

# Pembina County Drain 16 Expansion Analysis

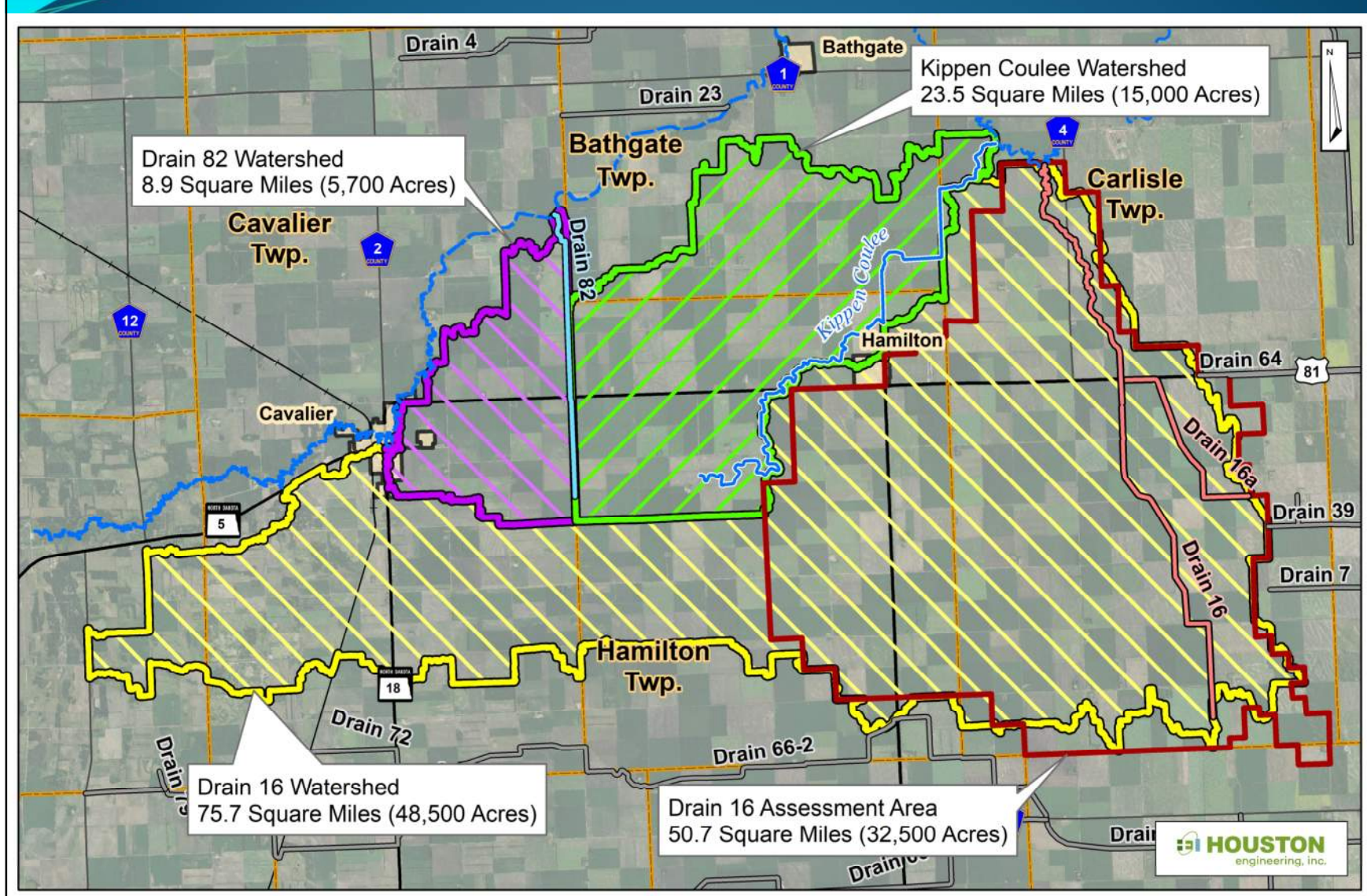
## Alternatives Review – 1

July 27, 2023  
Cavalier, ND

# Scope

- **Purpose of Study:** Explore alternatives that will alleviate flood damages within the Drain 16 Assessment Area.
  - Project Phases
    - Field Survey
    - Existing Conditions Hydrology and Hydraulics
    - Alternative Development and Analysis
    - Concept Design of Alternative(s)
  - **Purpose of this Meeting:**
    - Review alternatives developed for Kippen Coulee and western Drain 16 watershed
- Public Participation Occurs Throughout

# Background

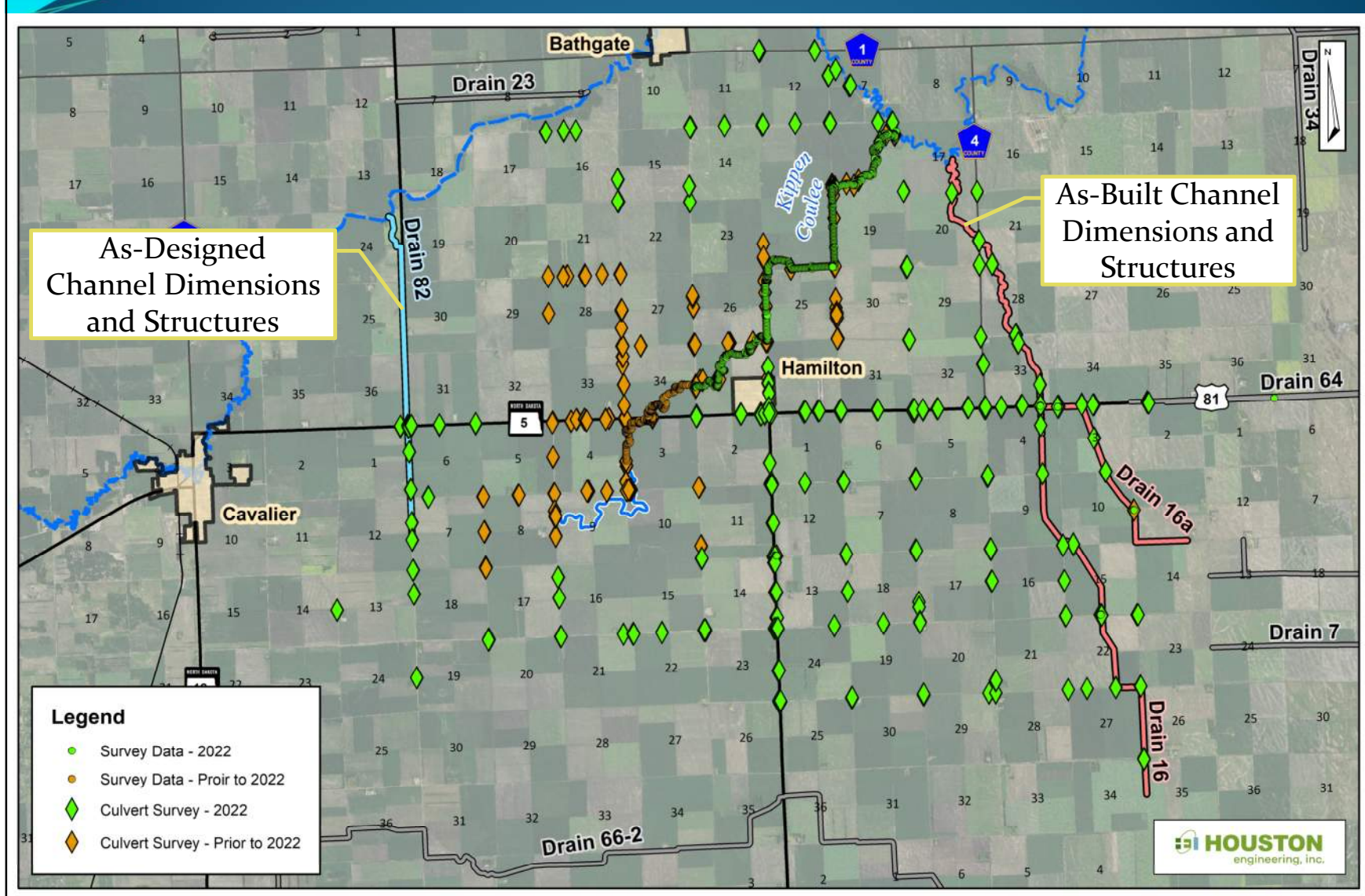


## Noted Issues Related to Drainage and Flooding

- Prolonged high water in/along Drain 16.
- Overland flooding near Hamilton, ND
- Overland flooding in the Kippen Coulee area.
- Impacts:
  - Roadway damages
  - Agricultural impacts
  - Scour/erosion on agricultural land.
  - Impacts to Hamilton, ND.

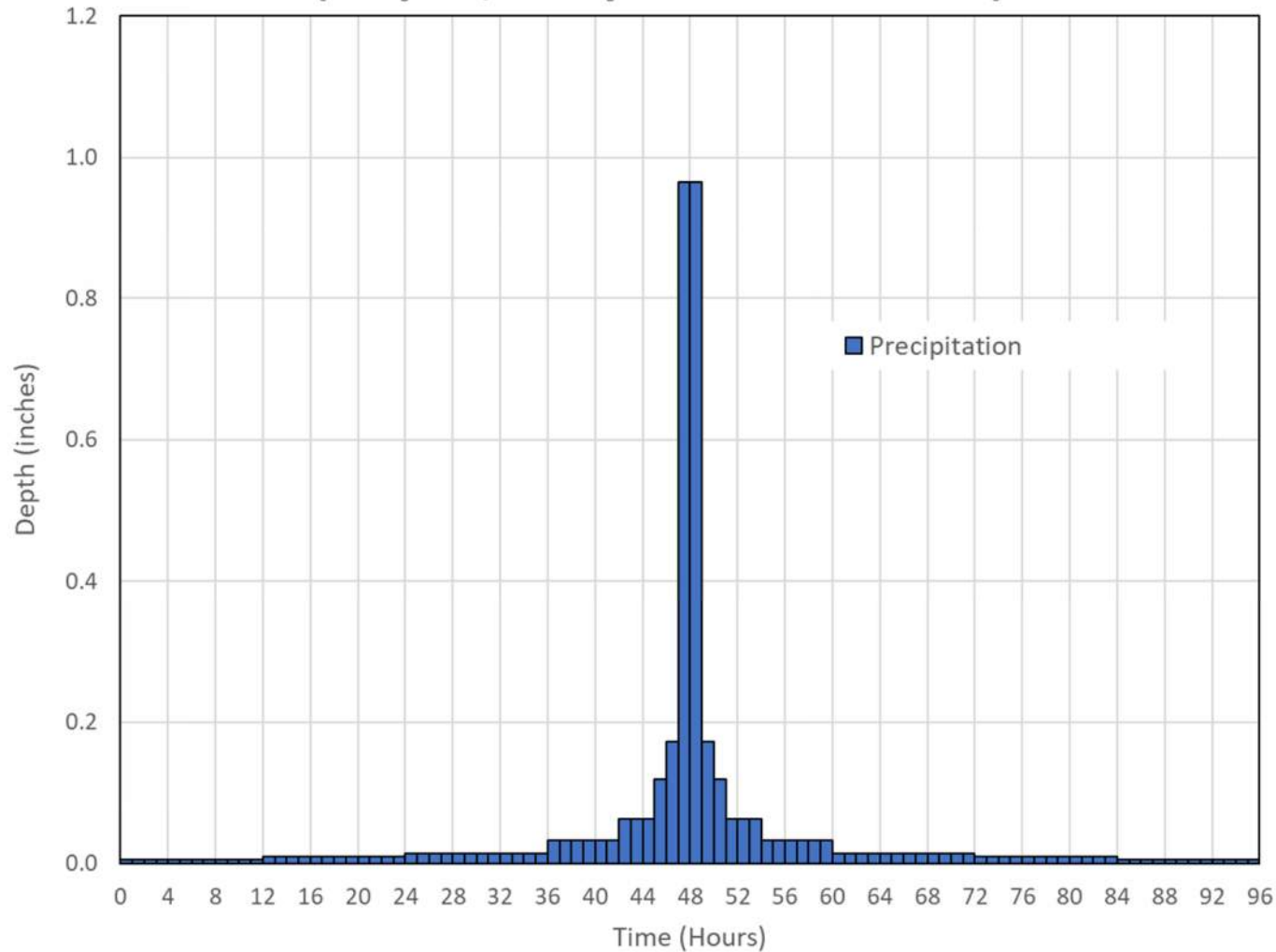


# Field Survey



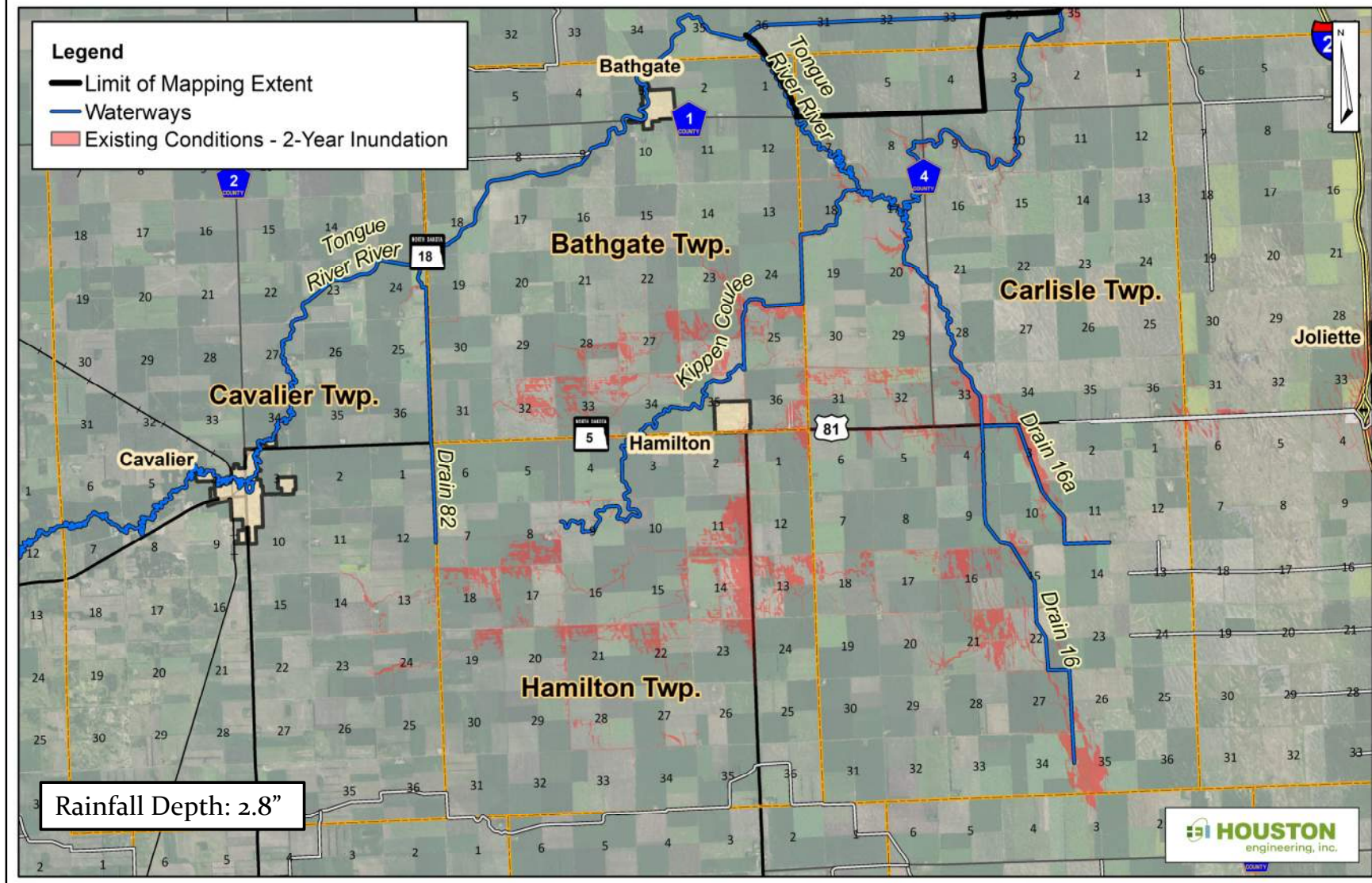
# Hydrology & Hydraulics

**Rainfall Hyetograph for Tongue River Watershed  
(10-year, 4-day Duration Rainfall)**



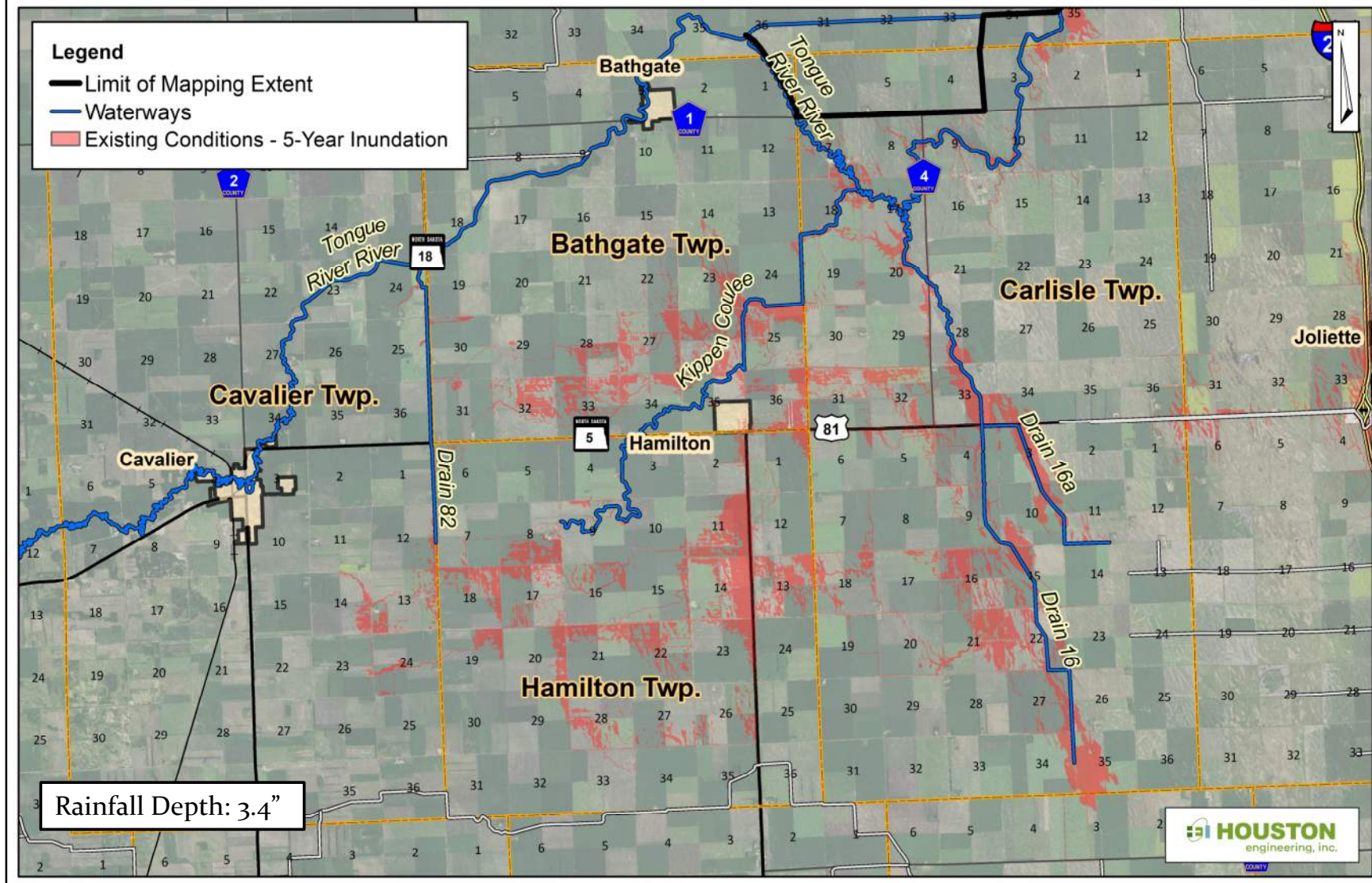


# Inundation Review – Existing Conditions: 2-year Event



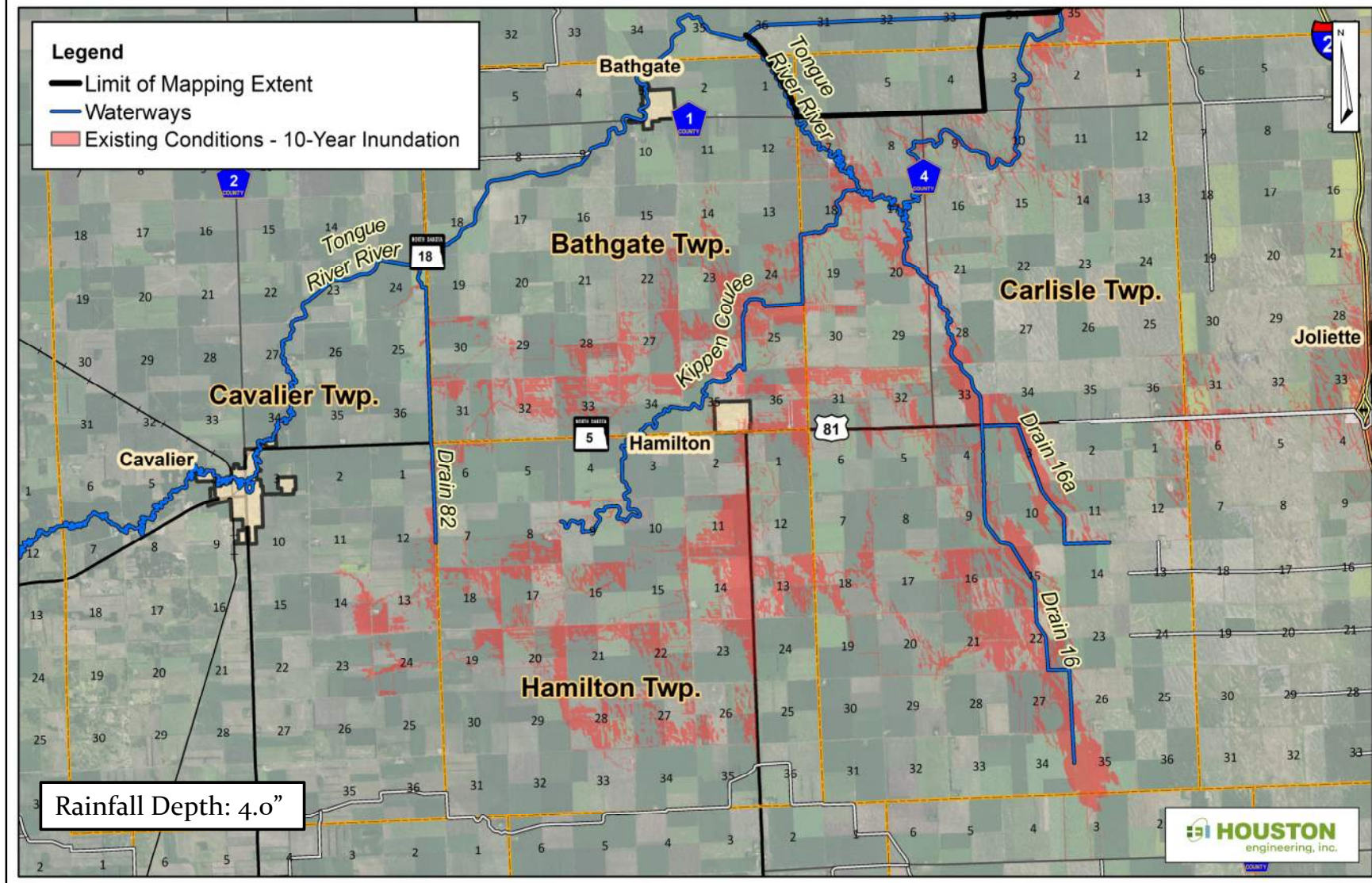


# Inundation Review – Existing Conditions: 5-year Event



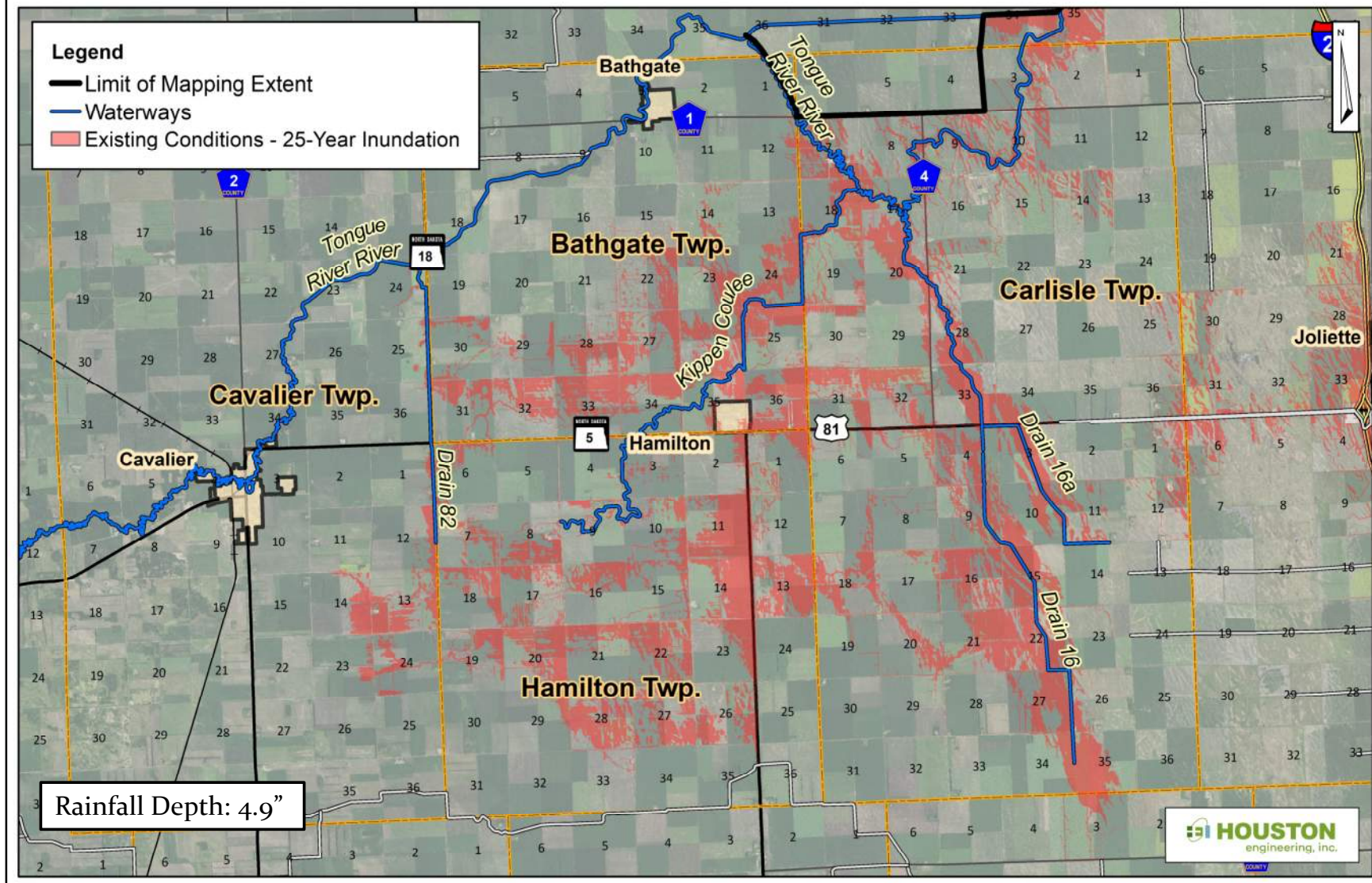


# Inundation Review – Existing Conditions: 10-year Event



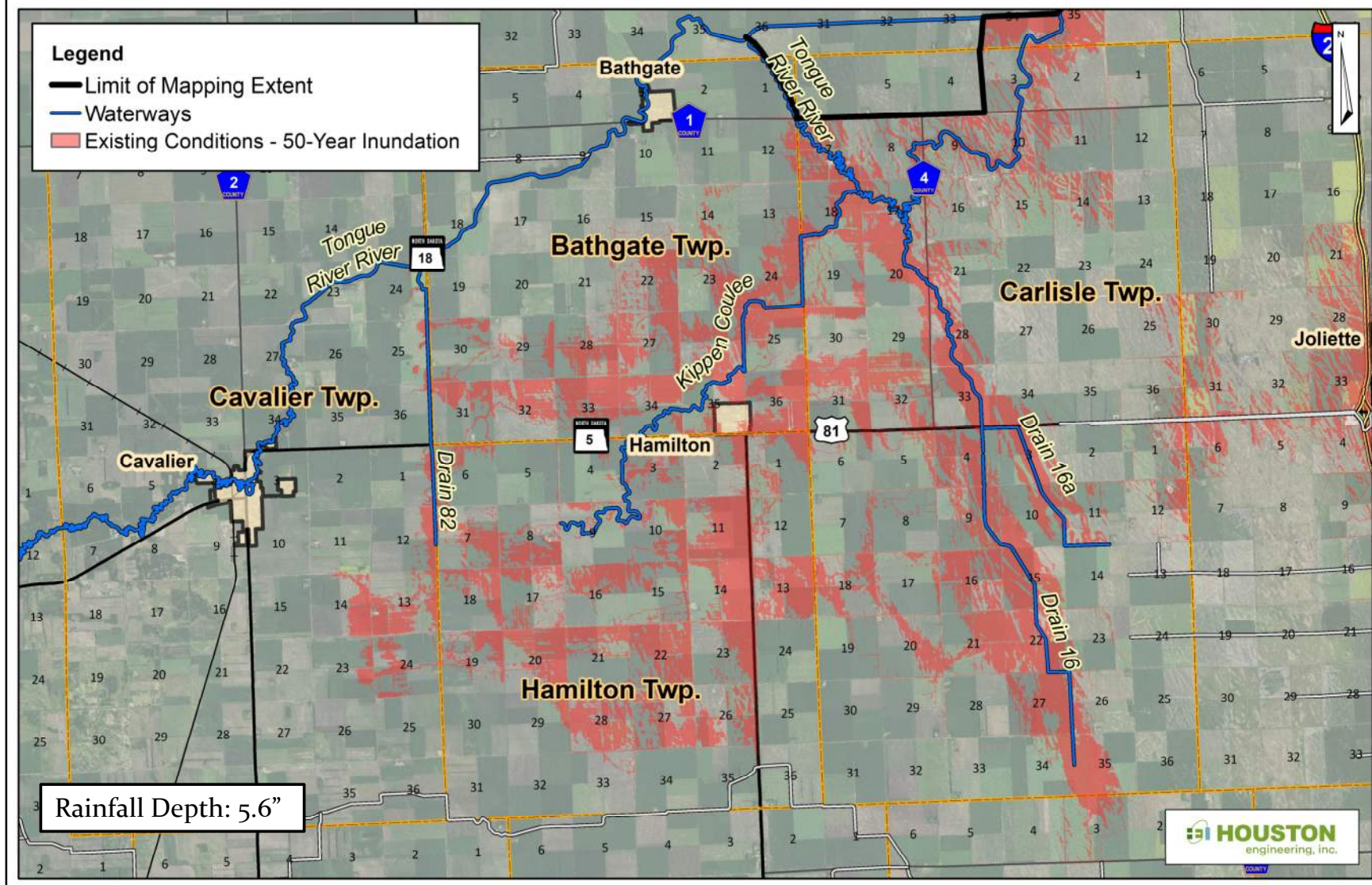


# Inundation Review – Existing Conditions: 25-year Event



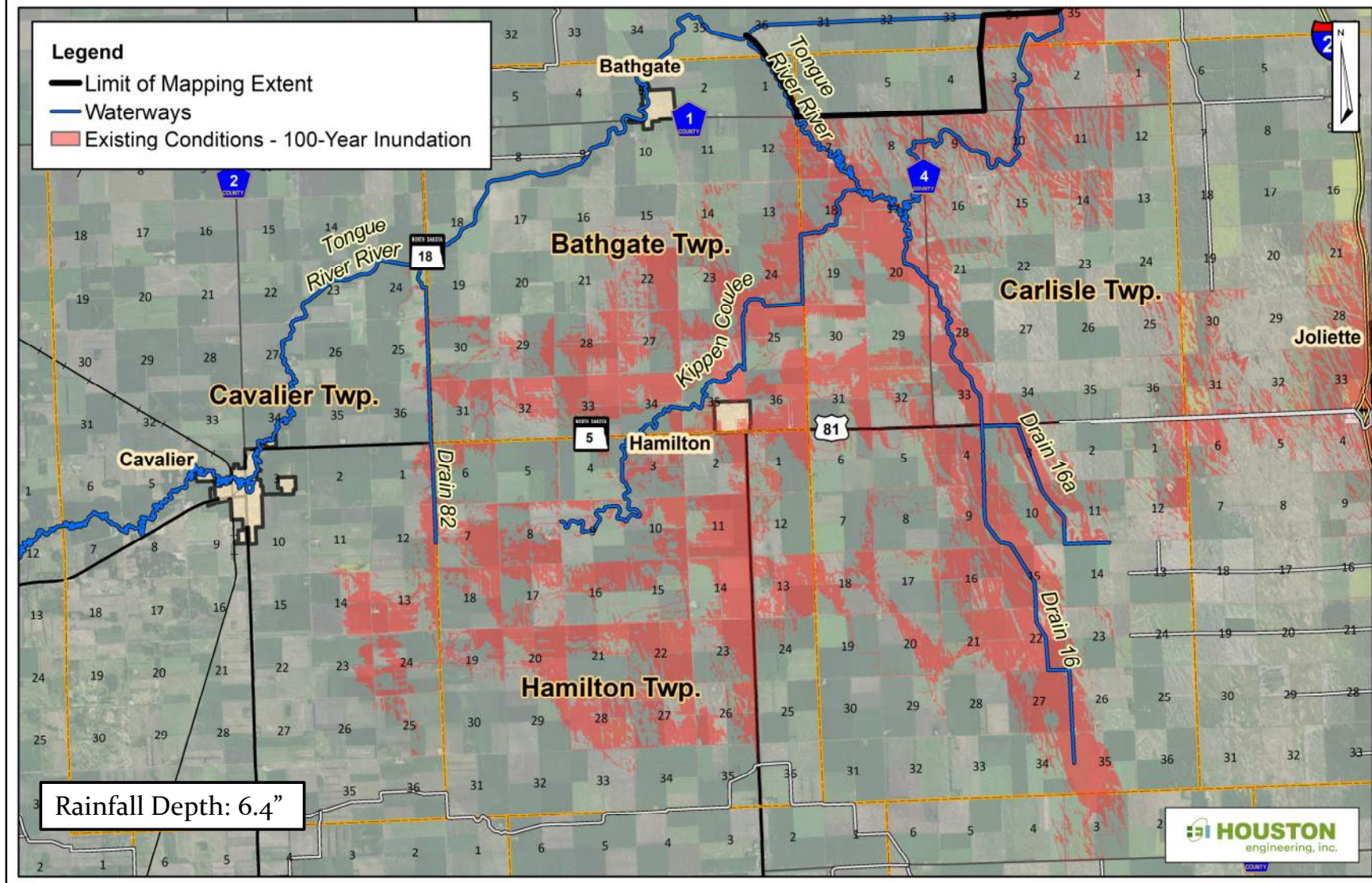


## Inundation Review – Existing Conditions: 50-year Event





# Inundation Review – Existing Conditions: 100-year Event



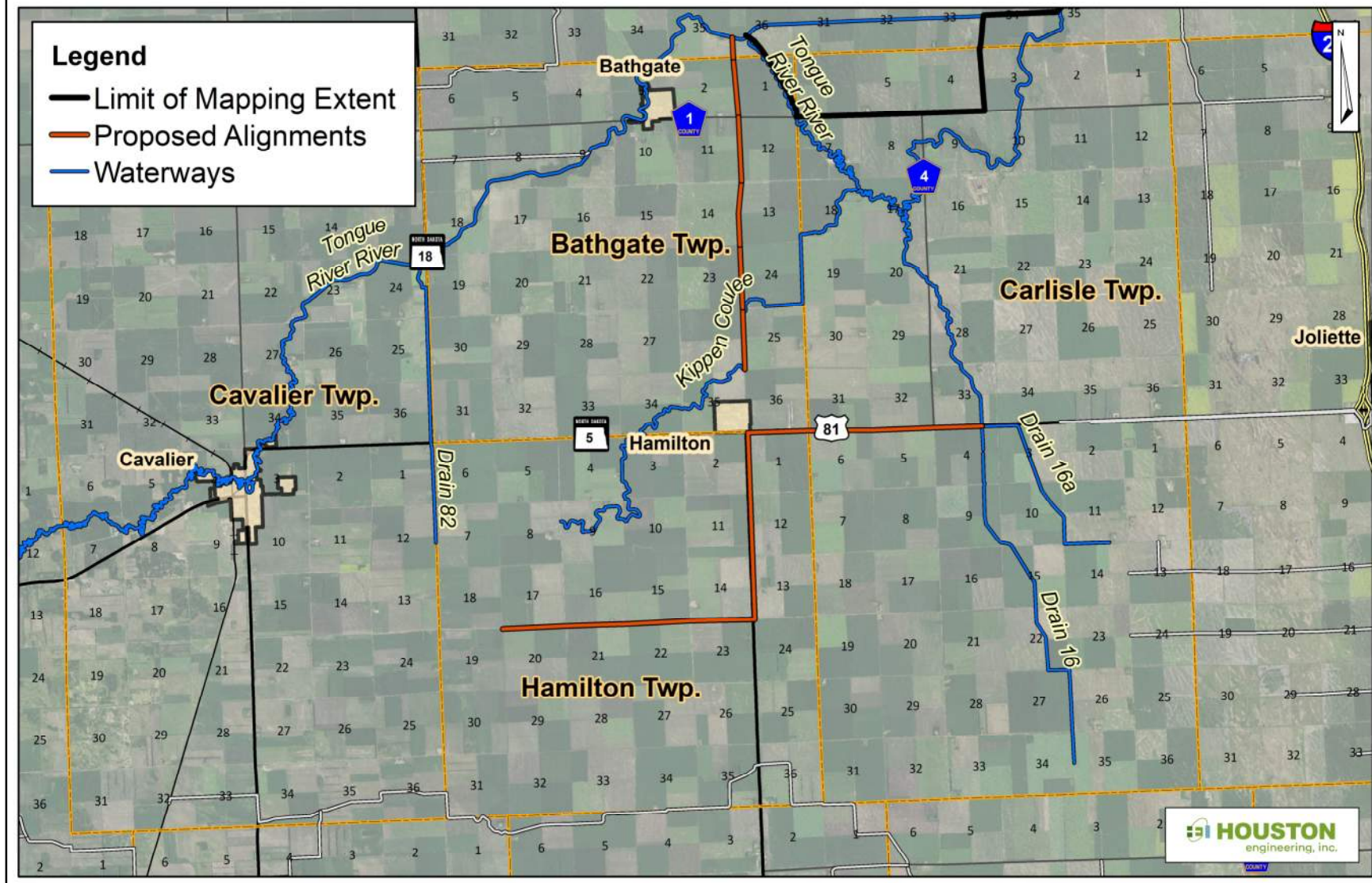
## Scenarios Analyzed

- Existing Conditions
- 2017 Conditions (Railroad in-place)
- Drain 82 Removed
- *Proposed* Drain 16 Lateral
- *Proposed* North Drain to Tongue River
- Removal of Entire Railroad Bed

**Only Reviewing 2-, 10-, 100-year events during presentation. Other data is available upon request.**

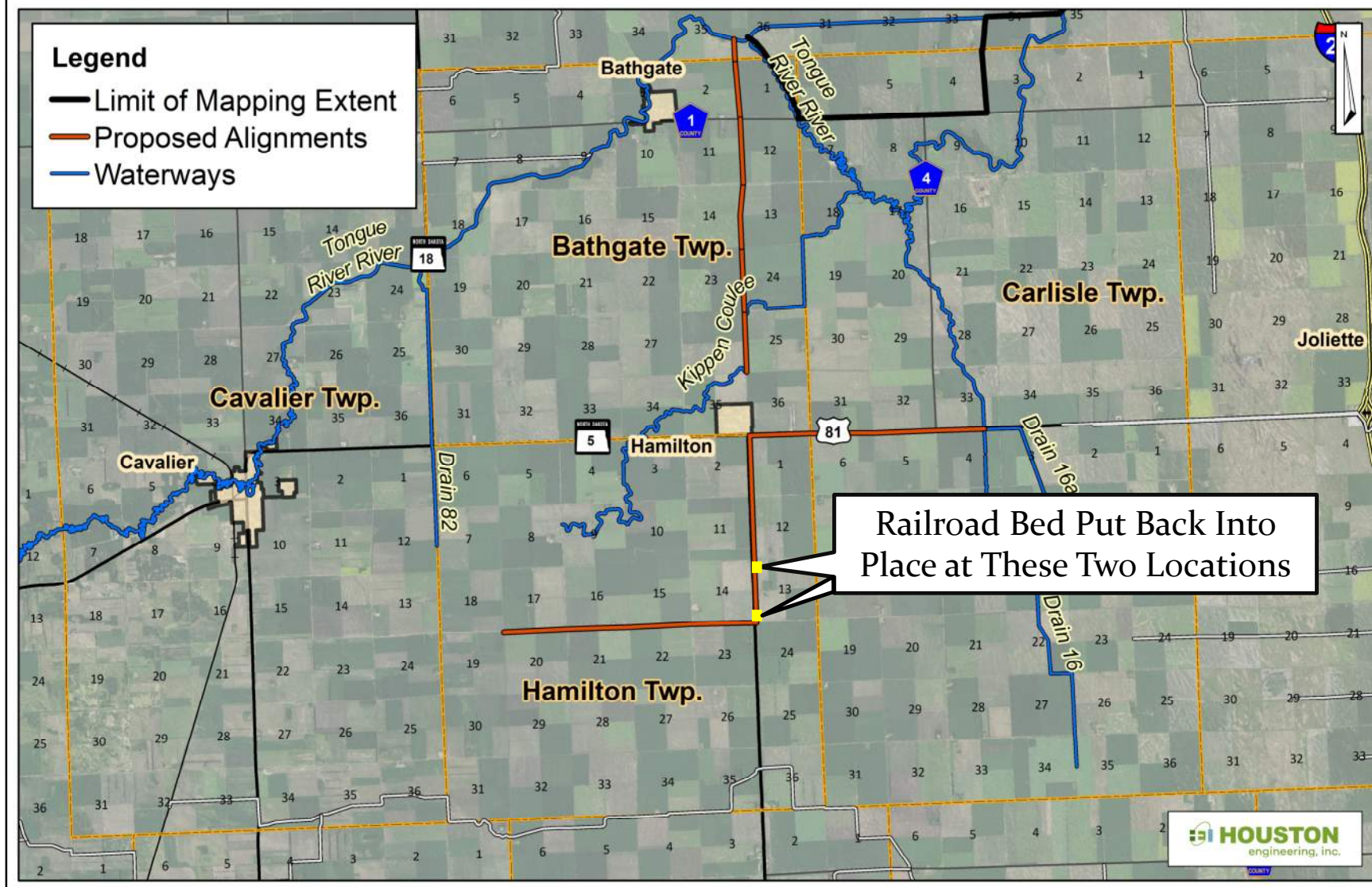


# Proposed Alignments



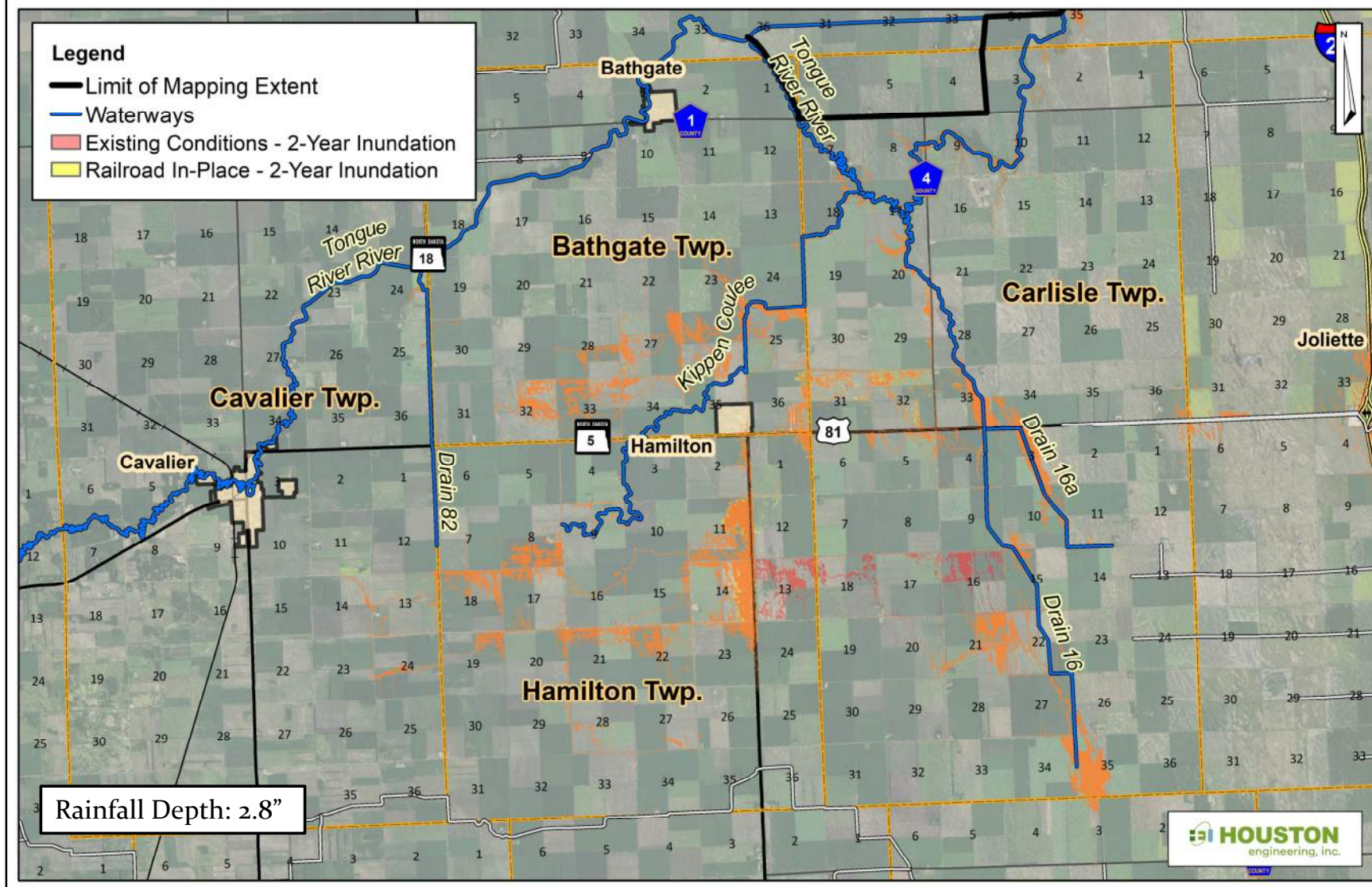


# Scenario Analyzed: 2017 Conditions



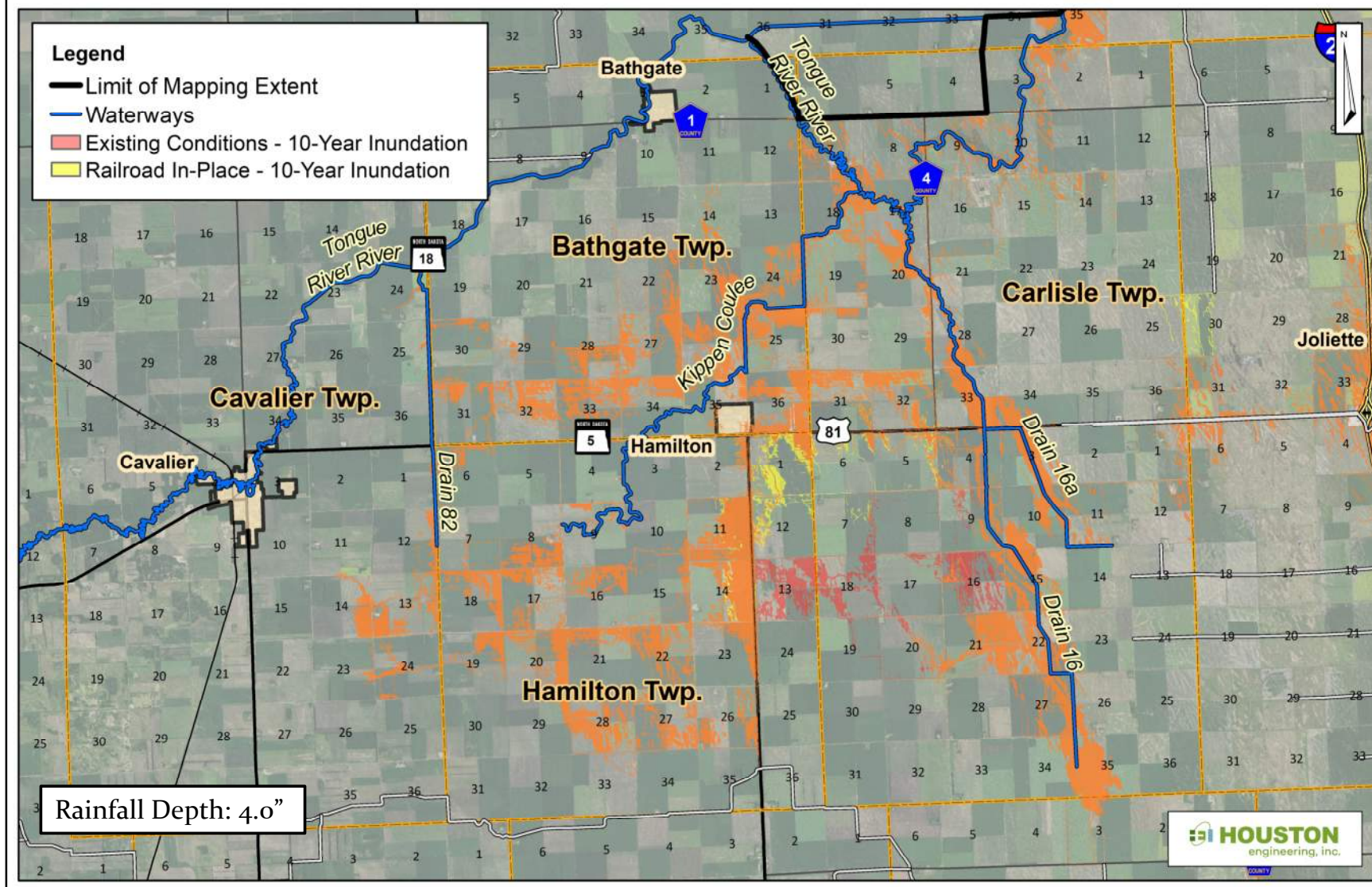


# Inundation Review – 2017 Conditions: 2-year Event



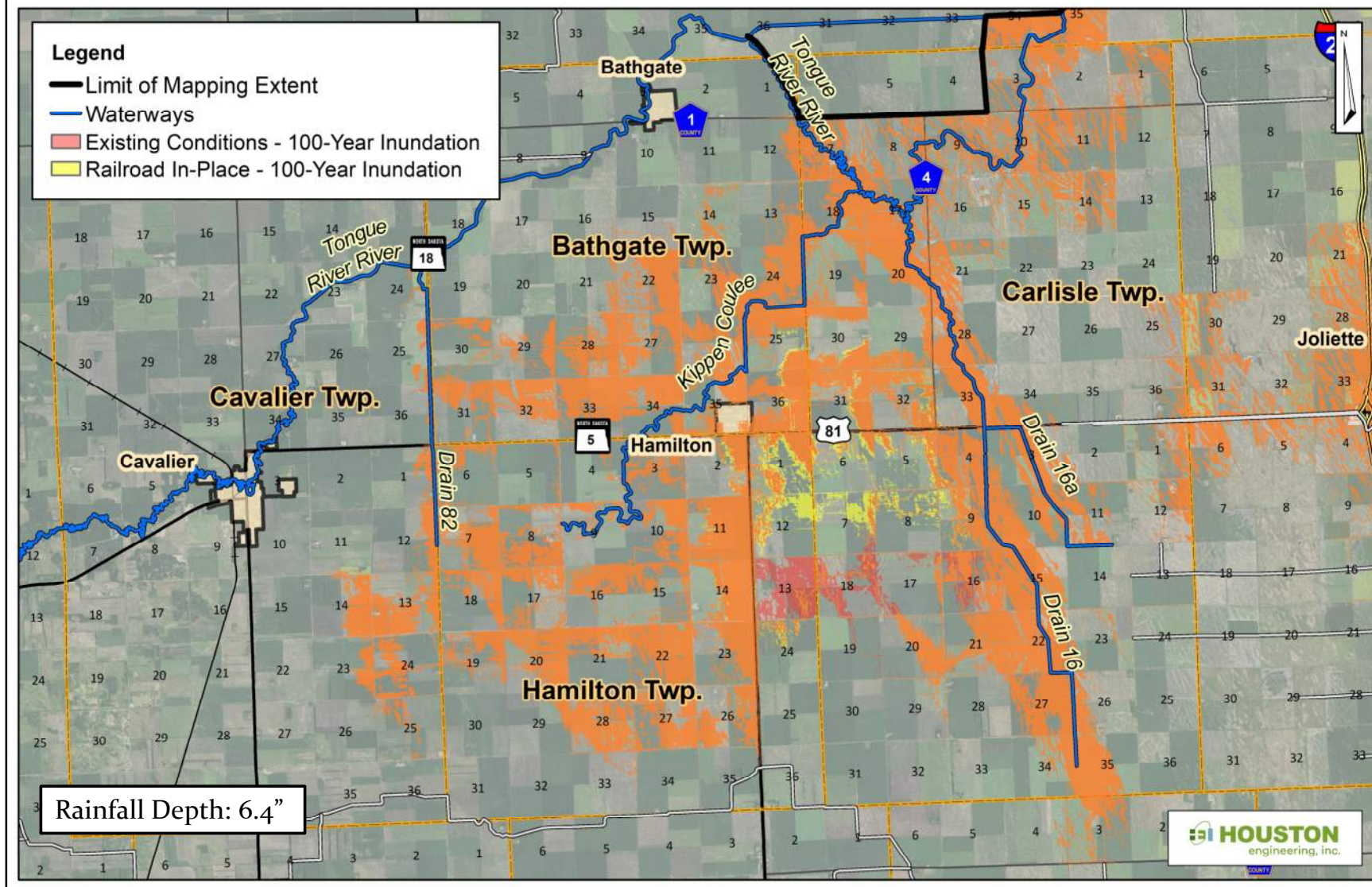


# Inundation Review – 2017 Conditions: 10-year Event



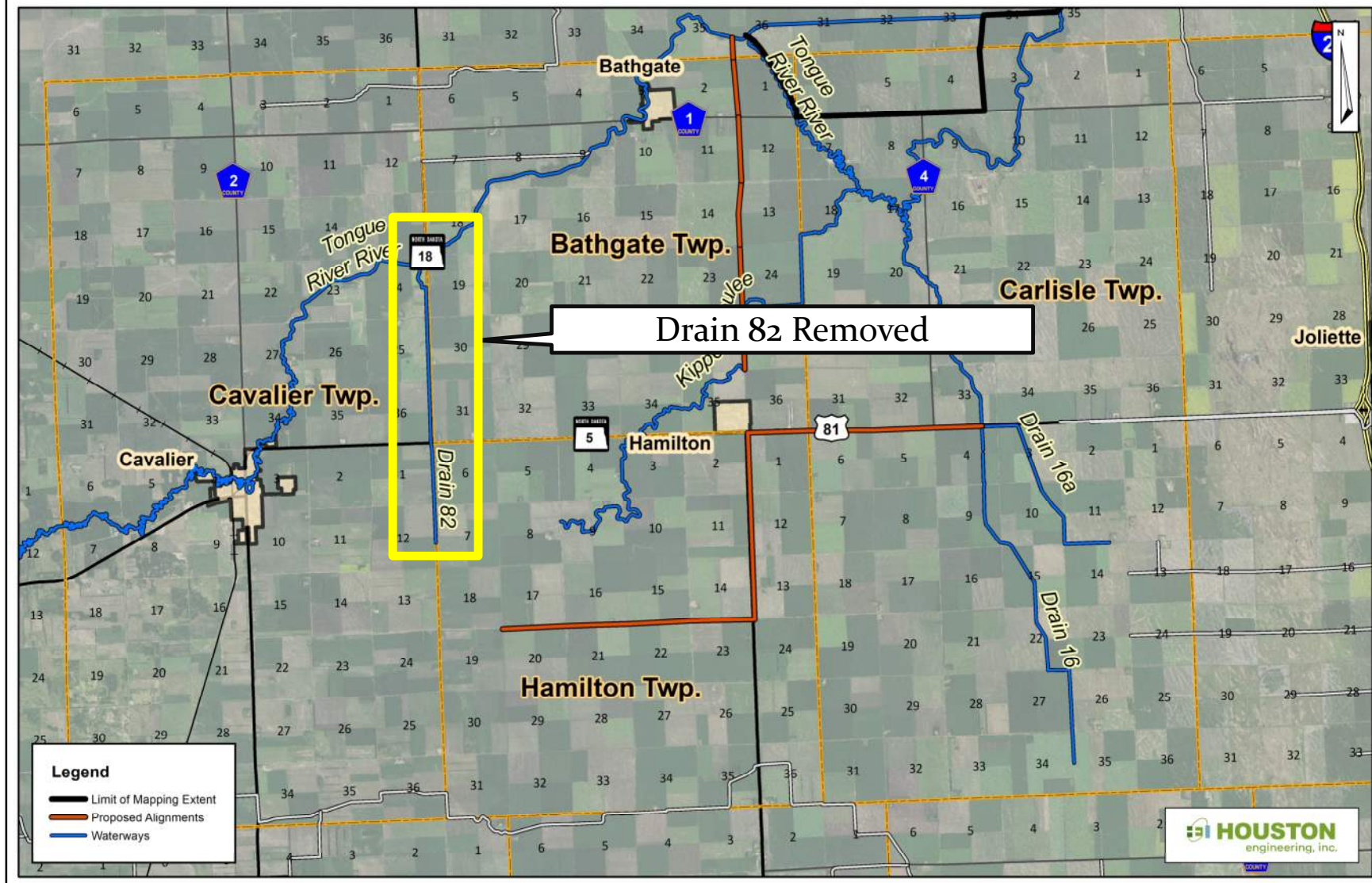


# Inundation Review – 2017 Conditions: 100-year Event



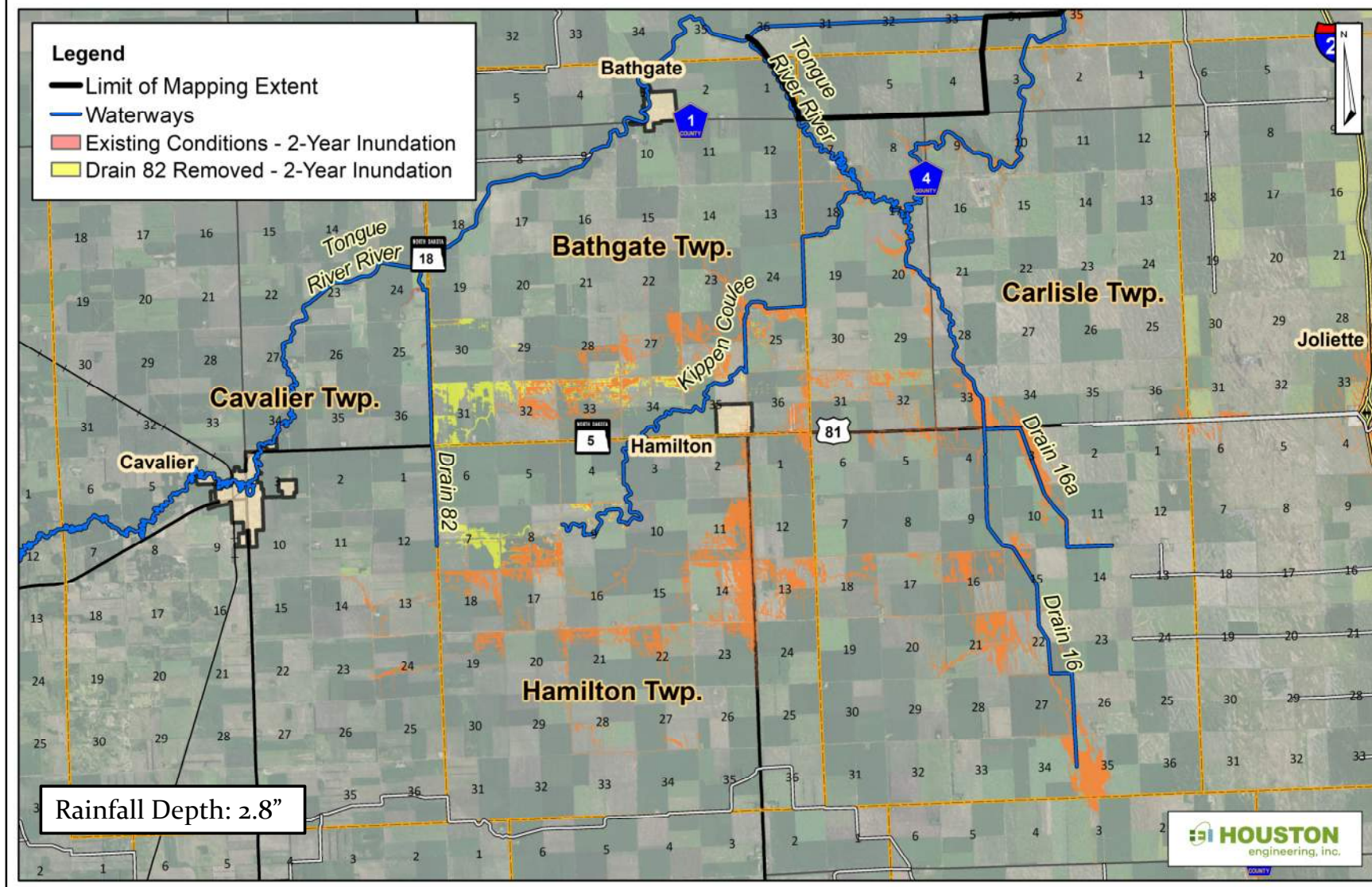


# Scenario Analyzed: Drain 82 Removed



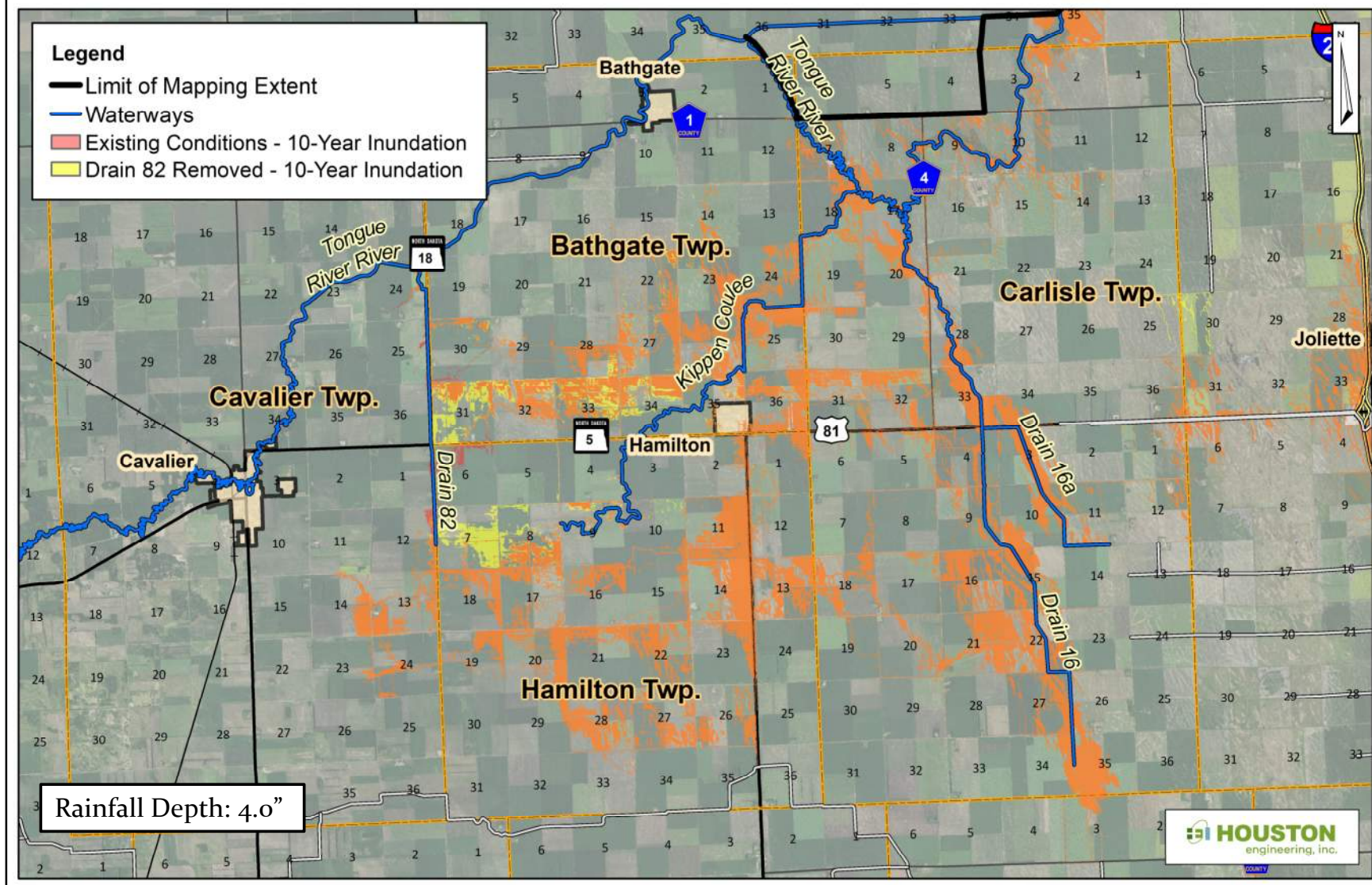


# Inundation Review – Drain 82 Removed: 2-year Event



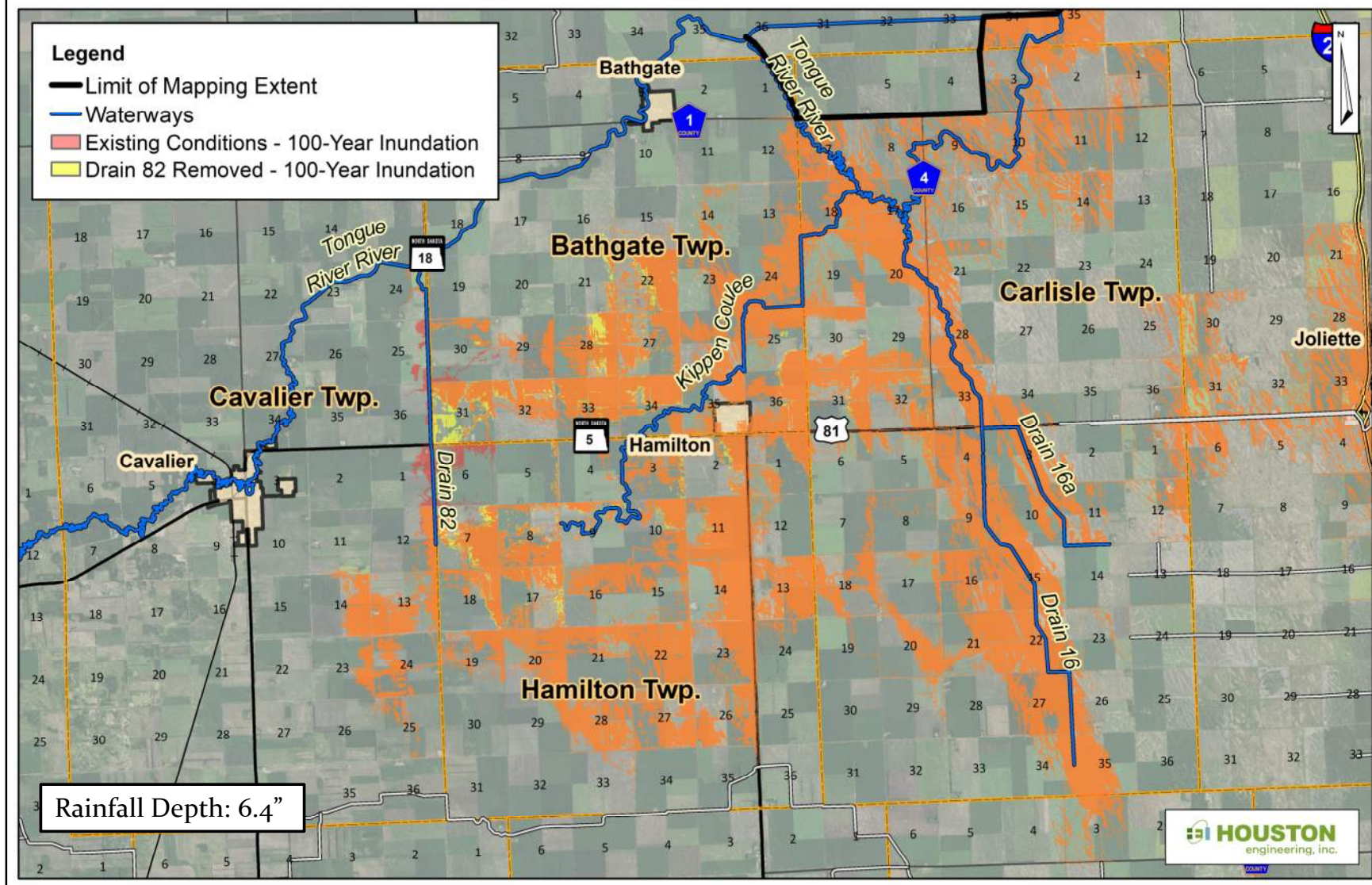


# Inundation Review – Drain 82 Removed: 10-year Event



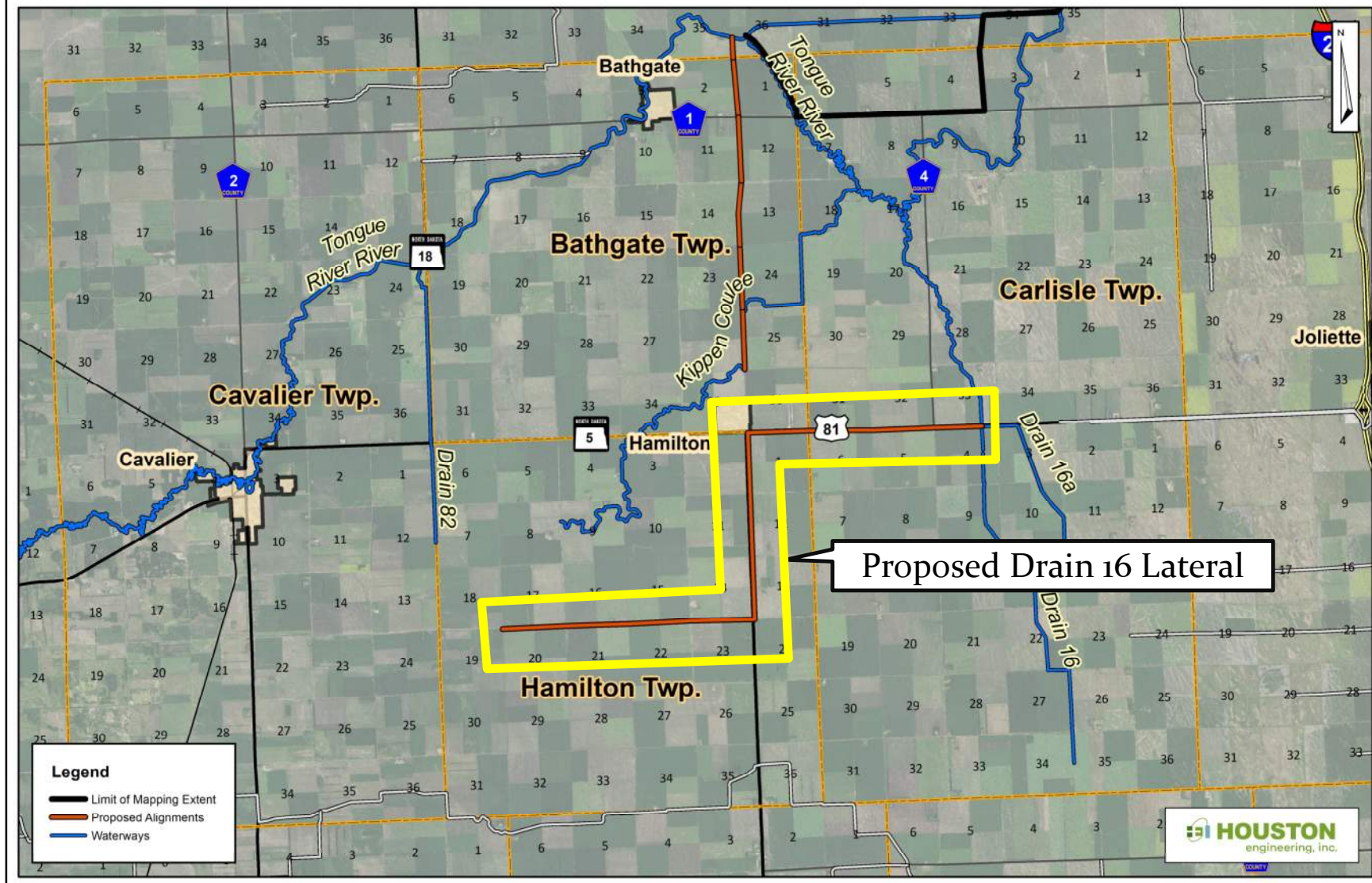


# Inundation Review – Drain 82 Removed: 100-year Event

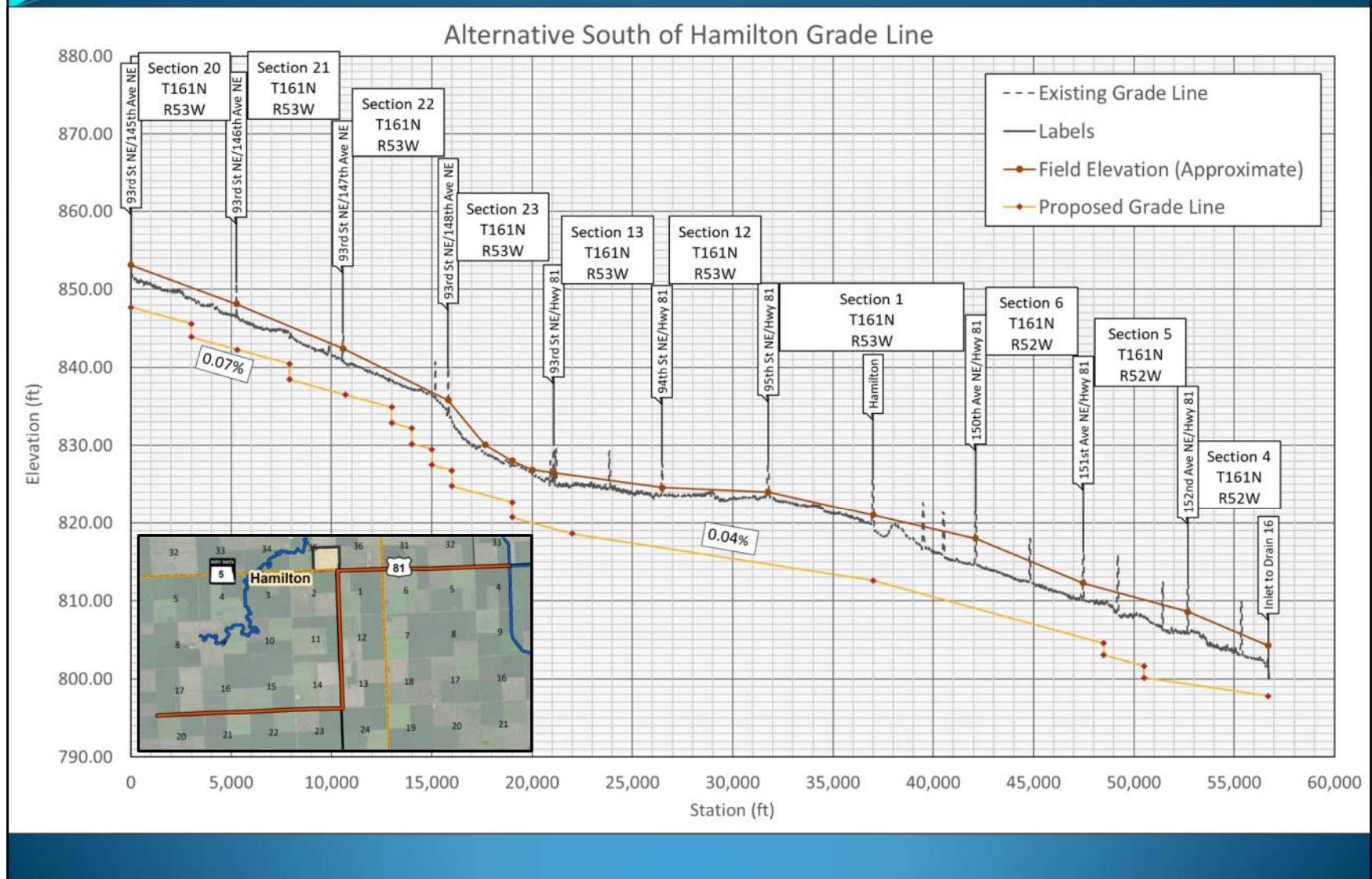




# Scenario Analyzed: Proposed Drain 16 Lateral

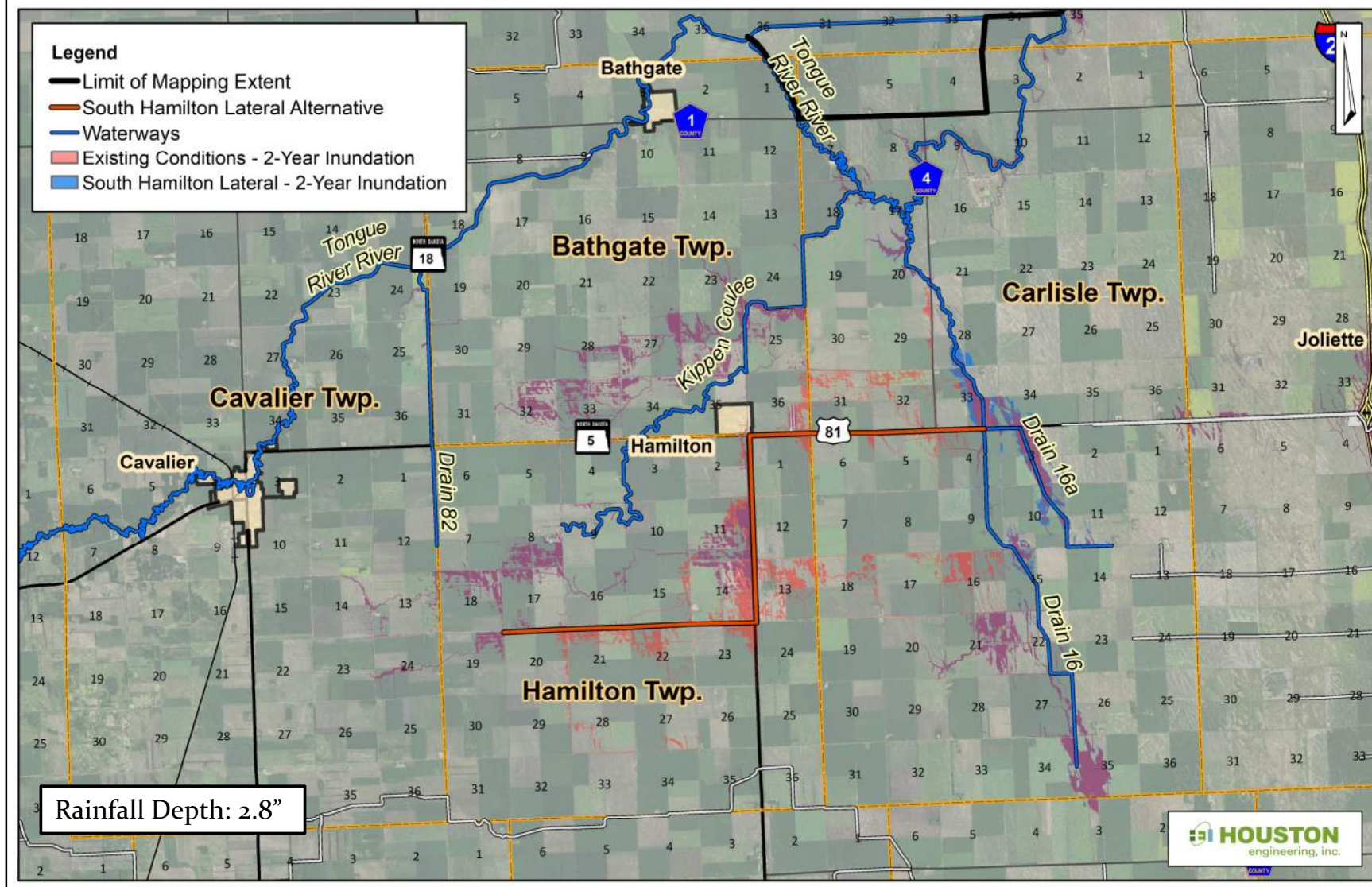


# Proposed Grade Line – Drain 16 Lateral



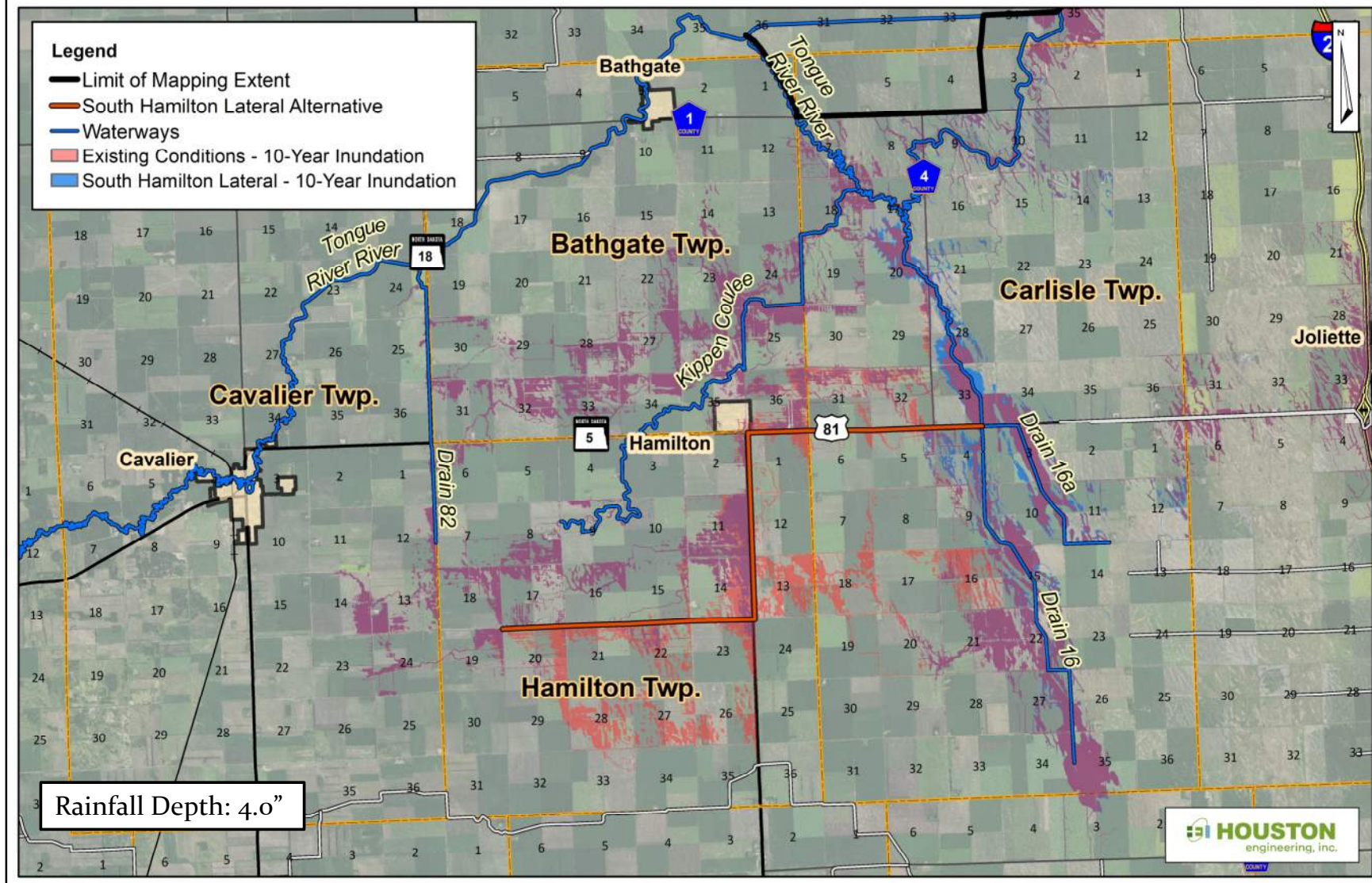


# Inundation Review – Drain 16 Lateral: 2-year Event



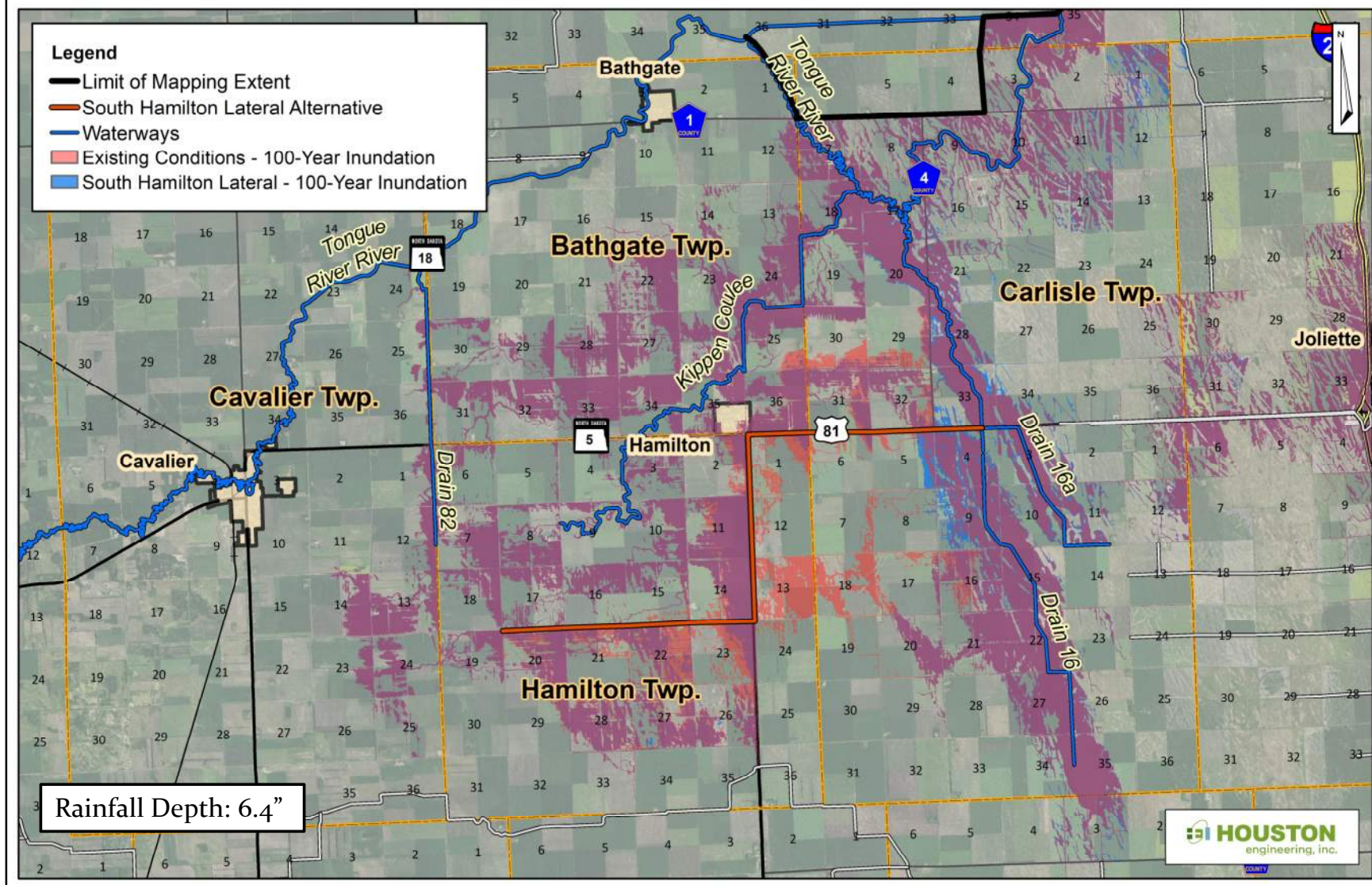


# Inundation Review – Drain 16 Lateral: 10-year Event



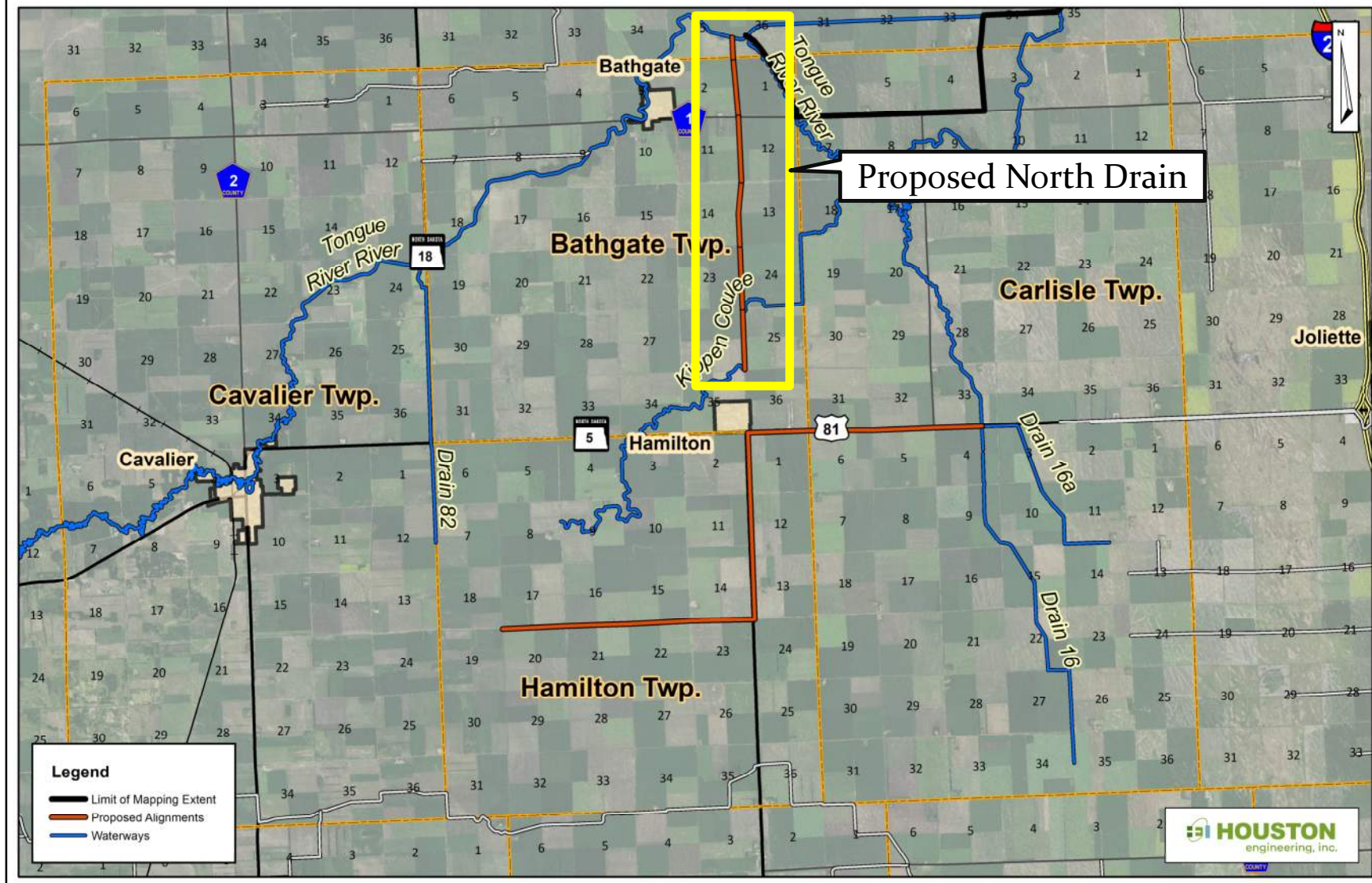


# Inundation Review – Drain 16 Lateral: 100-year Event



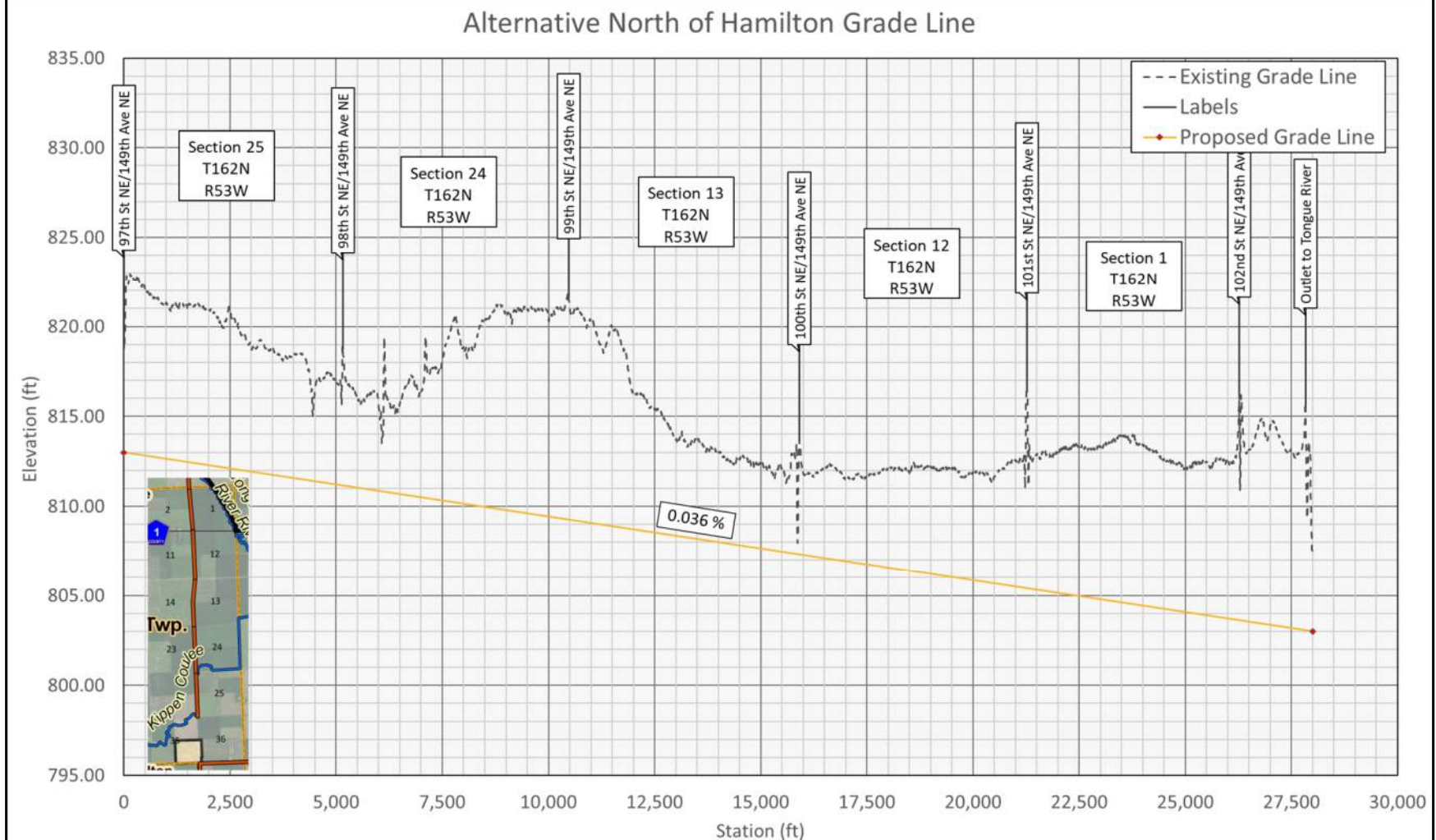


# Scenario Analyzed: Proposed North Drain



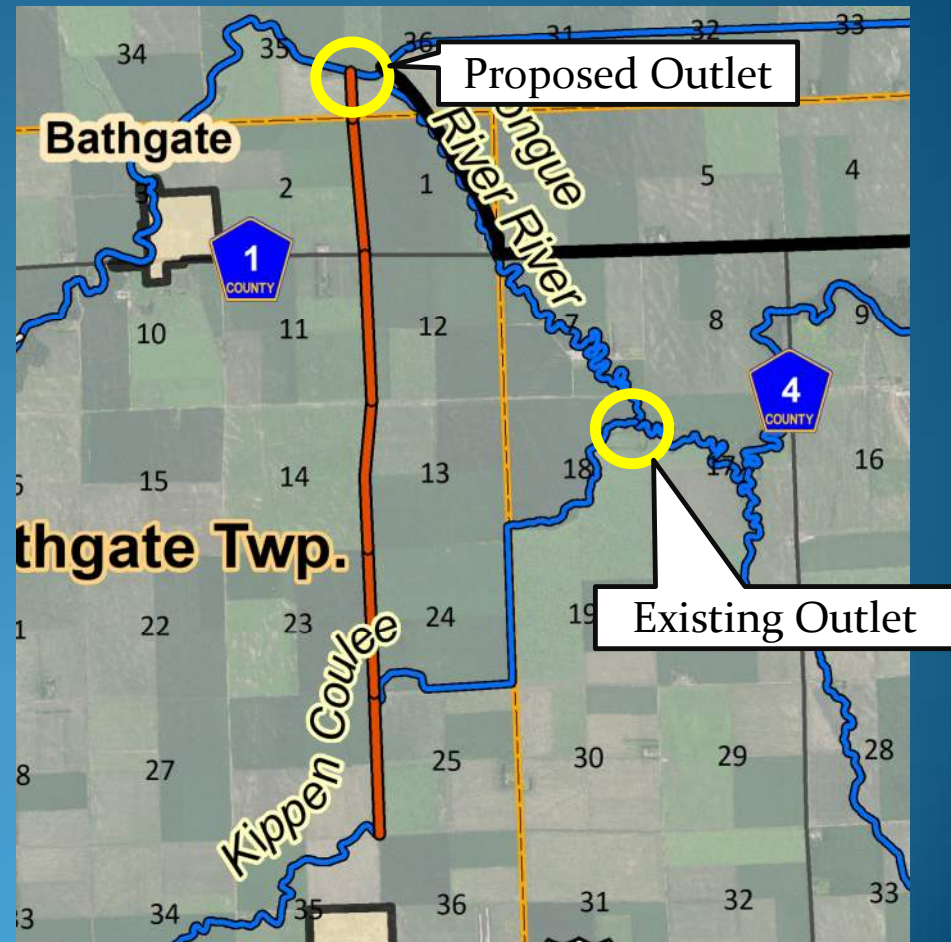


# Proposed Grade Line – North Drain



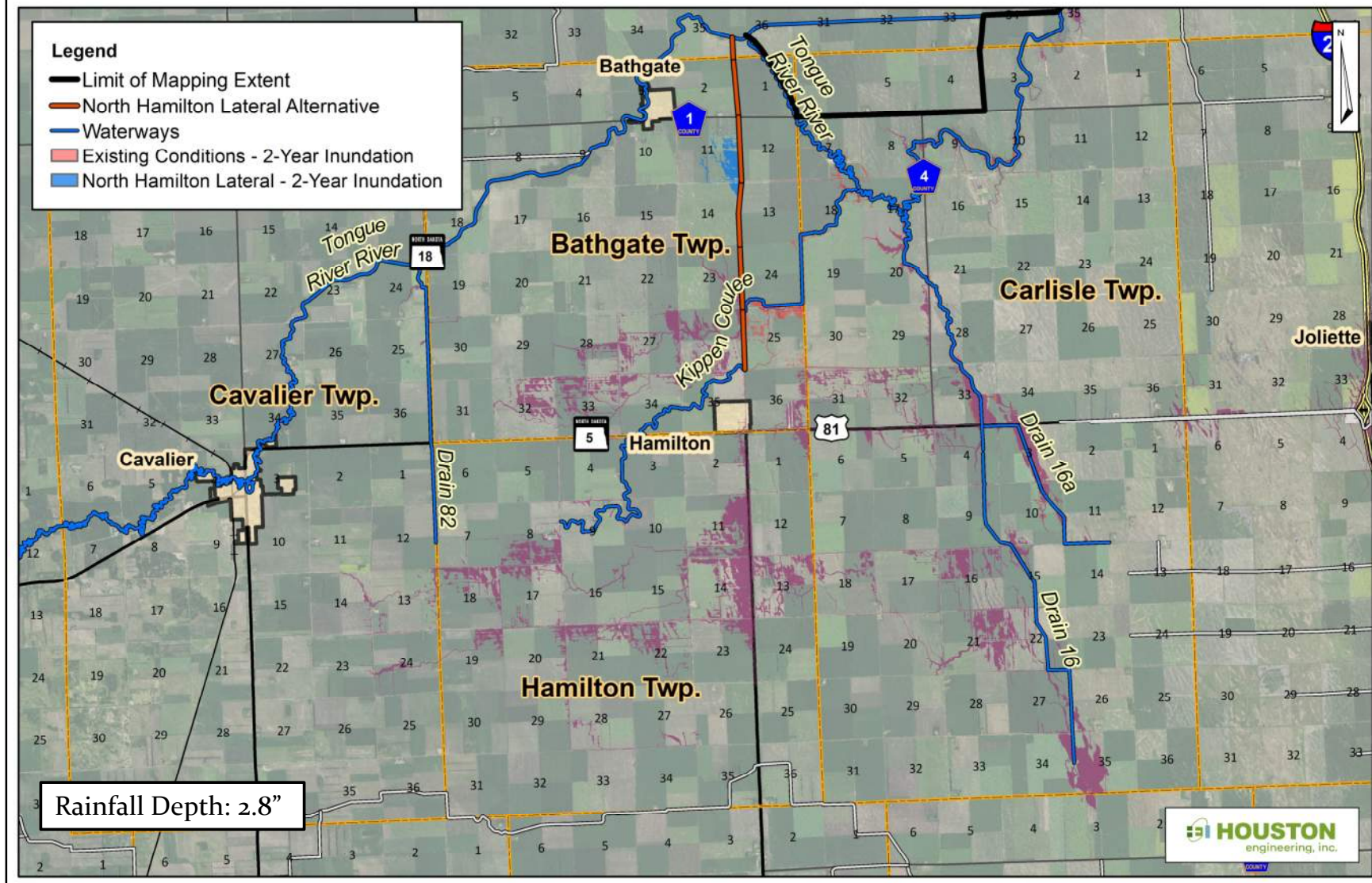
# North Drain Outlet

- Tongue river elevation at new flow split for Cutoff Channel: 802.9
- Kippen Coulee outlet elevation: 798.3
- Tongue River elevation near existing Kippen Coulee outlet: 797.0
- Additional flow for the Tongue River west of Cutoff Channel Inlet causes increased tailwater effect on North Drain.



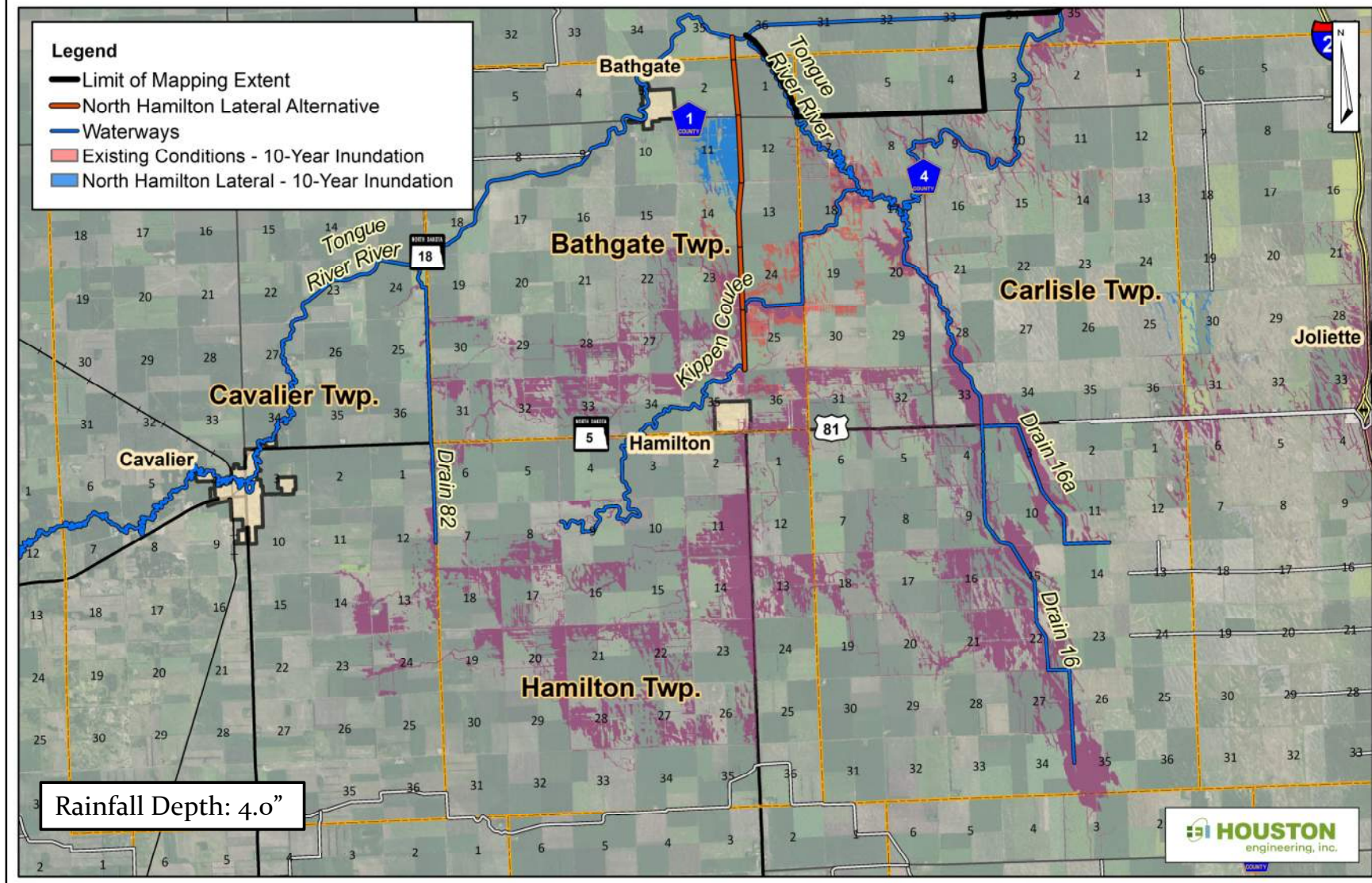


# Inundation Review – North Drain: 2-year Event



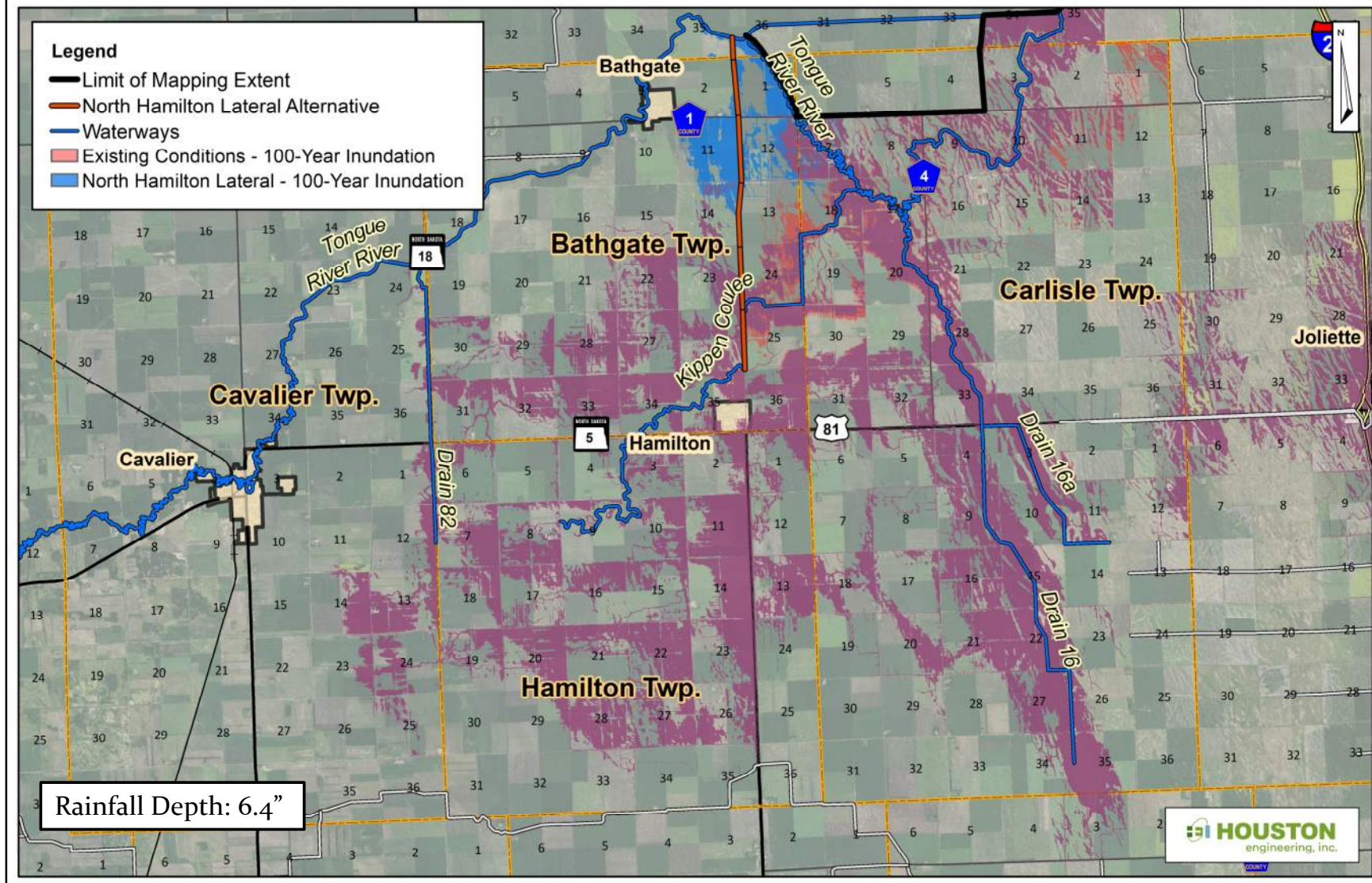


# Inundation Review – North Drain: 10-year Event



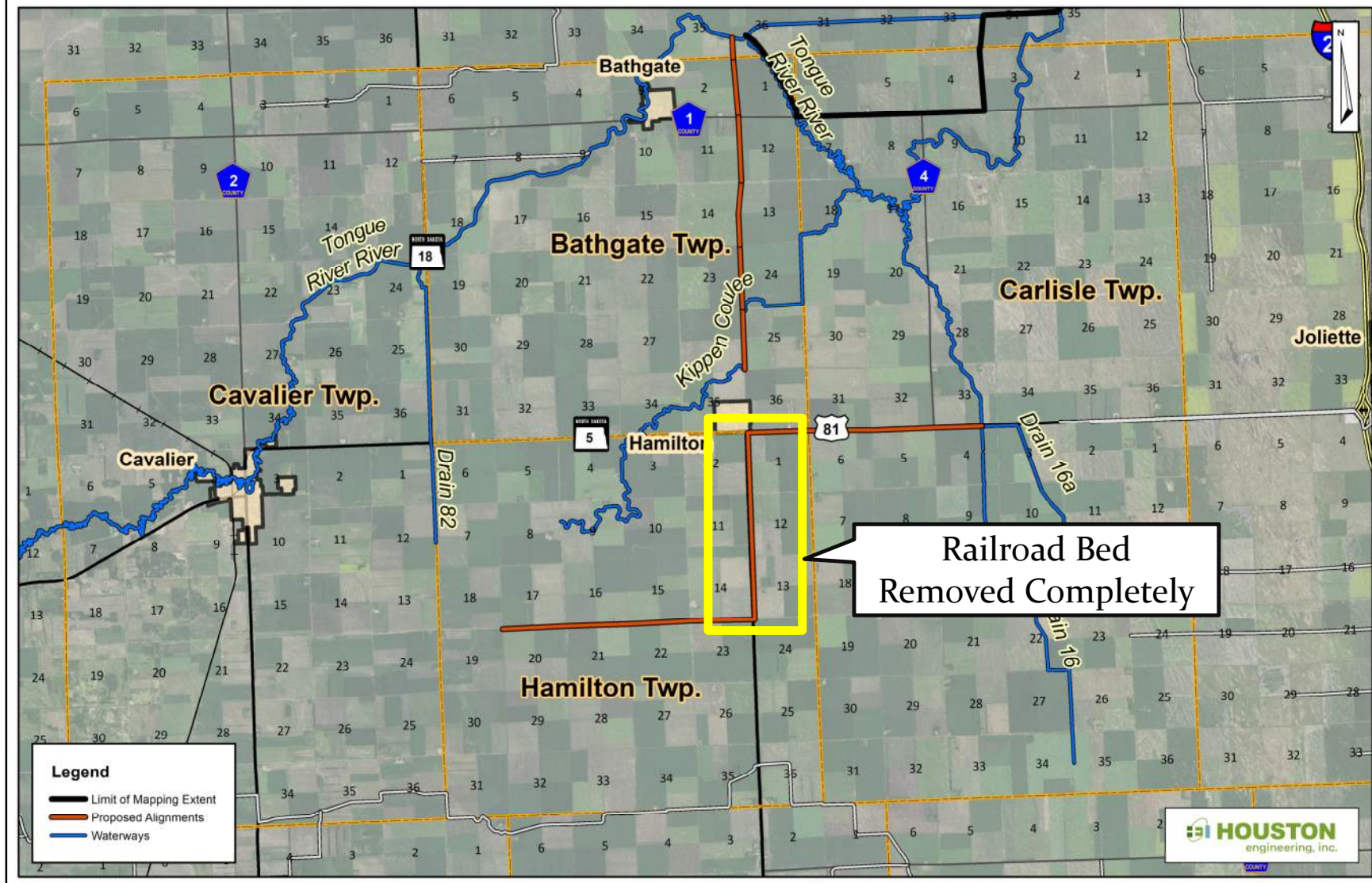


# Inundation Review – North Drain: 100-year Event



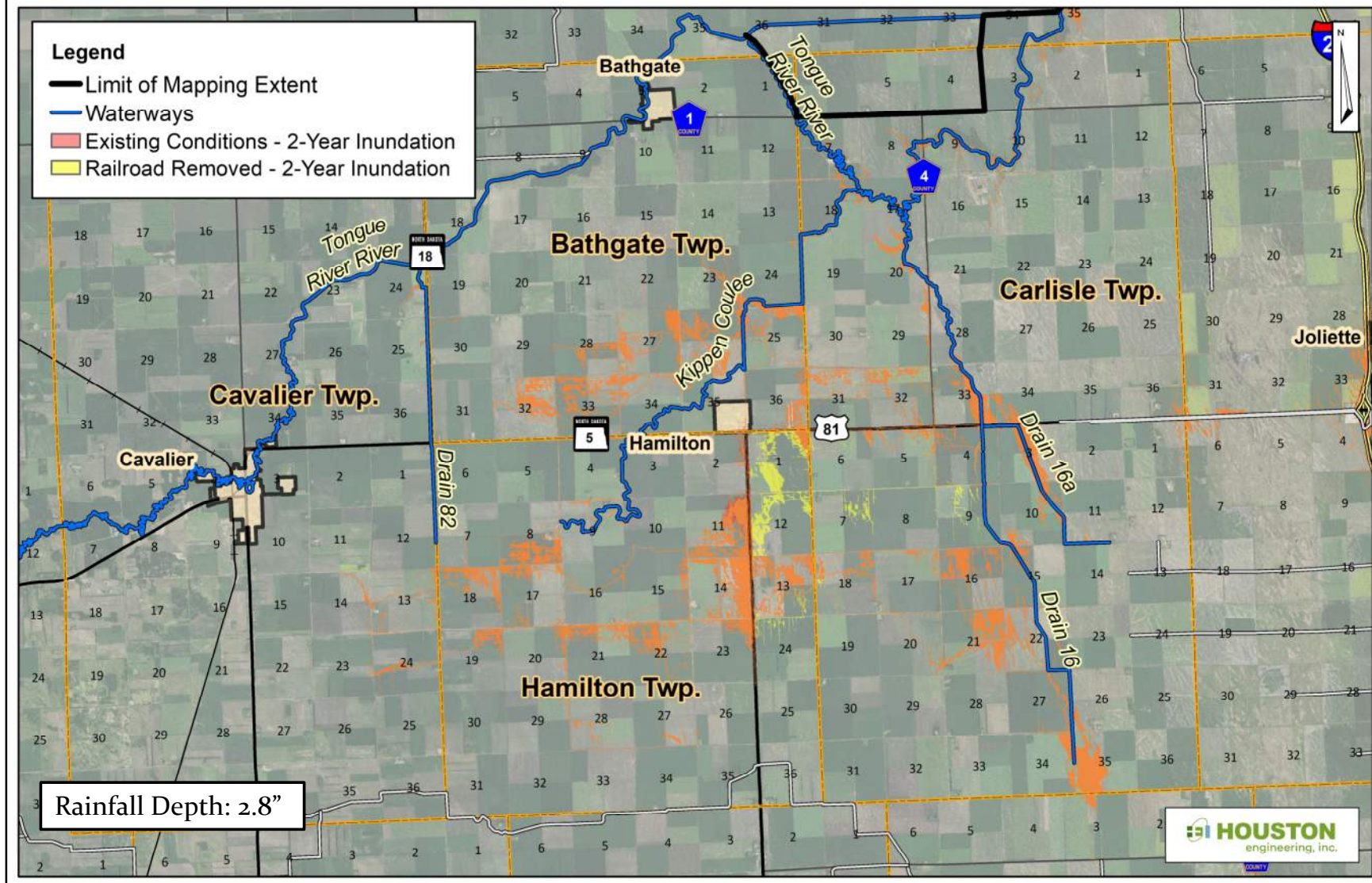


# Scenario Analyzed: Railroad Bed Removed



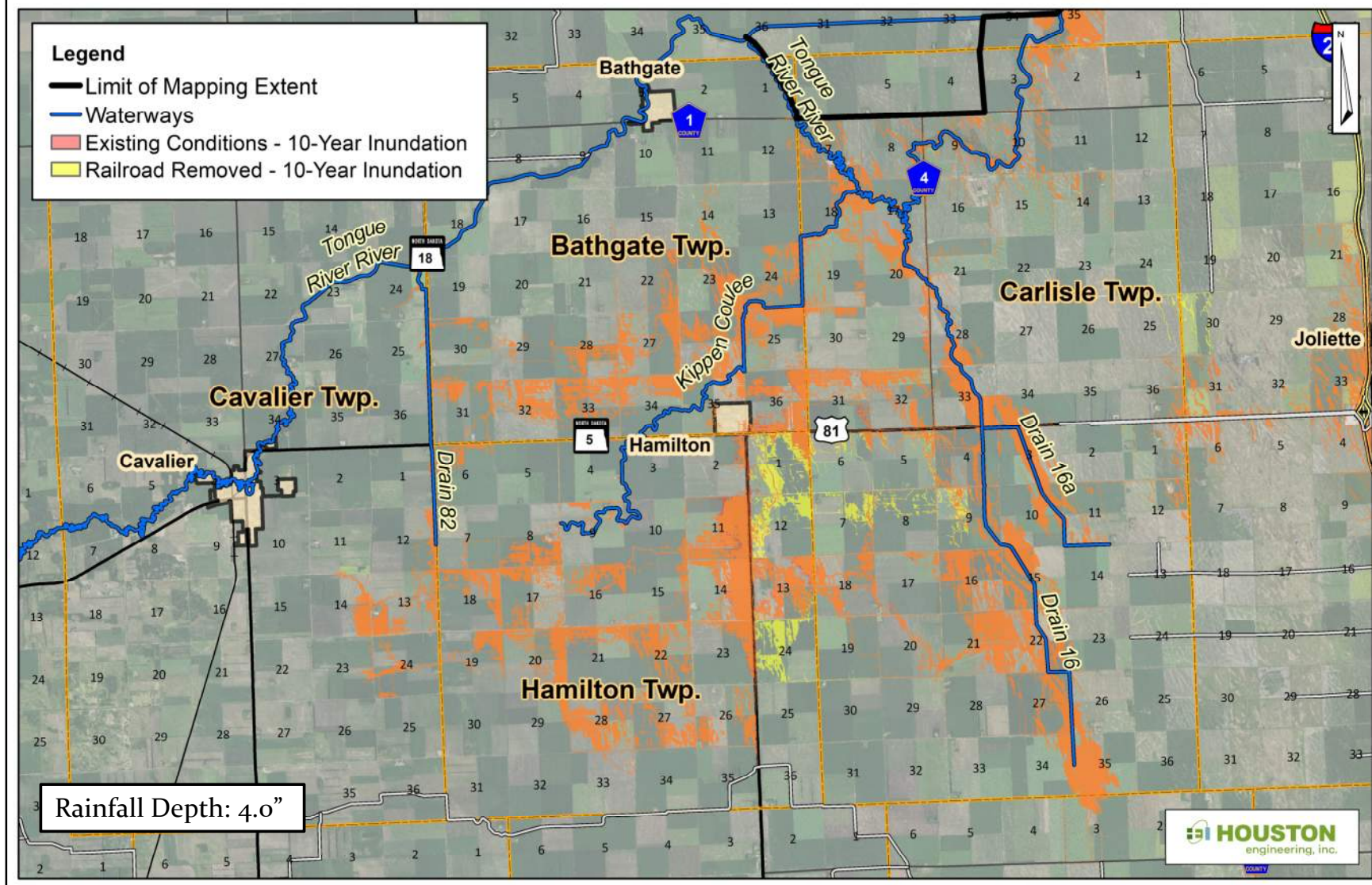


# Inundation Review – Railroad Removed: 2-year Event



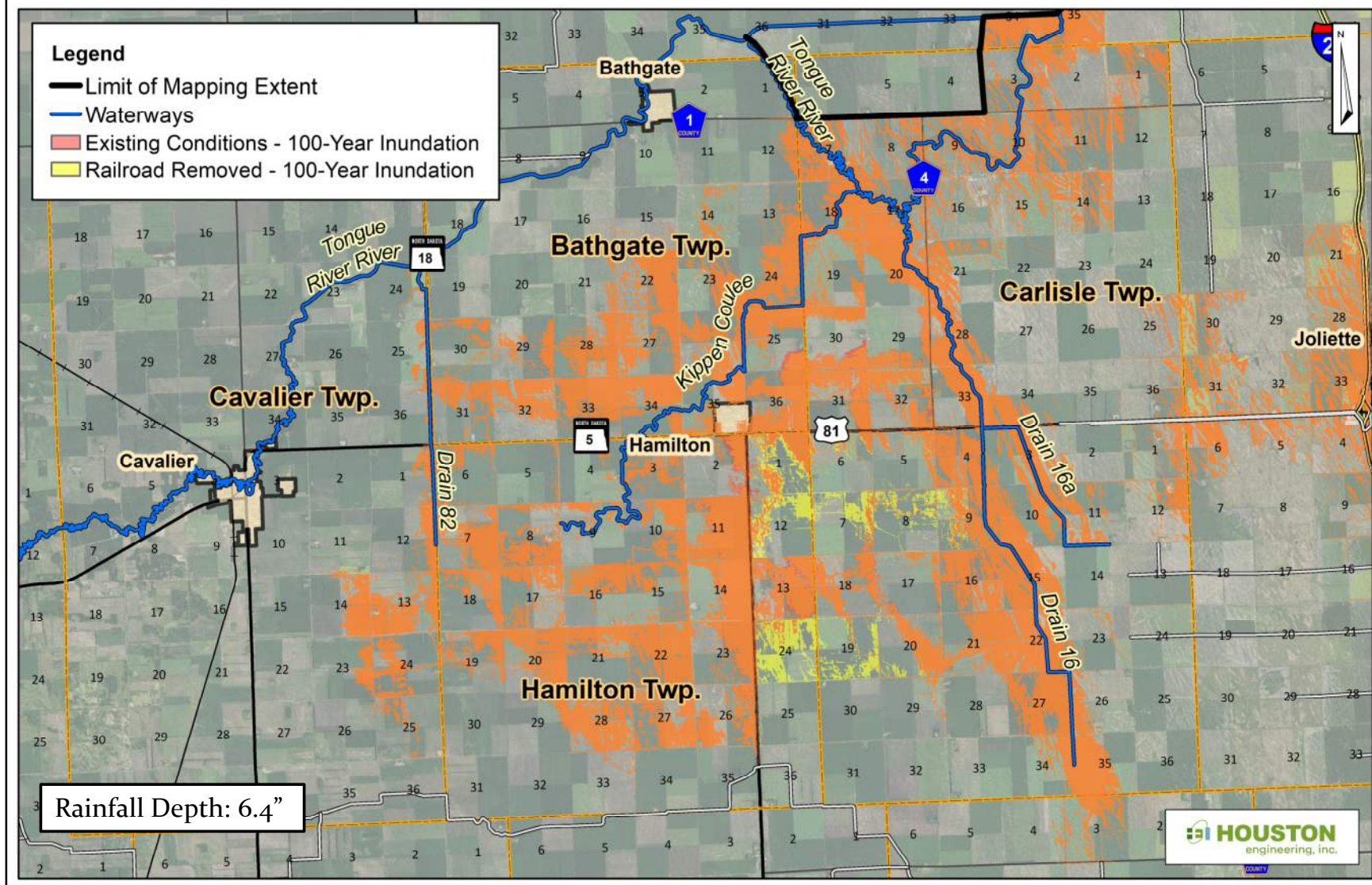


# Inundation Review – Railroad Removed: 10-year Event



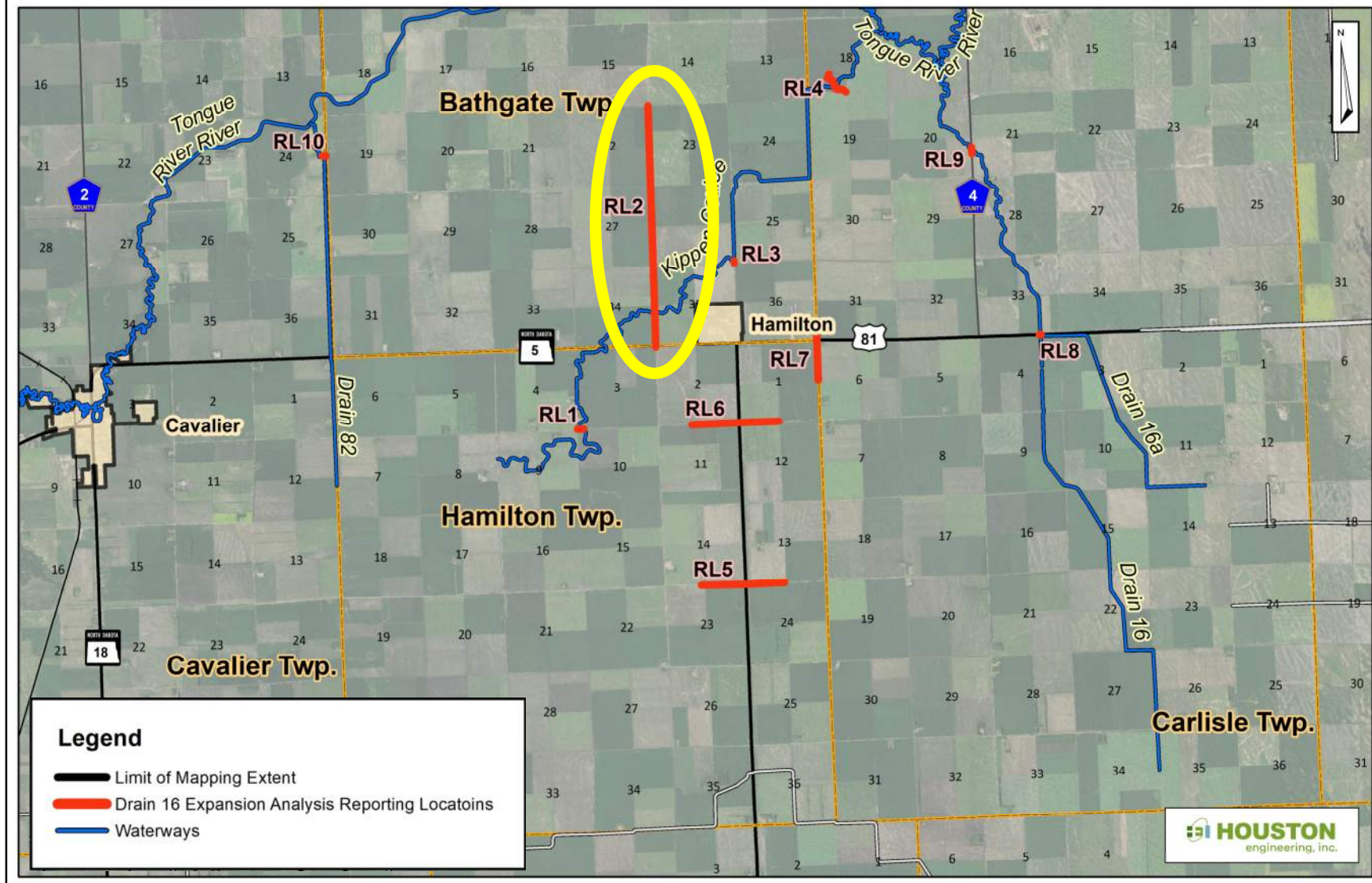


# Inundation Review – Railroad Removed: 100-year Event



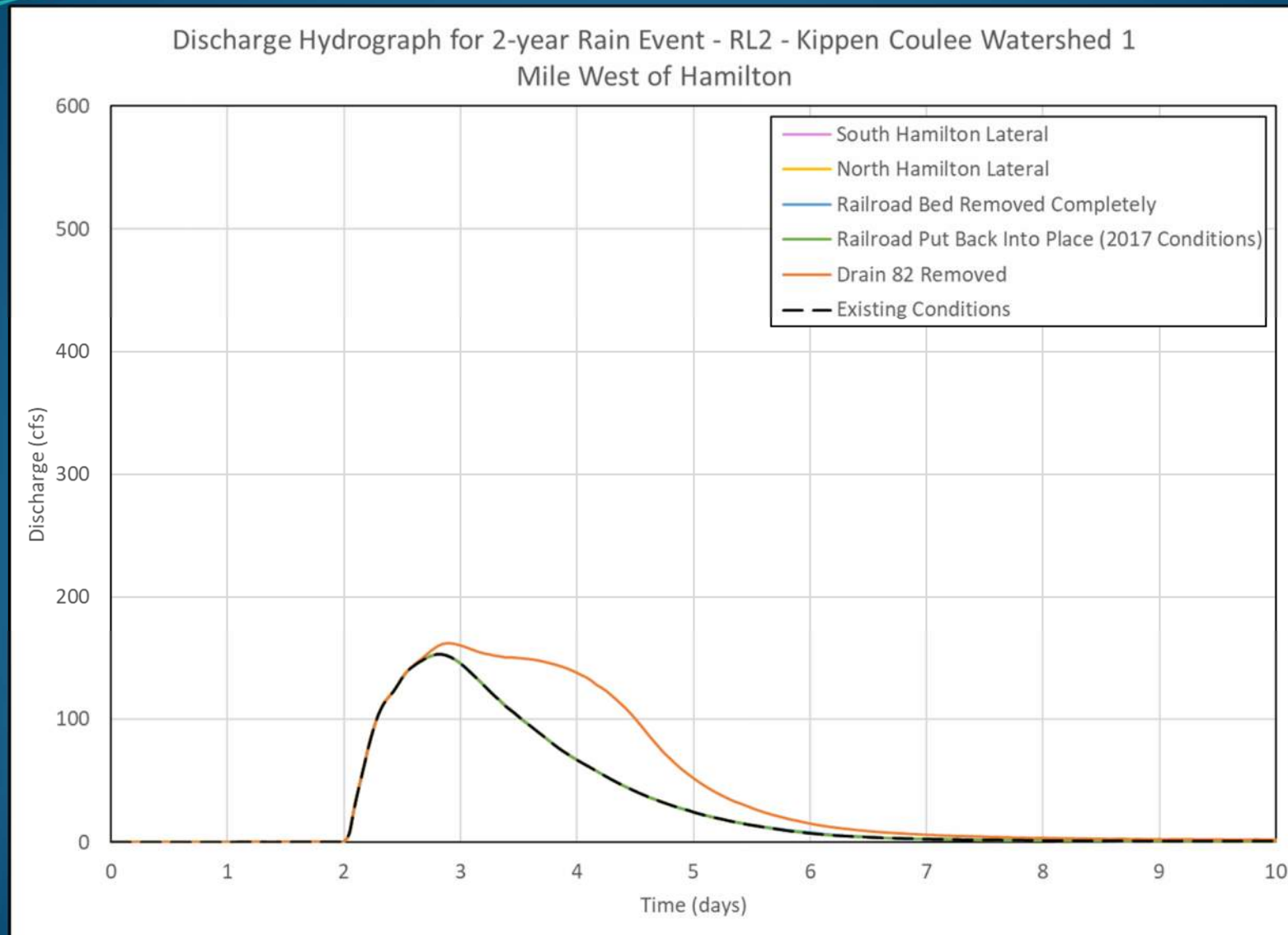


# Reporting Locations

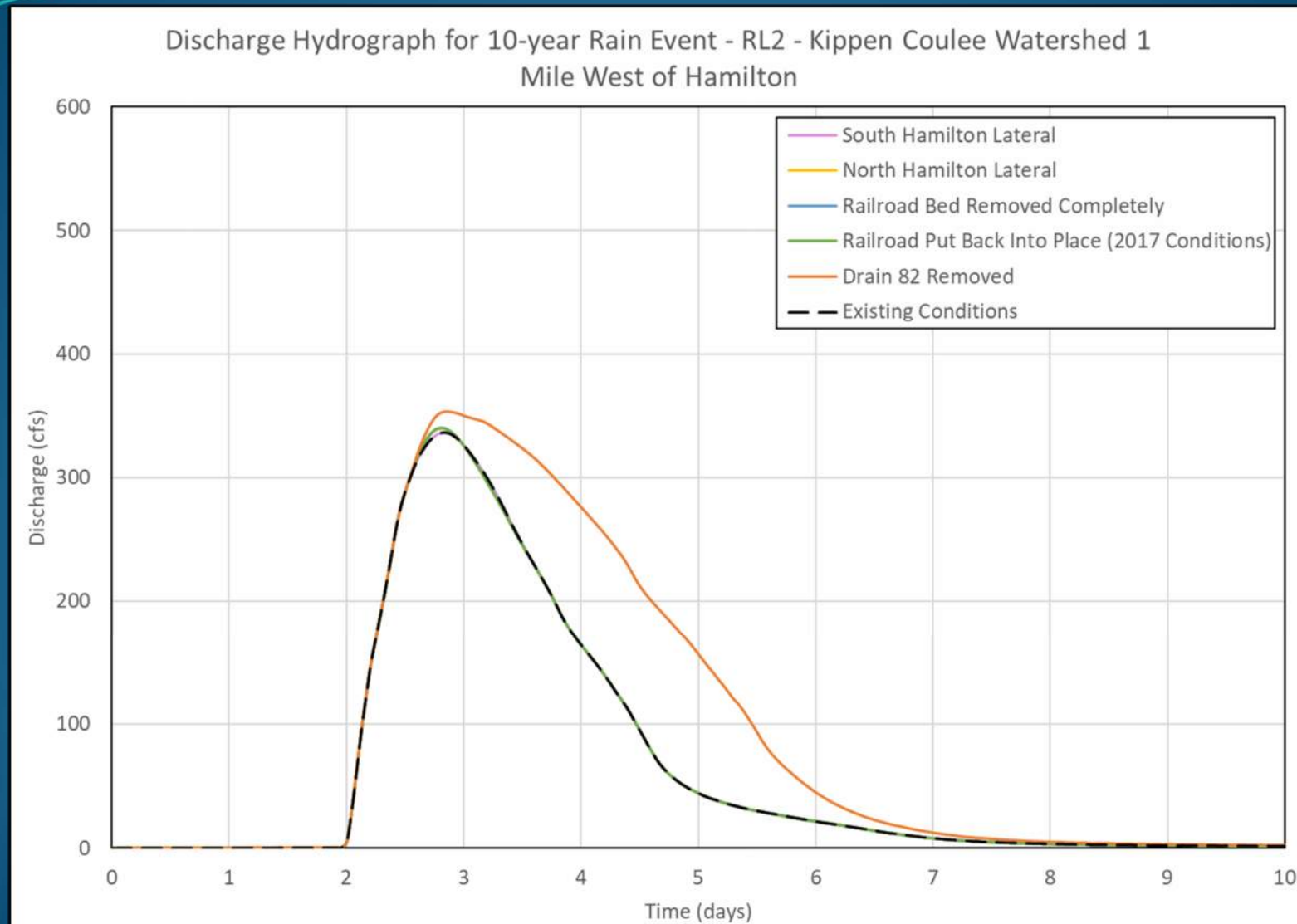




# Discharge Hydrograph Review

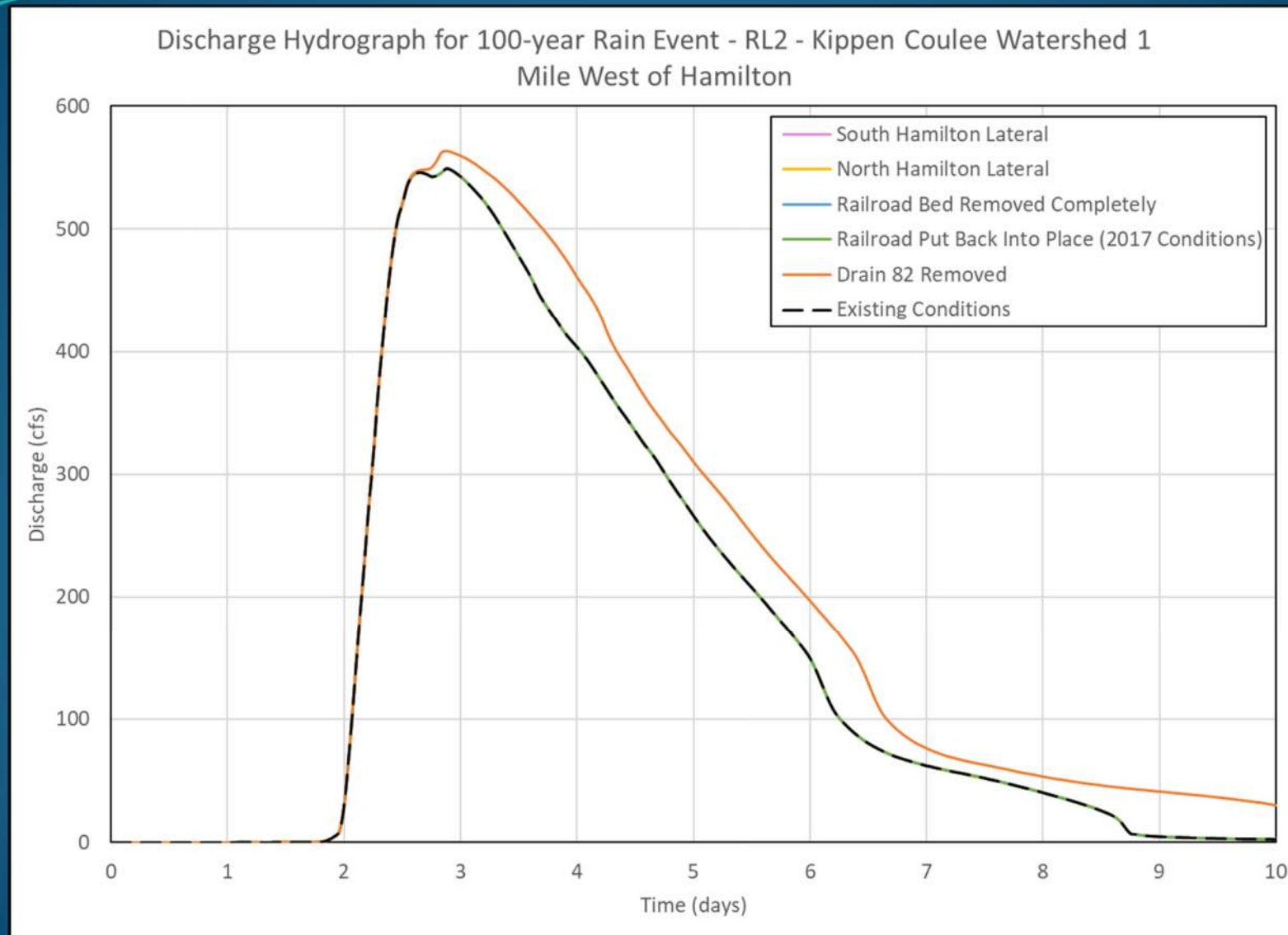


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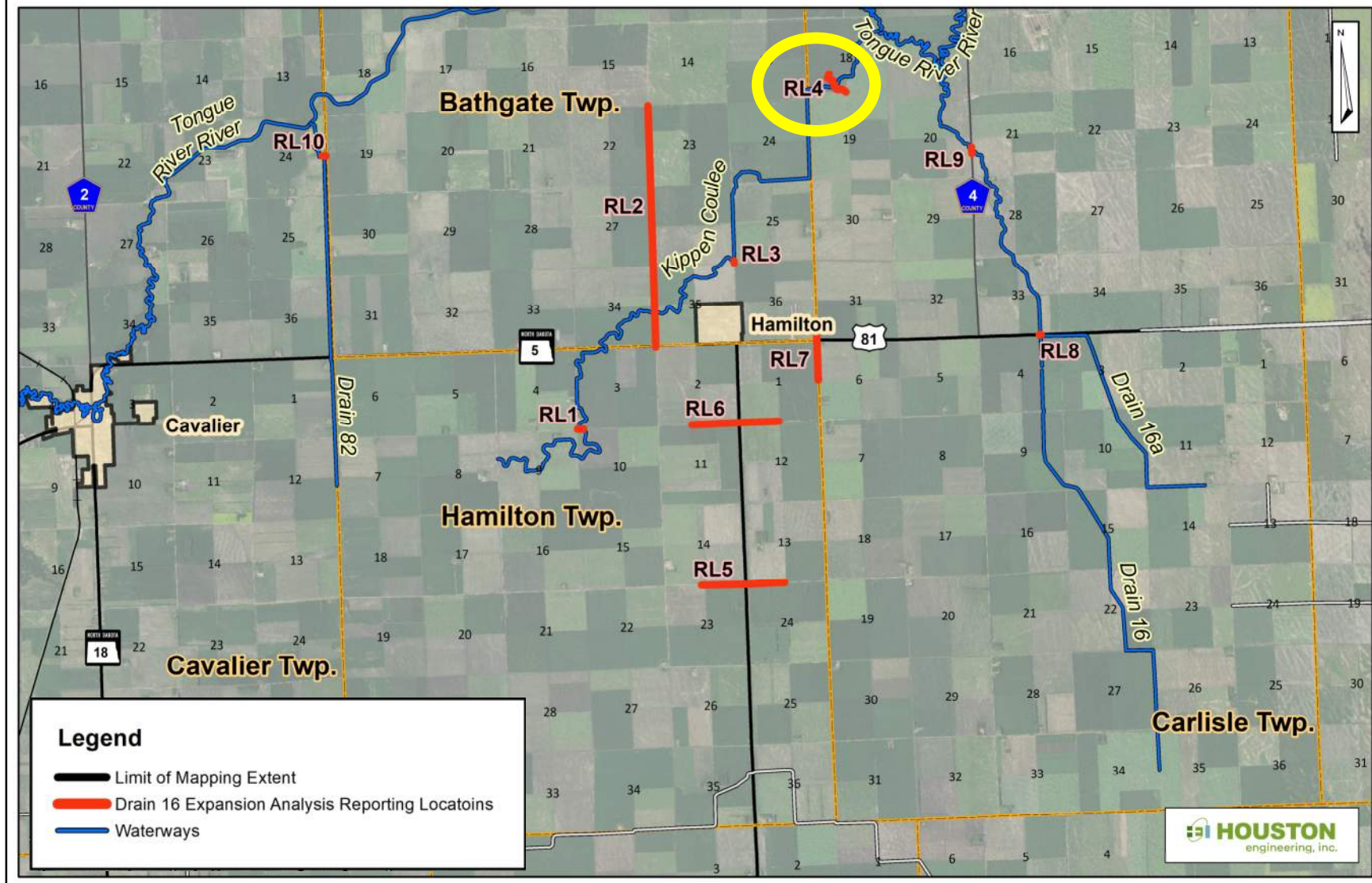




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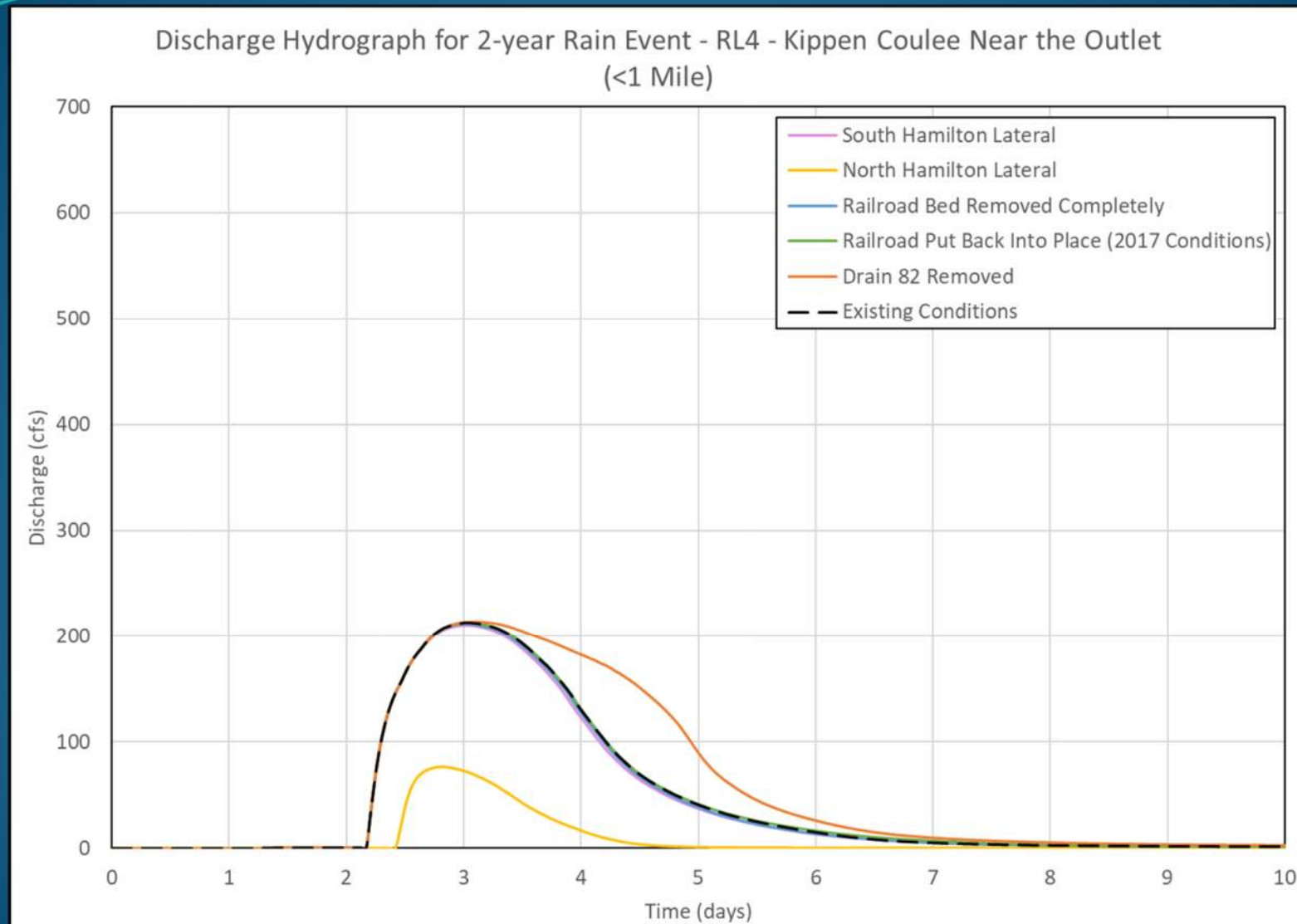


# Reporting Locations

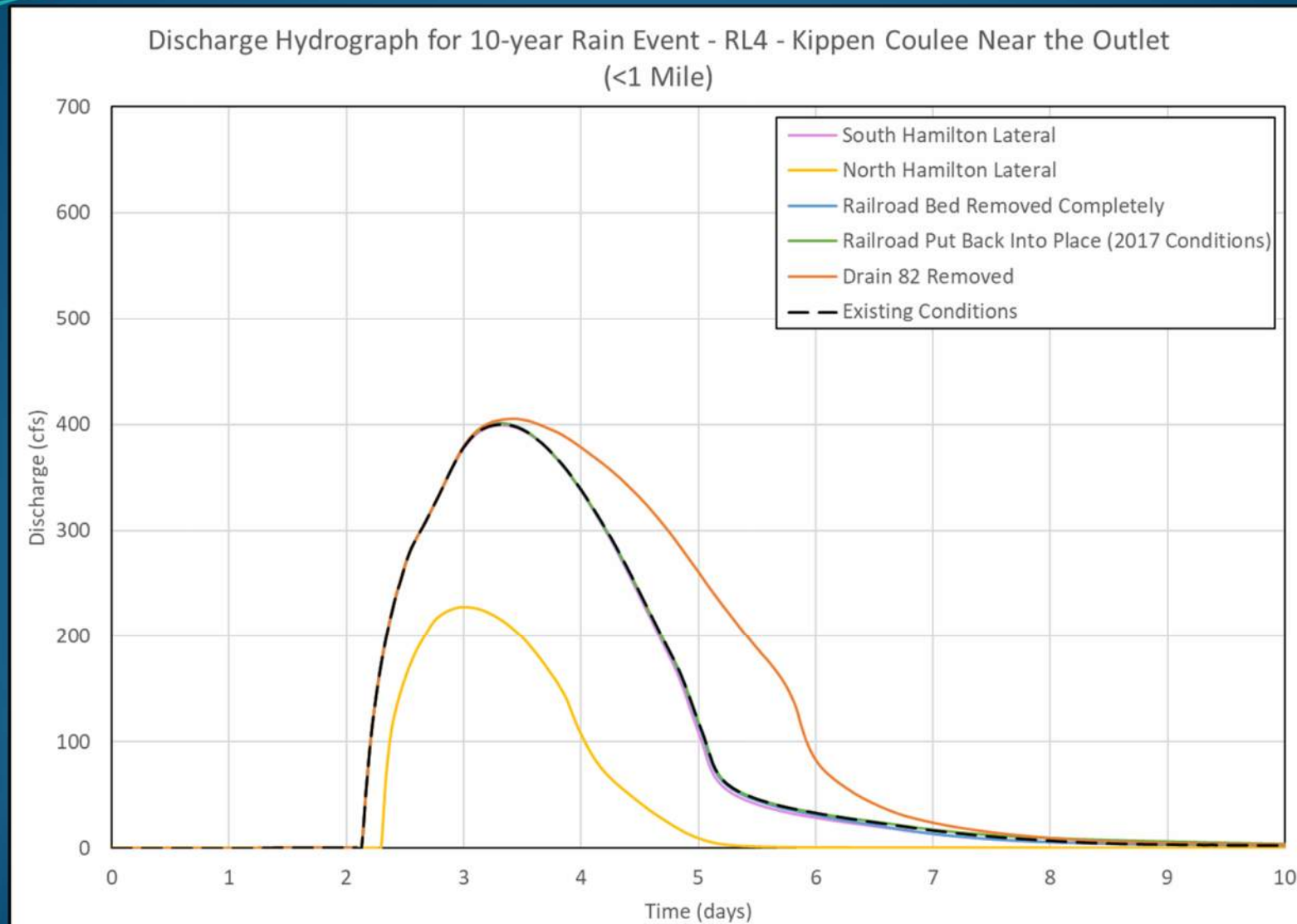




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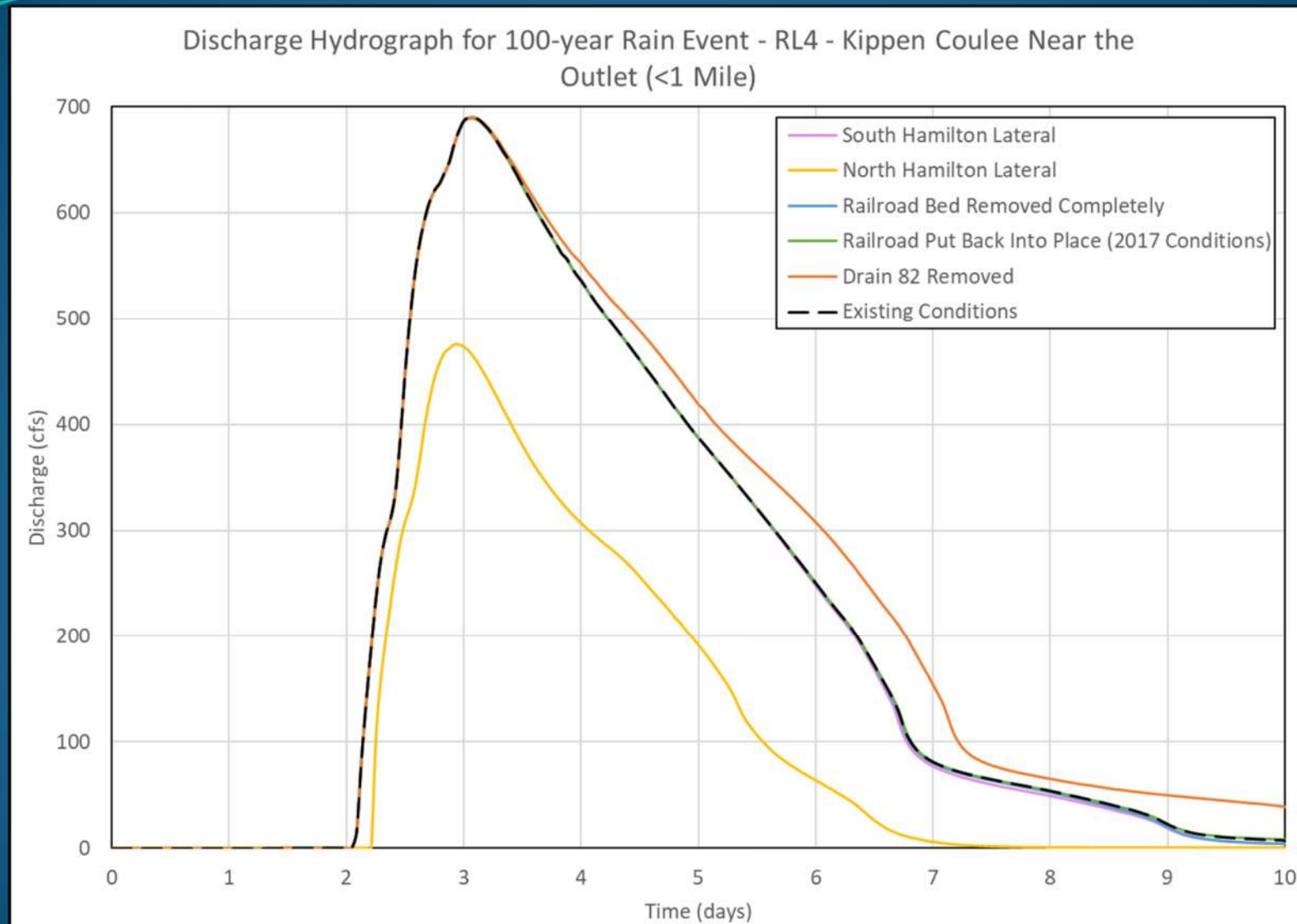


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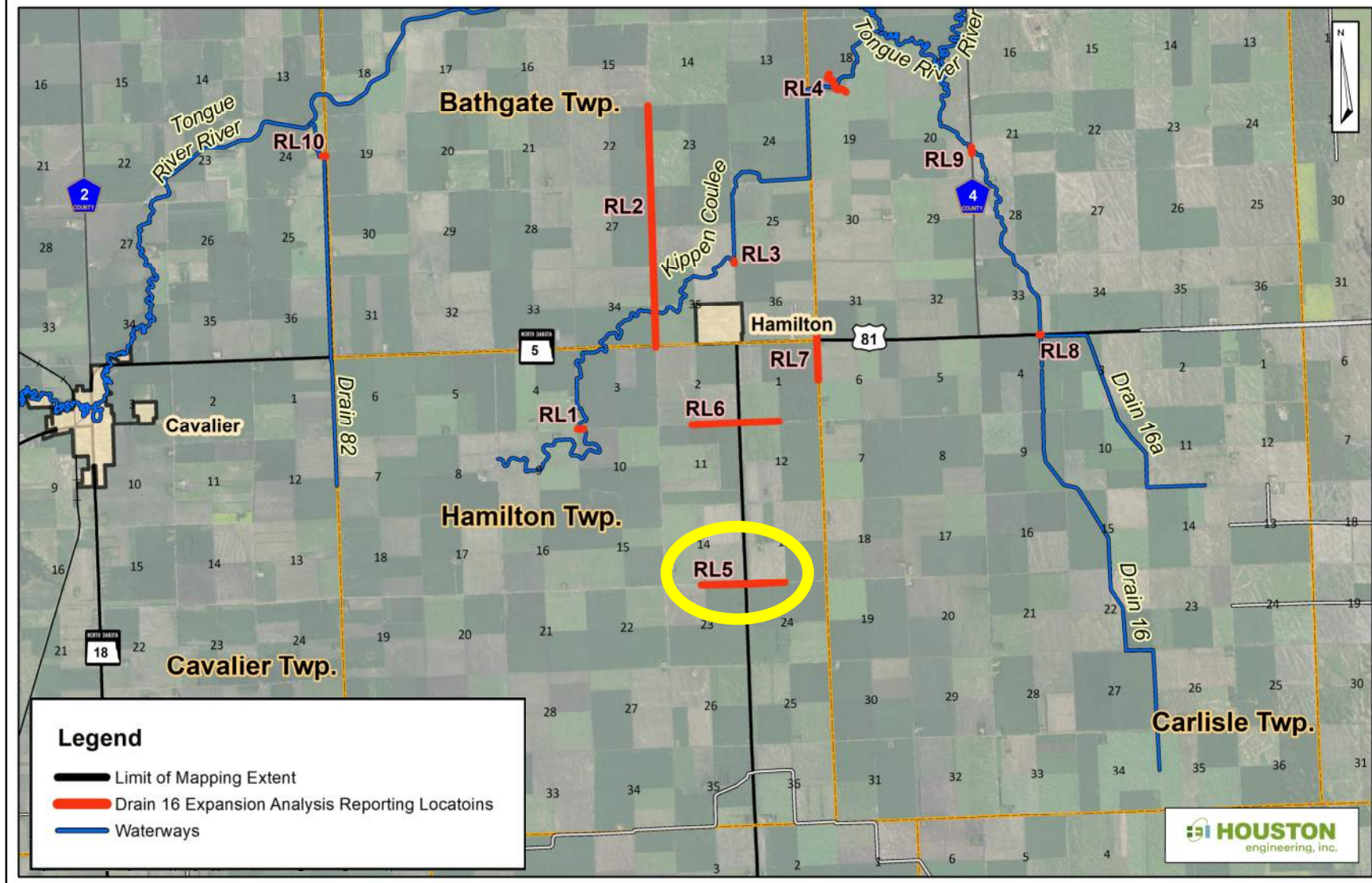




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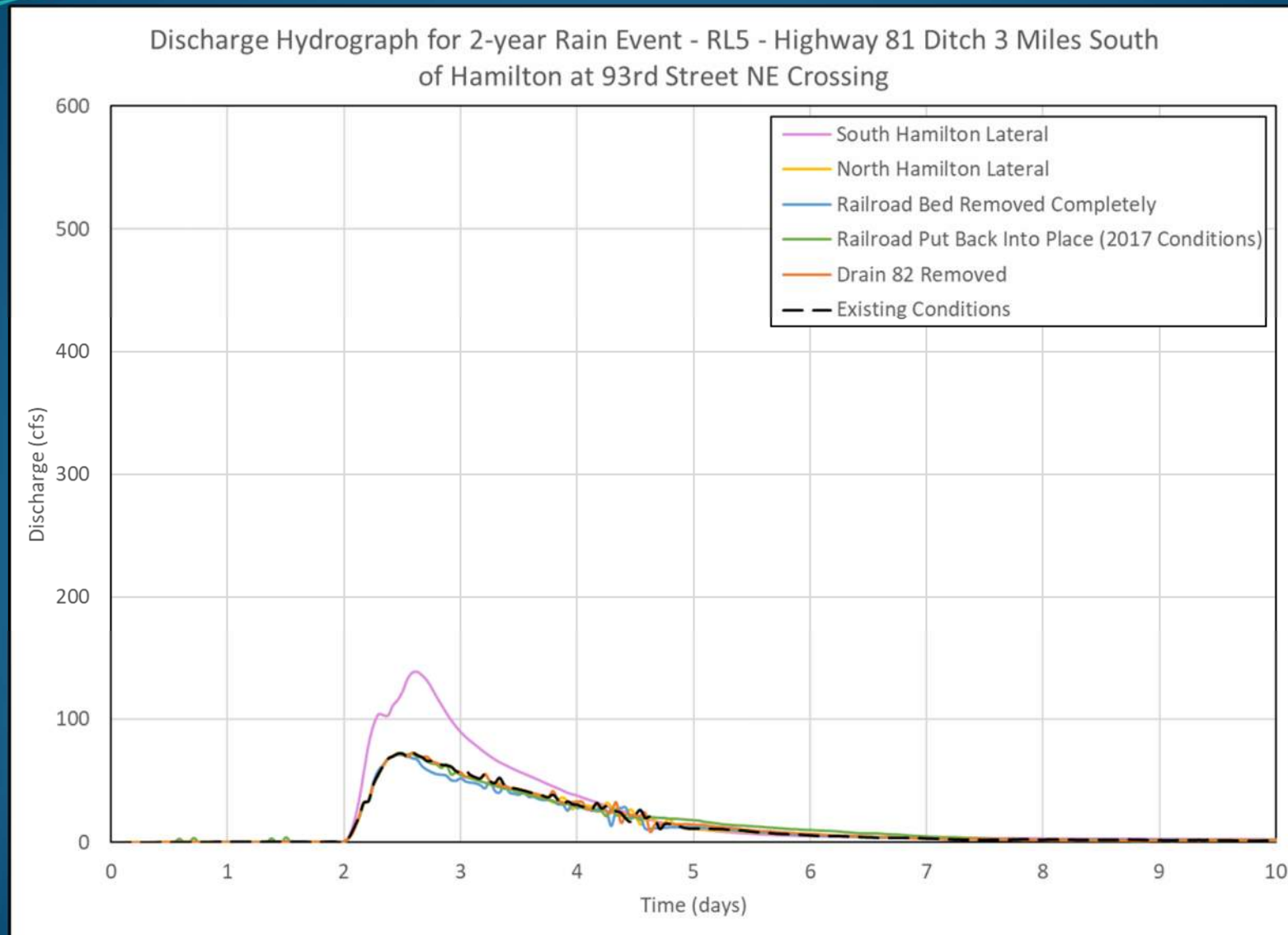


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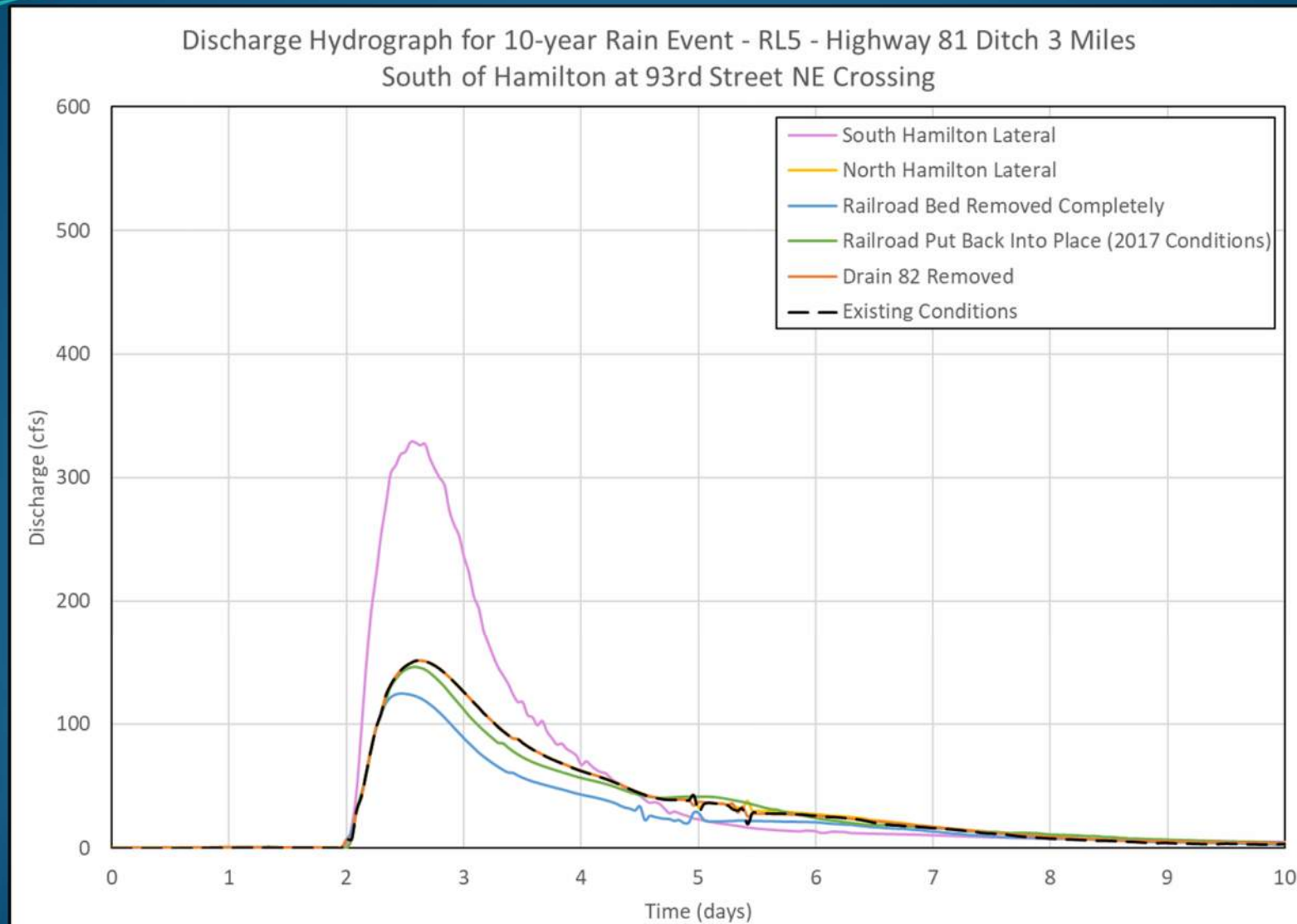




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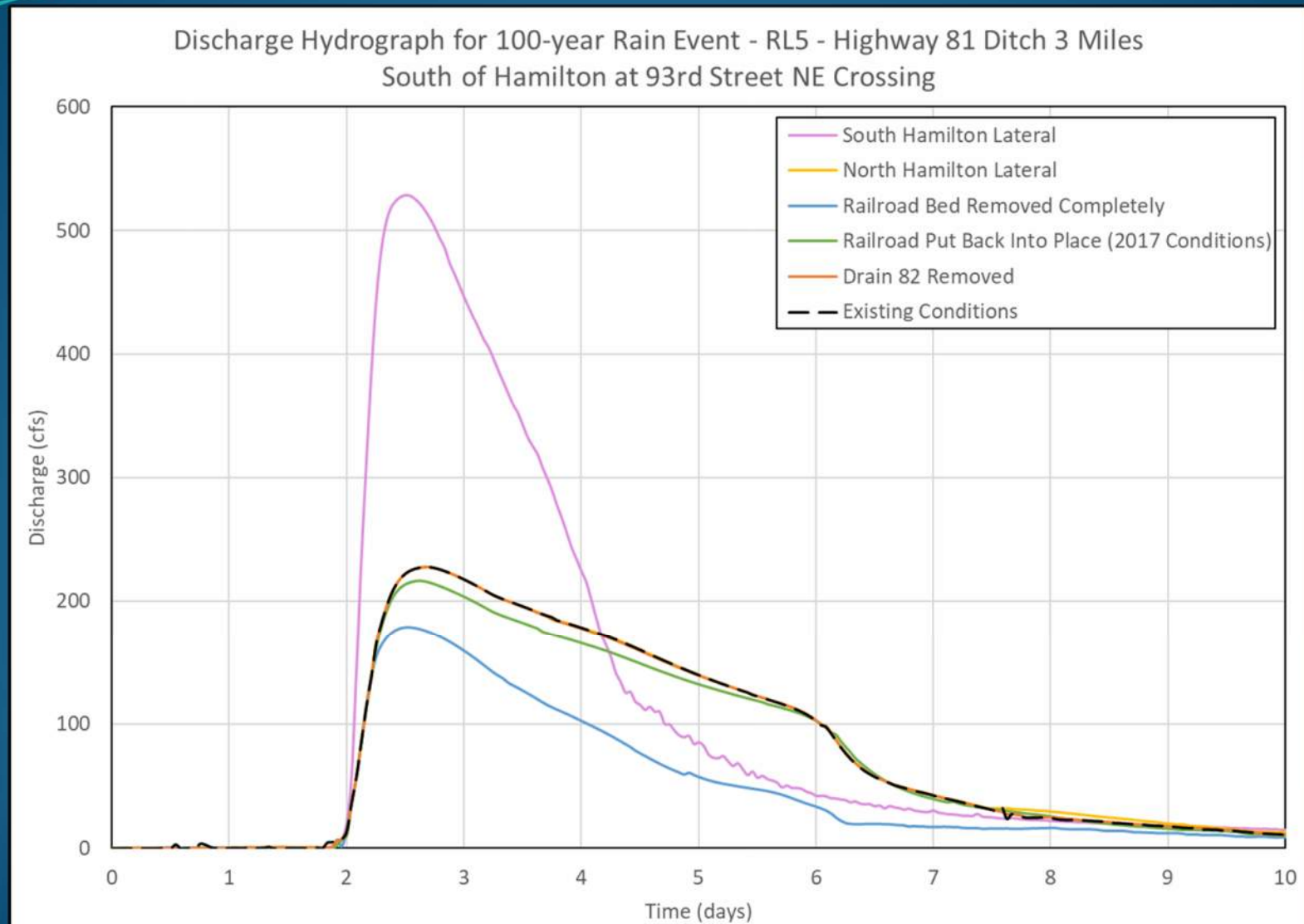


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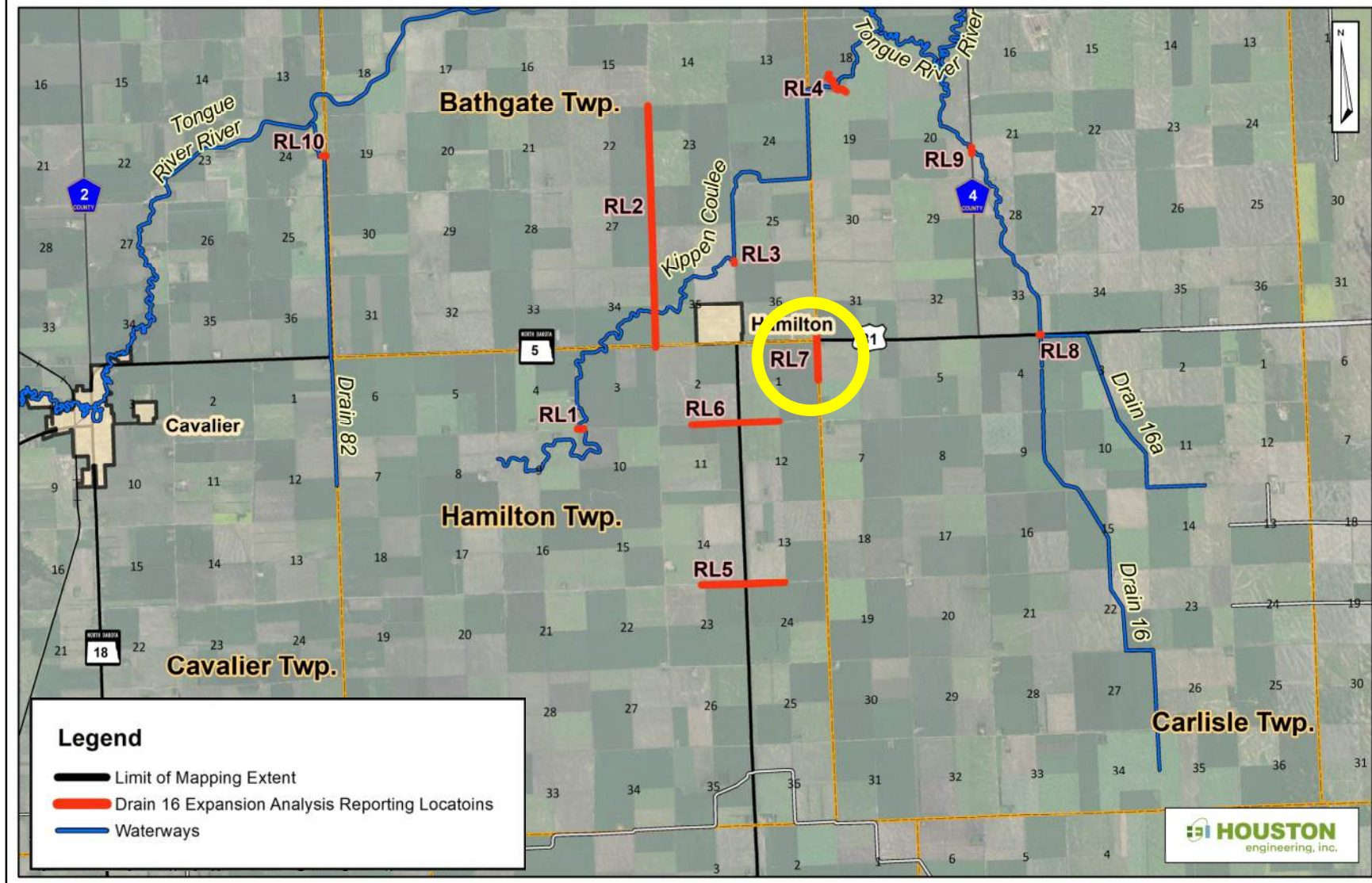




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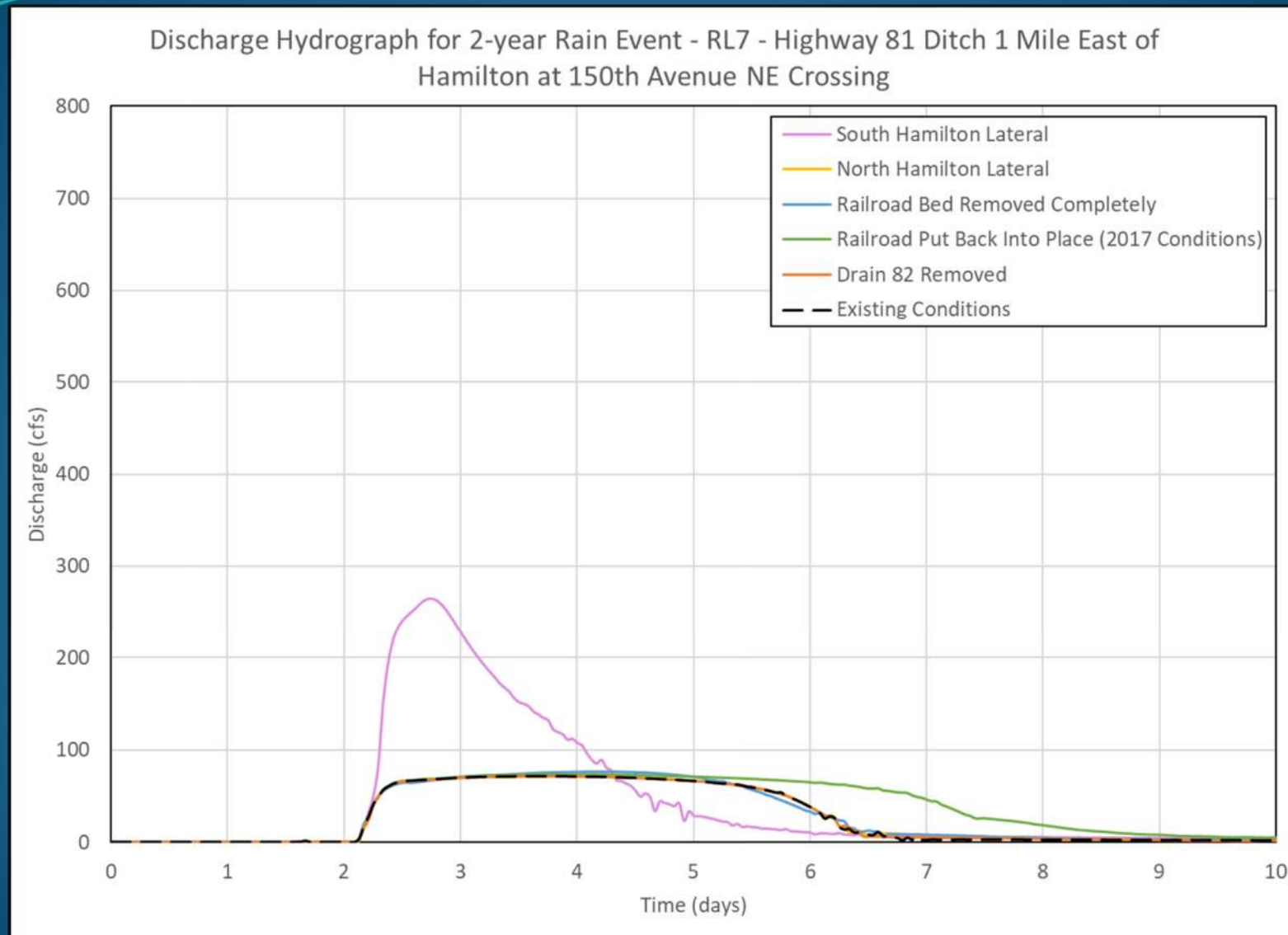


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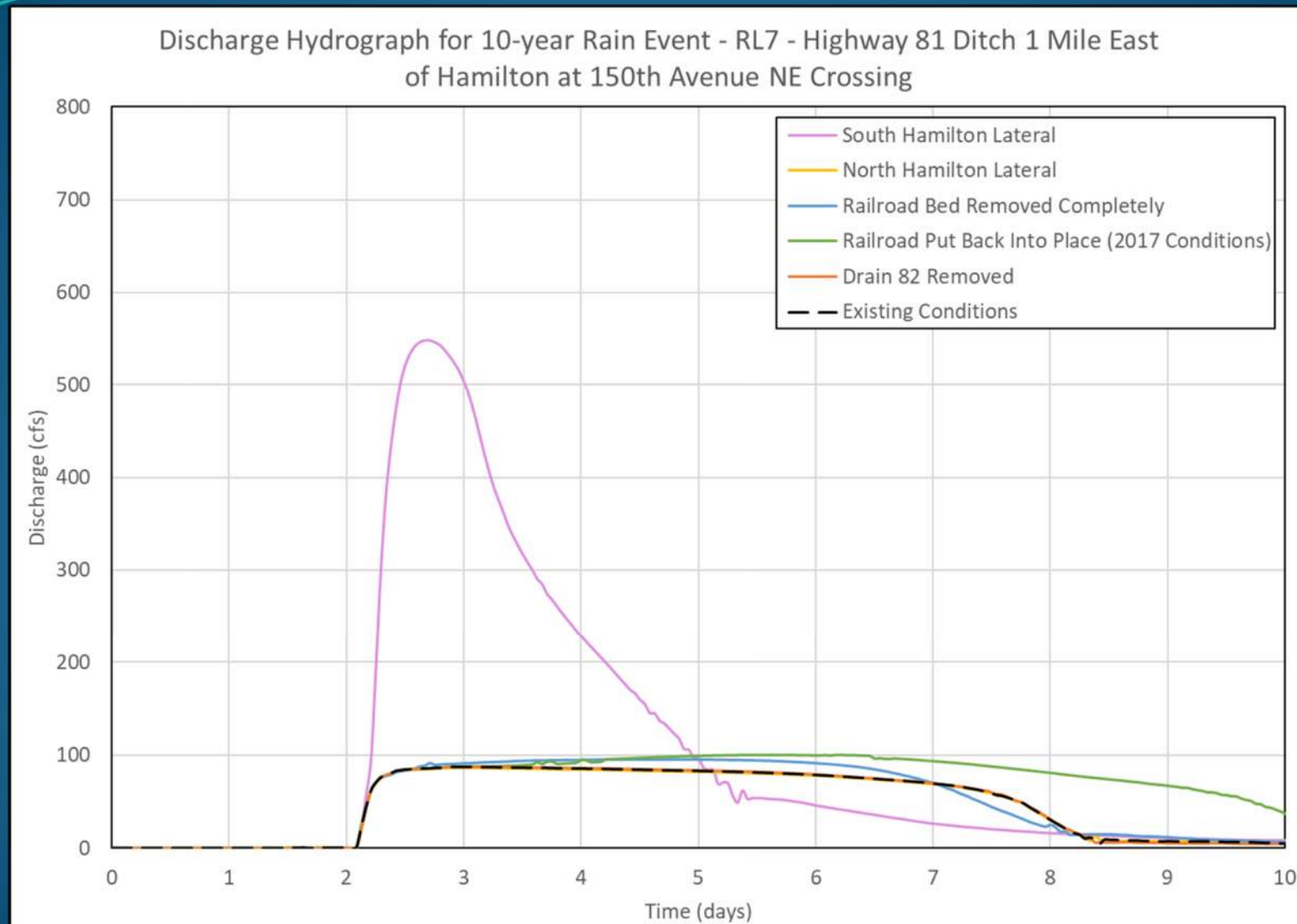




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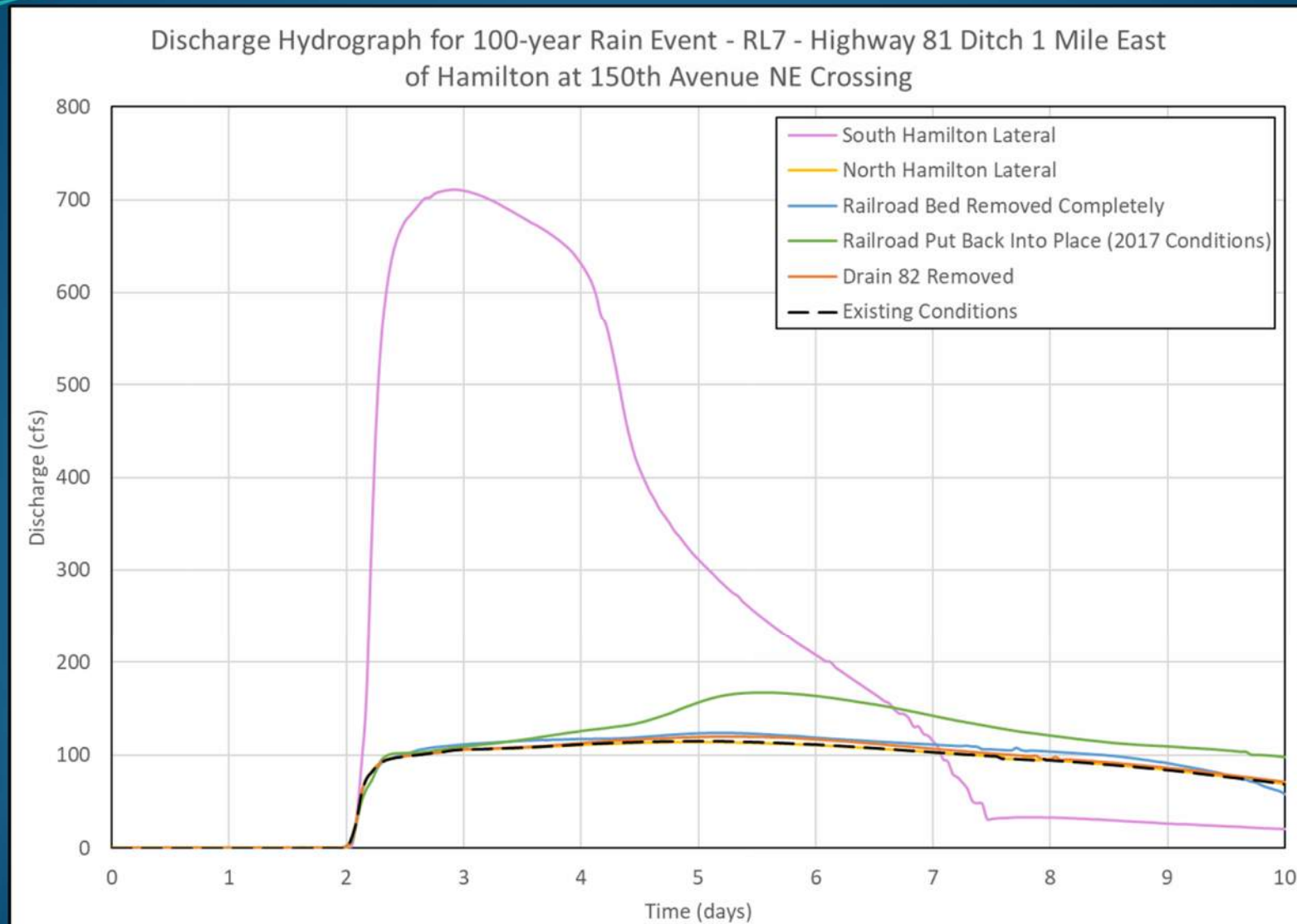


# Discharge Hydrograph Review





# Discharge Hydrograph Review



# Reporting Locations

This map displays the reporting locations for the Drain 16 Expansion Analysis. The map area includes Bathgate Twp., Hamilton Twp., Cavalier Twp., and Carlisle Twp. Key features include the Tongue River, Kippen Coulee, and various drains (82, 16, 16a). Reporting locations are marked with red dots and labeled RL1 through RL10. RL9 is highlighted with a yellow circle. The map also shows the limit of mapping extent (black line), waterways (blue lines), and the location of Cavalier and Hamilton. A legend in the bottom left corner defines the symbols used. The Houston Engineering, Inc. logo is in the bottom right corner.

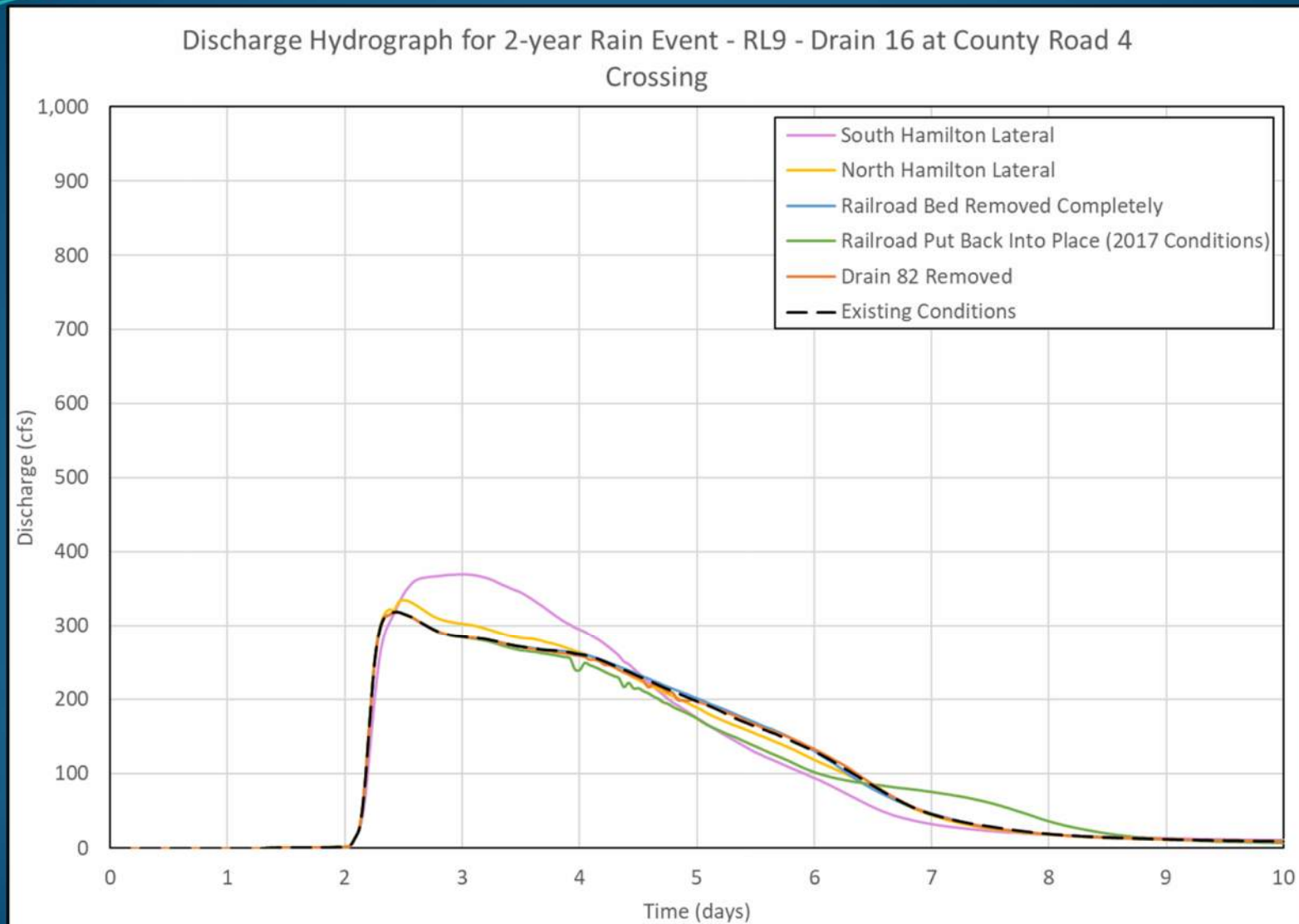
**Legend**

- Limit of Mapping Extent
- Drain 16 Expansion Analysis Reporting Locations
- Waterways

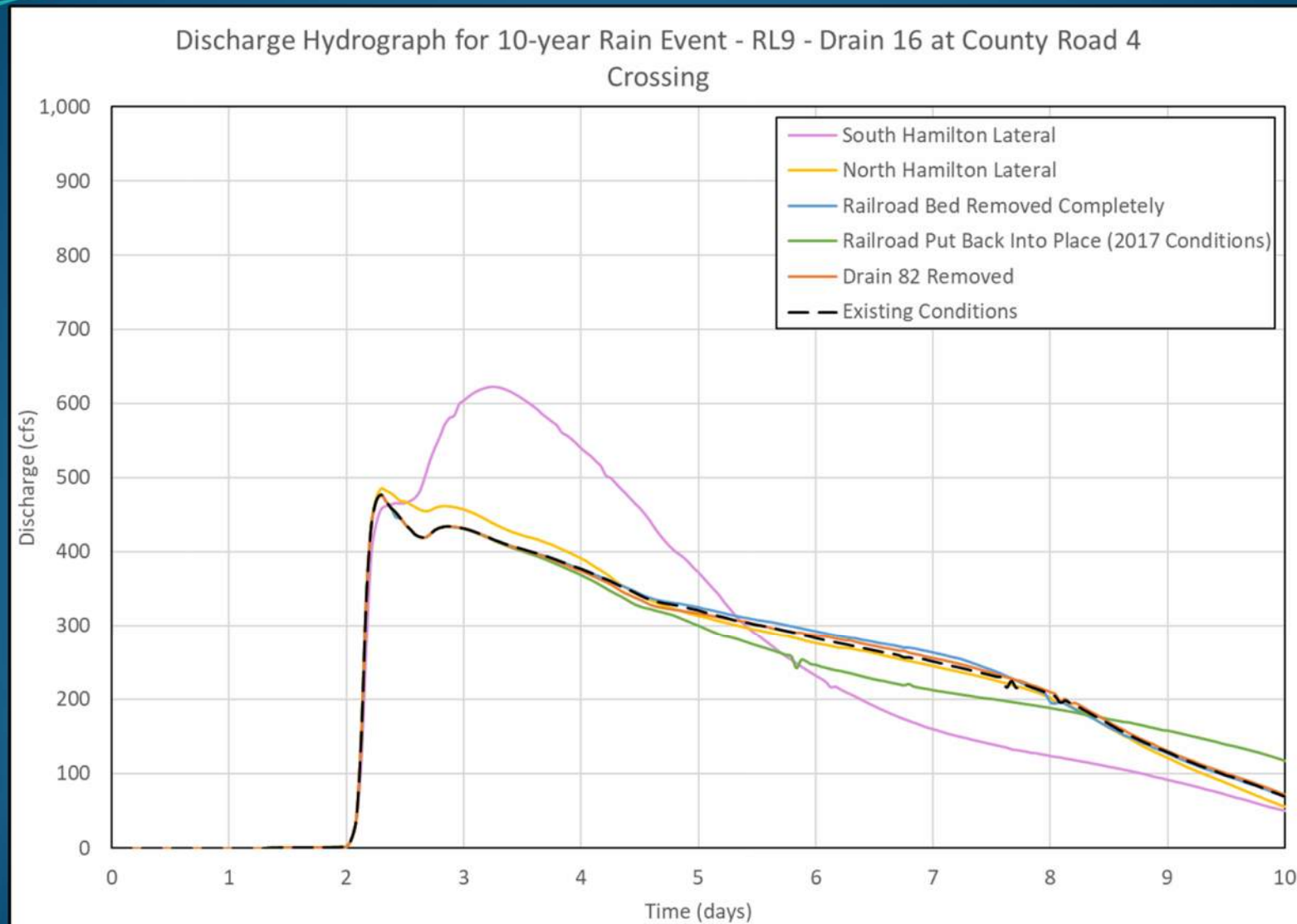
**Houston Engineering, Inc.**



# Discharge Hydrograph Review

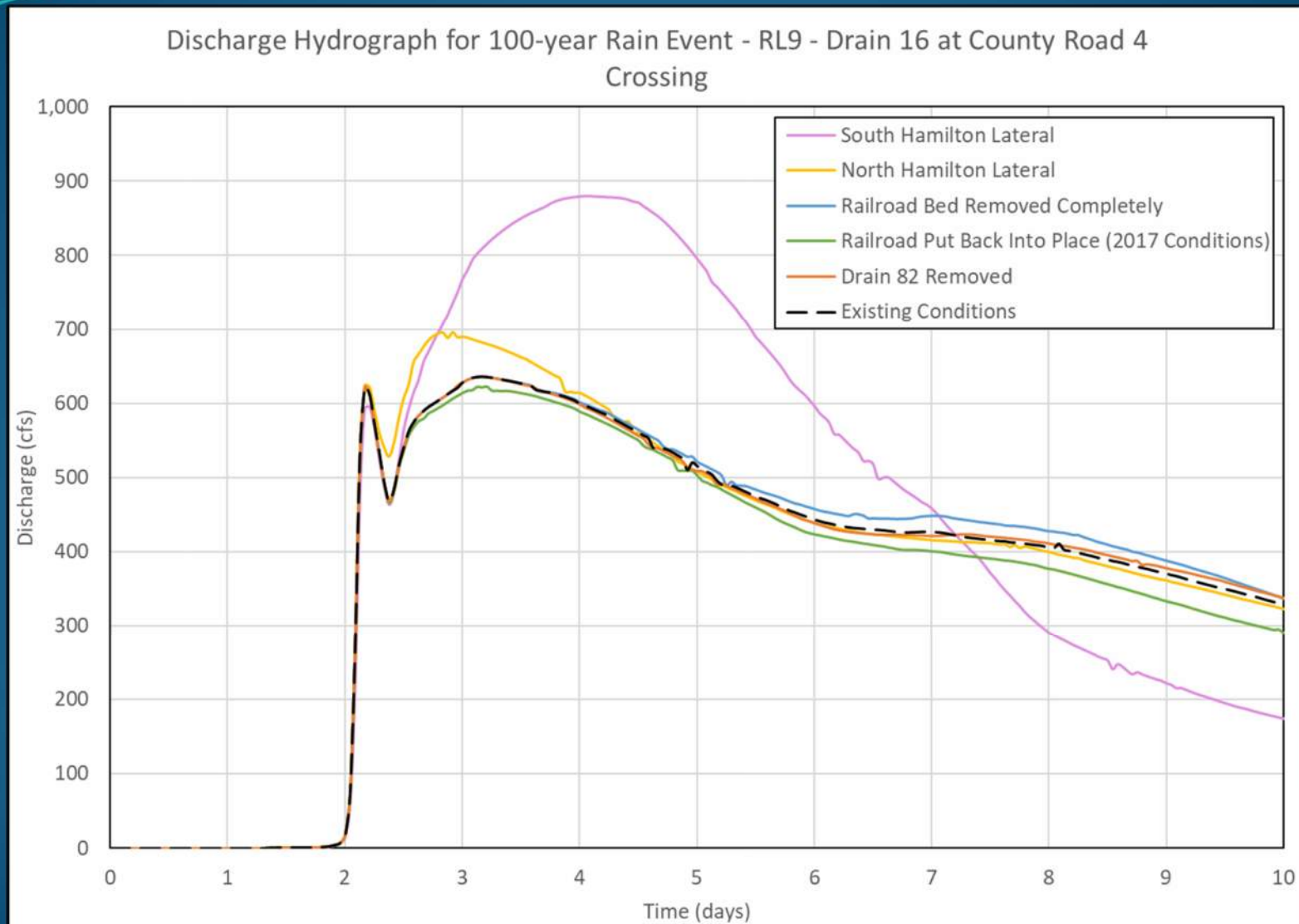


# Discharge Hydrograph Review





# Discharge Hydrograph Review

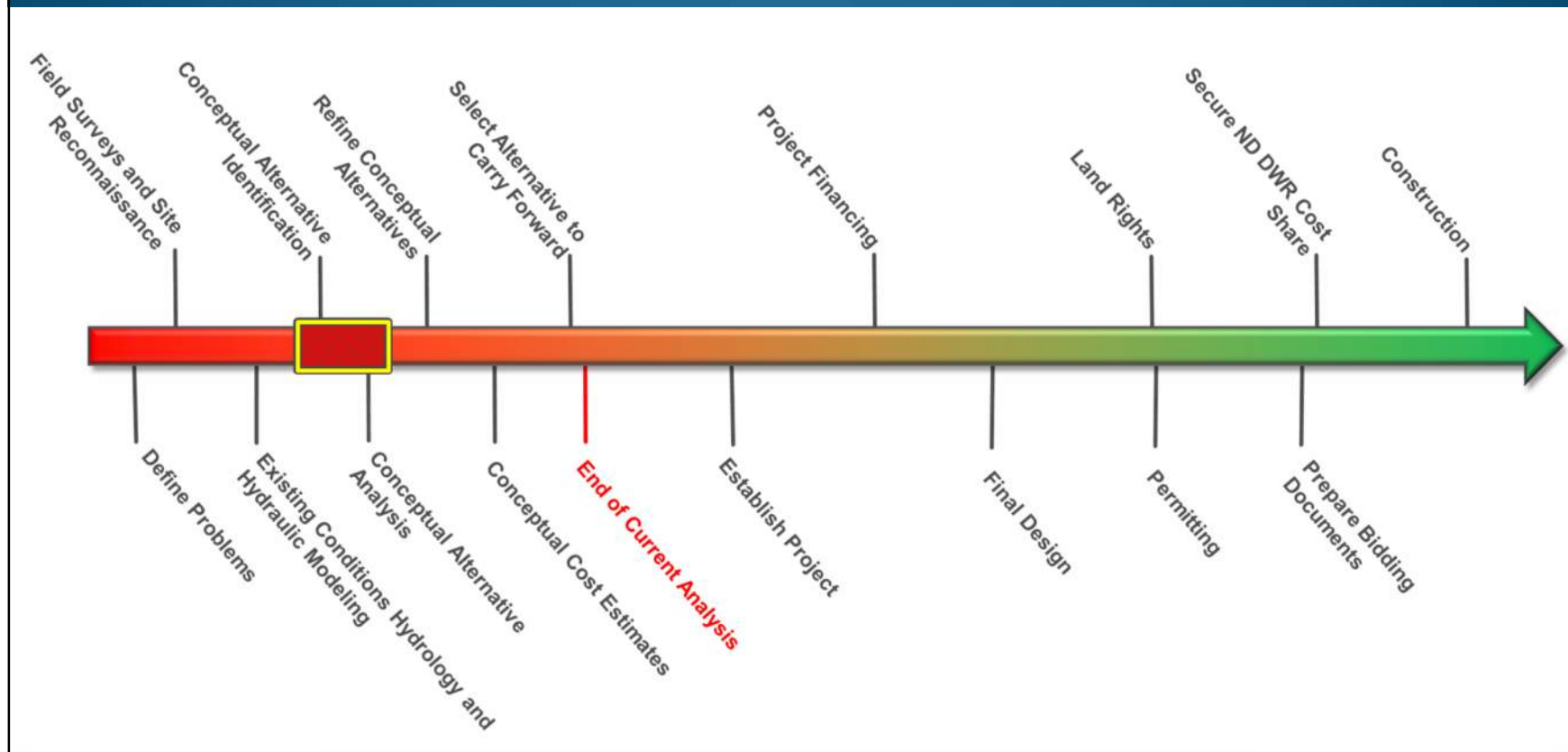


# Scope

- **Purpose of Study**: Explore Alternatives to Alleviate Flood Damages within the Drain 16 Assessment Area
  - Project Phases
    - Field Survey
    - Existing Conditions Hydrology and Hydraulics
    - Alternative Development and Analysis
    - Concept Design of Alternative(s)
  - **Next Steps**
    - Review alternative methods to alleviate negative impacts from increased conveyance
    - Develop concept design of preferred alternative
- Public Participation



# Project Timeline



## COMMENT SHEET

### Pembina County Drain 16 Expansion Analysis Alternatives Review – 1

Public Meeting – July 27<sup>th</sup>, 2023

Please list any comments or concerns related to the alternatives reviewed for this Project: \_\_\_\_\_

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*(You may also use the attached map located on the reverse side of this sheet to expand on the comments.)*

May we follow up with you for more information?      YES      NO

Please provide your name, address, email address, and phone number:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Email: \_\_\_\_\_

Phone Number: \_\_\_\_\_

**Please drop this form off at the conclusion of the meeting, email, or mail back to:**

**EMAIL:** pleclaire@houstoneng.com

**MAIL:** Pembina County Drain 16 Expansion Analysis  
c/o Pembina County Water Resource District  
308 Courthouse Drive #5  
Cavalier, ND 58220

Thank you for taking the time to complete this comment form. Please return any completed form to the Pembina County Water Resource District before leaving.

If you would like more time to complete this form, please return no later than FRIDAY, AUGUST 25, 2023, using the email/mail instructions above. Completed forms may also be dropped off at the Pembina County Water Resource District office.

*Thank You!!*

 **HOUSTON**  
engineering, inc.

*Pembina County*  
NORTH DAKOTA

- Comment sheets available at the public meeting on July 27<sup>th</sup> and on PCWRD website.
- Map of watershed is provided on the reverse side.
- Submit comments by August 25, 2023.