Stewardship Tool for Environmental Performance (STEP)

NRCS Technology Support Background:

The NRCS **Conservation Delivery Streamlining Initiative** (CDSI) required NRCS technology support for Field Office (FO) staff to evolve from relatively complex standalone tools and databases to a simpler more integrated approach that everyone can use. As part of this effort, NRCS Water Quality Specialists started developing a **CDSI Water Quality Module** in 2012 to efficiently support FO decision-making for water quality resource concerns. The CDSI WQ Module evaluated site-specific potential for water quality contaminant loss as well as expected benefits of applicable conservation practices. The same basic water quality technology was later used in the NRCS **Resource Stewardship Evaluation Tool (RSET)** branded as the **Stewardship Tool for Environmental Performance (STEP)**. STEP technology for risk assessment is also utilized in NRCS's new **Conservation Assessment and Ranking Tool (CART)**. Different applications of **STEP technology** can vary in terms of the level of detail for site, management, and conservation practice characterization, but they are all based on a similar structure. STEP looks at site risk to establish a site-specific planning threshold and then evaluates how different management alternatives can adequately address the level of risk for site-specific resource concerns. It is important to emphasize that STEP technology is not designed to predict an expected level of contaminant loss – it is designed to support conservation management decisions that are appropriate for each site's natural resource limitations.

The overall goal of CDSI is to modernize and streamline NRCS's conservation planning process and program delivery, reduce field staff workload, and improve customer experience with an efficient program application process. One of the primary goals of CART is to give field staff more time to provide technical assistance to producers by automating preliminary resource assessments and better organizing the conservation planning process. CART evaluates high level resource concerns and conservation practice benefits to support the selection of appropriate practices for each land unit and rank the alternatives for cost effective conservation benefits. The application of basic STEP technology in CART will help support ranking and prioritization, and in the future more detailed STEP analysis will help support detailed practice implementation. Highly variable conservation practices like Nutrient Management – Code 590 can be parameterized in CART to identify multiple levels of management intensity and associated conservation benefits. Technical specialists will steward all of STEP's planning thresholds and practice credits so they can be adjusted over time based on an expanding knowledge base.

Nutrient Management in STEP:

Based on soil properties and general climate characteristics, STEP rates the potential for nutrients to runoff beyond the edge of the field or leach below the rootzone into one of four categories. STEP does not model or quantify nutrient losses – it evaluates the applicability of conservation practices and management techniques to address site-specific nutrient loss potential. For example, on a medium risk site, STEP might generally evaluate nutrient management as sufficient for 'base level' water quality concerns when the ratio of nutrient application rate to crop removal of nutrients for expected yield is

1.4 or less with application timing and method that meets the needs of efficient crop production. But on a higher risk site, nutrient application rate may have to adjusted to a crop removal ratio closer to 1.0 and perhaps for a lower yield goal. Timing may need to be adjusted to be closer to the time of nutrient utilization and that may require multiple nutrient applications. Method may have to be adjusted to injection or immediate incorporation to reduce surface loss potential. These changes in nutrient management to address high nutrient loss potential may potentially cost more than “efficient nutrient management for production”, but the extra cost is justified on higher risk sites to help protect offsite water resources, and conservation programs may be available to help offset some of those costs.

STEP evaluation is based on planning thresholds that vary based on site risk and on nutrient management credits that vary based on the system’s potential to manage nutrient losses. The only connection STEP has to contaminant thresholds came after the fact in a national evaluation of STEP planning thresholds. STEP was applied on nationwide Natural Resource Inventory (NRI) points and those results were compared to CEAP modeled losses at those same points to confirm that STEP planning thresholds were reasonable. Because CEAP already published specific contaminate loss thresholds for nationwide Conservation Effects Assessment Project (CEAP) analysis, NRCS decided to use those same contaminate loss thresholds to evaluate STEP’s planning thresholds. Our reasonableness test was meeting the CEAP contaminant loss thresholds at least 80% of the time on a national basis. For these comparisons we had the ability to consider each loss pathway independently or combine them as needed to look at the potential for offsite water quality impacts. Specifically, we looked at nitrogen and phosphorus loss associated with sediment loss in runoff, soluble loss in runoff, soluble loss in subsurface lateral flow, soluble loss in tile flow, and soluble loss in leaching.

CEAP reports for phosphorus combine loss pathways for Total losses vs Soluble losses, but for RSET and CART we evaluate nitrogen and phosphorus surface loss as a combination of particulate and soluble loss in runoff and we evaluate nitrogen and phosphorus subsurface loss as soluble loss in leaching. We look at surface losses and subsurface losses separately so we can evaluate nutrient management benefits for runoff and leaching independently.

STEP Background:

This approach of basing conservation planning requirements on intrinsic site limitations supports site-specific planning and that is the foundation of the STEP process. The goal is to help field office planners understand when a given resource concern is adequately addressed for a specific field’s natural resource limitations. This is the foundation for evaluating all water quality resource concerns in the STEP process. The overall conservation planning threshold concept is very similar to the way that we “plan to T” for soil erosion concerns where more management “credit” is required as soil erosion risk increases.

Initial STEP conservation planning thresholds for nutrients were developed based on professional judgment, similar to the process described in Agronomy Tech Note 5 for pesticides. The concept is based on planning sufficient treatment (mitigation credit points) to address a field’s level of risk (conservation planning threshold). In 2015 the STEP process was applied at nationwide CEAP NRI points to facilitate a comparison between meeting STEP pass/fail criteria and APEX modeled contaminant losses. Selected STEP planning thresholds were adjusted to better fit with CEAP results. The objective was to correlate STEP criteria with meeting each of the contaminant loss thresholds that were used in CEAP at least 80% of the time on a national basis. The CEAP contaminant loss thresholds for sediment, nitrogen and phosphorus loss were established in consultation with the SERA-17 Group. STEP is designed to conservatively award management credits based on limited inputs, so it errs on the side of resource protection. Achieving STEP planning thresholds for a given field theoretically implies that FIELD will do its part contributing to meeting the indicated national contaminant thresholds with management that's appropriate for applicable site limitations, even though that field's losses may vary from the indicated national contaminant thresholds. While the 2015 STEP system generally met our goal of 80% consistency with CEAP APEX results, refinements have been made to STEP since that time based on improved APEX modeling. Criteria in the STEP system can be adjusted in the future as new research, simulation modeling, and monitoring information becomes available.

It is important to note that the contaminate loss thresholds that we use to evaluate our STEP planning thresholds on a national basis are not directly connected to field by field STEP evaluation and site-specific nutrient losses. Even when national STEP planning criteria are met for a field being planned there is no direct connection to meeting the national CEAP contaminate thresholds on that field. If we modeled predicted losses on the field in question they could be significantly less or significantly more than the national contaminant thresholds that we used to check the reasonableness of the national STEP thresholds. In addition, actual losses could be significantly different than modeled losses. NRCS uses the CEAP contaminant thresholds as a general target for STEP planning thresholds to help define the context of STEP planning thresholds as a "reasonable level of planning" based on site-specific loss potential.

At the beginning of the conservation planning process STEP can serve as a method to link to existing field data, as well as provide an interface to collect, inventory, and store additional resource data. By inventorying multiple resource concerns the STEP process can highlight additional areas of concern and opportunities for further conservation based on the characteristics of each field. Besides establishing a benchmark of the current management for a specific site, STEP also allows for comparing alternative conservation systems and documenting the effectiveness of the chosen conservation system.

In addition to nutrient impacts on water quality STEP also addresses sediment impacts on water quality with credit for crop and soil management and pesticide impacts on water quality with credit for Integrated Pest Management (IPM). Coordinating the evaluation of these related resource concerns in a streamlined interface will help planners address multiple resource concerns with coordinated management techniques and conservation practices that are appropriate for each site being planned.

The STEP process:

- Designed to support conservation planners
- Begins with a high level vulnerability assessment based on soil type and climate (including irrigation)
- Evaluates sediment, nutrient and pesticide impacts on Water Quality (WQ) through runoff and leaching
- Evaluates water erosion, wind erosion, and soil carbon on Soil Health (SH)
- Evaluates soil carbon and nitrogen impacts on Air Quality (AQ)
- **Sets** the planning unit with a net positive effect on greenhouse gases when considering soil carbon management and fertilizer losses. This is not a life cycle analysis and does not include associated energy utilization and transportation effects on air quality and greenhouse gases.
- STEP criteria have been set to attempt to achieve WQ thresholds on a national basis at least 80% of the time based on national CEAP modeling with APEX. This does not mean

that contaminate thresholds will be met on every field – those thresholds are used on a national basis to set the planning thresholds for each field based on its level of vulnerability. Soil Health and Air quality thresholds are set with similar expectations.

STEP Contaminant Loss Thresholds:

The water quality contaminant loss thresholds that were used to define conservation treatment needs in national CEAP analysis are the same thresholds that we used as a target to establish individual STEP point requirements for a Stewardship Level of conservation treatment:

- Sediment loss ≤ 2 tons per acre per year beyond the edge of the field;
- Surface nitrogen loss ≤ 15 pounds of N per acre per year;
- Subsurface nitrogen loss ≤ 25 pounds of N per acre per year;
- Surface phosphorus loss ≤3 pounds of P per acre per year; and
- For Pesticide losses, no contaminant thresholds were used in CEAP, but NRCS policy is to maintain pesticide risk equivalent to ≤ WIN-PST Soil/Pesticide Interaction Hazard Rating of Low risk.

The Soil quality thresholds that were used to define conservation treatment needs are based on the NRCS planning criteria as a target to establish individual STEP point requirements for Stewardship level treatment:

- No uncontrolled gully erosion
- Water and wind erosion at or less than the Tolerable Soil Loss Rate (T)
- Soil Carbon as evaluated by the Soil Conditioning Index at or above 0

The Air quality thresholds that were used to define conservation treatment needs are based on the NRCS planning criteria as a target to establish individual STEP point requirements for Stewardship level treatment:

- Soil Carbon Sequestration as evaluated by the Soil Conditioning Index at or above 0
- Nitrogen Loss as evaluated by achieving management to minimize loss pathways

Conservation Planning to Address Natural Resource Concerns:

NRCS provides conservation planning and technical assistance to protect Water Quality on a nationwide basis. Nutrient Management can have a significant impact on water quality, so it needs to be carefully planned. The goal is to balance crop production needs with intrinsic site characteristics/limitations of each field or Planning Land Unit (PLU) or field in order to minimize offsite nutrient losses that can negatively impact water resources.

For STEP, the soils in each field are rated for leaching potential and runoff potential with a modified CEAP Soil Vulnerability Index (SVI) methodology, henceforth called STEP mSVI.

Each field will have the field soil runoff potential determined. Each soil map unit within the field will be categorized into one of four soil runoff potential classes through the Water Quality Management Services - Soil Runoff, based on its published map unit components. This service utilizes the NRCS published soils database (SSURGO) according to the charts in Table 1, Table 2, and Table 3. Dual hydrologic group soils with an apparent water table in the rootzone will default their runoff rating to the drained phase if the field is drained and to the undrained phase if the field is not drained. The acre weighted average for the field is then determined based on ratings for each soil map unit in the field.

Table 1*: Soil Runoff Potential: Drained/No High Water Table*

Soil Runoff Potential	A	B	C	D
Low =0	ALL	Slope < 4	Slope < 2	Slope < 2 AND kfactor < 0.28
Moderate =1	-	Slope >= 4 AND Slope <= 6 AND kfactor < 0.32	Slope >= 2 AND slope <= 6 AND kfactor < 0.28	Slope < 2 AND kfactor >= 0.28
Moderately High =2	-	Slope>= 4 AND slope <= 6 AND kfactor >= 0.32	slope>= 2 AND slope <= 6 AND kfactor >= 0.28	(slope>= 2 AND slope <= 4)
High =3	-	Slope > 6	Slope > 6	Slope > 4

Table 2*: Soil Runoff Potential: If High Water Table Kind is Perched or Apparent and High Water Table is <= 61 cm AND Not Drained*

Soil Runoff Potential	A	B	C	D
Low =0	-	-	-	-
Moderate =1	-	-	-	-
Moderately High =2	-	-	-	-
High =3	All	All	All	All

Table 3*: Soil Runoff Potential: Dual hydrologic soil groups A/D, BD, C/D that are not drained*

Soil Runoff Potential	A/D	B/D	C/D
Low =0	-	-	-
Moderate =1	-	-	-
Moderately High =2	-	-	-
High =3	All	All	All

Table 4: *Irrigation Adjustment:*

Irrigation R Factor Modification				
R Factor Modification	R factor Class Inches per acre per year of irrigation			
	<= 50	>50 – 150	>150 – 250	>250
Move 1 Class Higher	18 to 29.9	12 to 23.9	≥6	N/A
Move 2 Classes Higher	30 to 41.9	≥24	N/A	N/A
Move 3 Classes Higher	≥42	N/A	N/A	N/A
• Cannot move class higher than ">250"				

Using the R factor from Water Quality R factor service modified by the amount of irrigation and the field soil runoff potential, determine the threshold of conservation management points necessary to meet the assessment threshold.

Results are binned into one of four risk categories: Low, Moderate, Moderately High, or High. Rainfall/Irrigation is similarly rated in the same four risk categories. As STEP mSVI Soil Ratings increase from Low to High and STEP Rainfall/Irrigation ratings increase from Low to High the overall potential for nutrient loss increases. Higher nutrient loss potential requires more careful management to prevent offsite losses. STEP contains a set of contaminant-specific conservation planning thresholds for each loss pathway in a 4x4 matrix of STEP mSVI Soil Ratings and STEP Rainfall/Irrigation ratings. These conservation planning thresholds increase as the potential for nutrient loss increases based on higher STEP Soil and Rainfall/Irrigation ratings.

Note that Nutrients Transported to Surface Water has a nitrogen component and a phosphorus component that each have separate thresholds established as seen in Table 5 **and** 6**.**

Table 5*: Determining Nonpoint Nitrogen Surface Loss Threshold*

Soil Vulnerability to Runoff	R Factor			
	≤50	>50-150	>150-250	>250
High	35	65	85	100
Moderately High	30	35	65	85
Moderate	30	30	35	65
Low	25	30	30	35

Table 6*: Determining Nonpoint Phosphorus Surface Loss Threshold*

Soil Vulnerability to Runoff	R Factor			
	≤50	>50-150	>150-250	>250
High	50	60	70	80
Moderately High	45	50	60	70
Moderate	40	45	55	65
Low	40	45	50	55

Each field will have the field soil leaching potential determined. Each soil map unit within the field will be categorized into one of four soil leaching potentials through the Water Quality Management Services - Soil Leaching, based on published map unit components. The service utilizes the NRCS-published soils database (SSURGO) for mineral soils with no high water table according to the chart in Table 76. Dual hydrologic group soils with an apparent water table in the rootzone will default their leaching rating to High whether the field is drained or undrained. The acre weighted average rating for the field is then determined based on ratings for each soil map unit in the field.

Table 7*: Soil Leaching Potential*

Soil Leaching Potential	A	B	C	D
Low =0	-	-	-	ALL
Moderate =1	-	(Slope <= 12 AND kfact >= 0.24) OR slope > 12	ALL	-
Moderately High =2	Slope > 12	Slope >= 3 AND slope <= 12 AND kfact < 0.24	-	-
High =3	Slope <=12	Slope < 3 AND kfactor < 0.24		

Exceptions:

High:

- Dual hydrologic soil group (A/D, B/D, C/D)
- Water table kind = “Apparent" AND High Water Table <= 76 cm)
- Taxonomic order = Histosols

Note: Drainage has no effect on

leaching potential. Coarse Fragment

correction:

If coarse fragment volume > 30 then + 2 to NSLP (Note: final maximum NSLP is 3)

If coarse fragment volume > 10 AND <= 30 then + 1 to NSLP (Note: final maximum NSLP is 3)

Irrigation Adjustment:

Using the R factor from Water Quality R factor service modified by the amount of irrigation and the FIELD soil leaching potential, determine the threshold of conservation management points necessary to meet the assessment threshold. **Note that Nutrients Transported to Groundwater has a nitrogen component and a phosphorus component that each have separate thresholds established as seen in** Table 7 **and** Table 8**.**

Table 8*: Determining Nonpoint Nitrogen Leaching Loss Threshold*

Soil Vulnerability to Leaching	R Factor			
	≤50	>50-150	>150-250	>250
High	30	50	60	75
Moderately High	30	40	50	60
Moderate	25	30	40	50
Low	25	30	30	40

Table 9*: Determining Nonpoint Phosphorus Sub-surface Loss Threshold*

Soil Vulnerability to Leaching	R Factor			
	≤50	>50-150	>150-250	>250
High	45	45	45	45
Moderately High	30	30	30	30
Moderate	20	20	20	20
Low	20	20	20	20

In order to meet an applicable conservation planning threshold for a specific contaminant and loss pathway, appropriate conservation must be planned and applied. This conservation includes specific nutrient management techniques and conservation practices that are credited in the CDSI WQM with points that vary based on Avoid, Control and Trap (ACT) effectiveness ratings. *Avoiding* the need for adding nutrients, *controlling* nutrient losses, and *trapping* nutrients before they leave the bottom of the rootzone or the edge of the field are all important. Applicable nutrient management technique credits and conservation practice credits for the field are then summed. When the total equals or exceeds the conservation planning threshold for a given field the conservation "target" is achieved for that specific contaminant and loss pathway. The CDSI WQM credit point system was validated by comparing credits for conservation management systems applied with modeled contaminate losses in national CEAP analysis.

STEP Evaluation of NRCS Resource Concerns

Using the water quality resource concern "***Nutrients Transported to Surface Water (Cropland)"*** as an example, STEP assesses two separate components: "Nonpoint Nitrogen Surface Loss" and "Nonpoint Phosphorus Surface Loss". They need to be evaluated separately because they respond differently to management techniques and conservation practices for each potential loss pathway.

NRCS Planning Criteria: *Nutrients (organic or inorganic) are applied based on a plan, in accordance with Land Grant University recommendations, which specifies the source, amount, timing and method of application, required conservation practices needed to reduce nutrient movement to surface waters, and contains State-specific nutrient application and livestock access setbacks (e.g., sinkholes, wells, water courses, wetlands, or rapidly permeable soil areas).*

STEP conservation planning thresholds have been designed to improve upon the current planning criteria by quantitatively defining when the resource concern has been adequately addressed.

Assessment Method: STEP methodology independently assesses *Nitrogen surface loss potential* and *Phosphorus surface loss potential* and the management systems (practices and techn99iques) that are in place or proposed. Evaluating the management systems can be broken down into subparts as follows:

- Residue: Determine Residue related management points by evaluating the crops and cover crops and tillage and grazing effects on residue.
- Nutrient Management: Determine Nutrient Management points by evaluating the rate, timing, method, and form (4 R's of Nutrient Management).
- Management Techniques: Determine any Nutrient Management Techniques used above the basic 4 R's, including precision agriculture, setbacks, inhibitors, etc.
- Conservation Practices: Determine any conservation practices on site which will affect offsite nutrient movement including Cover Crop, Stripcropping, Filter Strip, etc.

The sum of these management points for the field is compared to the field's conservation planning threshold to determine if the site-specific goal is achieved.

The STEP process in Conservation Planning:

- Establishes a site-specific threshold so it meets or exceeds existing planning criteria by defining what "minimize" means based on intrinsic site limitations.
- Provides quantitative measure of the benefits of conservation practices and management techniques.
- Exceeds current nutrient management planning criteria which is to "minimize" nutrient losses based on realistic nutrient application rates utilizing the 4 R's and applying appropriate conservation practices and management techniques.
- Supports addressing multiple resource concerns simultaneously to help streamline the conservation planning process.

STEP flexibility to address a variable level of Resource Concern
The STEP system currently contains a set of conservation planning thresholds for a "Basic" level of resource concern that addresses offsite losses based on site limitations. It is a preliminary assessment of site specific criteria to assess water quality concerns. It can simply establish that planning criteria for a field are met or establish that additional conservation or assessment is necessary.

For example, if a field is located within a watershed where the waterbody is "Sensitive" to a specific contaminant loss it may require a more stringent set of conservation planning thresholds to address the needs of that specific waterbody as well as field site limitations. If a field is located in a watershed where a waterbody has "Critical" regulatory requirements such as a TMDL it may require a third set of even more stringent conservation planning thresholds to address the needs of that specific waterbody as well as field site limitations.

The STEP system can accommodate variable planning requirements in its existing structure because the level of planning is handled as a data element. The three tiered Basic/Sensitive/Critical approach to planning can be developed in conjunction with a mechanism to identify which fields warrant a higher level of planning to adequately address a higher level of resource concern.

Table 10. Stepping through STEP for Cropland

#	Inventory Input	Activity Output
1	Identify field • Soils • Climate	Determine Intrinsic Soil Risk • Soil Leaching Potential • Soil Run-off Potential Identify R Factor Identify C Factor
2	Inventory field • Stewardship Level • Irrigation • Drainage • Gully Erosion	Determine Threshold Points • Water Erosion • Wind Erosion • Soil Carbon • Sediment Loss to Surface Water • Surface Phosphorus Loss • Sub-surface Phosphorus Loss • Nitrogen Loss to Surface Water • Nitrogen Loss to Ground Water • Nitrogen Loss to Air
3	Define Rotational Cropping System • Number of years in rotation • For each Crop: • Crop Name	Determine Management Points for Cropping System • Water Erosion • Wind Erosion • Soil Carbon • Sediment Loss to Surface Water • Surface Phosphorus Loss

	• Crop Yield • Tillage Type • Next Cover Type	• Sub-surface Phosphorus Loss • Nitrogen Loss to Surface Water • Nitrogen Loss to Ground Water • Nitrogen Loss to Air
4	Inventory Nutrient Management • Rate • Form • Timing • Placement	Determine Management Points for Nutrient Management • Surface Phosphorus Loss • Sub-surface Phosphorus Loss • Nitrogen Loss to Surface Water • Nitrogen Loss to Ground Water • Nitrogen Loss to Air
5	Inventory Conservation Practices and Management Techniques • Conservation Practices • Management Techniques	Determine Management Points for the Avoid, Control, & Trap (ACT) • Water Erosion • Wind Erosion • Soil Carbon • Sediment Loss to Surface Water • Surface Phosphorus Loss • Sub-surface Phosphorus Loss • Nitrogen Loss to Surface Water • Nitrogen Loss to Ground Water • Nitrogen Loss to Air
6	• Program Calculations	Calculate Management Score and Compare to Threshold • Water Erosion • Wind Erosion • Soil Carbon • Sediment Loss to Surface Water • Surface Phosphorus Loss • Sub-surface Phosphorus Loss • Nitrogen Loss to Surface Water • Nitrogen Loss to Ground Water • Nitrogen Loss to Air
7	Optional override with results from External Evaluation Tools • RUSLE2 Values • WEPS Values • COMET Farm Values	Revise Appropriate Management and Threshold Values if applicable • Water Erosion • Wind Erosion • Soil Carbon • N Loss to Air
8	Inventory Planned Condition changes to the STEPs 2-8 • Rotational Cropping System • Nutrient Management	Calculate Planned Condition Management Score and Compare to Threshold • Water Erosion • Wind Erosion • Soil Carbon

	• Conservation Practices and Management Techniques	• Sediment Loss to Surface Water • Surface Phosphorus Loss • Sub-surface Phosphorus Loss • Nitrogen Loss to Surface Water • Nitrogen Loss to Ground Water • Nitrogen Loss to Air

STEP Questions and Answers:

- **What is the origin of the numeric loss rating table?**
  - *In 2015 the STEP process was applied at nationwide CEAP NRI points to facilitate a comparison between meeting STEP pass/fail criteria and APEX modeled contaminant losses. Selected STEP planning thresholds were adjusted to better fit with CEAP results. The objective was to correlate STEP criteria with meeting each of the contaminant loss thresholds that were used in CEAP at least 80% of the time on a national basis. The CEAP contaminant loss thresholds for sediment, nitrogen and phosphorus loss were established in consultation with the SERA-17 Group. For this example, total Phosphorus loss to surface water must be less than or equal to 3 lbs/acre/year and Nitrogen loss to surface water must be less than or equal to 15 lbs/acre/year. STEP is designed to conservatively award management credits based on limited inputs, so it errs on the side of resource protection. Achieving STEP planning thresholds for a given field theoretically implies that field will do its part contributing to meeting the indicated national contaminant thresholds with management that's appropriate for applicable site limitations, even though that field's losses may vary from the indicated national contaminant thresholds. While the 2015 STEP system generally met our goal of 80% consistency with CEAP APEX results, refinements have been made to STEP since that time and a new comparison is underway with improved APEX modeling. Criteria in the STEP system can be adjusted in the future as new research, simulation modeling, and monitoring information becomes available.*

- **Is there no penalty for not having a soil P test if there is no P application? Why doesn't the penalty continue to increase with increased P application for cases where the soil P test is very high?**
  - *No, there is no penalty, no P application gets a full P credit. If P is not (never) applied, no P soil test is needed (theoretically), but once P application is a go, P soil test should always be conducted according to LGU procedures.*

- **Why are split fertilizer applications not counted unless there are at least three splits?**
  - *There is credit for 2 splits and additional extra credit for 3 or more splits*

- **Is there any credit for using a nitrification inhibitor when applying N more than 21 days before planting?**
  - *There is credit for applying nitrification inhibitor (as well as urease inhibitor) in the management techniques. The assumption is that the nutrient application*

timing, while outside of the 21 day window, still gets credit when using the inhibitor as directed in the fall or early spring.

- **Is the nutrient (N &P) uptake influenced by crop varietal differences?**
  - *Yes, nutrient uptake is influenced by varietal differences, but no, there are no crop nutrient uptake or removal differences in the current Crops Database based on varietal differences at this point. We recognize this issue and have been working with industry (IPNI) and the USDA PLANTS database stewards to update nutrient removal numbers (most data are 20+ years outdated by now). Great point and a huge issue that all need to embrace with the establishment of an authoritative and comprehensive crop nutrient removal database with eventual regional and varietal differences.*

- **Are the sinks for the nutrients in soil considered while determining the risk for losses?**
  - *Yes, conceptually they are considered. STEP is a meta model based on basic understanding of nutrient sinks in the system; individual sinks are not quantified as STEP is not a computational model.*

- **If innovative practices such as tile drains are integrated with filtration system, can it be reflected in the score?**
  - *Drainage water management systems apply a variety of practices including filtration system components such as filter strip, bioreactors, constructed wetlands, and saturated buffers. STEP is flexible so each additional practice or management technique can be added and scored individually.*

- **Can STEP accommodate other evolving innovative field practices such as bioreactors (NRCS has practice standard)?**
  - *Yes, Denitrifying Bioreactor (NRCS CPS Code 605 dated 09/2015) is already one of the conservation practices that can be applied as are/will/would other practices to address water quality resource concerns. STEP is flexible and can add newly approved conservation practices and management techniques.*

- **Does irrigation type and the chemical quality of irrigation water/source water quality affect the N&P fate in the field?**
  - *The amount of irrigation applied is added to the amount of rainfall and impacts nutrient loss risk threshold. N & P fate are not directly impacted or altered by the type of irrigation or chemistry of water (pH, ammonia volatilization, etc.) via the STEP process. N & P losses or utilization efficiency are built into the NM planning process to know how much nutrient is applied and crop available via a certain irrigation system. NM planning is done outside of STEP.*

- **How is the bias in weighting of input parameters addressed?**
  - *STEP is not a computational model so there are no “input parameters” or “weighting.” Assigning point scores or credits may be considered “biased”, and*

may actually "weight" certain practices, the only way we objectively manage bias and weighting is with collective expert opinion through peer review.

- **Weightage of input parameters seem inflexible, are temporal fluxes of nutrients considered?**
  - *No, STEP is not a computational loss model, but it does evaluate nutrient application timing compared to nutrient utilization timing to address "goodness" of NM. Application timing categories, while general, are relative to crop nutrient need. Splitting nutrient applications into two or more "splits" around crop needs, enhances nutrient use efficiency.*

- **Why doesn't the proximity to surface & subsurface water bodies influence the WQ score?**
  - *STEP is designed to describe edge of field and bottom of root zone losses (sediment, pesticides, nutrients) and therefore is not designed to consider proximity to surface or subsurface water. Proximity of water bodies is external to the field and is only one of many watershed level WQ rating or ranking considerations. STEP looks at "goodness" of NM compared to a fields' loss potential.*

- **Does the water quality metric consider the filtration capabilities of a rice field? Water leaving the field is typically cleaner (lower sediment load) than water entering the field.**
  - *No, currently we do not consider the filtration capabilities of a flooded rice field, yet we do understand the process and are looking for ways to incorporate such in future versions.*