent Phosphorus Load Reduction	Soil HSG @ drainfield (CaCO3 <= 1%)	Soil HSG @ drainfield (CaCO3 >1% and < 15%)*	Soil HSG @ drainfield (CaCO3 >= 15%)*	Distance to Surface Water (ft)
10	A	A	A	0-100
20			B	
40		B	C	
50				101-500
60	B	C	D	
80	C	D		501-5,000
100	D			>5,000


VALIDATION

- ▶ Comparison to 5 groundwater studies showed comparable results (68%-120% of study load)
- ▶ Currently working on using MT Ground Water Permit data to improve MEANSS validation

EXAMPLES OF MEANSS RESULTS

SITE	Number of Septics	% N reduction	% P reduction
Ashley Creek	3,342	58	94
Kalispell (draft)	1,662	47.4	94.6
Missoula DEQ-13	3,041	71.4	--
Helena DEQ-13	9,090	52	88
Billings DEQ-13	2,372	61.5	--

DEQ-13 NUTRIENT TRADING SUMMARY

- ▶ Designed primarily for Point Source (e.g. MPDES permitted source) to Non-Point Source (e.g. septics, agricultural, livestock), but can also be used in Point Source – Point Source.
 - ▶ Trade details are included and enforced through the MPDES permit
 - ▶ To date, only septic trades implemented in MT
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DEQ-13 TRADE RATIO

- ▶ Trades are based on a trading ratio.
- ▶ For every pound of nutrient reduction by the non-point source the Permittee receives “X” pounds of credit. The trade ratio is $1/X$ (X is ≤ 1)
- ▶ Trade ratio begins at 1 and then can be increased for:
 - ▶ Delivery Ratio (where applicable)
 - ▶ Uncertainty Ratio (where applicable)
- ▶ Agriculture/Livestock BMPs often have pre-set pound credits. Can also use models to estimate the BMP nutrient reduction.
- ▶ Septic trade ratios can also account for municipal wastewater discharge concentration

SEPTIC TRADE RATIO EXAMPLE

- ▶ Raw Wastewater is ~ 50 mg/L total nitrogen (TN) discharged from drainfields.
- ▶ MEANSS shows 50% N reduction as TN migrates into surface water. Delivery Ratio = 2 (TN reaching surface water equivalent to 25 mg/L)
- ▶ Uncertainty Ratio – none
- ▶ WWTF average TN discharge is 10 mg/L.
- ▶ By connecting septic to WWTF 15 mg/L TN (25-10) is removed from surface water.
- ▶ Trade ratio is therefore (50/15) or 3.3. For every 3.3 lbs TN discharged from drainfields the WWTP receives a 1 lb credit towards their permit limit.

MPDES PERMIT TRADE RATIOS

PERMIT	% N reduction	WWTF Avg. N conc. (mg/L)	Trade Ratio – Avg (Range)
Missoula	71.4	8.7	13.9 (2 - 31)
Helena	52	10.5	3.88 (3 – 5.2)
Billings	61.5	--	2.6

QUESTIONS

