Cost Benefit Analysis for Assessment Projects (Ag Focus)

Water Manager Training Seminar
January 26,2026

Agenda

- Background
- Purpose of the Committee
- Considerations and Assumptions
- Review of Methodology
- Example Drainage System
- Take-Aways

Purpose

- Method to satisfy recent court rulings.
- Determine benefit as it relates to apportioning the costs for purposes of assessment.
- Developed to satisfy WRD requirements to determine benefit amount on a parcel-by-parcel basis.
- Focus was on agricultural derived benefits. Structural and infrastructure benefits are to be considered on a case-by-case basis.
- Provide documentation to WRDs in an advisory capacity.
- *This is not a mandate for use.*

Considerations and Assumptions

- **Baseline for Benefits Comparison**:
  - NDCC 61-16.1-18(2) and 61-16.1-21 refer to the benefits from the “project” being proposed.
  - However, improvements to an existing “project” are not as clearly defined.
  - Improvements and reconstructions are typically completed to preserve and/or enhance the benefits provided by the system overall.
  - For purposes of this analysis, improvements were considered the entire system.

Considerations and Assumptions

- **Direct vs Indirect Benefits**:
  - Direct benefits ➔ Can be attached specifically to an individual interest (IE… parcel, lot, road authority, etc…)
  - Indirect benefits ➔ Provide a broader societal benefit not directly attributable to an individual interest.
  - Differentiation between indirect and direct benefits for the purposes of establishing drainage benefit is critical to determining an appropriate method for benefit determination, as required in NDCC 61-16.1-21.
  - Example Direct and Indirect Benefits are presented on the following slides.
  - The intent of the following slides is not to provide a comprehensive list, rather examples that could be considered “typical” for drainage projects in North Dakota.
  - Individual projects will be unique, and benefits will depend on the intended purpose and design of the drainage project.

Considerations and Assumptions

- **EXAMPLE Direct Benefits**:
  - Agricultural Productivity
    - Land adjacent to the drain will experience reduced inundation (depth and/or duration) as an immediate effect of the project.
    - All lands draining to the drain will have increased drainage opportunity through an improved outlet for surface and subsurface drainage. Benefits correlate to proximity to the drain.
    - Reduced burden for prior and future permitted private drainage projects within the drainage area to the drain through the establishment of an adequate outlet (NDAC 89-02-01-09.1).
    - Reduced repair costs from cropland erosion.
    - Increased drainage and flood protection facilitates intensification to other higher earning crops (IE… conversion to row crops and/or specialty crops).

Considerations and Assumptions

- **EXAMPLE Indirect Benefits**: *(Not eligible for any lot, piece, or parcel of land)*
  - Established Governance Model
    - Establishment of a legal drain provides for a governance model through ND Century Code to establish, maintain, and improve the drain.
    - ND Century Code established a process for equitably assessing costs to landowners for necessary work on the drain.
    - Provides the ability to better enforce drainage permits and/or complaints, specifically when dealing with added drainage area or drainage capacity improvements within the existing drainage area.
  - Water Quality
    - Drains are generally designed to minimize erosion and the resultant maintenance costs. In turn, this reduces sediment and nutrient loads on downstream watercourses.
    - Drains utilizing lateral inlet culverts keep sediment and nutrients on the adjacent agricultural field, reducing loads downstream.

Land Productivity Method

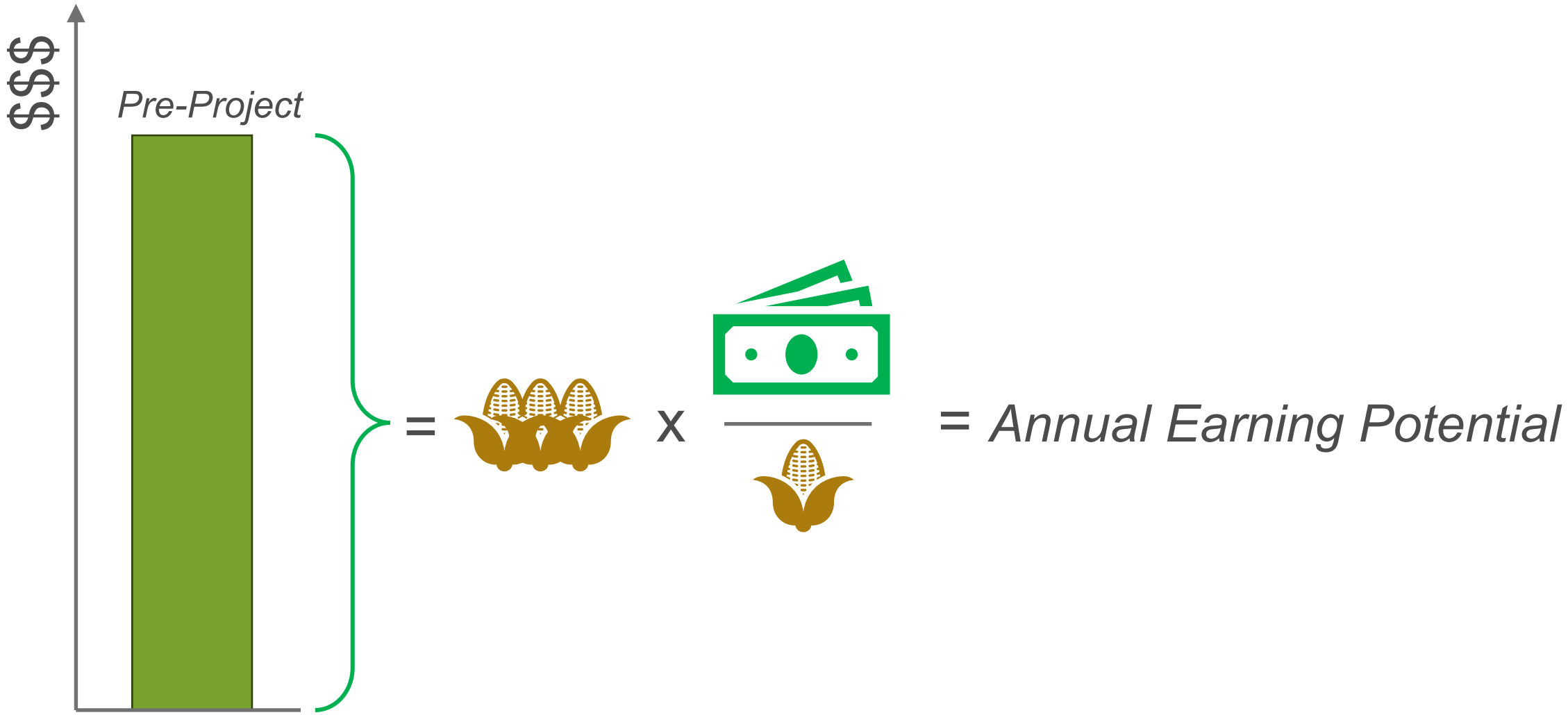
- **Method Background:**
  - The approach is grounded in the state's statutory valuation framework (NDCC §57-02-27.2), which defines agricultural land value as the capitalized average annual gross return.
  - The method uses taxation True and Full Value (TFV) and annually published capitalization rate to estimate production potential ($ per acre).
  - Provides flexibility to account of local considerations impacting increase in production from soil/water management.

Land Productivity Method

- **General Process:**

1. Derive estimated annual gross return based on land values used for taxation (NDCC §57-02-27.2).
2. Estimate annual gross return increase due to potential for intensification and yield increases due to water management.
3. Discount the gross return increase based on increased costs and hydrologic considerations.
4. Amortize the annual net return over the assumed drainage project life using the Federal Water Resources Discount Rate (published annually by the US Army Corps of Engineers).

Land Productivity Method



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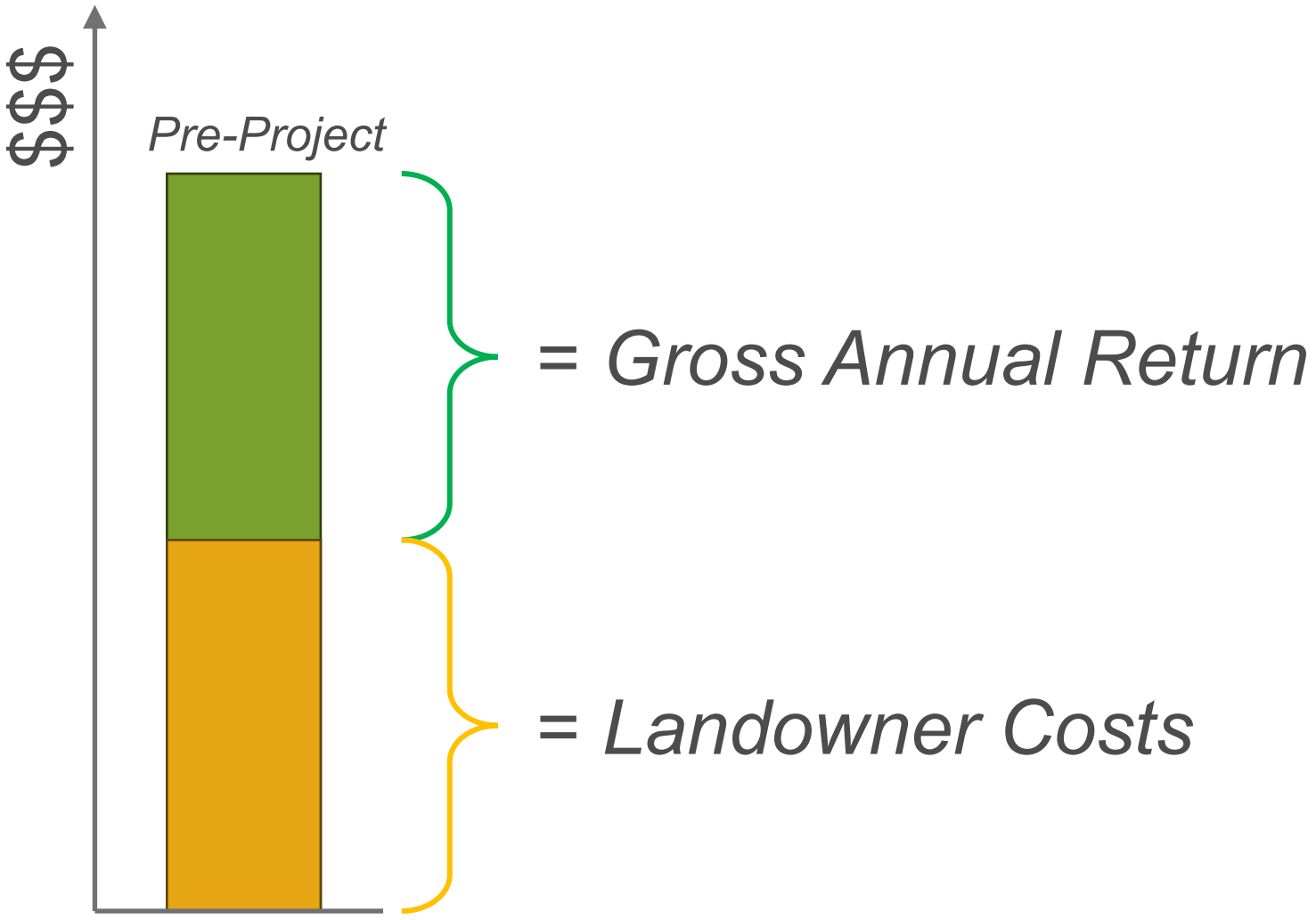

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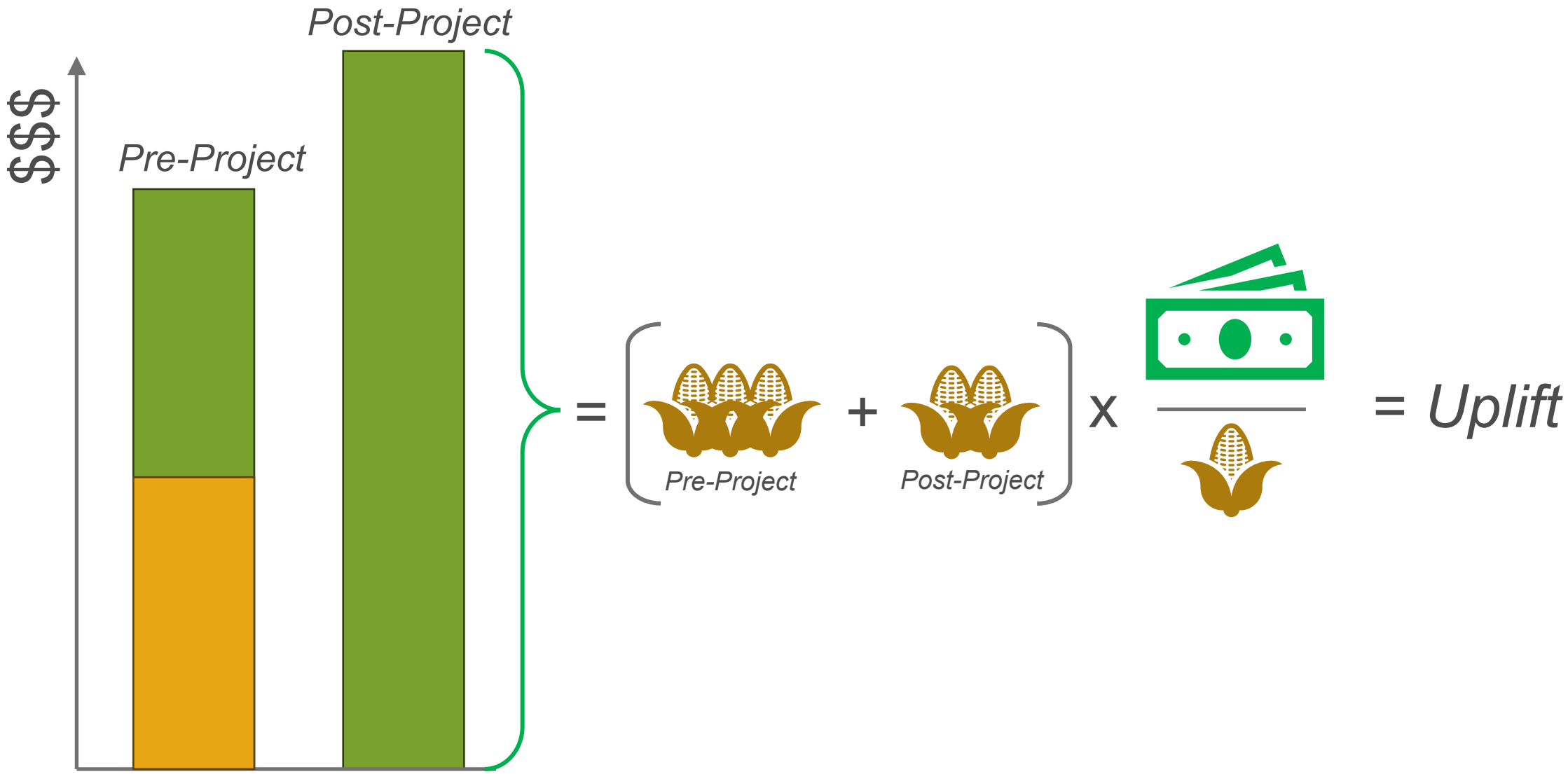

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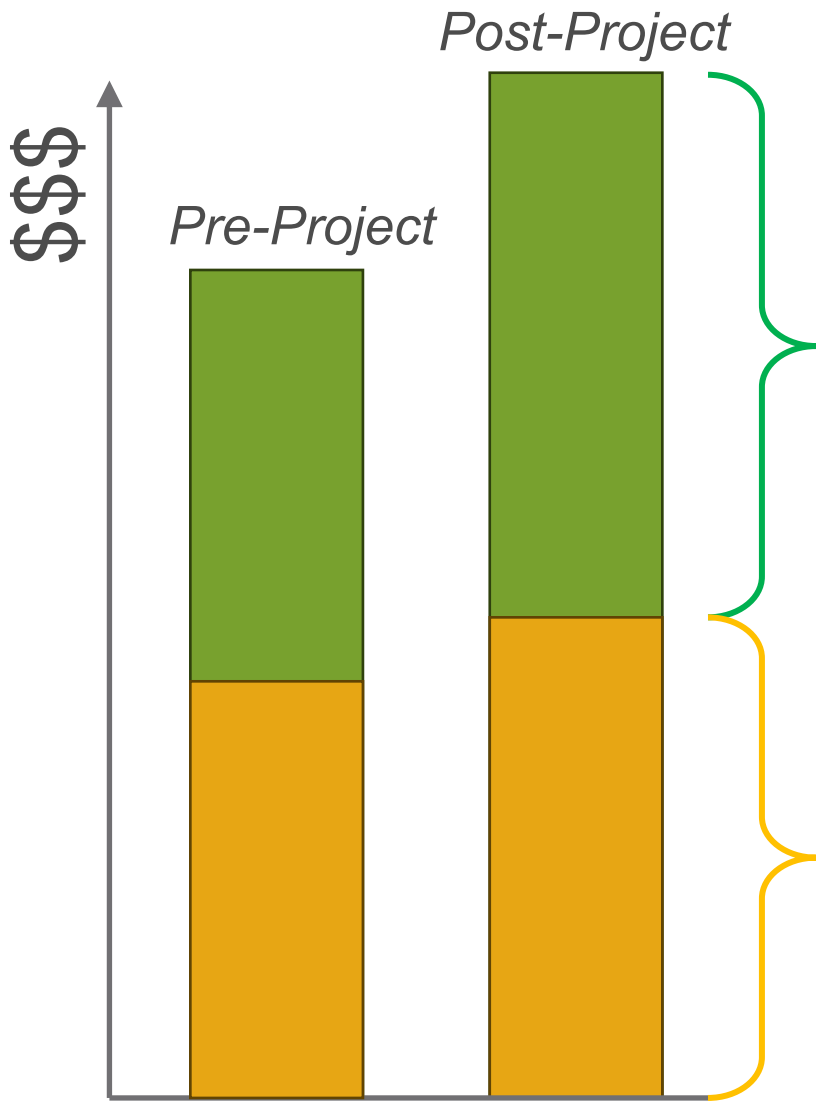
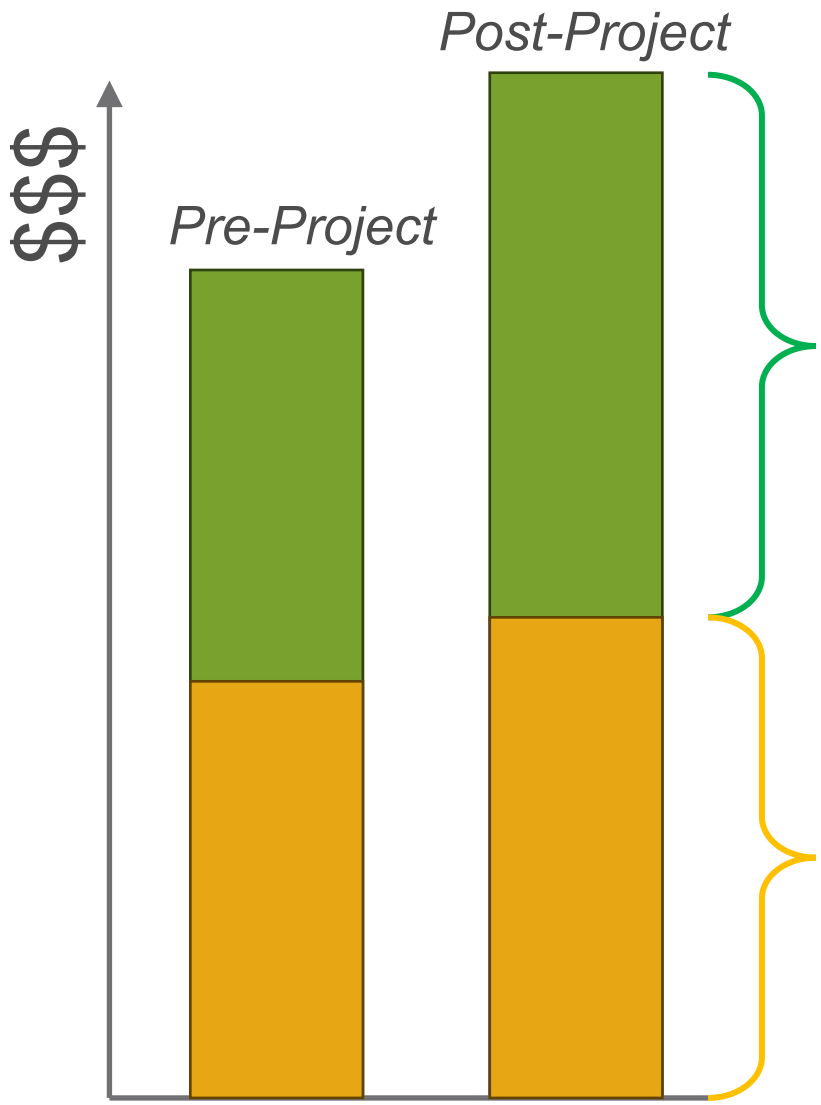


= *Gross Annual Return*

= *Landowner Costs + Marginal Increase*

Land Productivity Method



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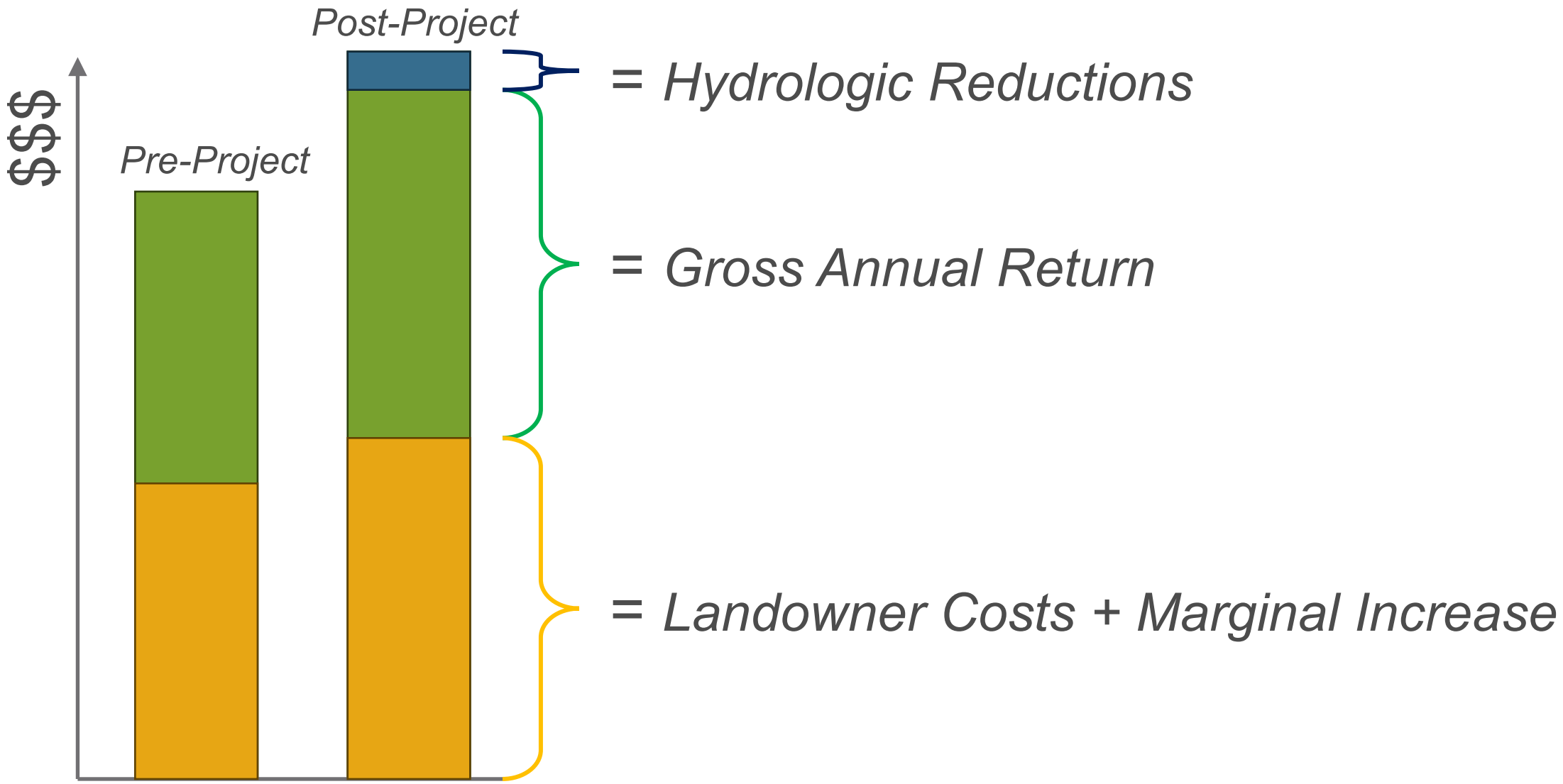

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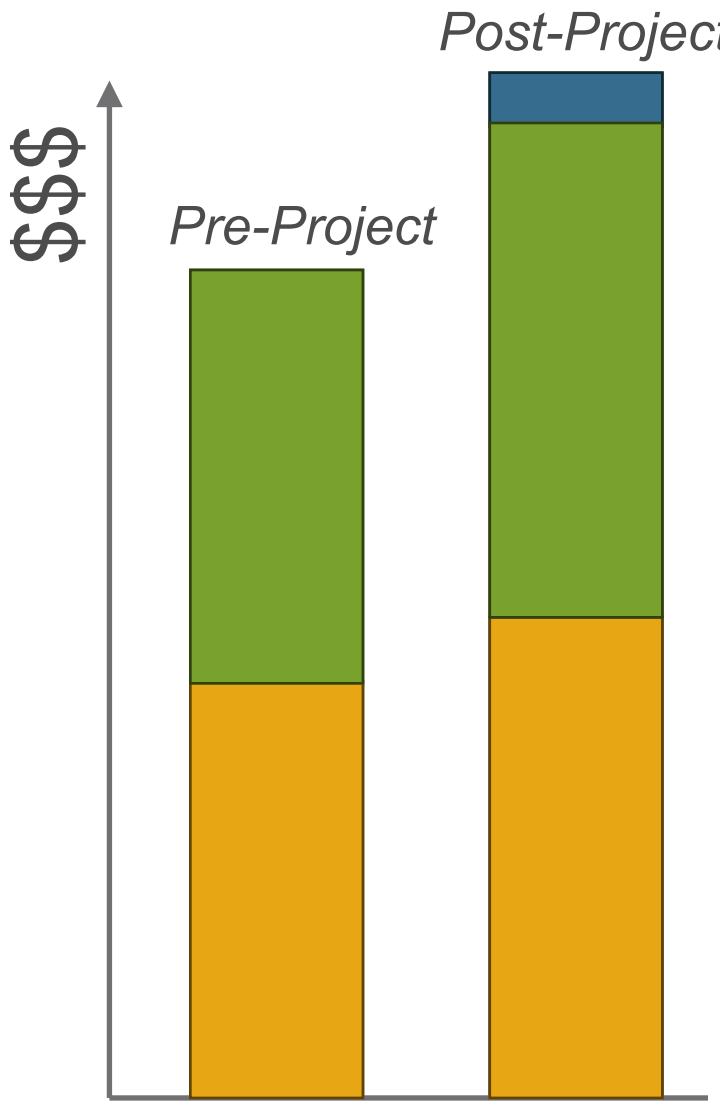

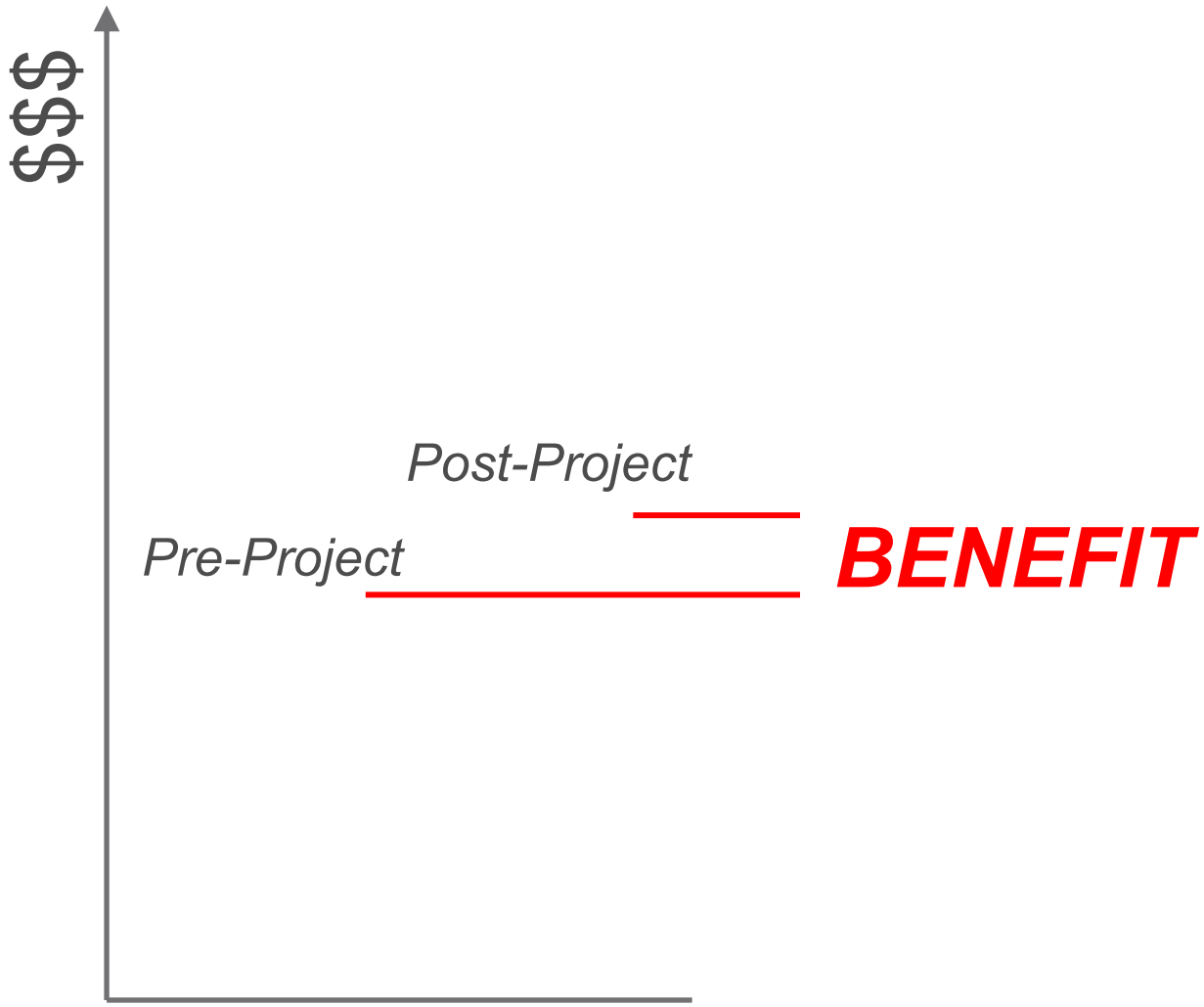

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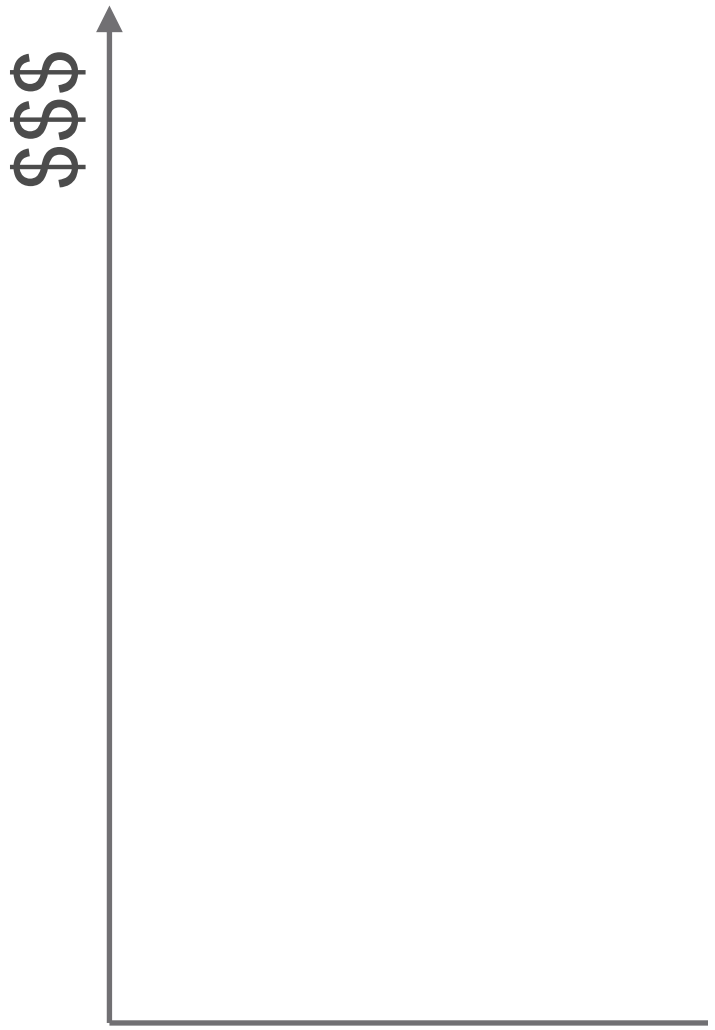
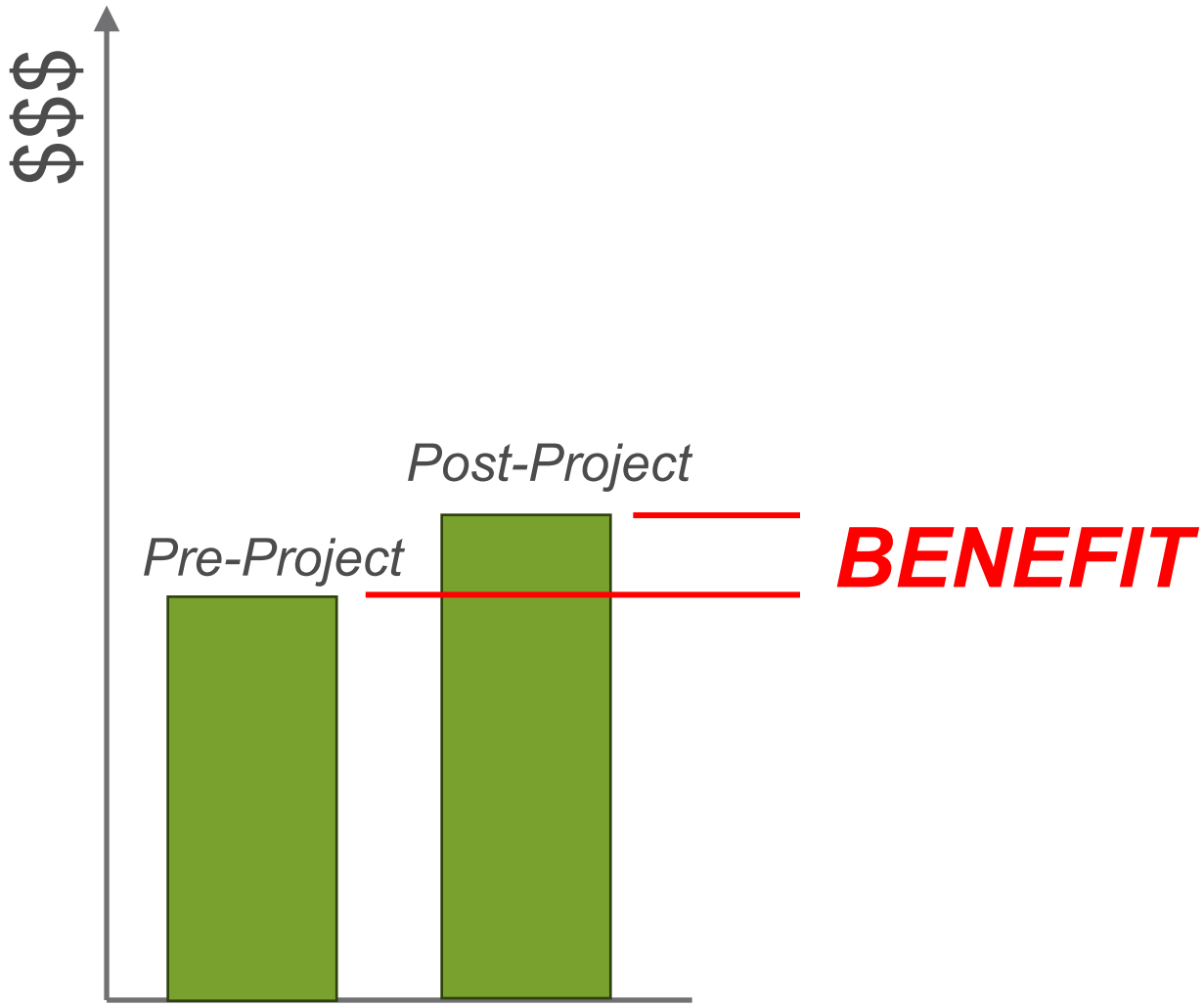
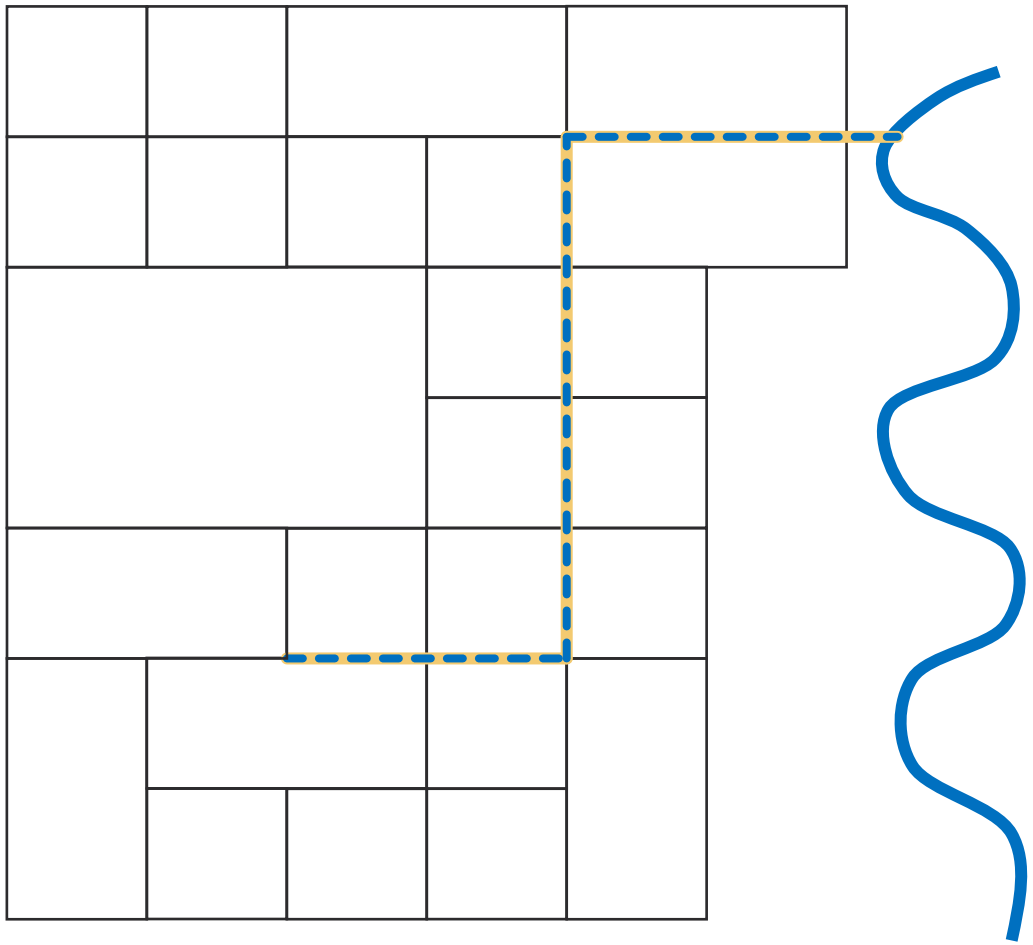




Land Productivity Method

- **STEP 1: Estimate Existing Conditions Annual Gross Return**
  - Inventory the ***True and Full Value (TFV)*** used for taxation (NDCC §57-02-27.2).
  - Inventory the ***Capitalization Rate*** published by the ND Tax Commissioner.
  - Inventory and estimate an appropriate ***Percentage Landowner Share***. Standard values are used based on crop type to determine the TFV used for taxation.
  - Calculate the Annual Gross Return consistent with methods used by NDSU to complete annual soils values used by the ND Tax Commissioner to assign TFV.

$$\textit{Annual Gross Return} = \frac{\textit{True and Full Value} \times \textit{Capitalization Rate}}{\textit{Percentage Landowner Share}}$$



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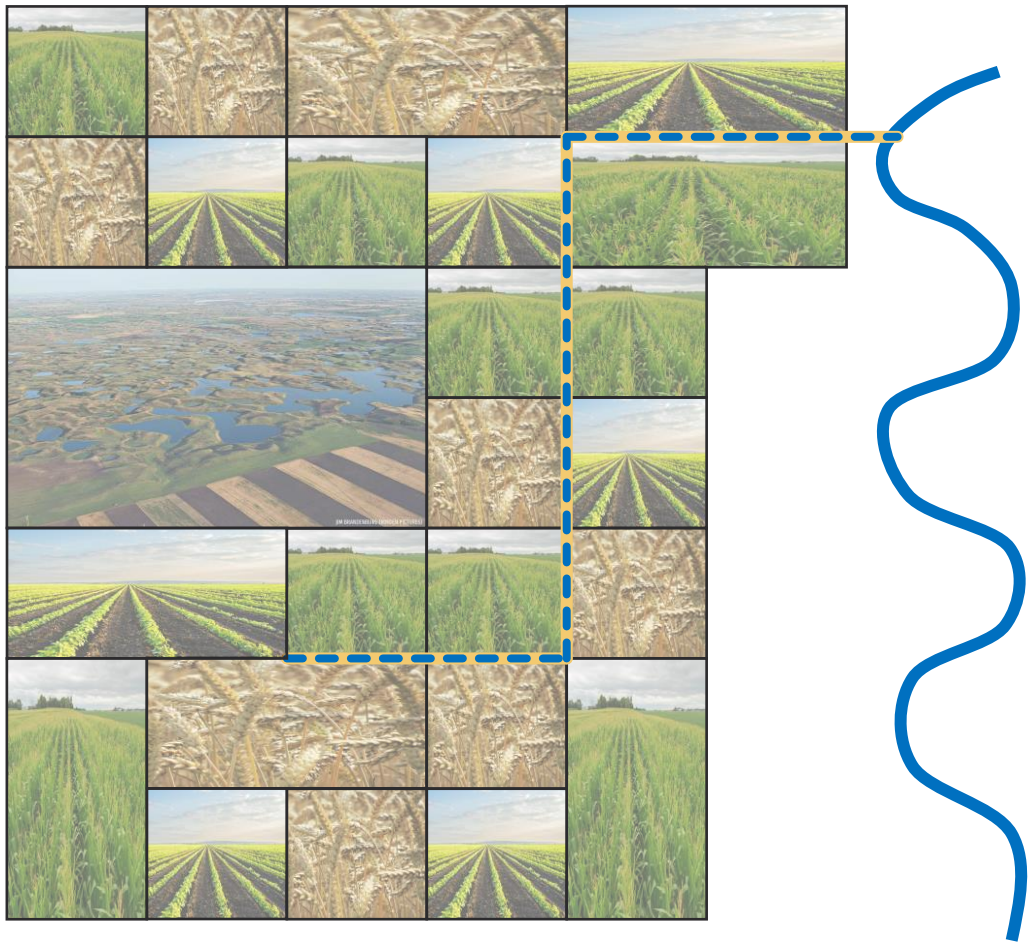

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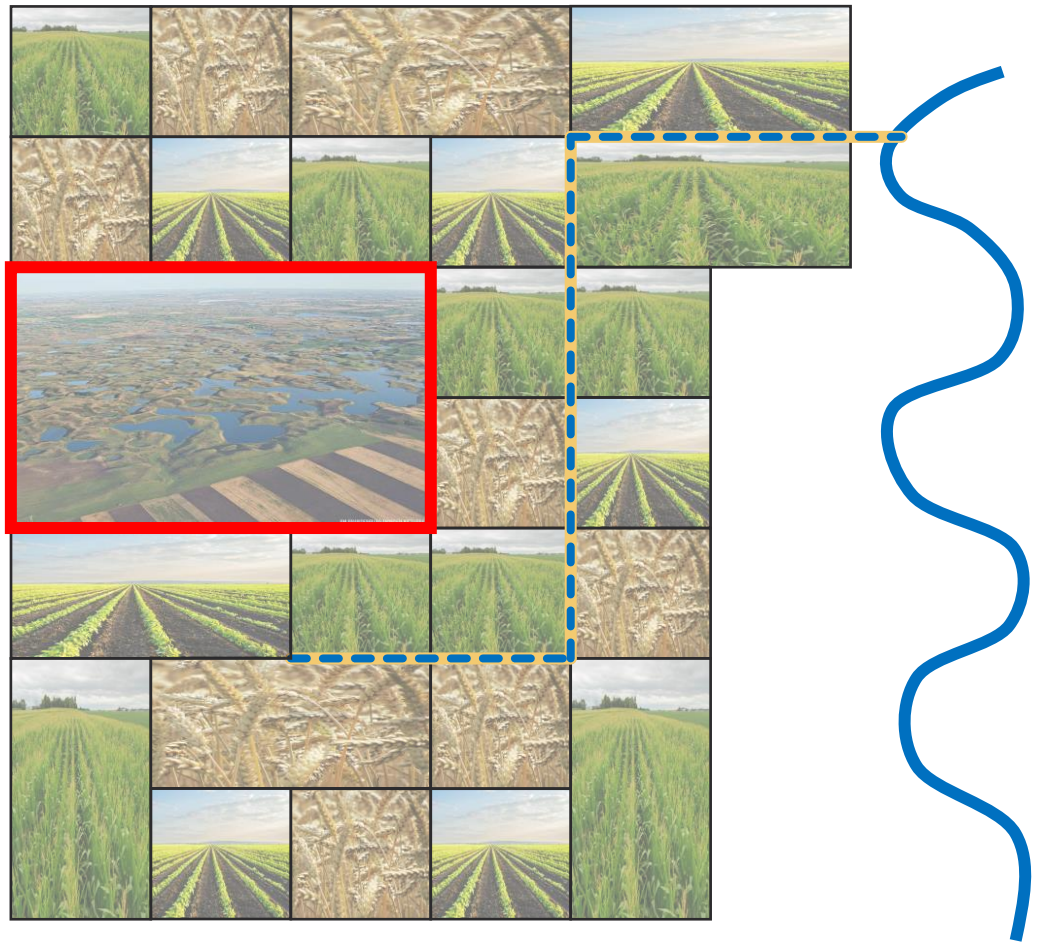

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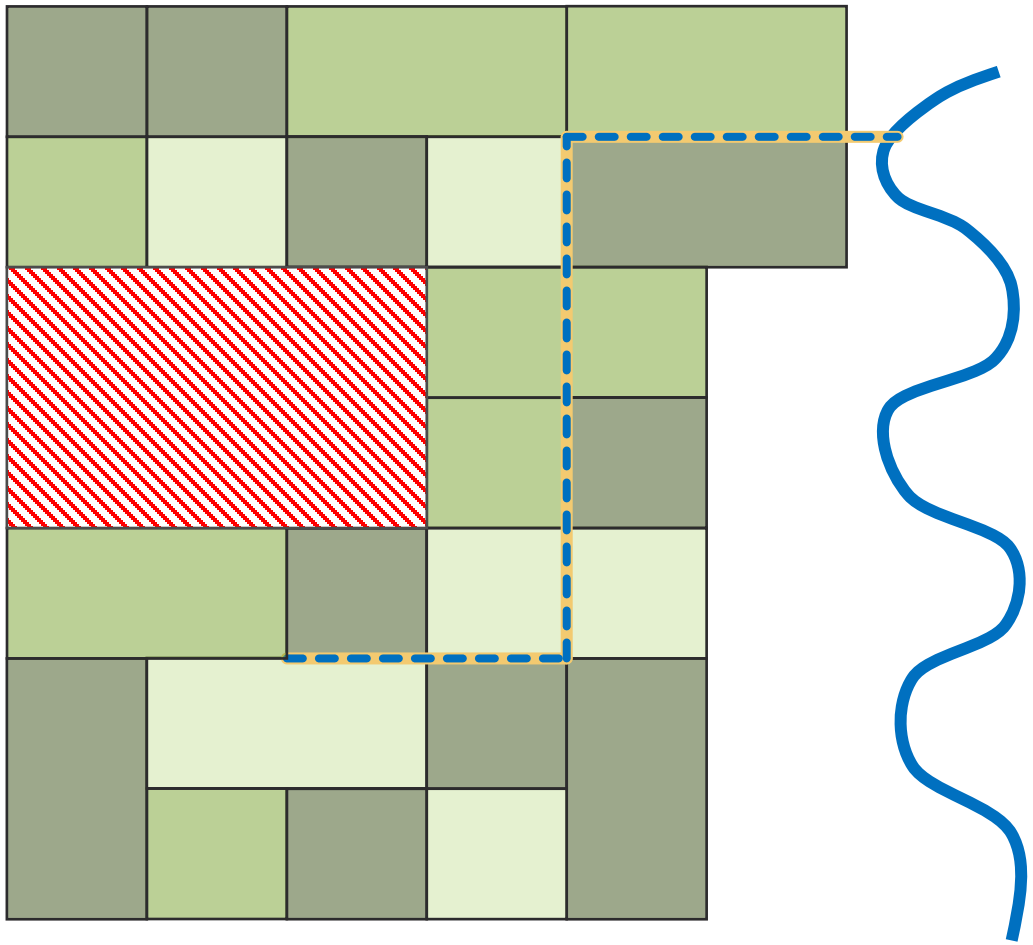
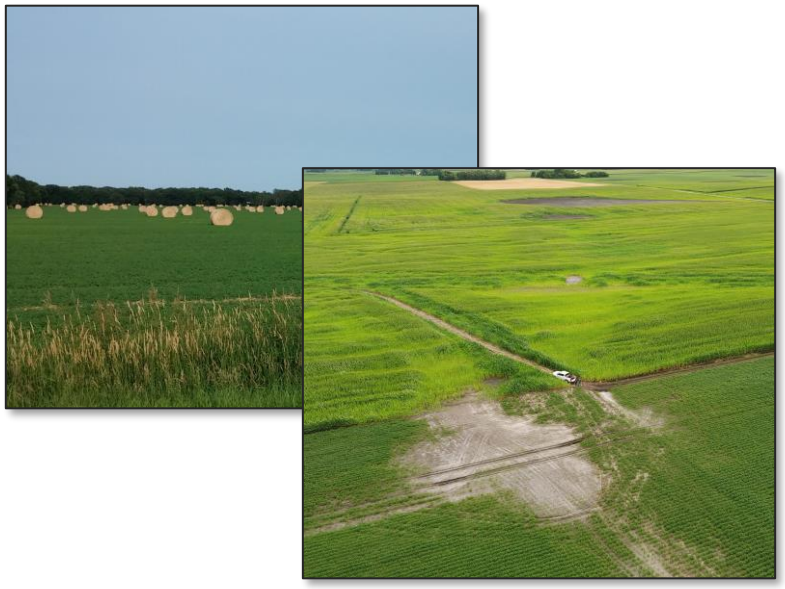


Land Productivity Method

- **STEP 2: Estimate the Uplift Potential in Annual Gross Return**

$$\boldsymbol{Annual\ Gross\ Return\ Uplift} =$$

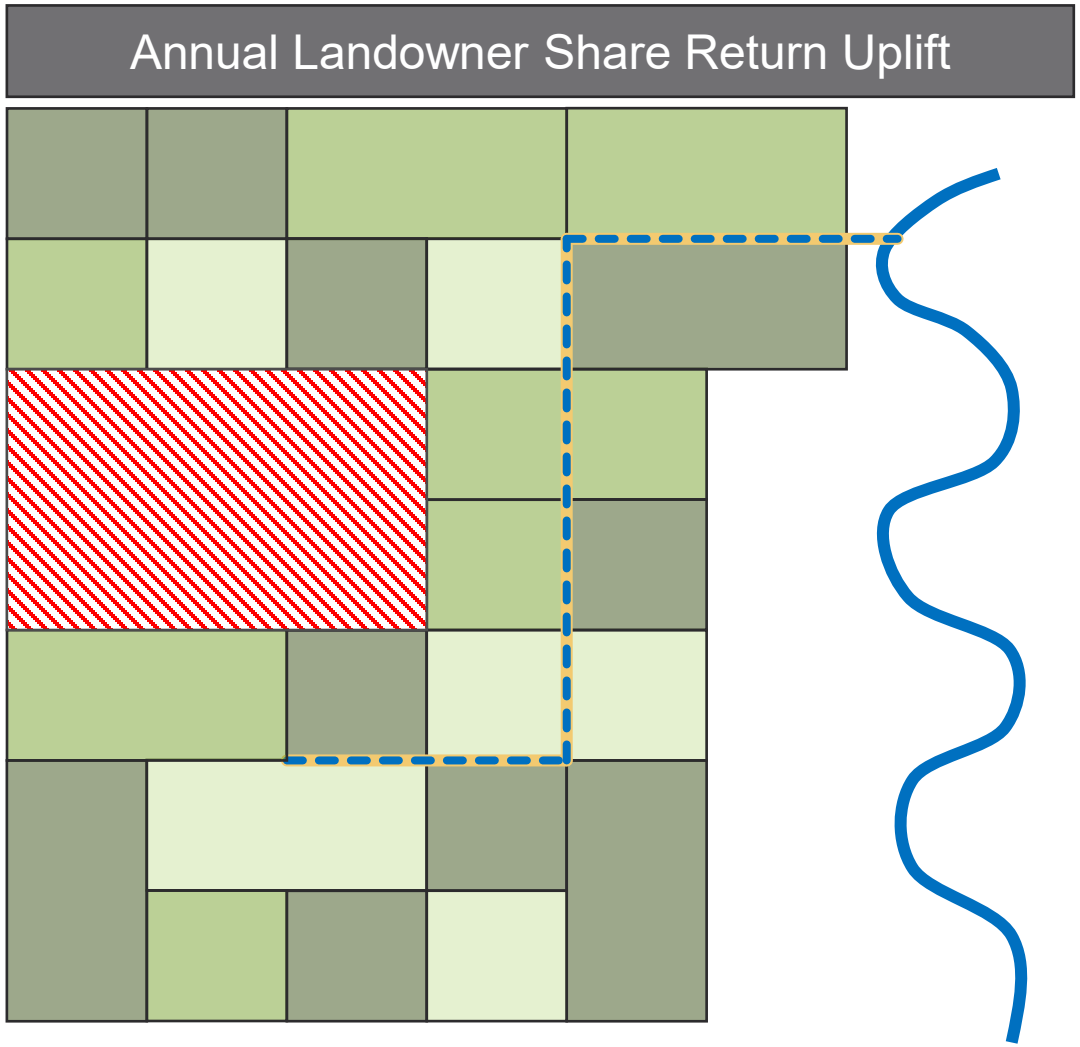
$$\boldsymbol{Annual\ Gross\ Return}_{(preproject)} \times [\boldsymbol{Intensification}\ \% + \boldsymbol{Yield\ Increase}\ \%]$$



Maximize Return

Land Productivity Method

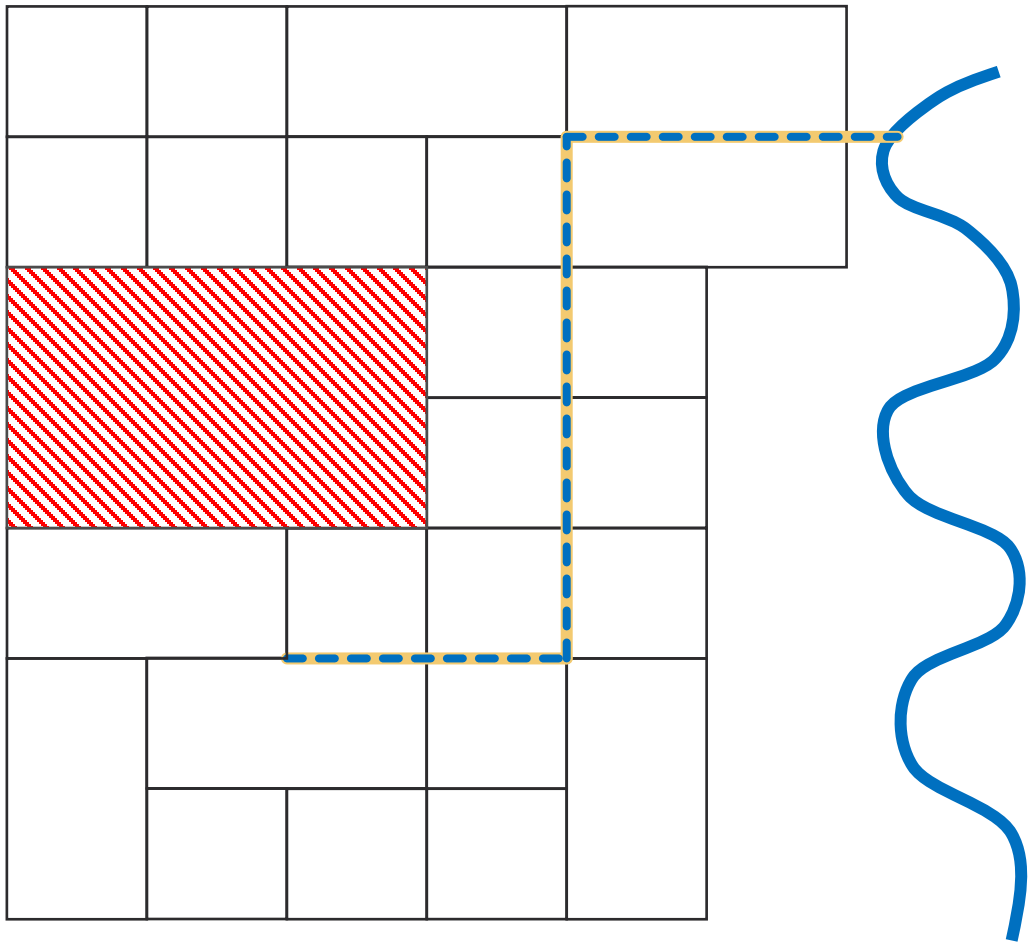
- **STEP 3A: Estimate Marginal Cost Increase**
  - Estimate the landowner annual cost increases due to increased production potential.
  - Users should rely on peer reviewed publications, expert consultants, and/or local knowledge of the area.
  - Calculate the Annual Landowner Share Return Uplift due to cropland intensification and/or increased yields.



$$\textit{Annual Landowner Share Return Uplift} = \textit{Annual Gross Return Uplift} \times [1 - \textit{Marginal Cost Increase}\ \%]$$

Land Productivity Method

- **STEP 3B: Consider Hydrology Factors**
  - Determine appropriate landowner costs related to ability to access the drainage benefits.
  - Example factors include (but not limited to):
    - Proximity & Cost to Access
    - Elevation relative to the drain
    - Land use challenges preventing benefit realization (IE… easements, regulatory limitations, etc…)
  - Users should rely on peer reviewed publications, expert consultants, and/or local knowledge of the area.
  - Calculate the Average Annual Benefit.



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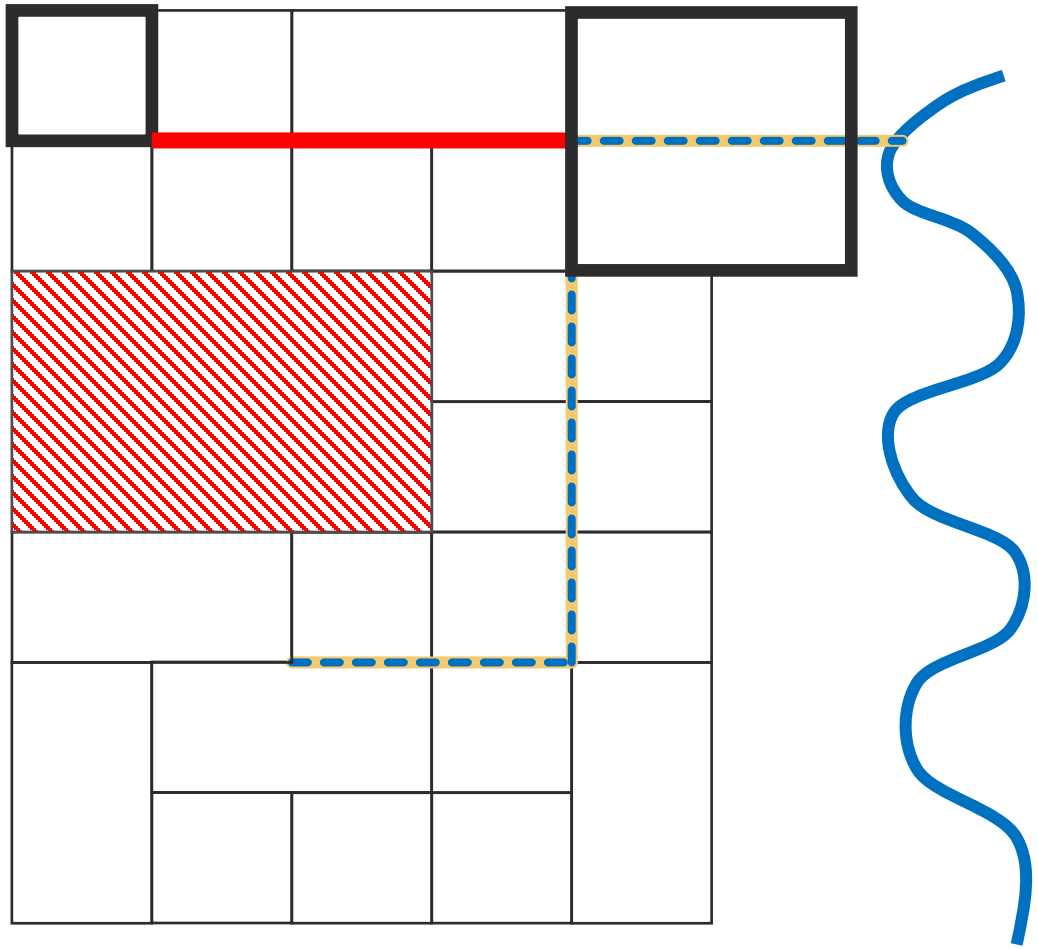

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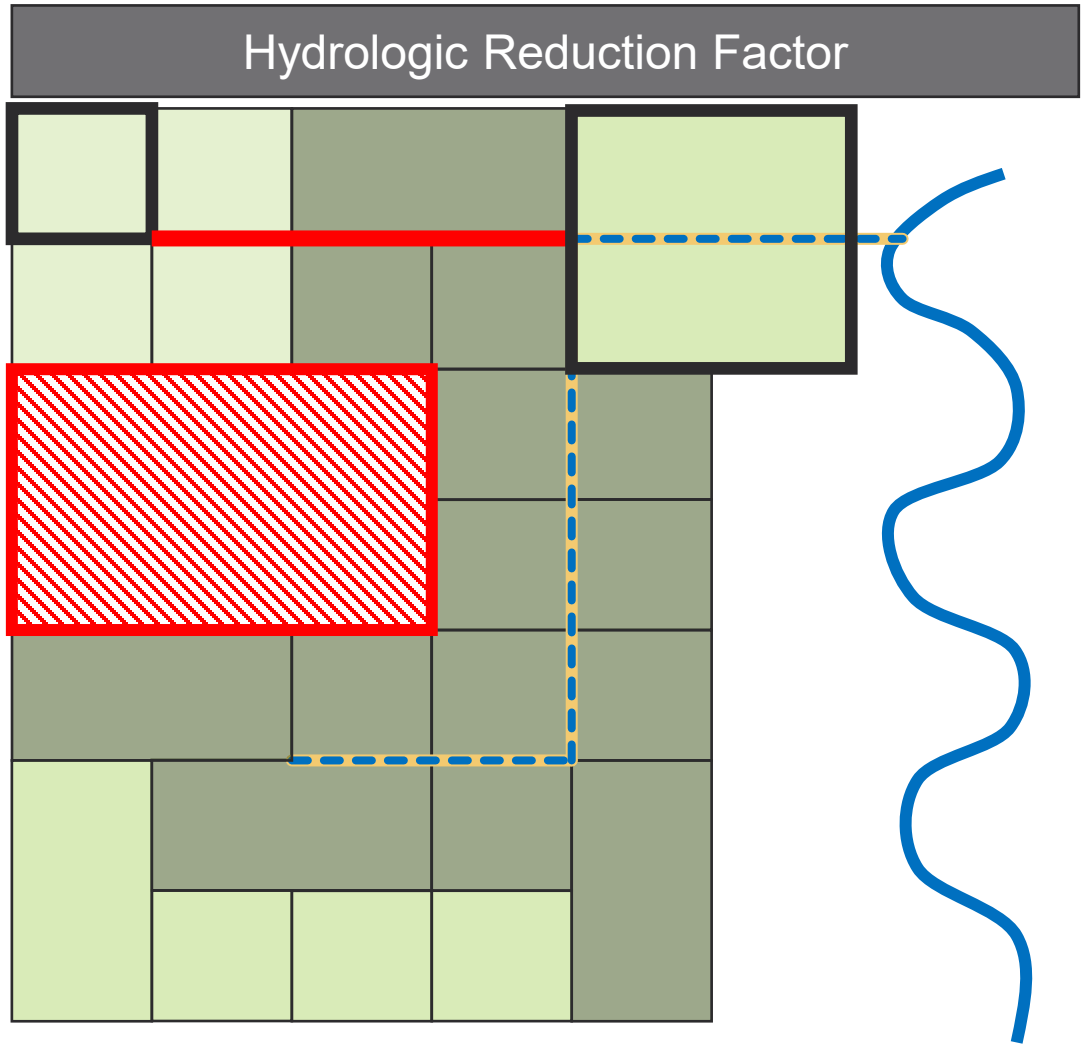

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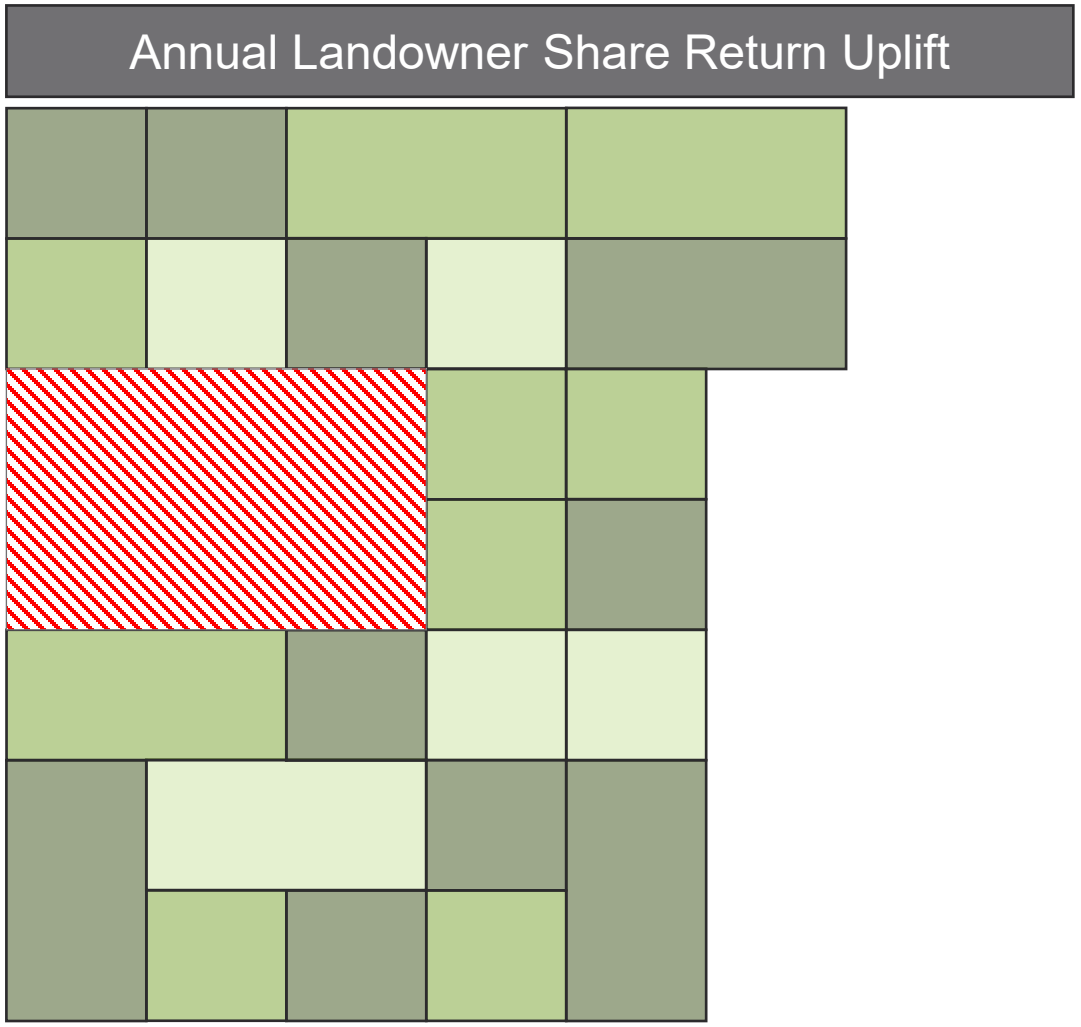
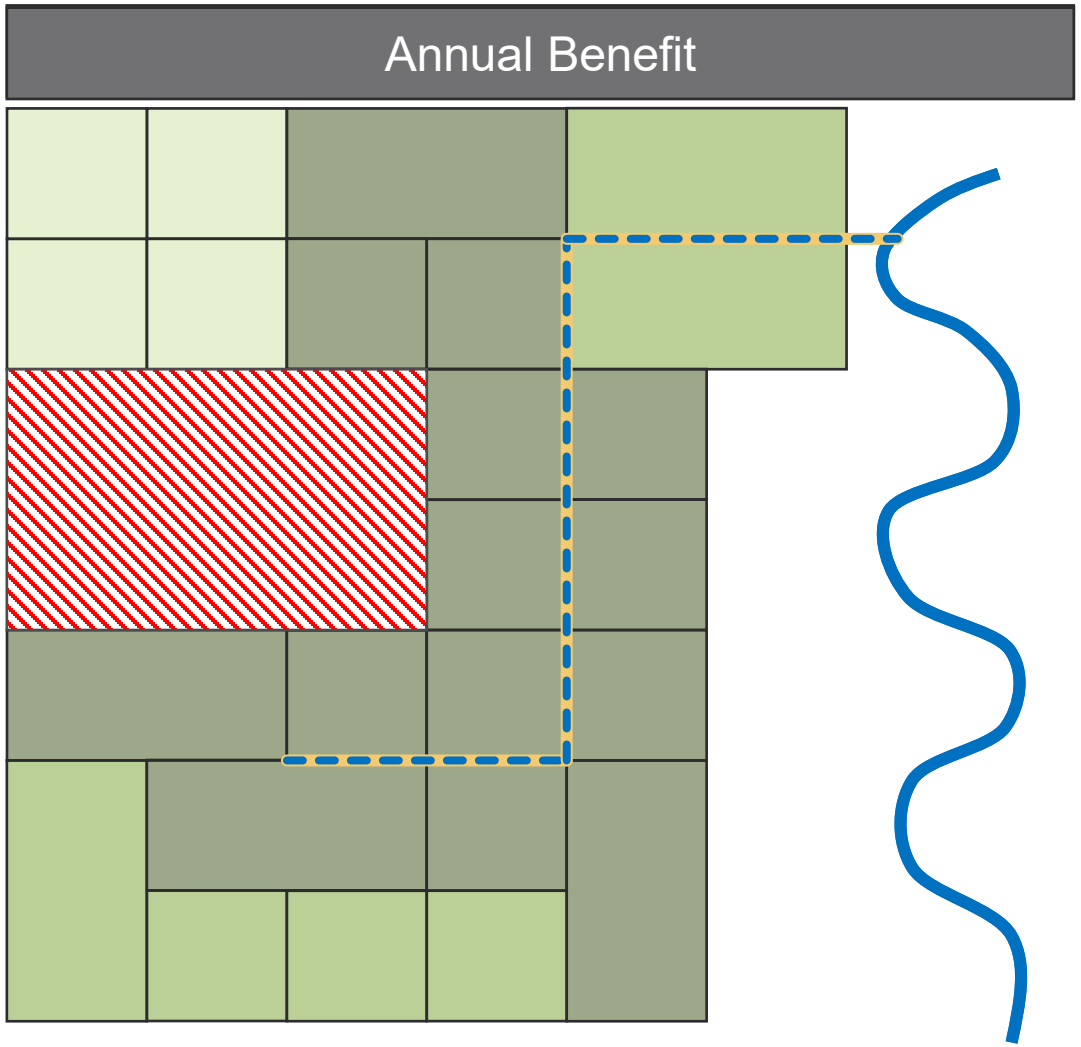
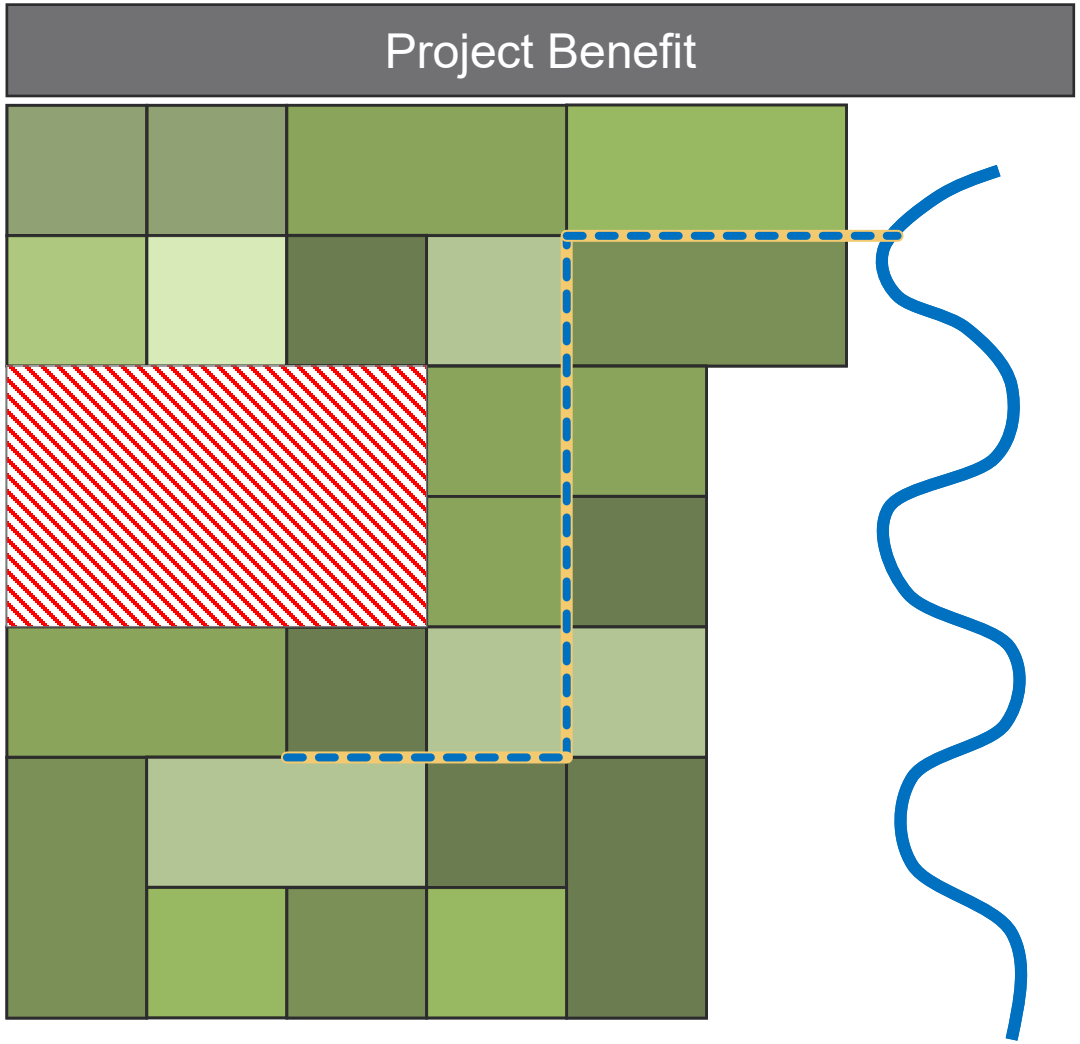


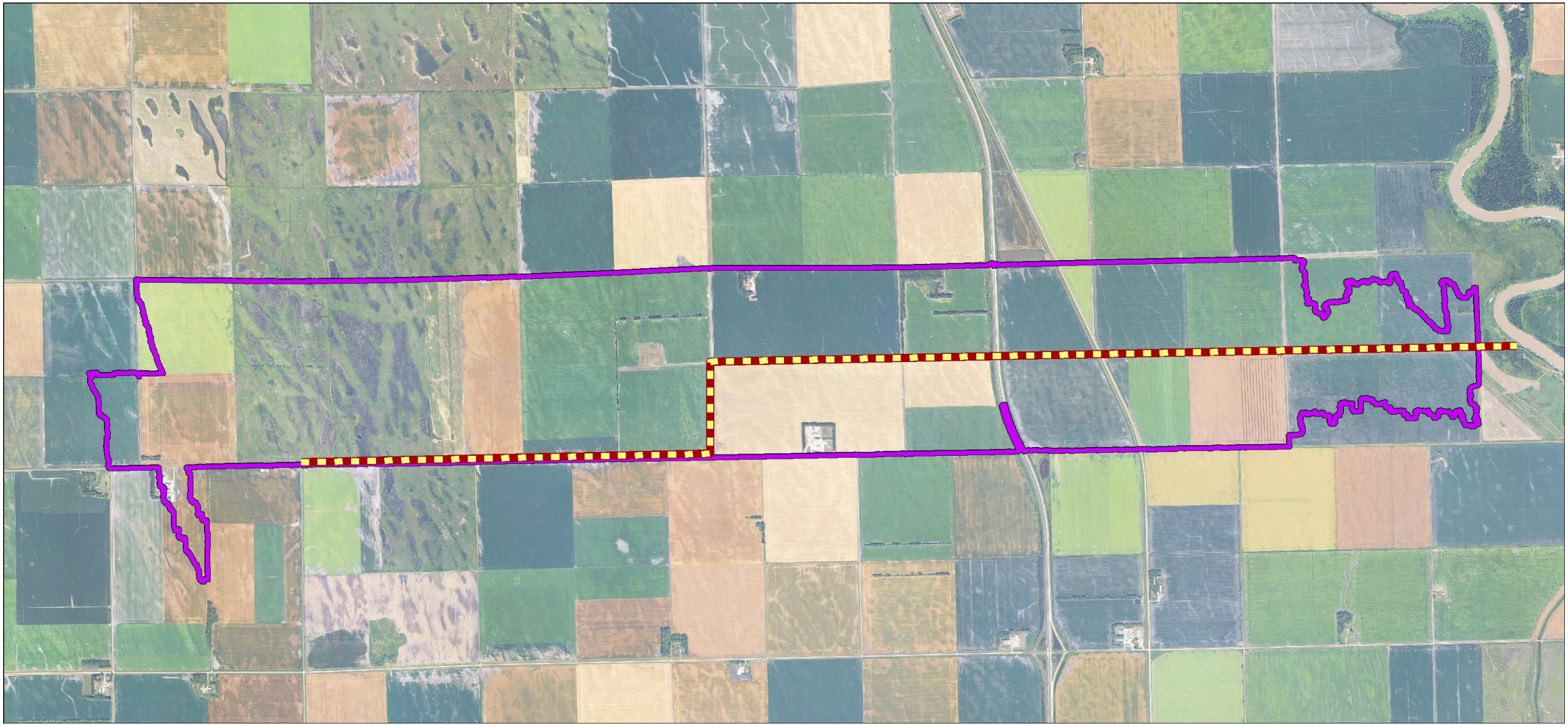


Land Productivity Method

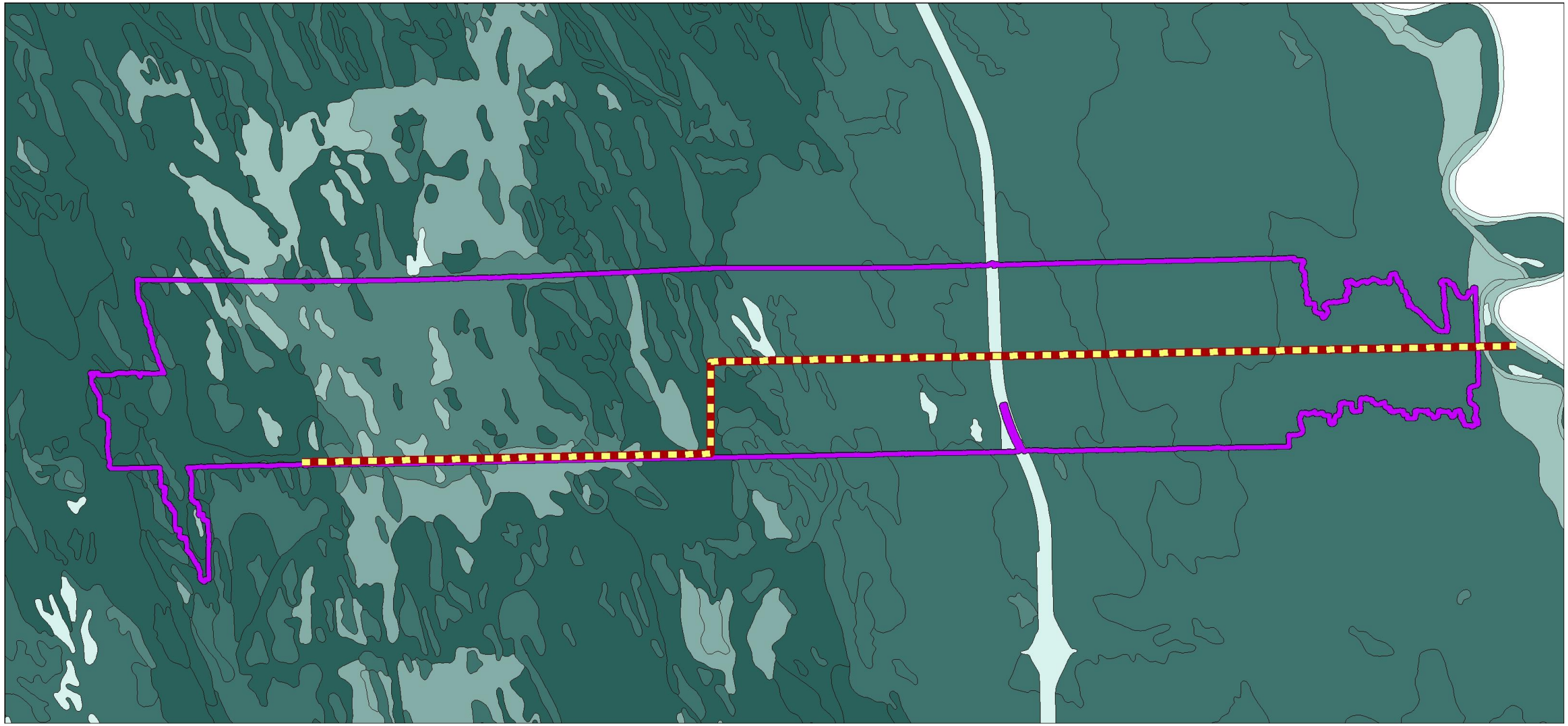
- **STEP 4: Ammortize the Average Annual Benefit over the Project Life**
  - Inventory the Discount Rate published by the US Army Corps of Engineers (2025 = 3.00%).
  - Amortize the costs over the project life to determine the total project benefits.



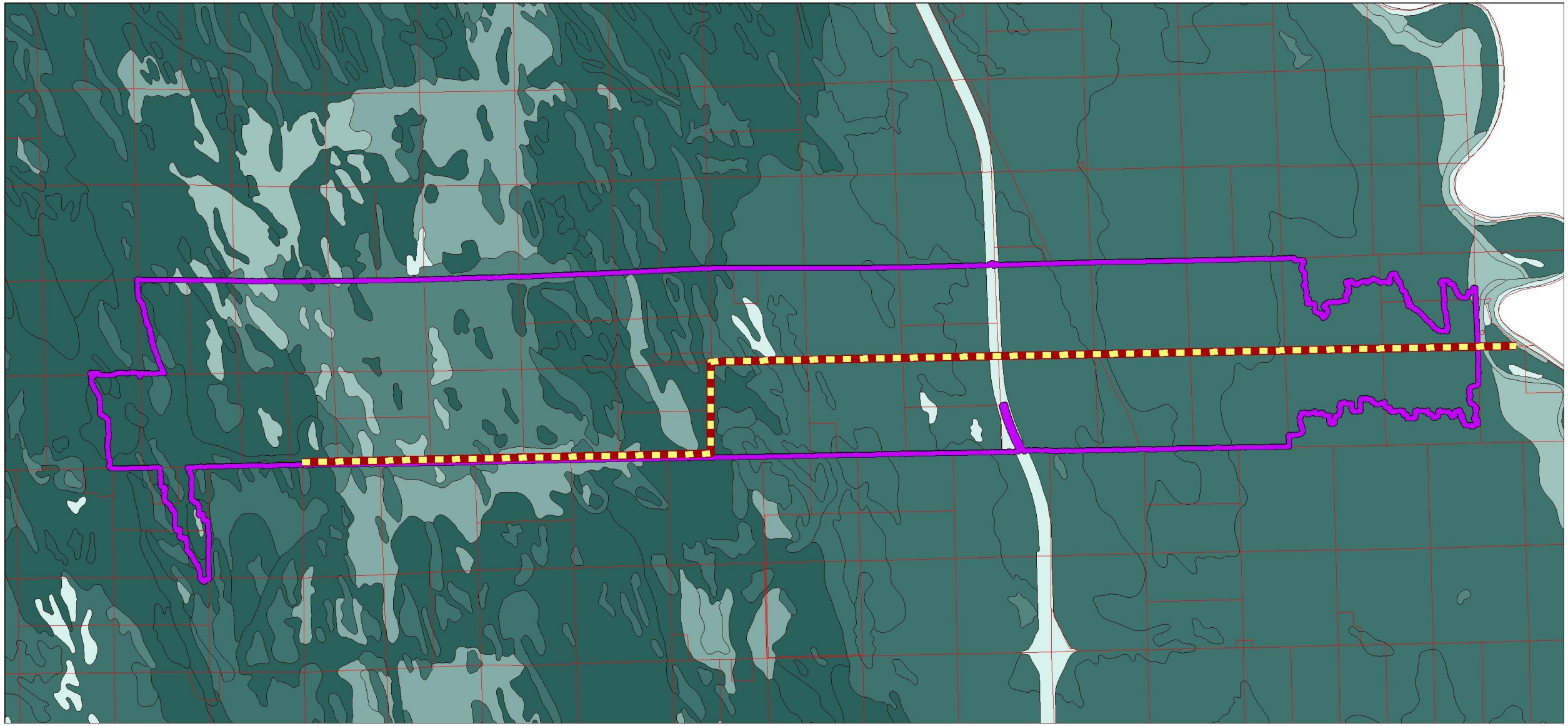
Example Drainage System



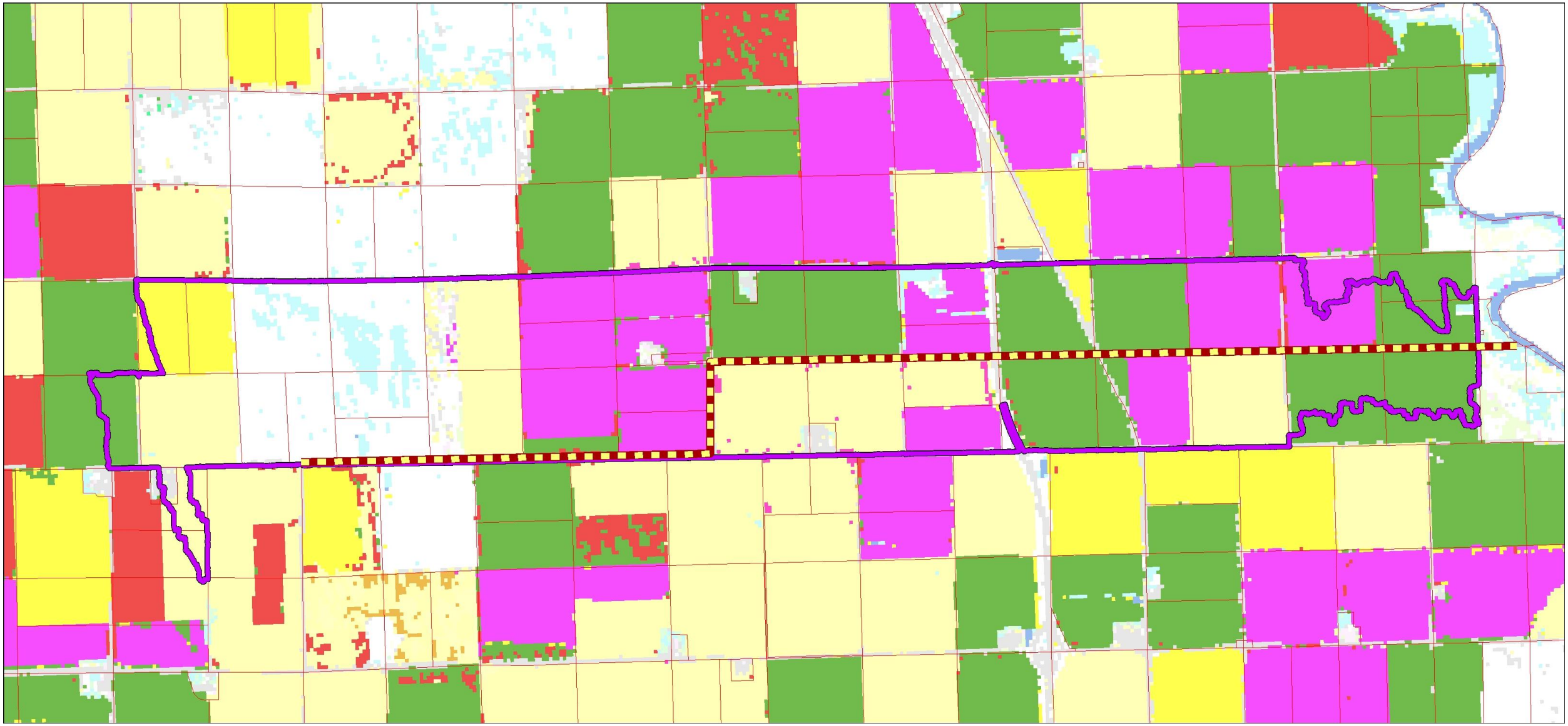
Example Drainage System – USDA SSURGO Soils Data *(CPI Attribute Shown)*



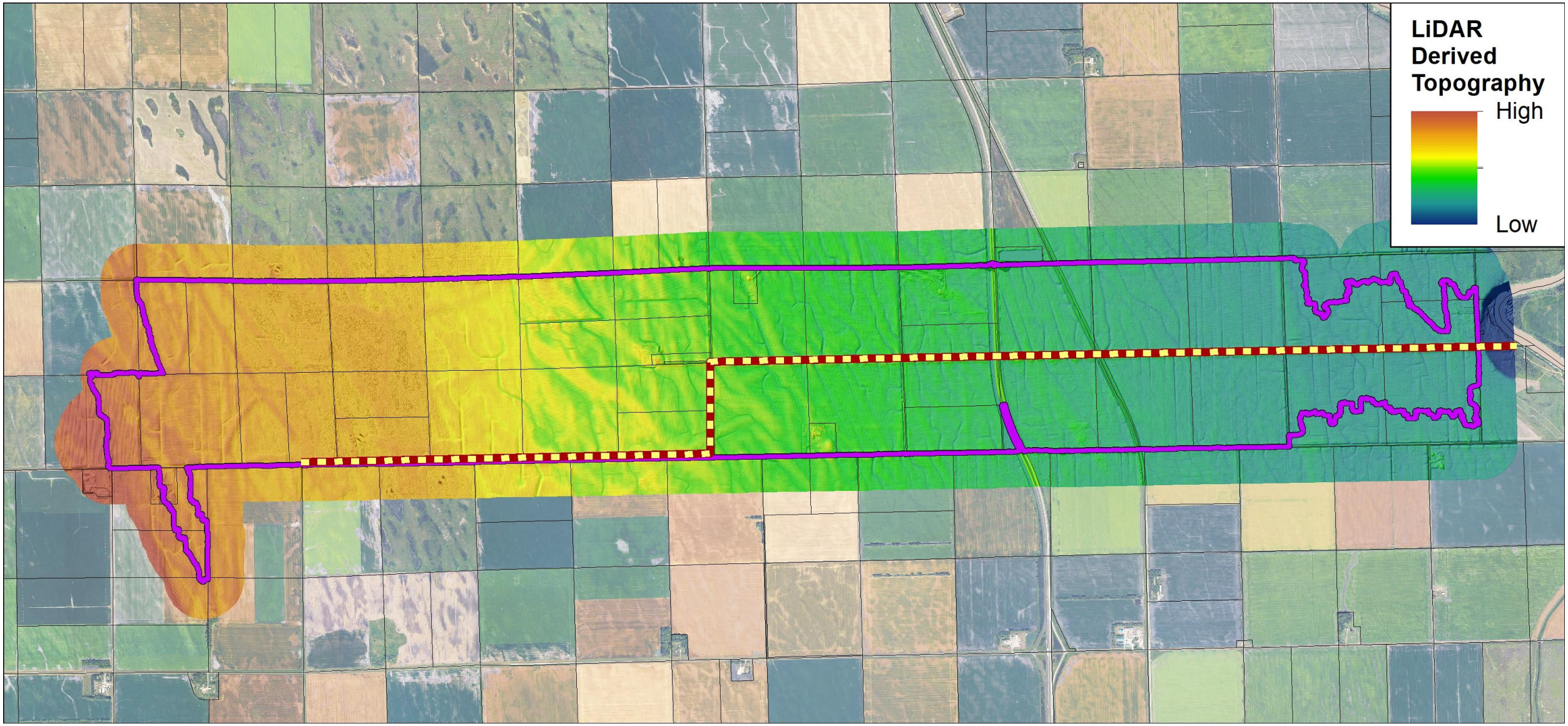
Example Drainage System – Geospatial Parcel Data



Example Drainage System – Cropping History (USDA NASS Database)



Example Drainage System – LiDAR Derived Hydrography



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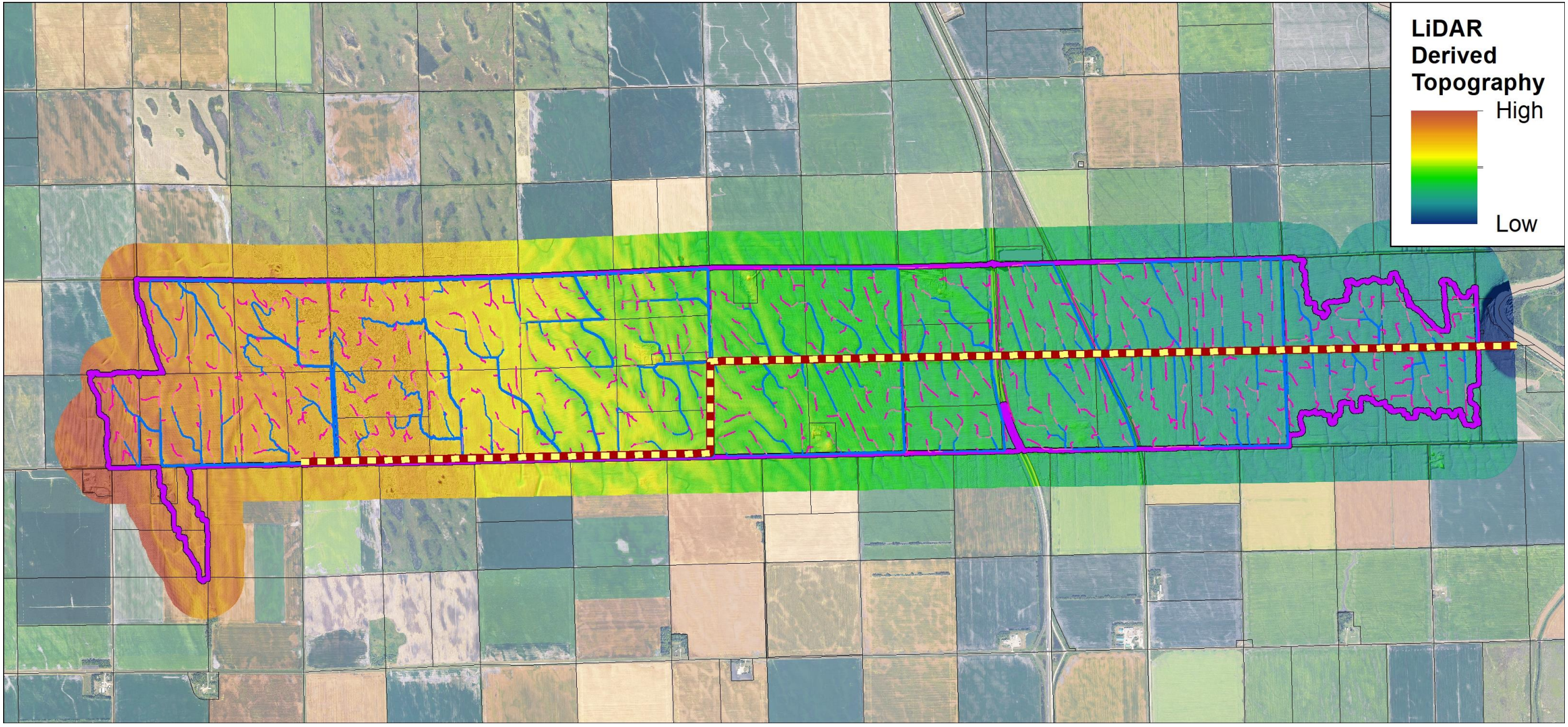

Example Drainage System – Step 1: Calculate Annual Gross Return

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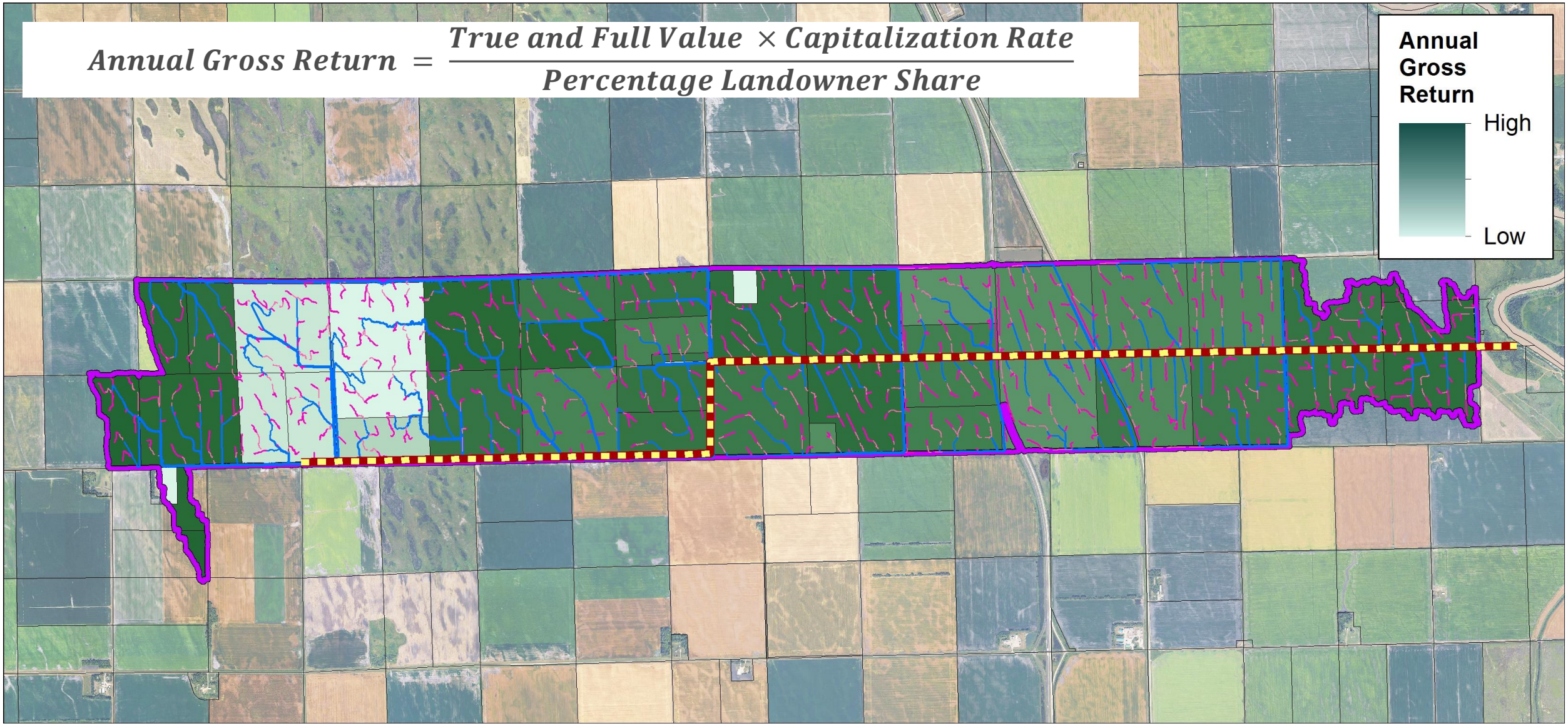

Example Drainage System – Step 2: Uplift & Intensification

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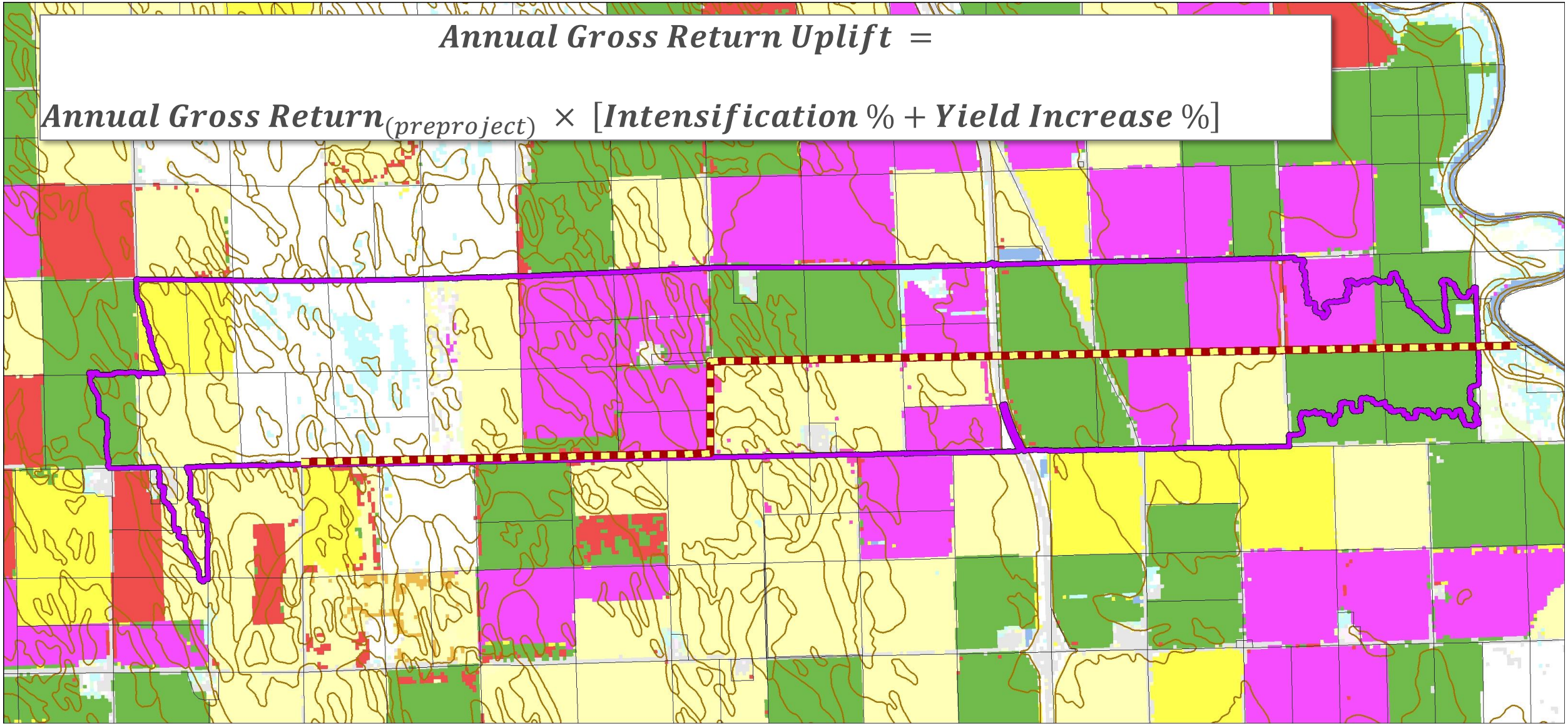

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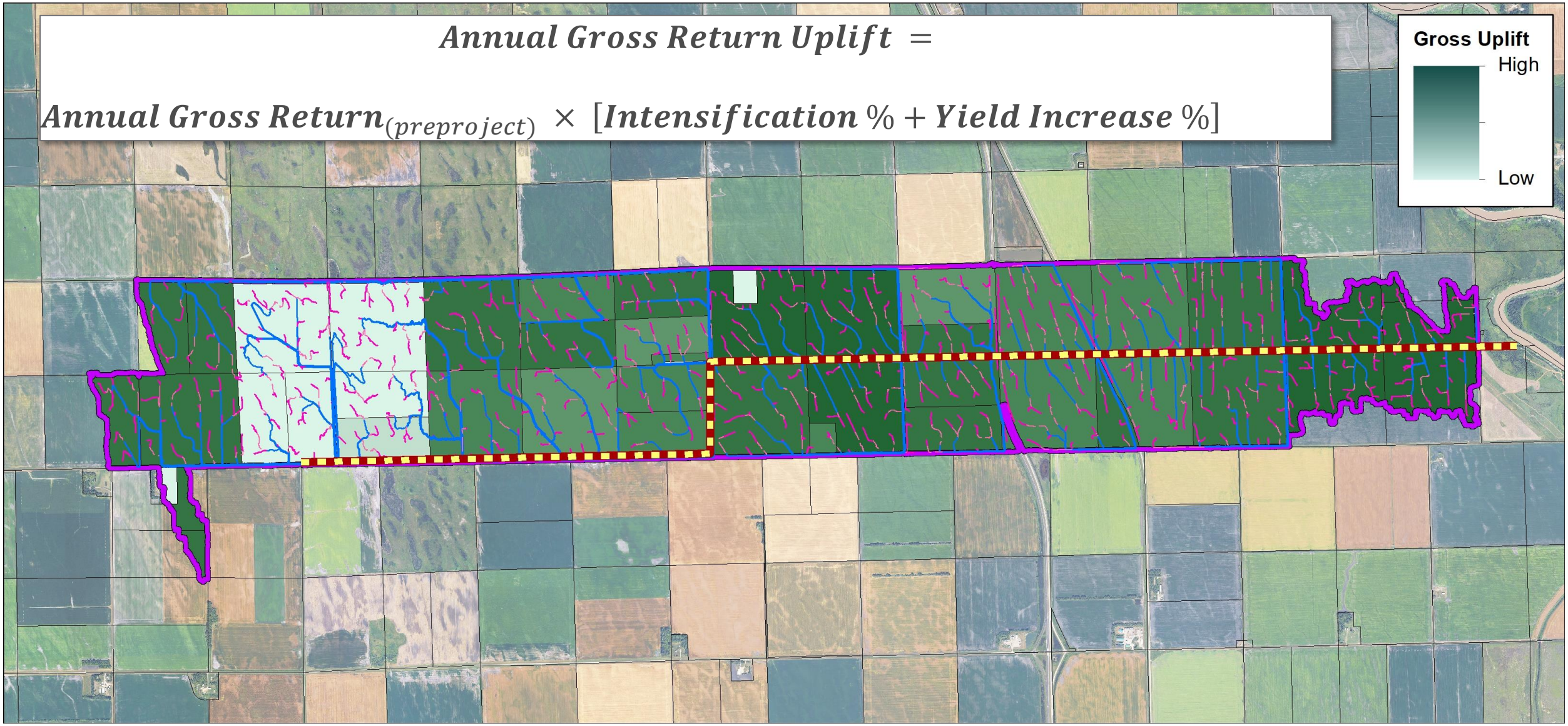
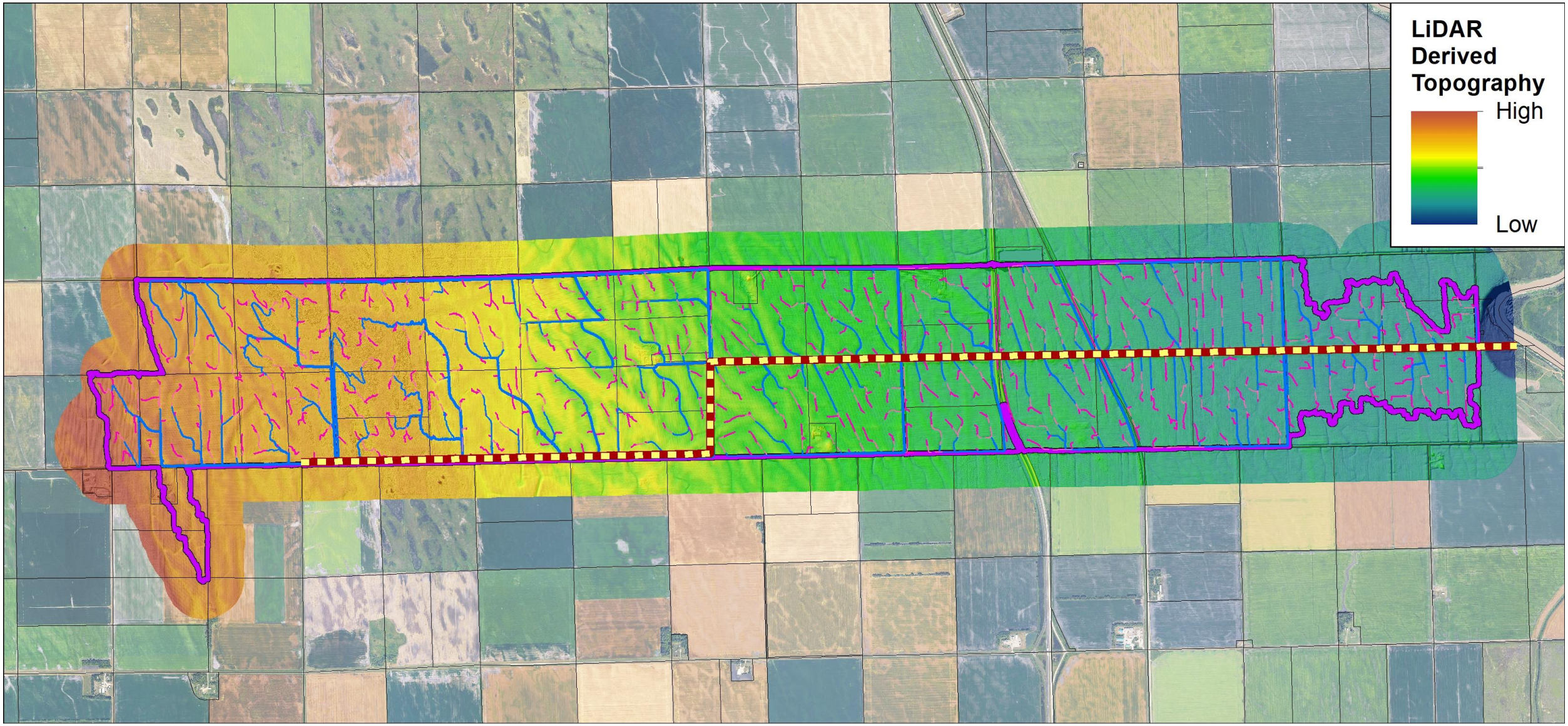


Example Drainage System – Step 3: Discounts *(Hydrologic Considerations)*



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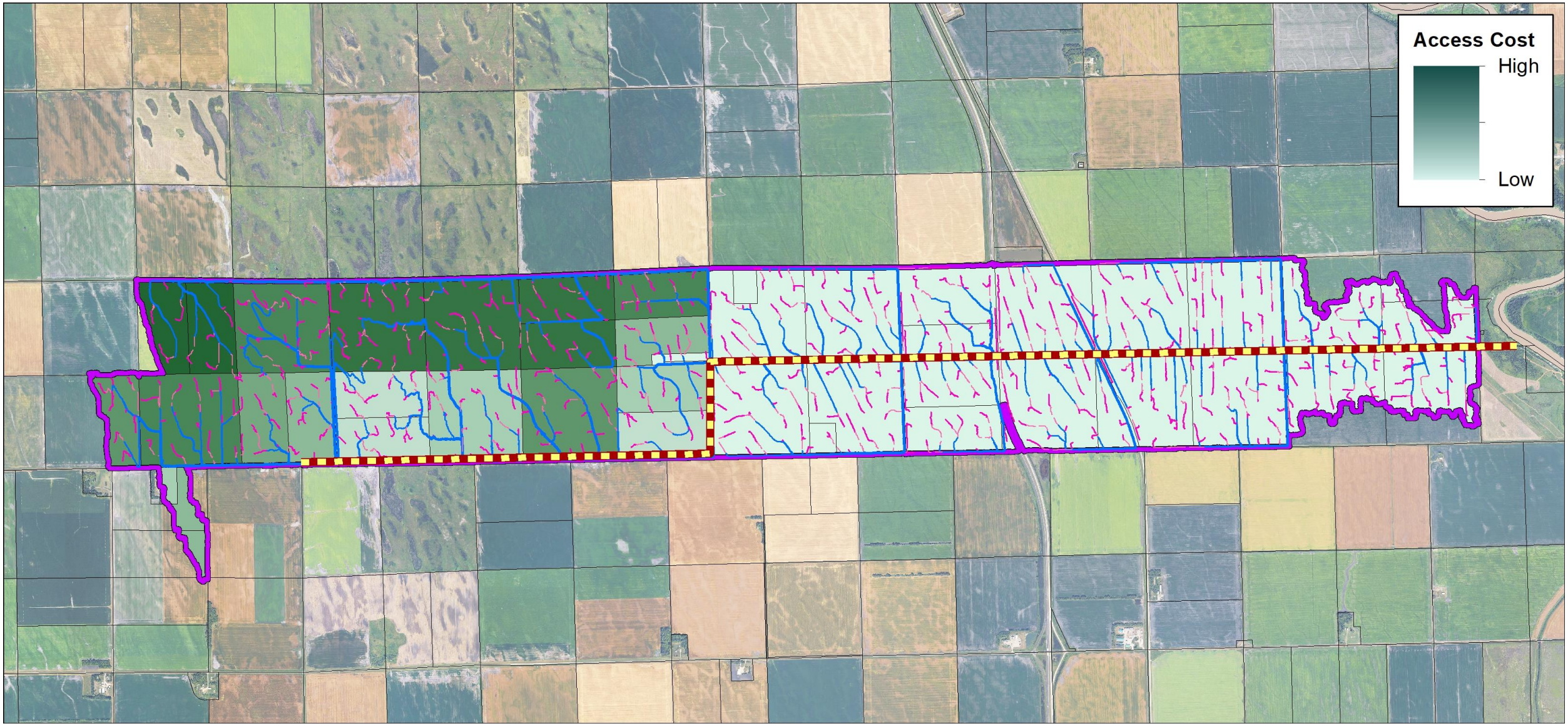

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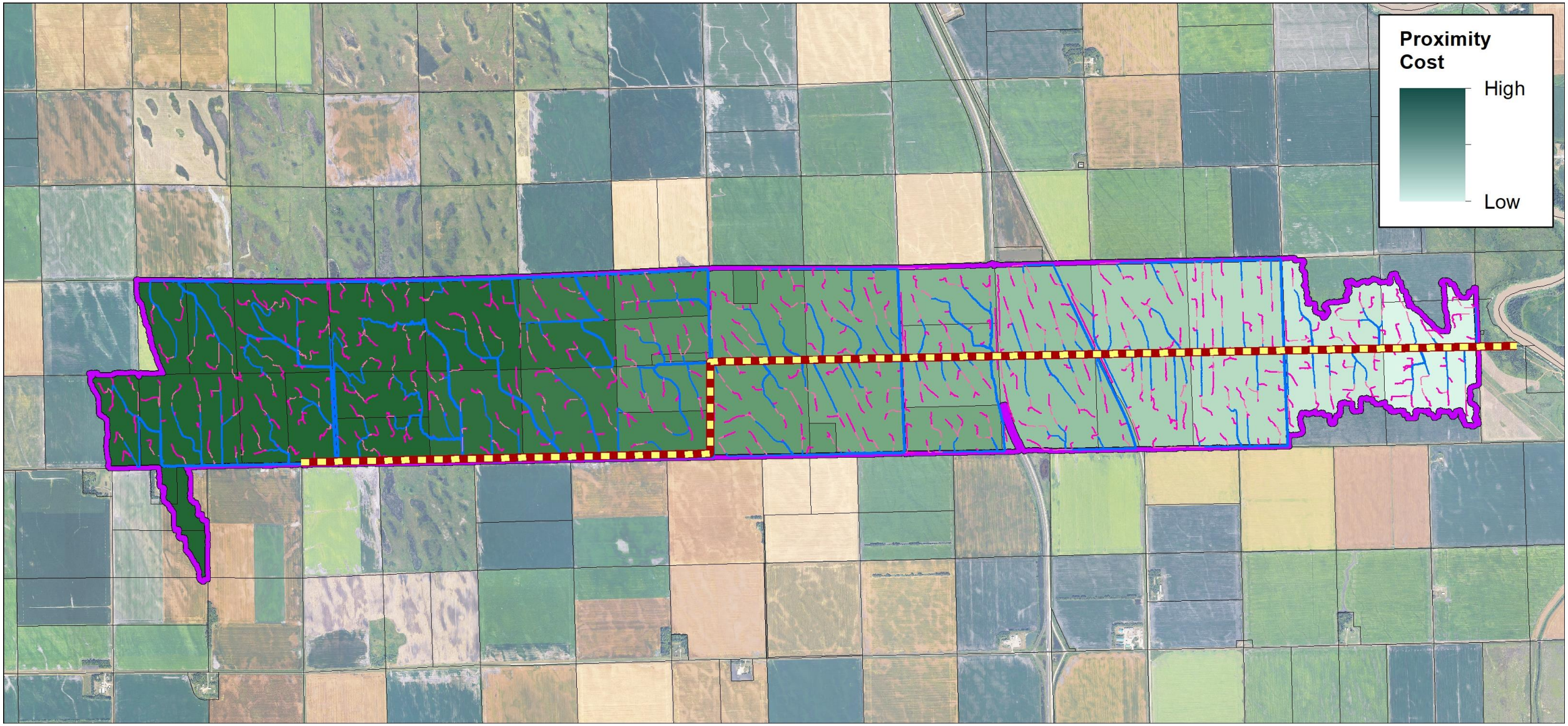
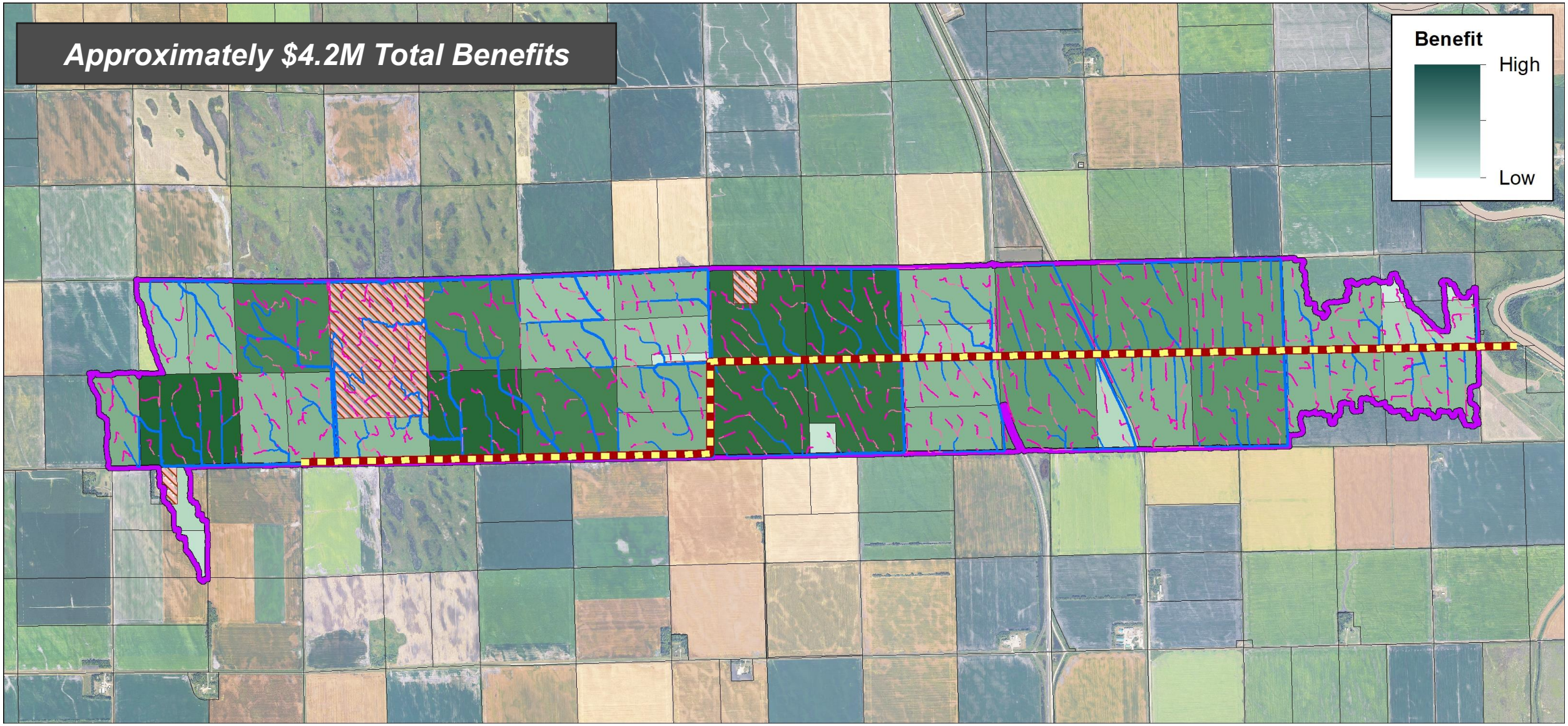
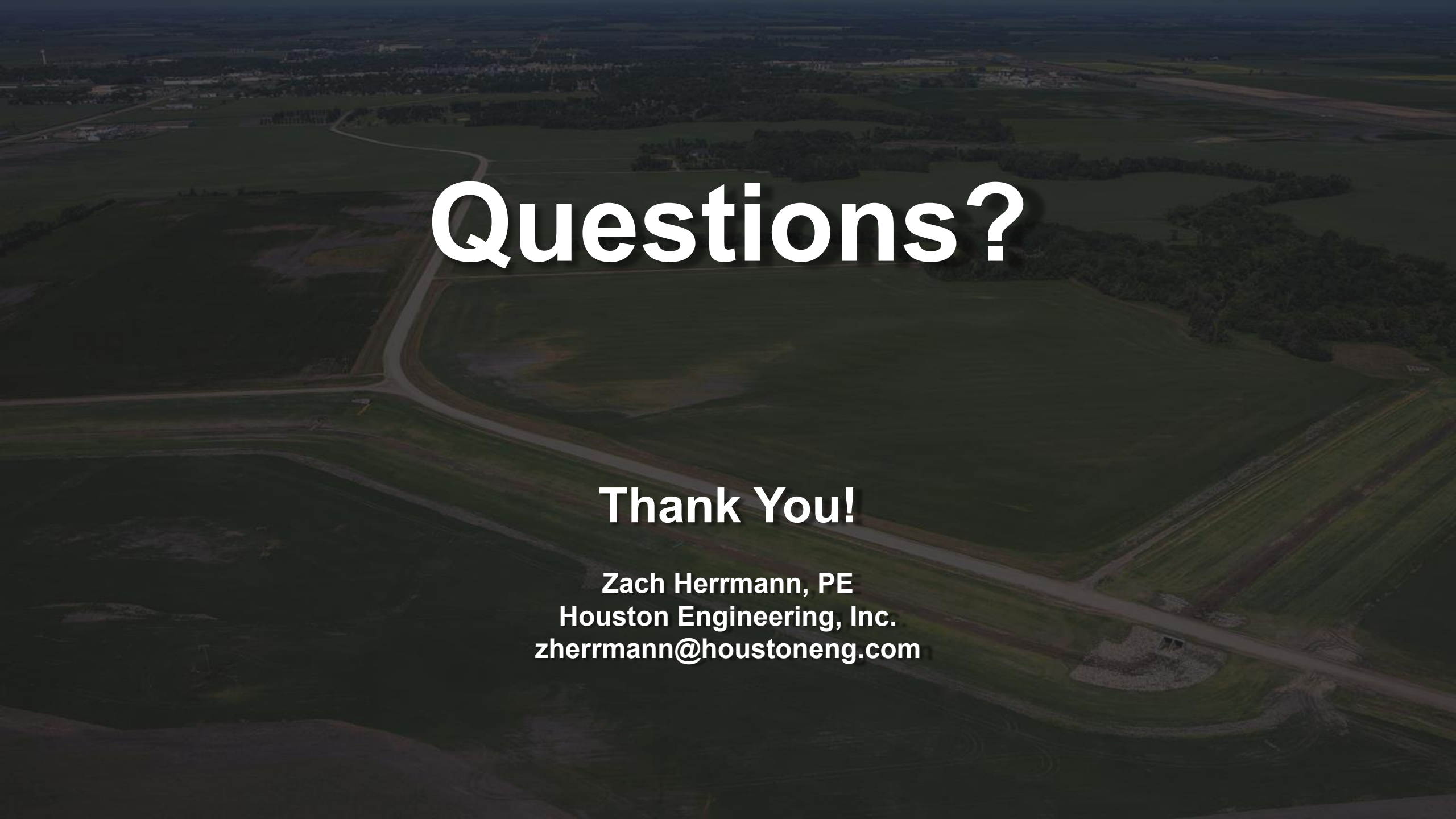


Example Drainage System – Step 4: Determine Benefit



Take-Aways

- This is not an exact science, rather a relative comparison based on reasonable, constant, assumptions.
- Local input is critical to vet assumed inputs.
- True and full taxation values need to be scrutinized to account for soil modifiers that may have been applied.
- There is no “one-size-fits-all” benefit method for all drainage projects. Rather, the proposed method provides a general framework for consistency and defensibility in benefit calculations.
- The method will continue to evolve as it's put into use.



Questions?

Thank You!

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zherrmann@houstoneng.com