

Pembina County Drain 16 Expansion Analysis

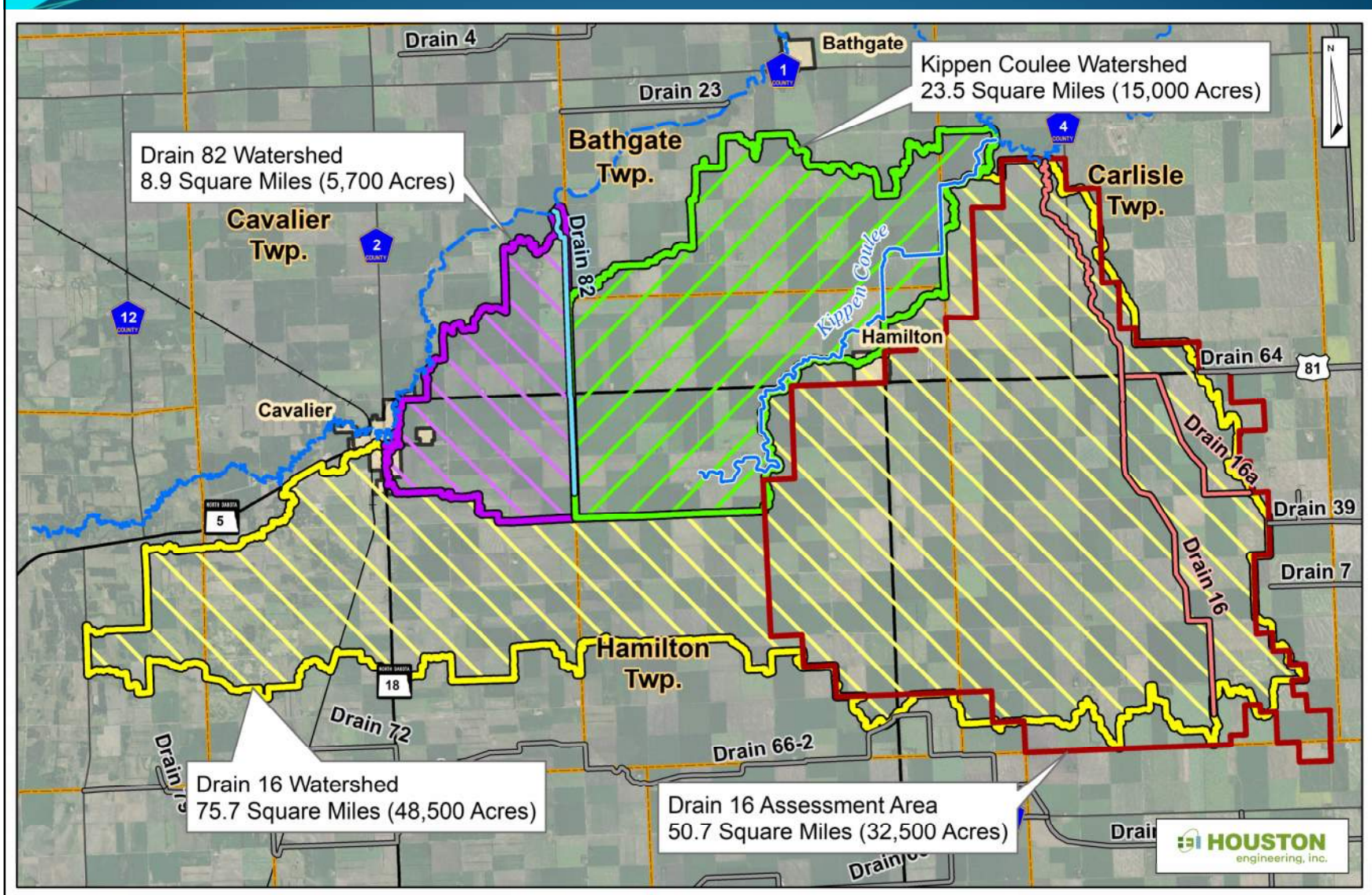
Alternatives Review – 2

March 28, 2024
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 previously completed analysis.
 - Review alternatives developed to alleviate negative impacts to lower end of Drain 16.
- Public Participation Occurs Throughout

Background

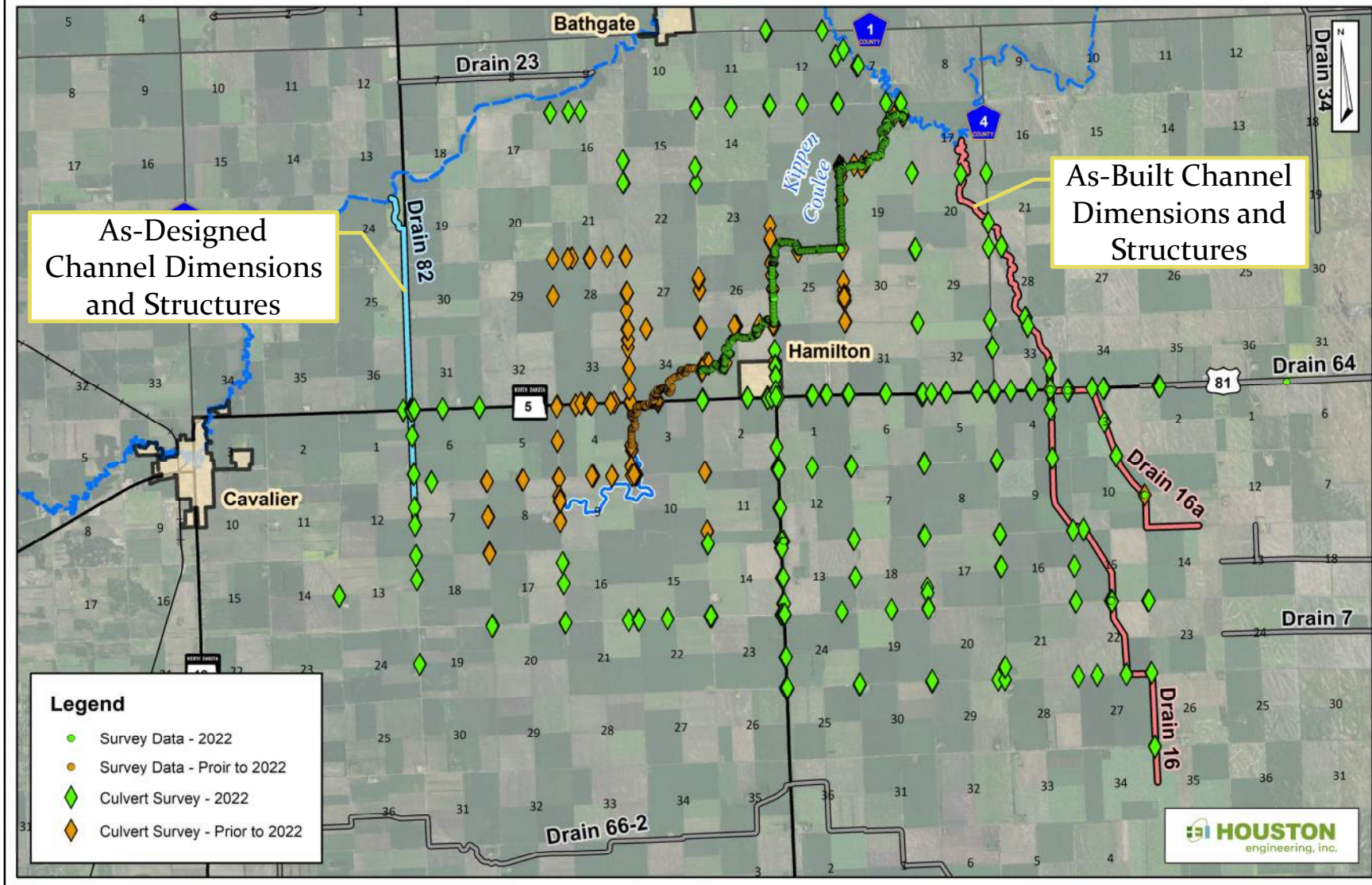


Noted Issues Related to Drainage and Flooding

- Prolonged high water in/along Drain 16.
- Overland flooding near Hamilton, ND
- Overland flooding in the Kippen Coulee area.

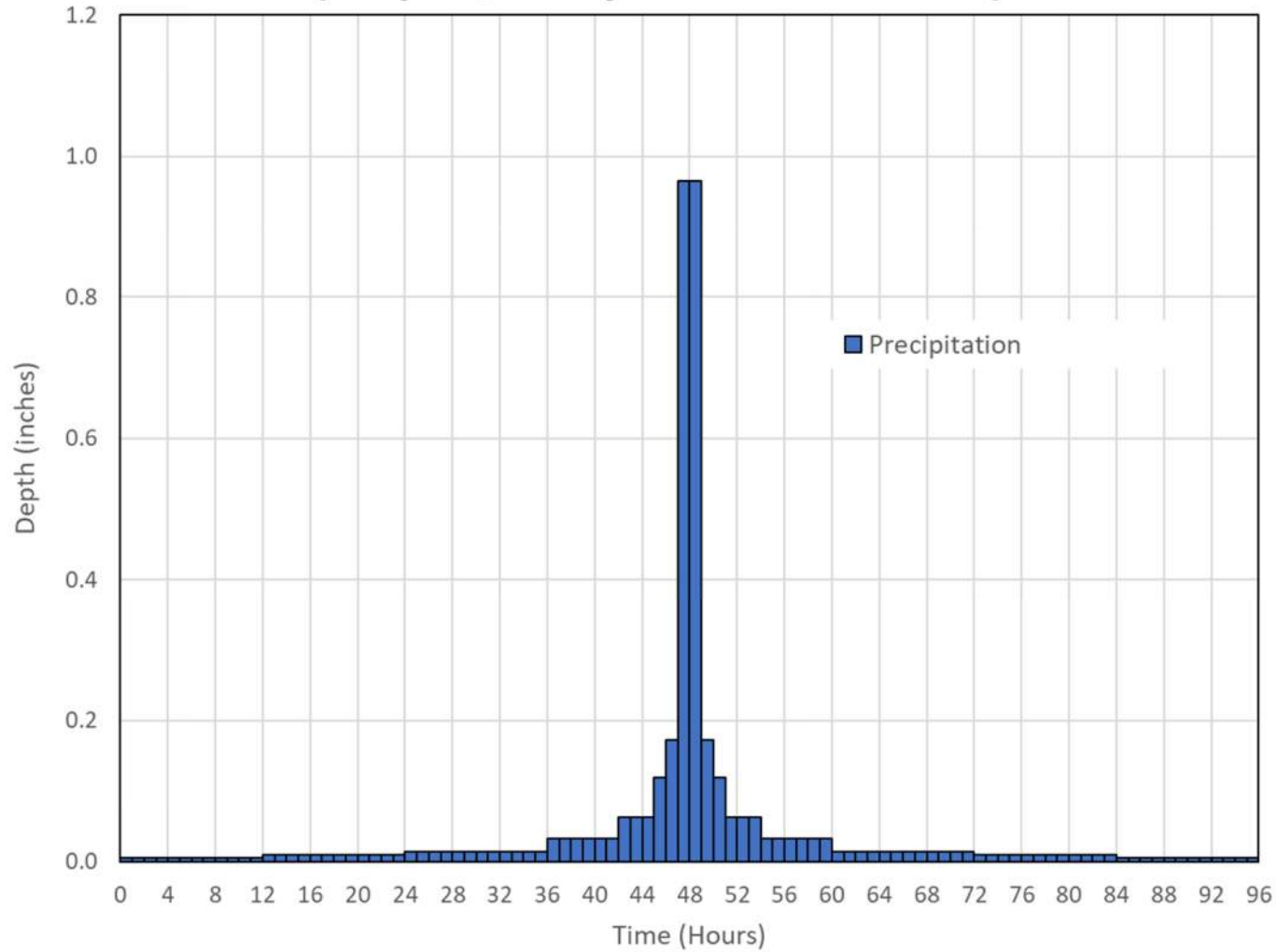
- Impacts:
 - Roadway damages
 - Agricultural impacts
 - Scour/erosion on agricultural land.
 - Impacts to Hamilton, ND.

Field Survey

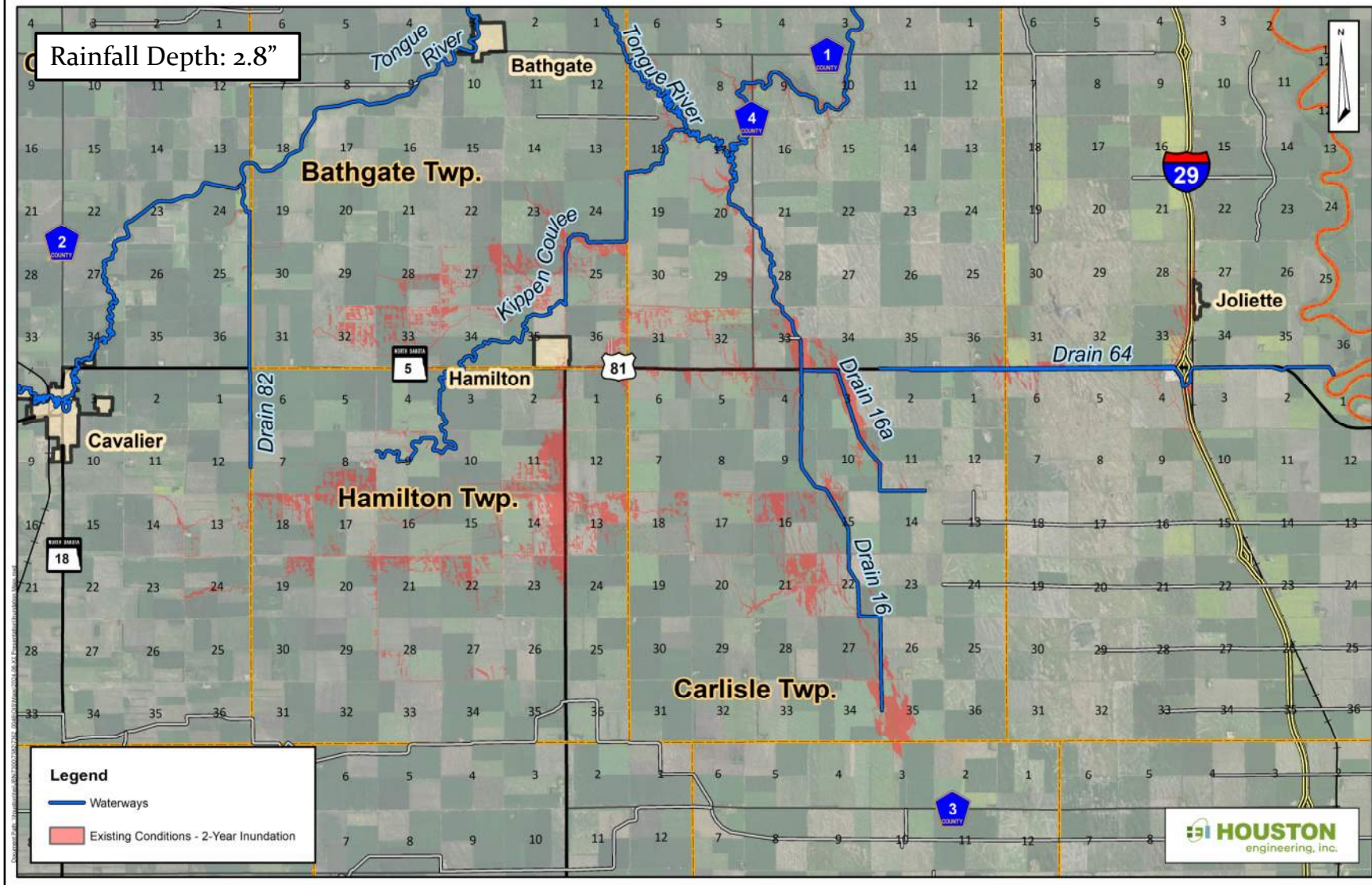


Hydrology & Hydraulics

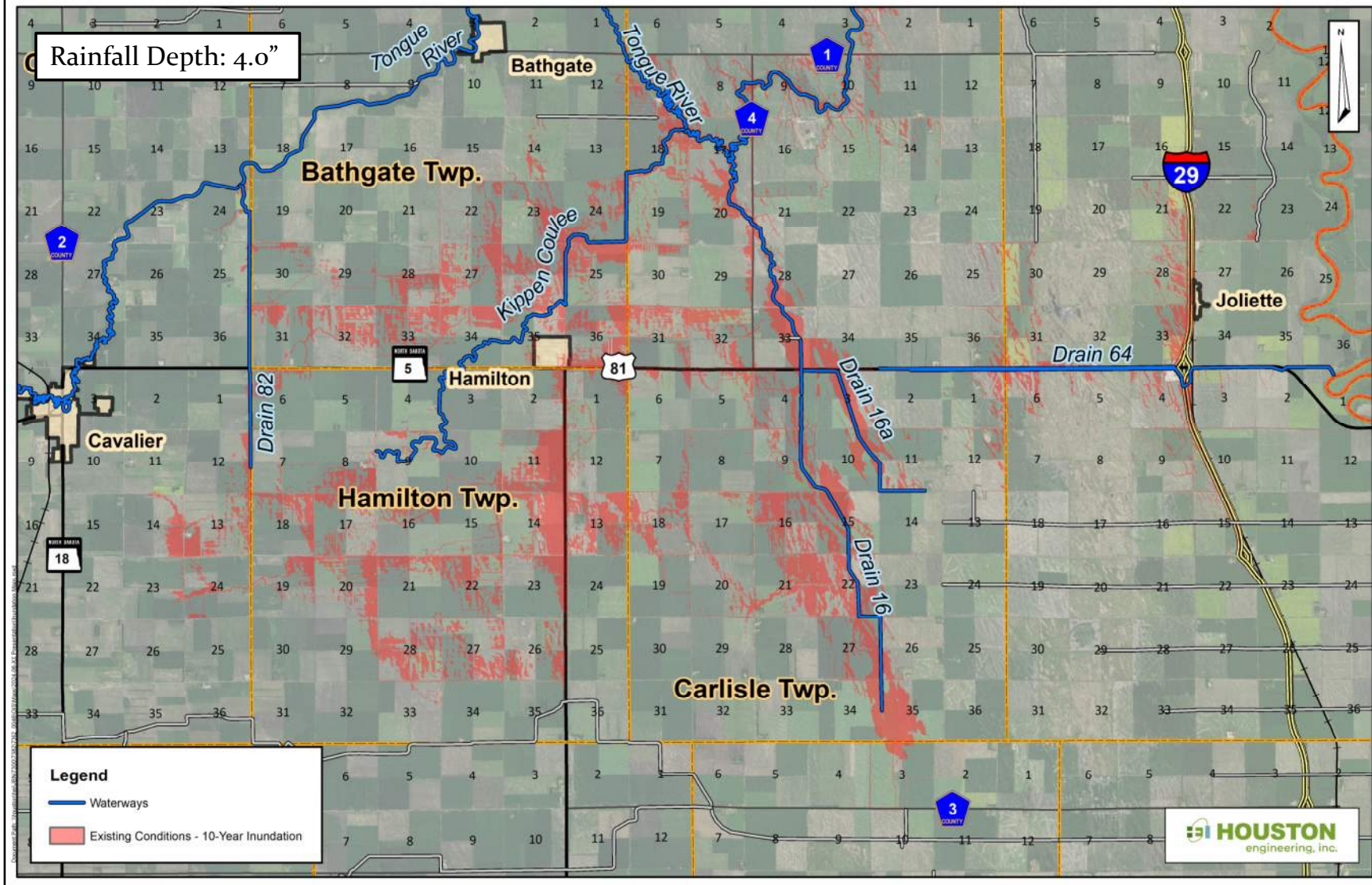
Rainfall Hyetograph for Tongue Rvier Watershed (10-year, 4-day Duration Rainfall)



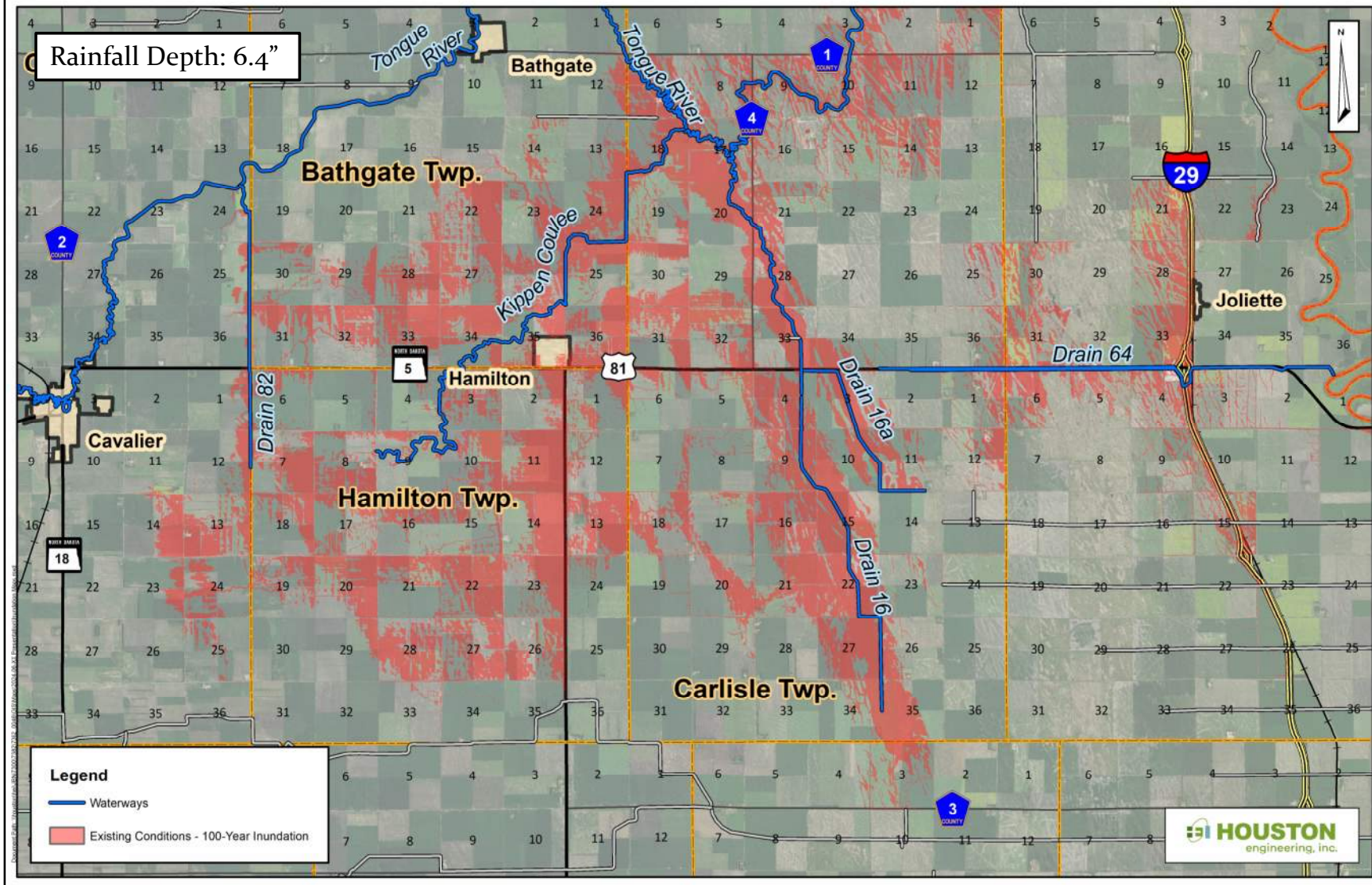
Inundation Review – Existing Conditions: 2-year Event



Inundation Review – Existing Conditions: 10-year Event



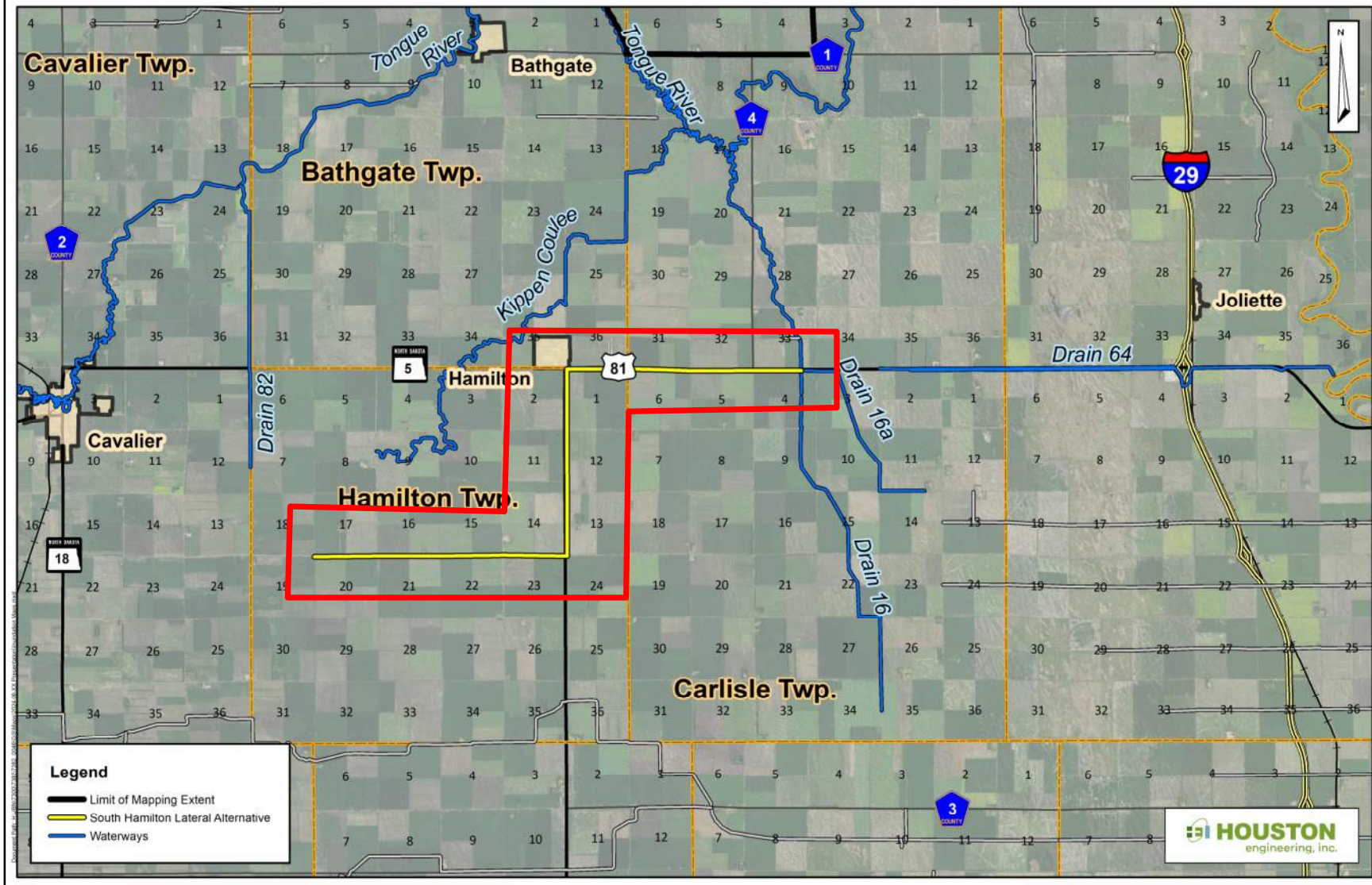
Inundation Review – Existing Conditions: 100-year Event



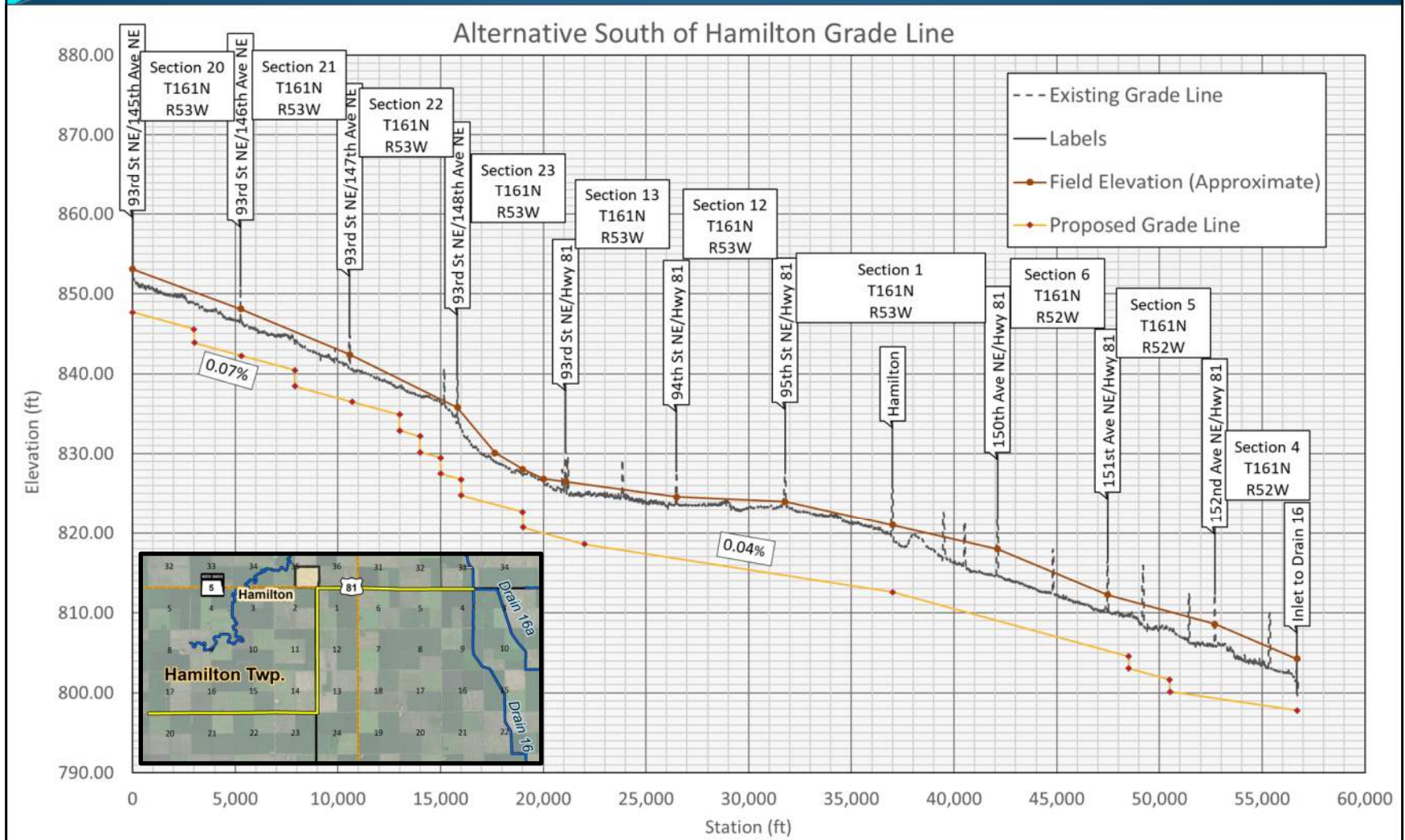
Scenarios Analyzed Previously

- 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

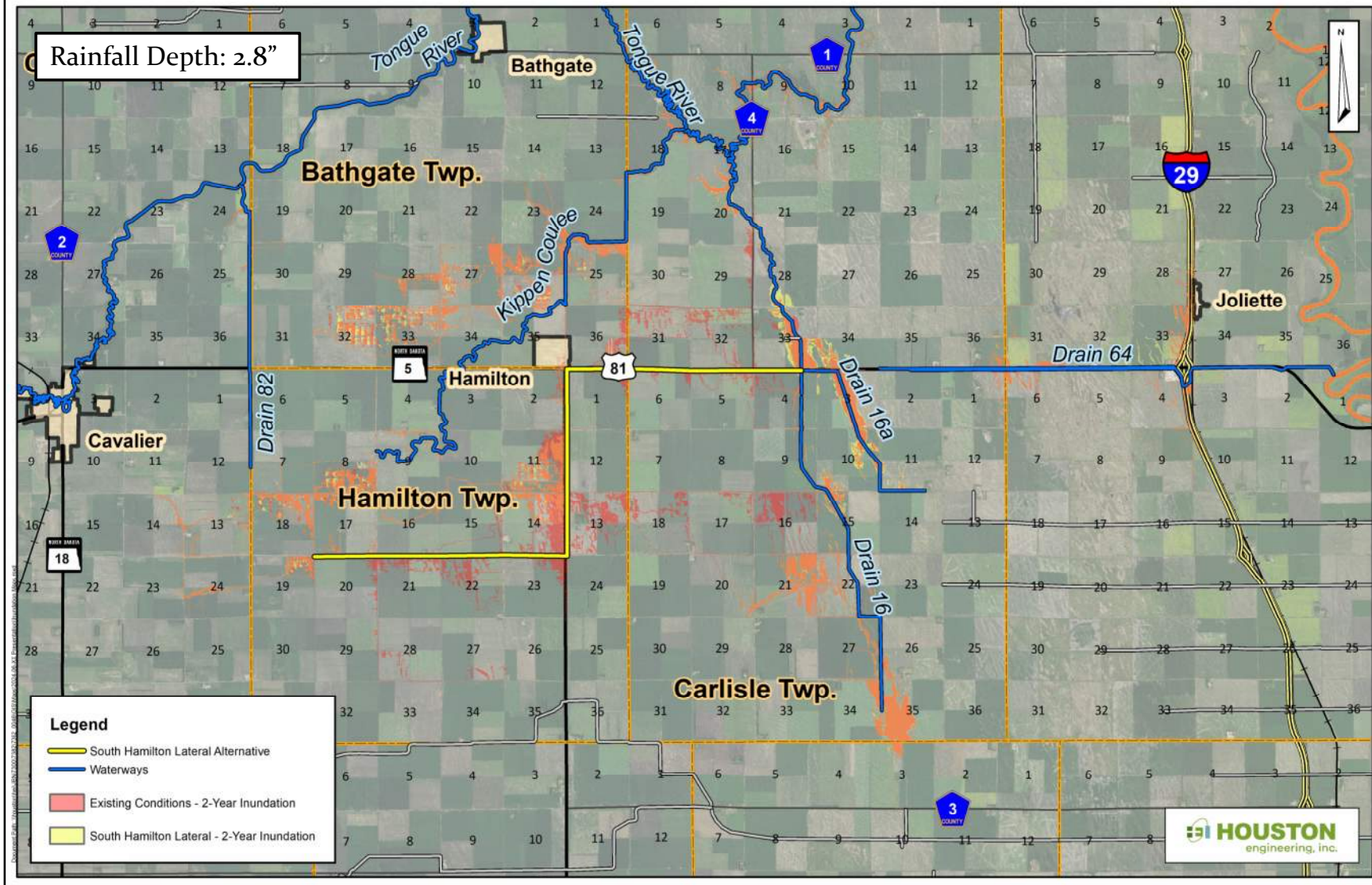
Proposed Alignment – South Hamilton Lateral



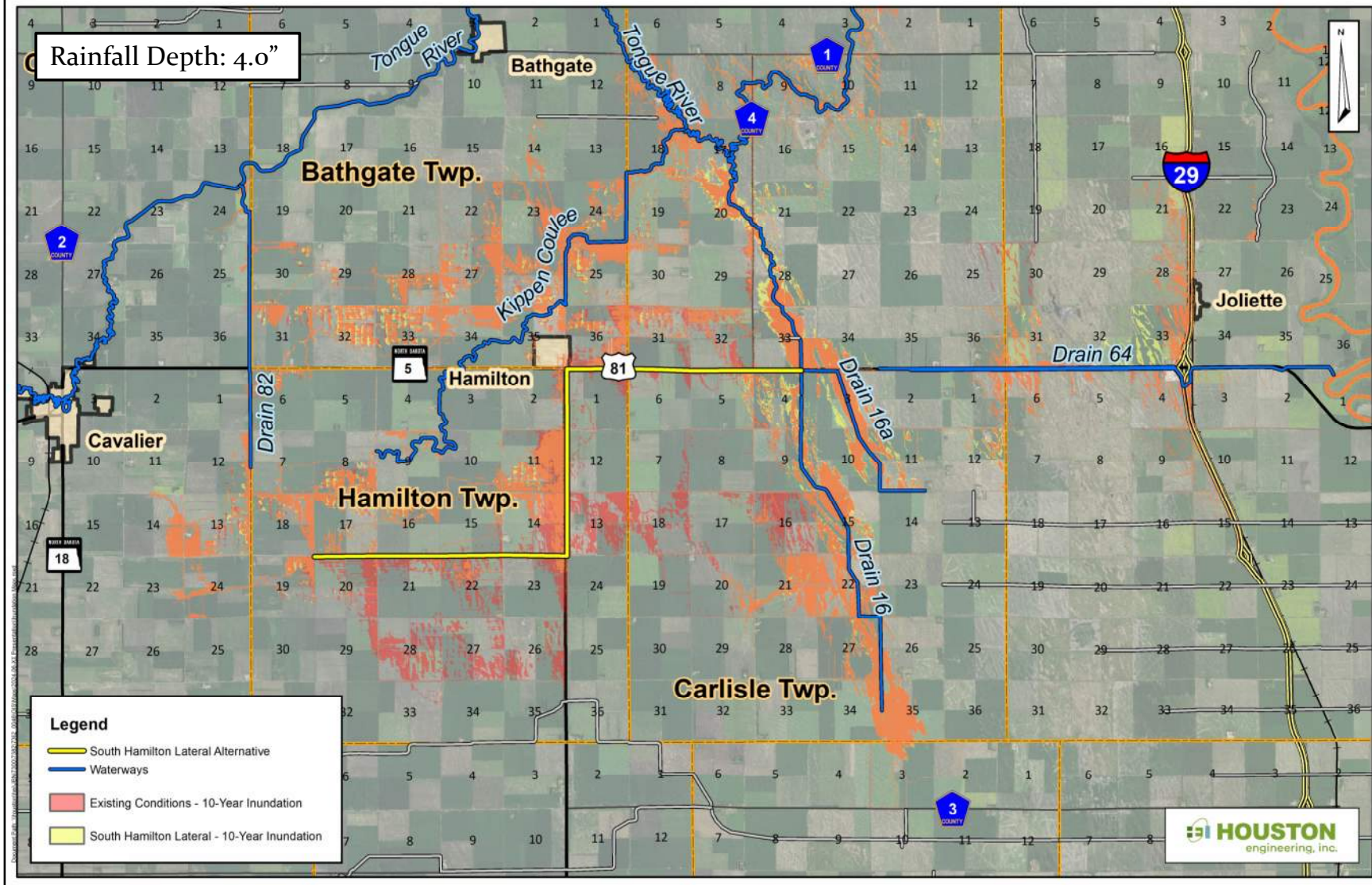
Proposed Grade Line - Drain 16 Lateral



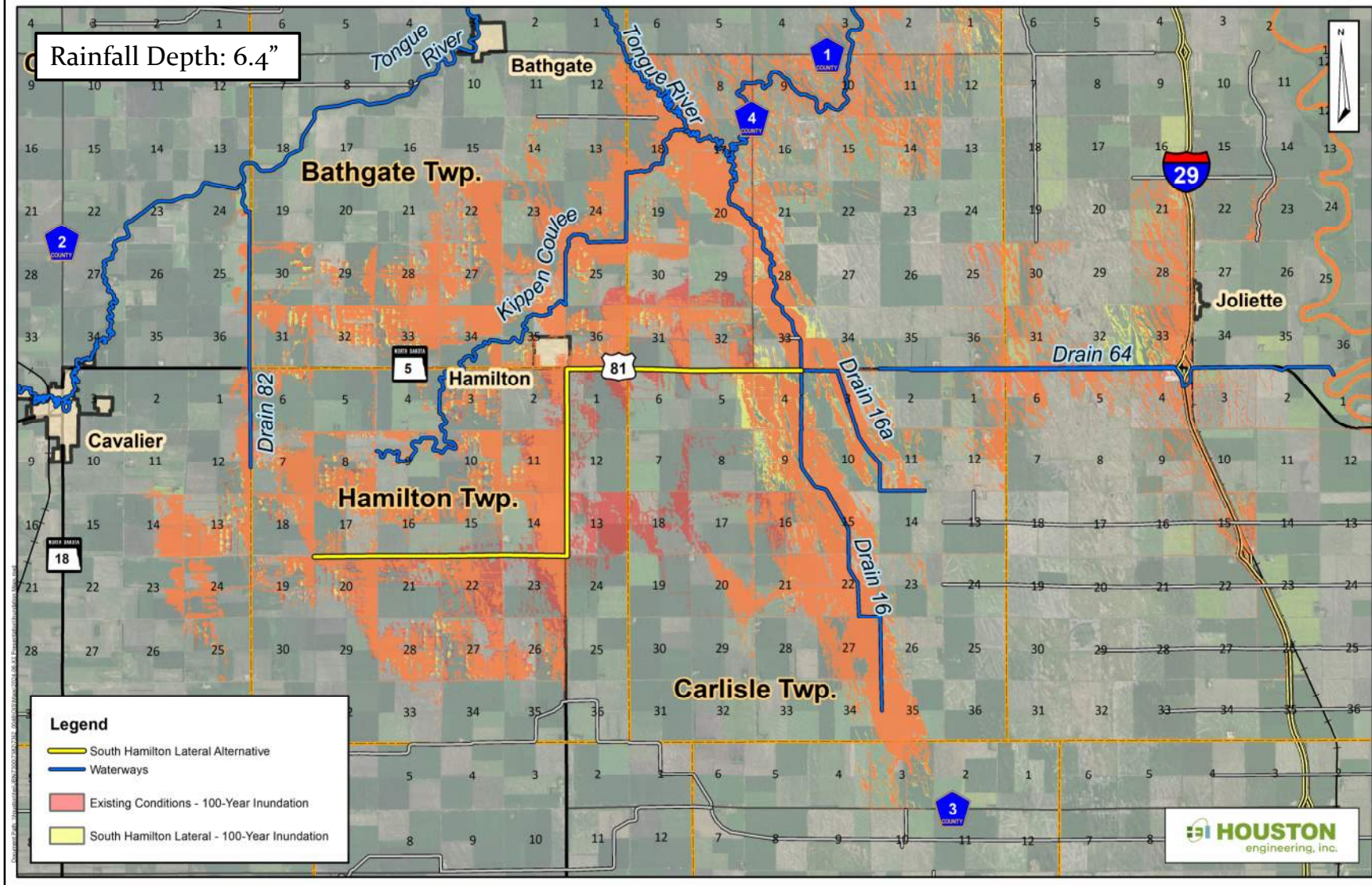
Inundation Review – Existing Conditions: 2-year Event



Inundation Review – Existing Conditions: 10-year Event



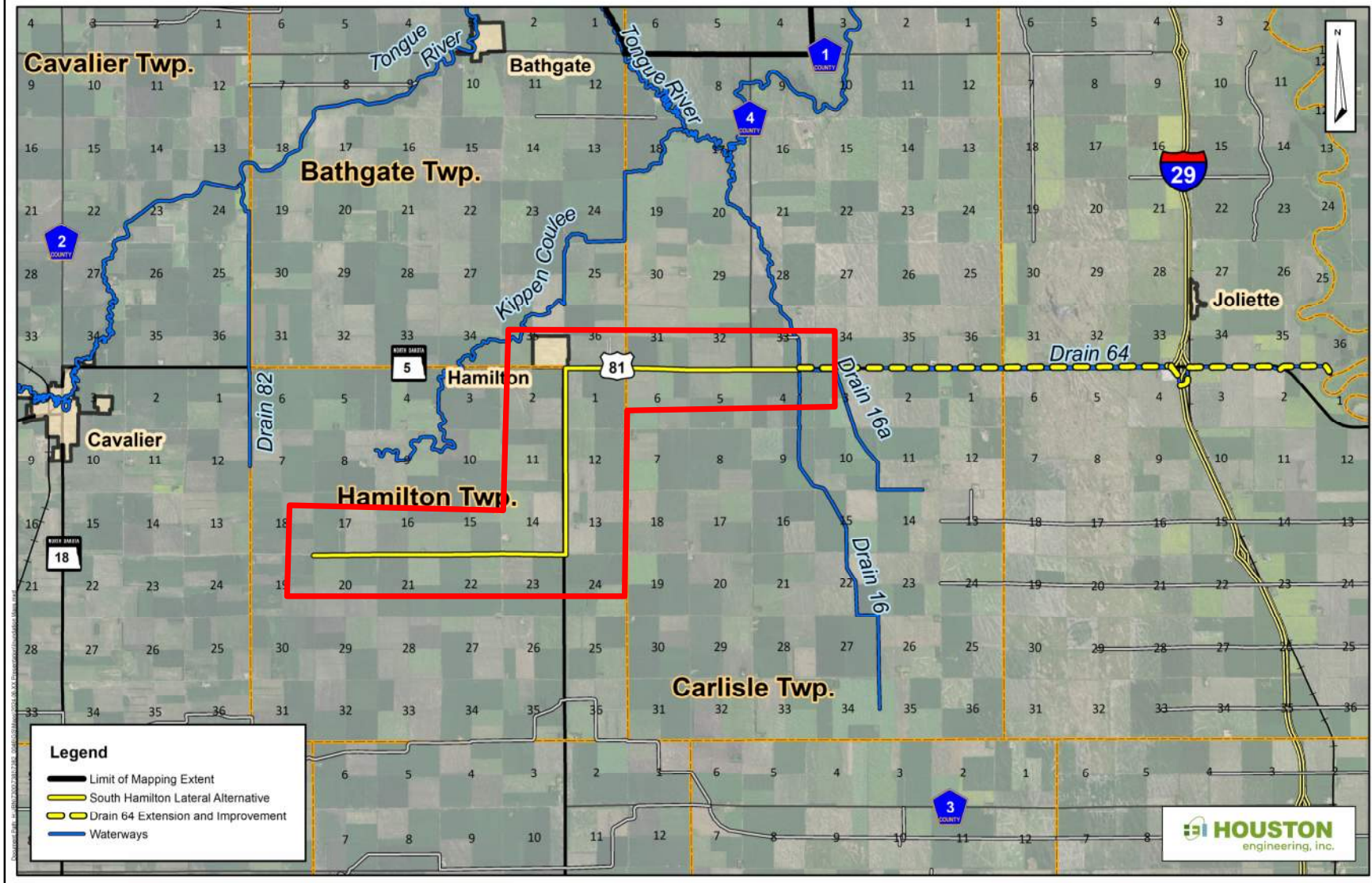
Inundation Review – Existing Conditions: 100-year Event



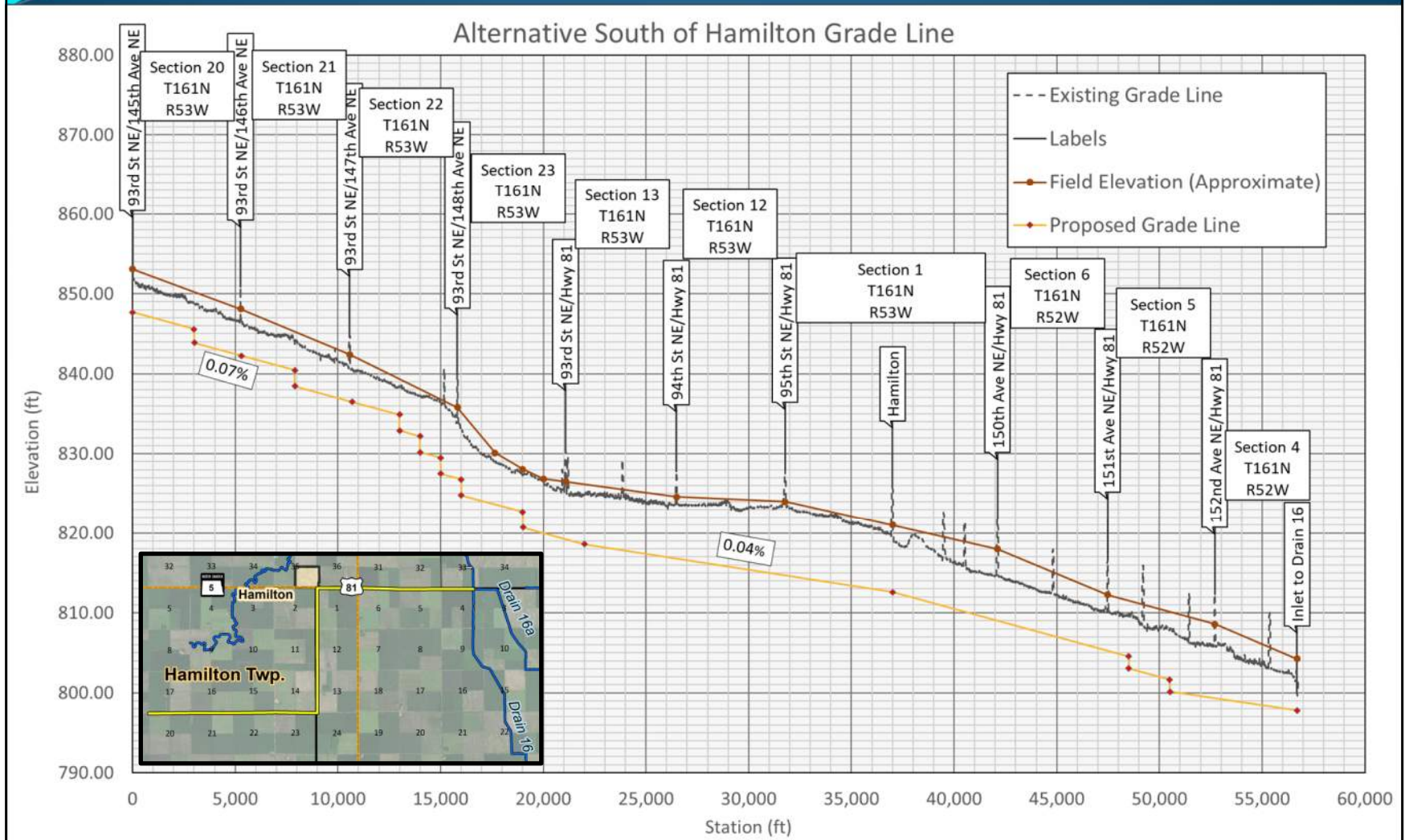
Scenario Analyzed For This Meeting

- Proposed Drain 16 lateral alignment
- Modified profile on Drain 16 lateral to reduce negative impacts to downstream landowners
- Added alternate route for flood water to reduce negative impacts to Drain 16 landowners
- Alternate route utilizes existing channel north of Highway 5.
- Modifications to Drain 64 to accommodate increased flow coming from Drain 16 watershed.

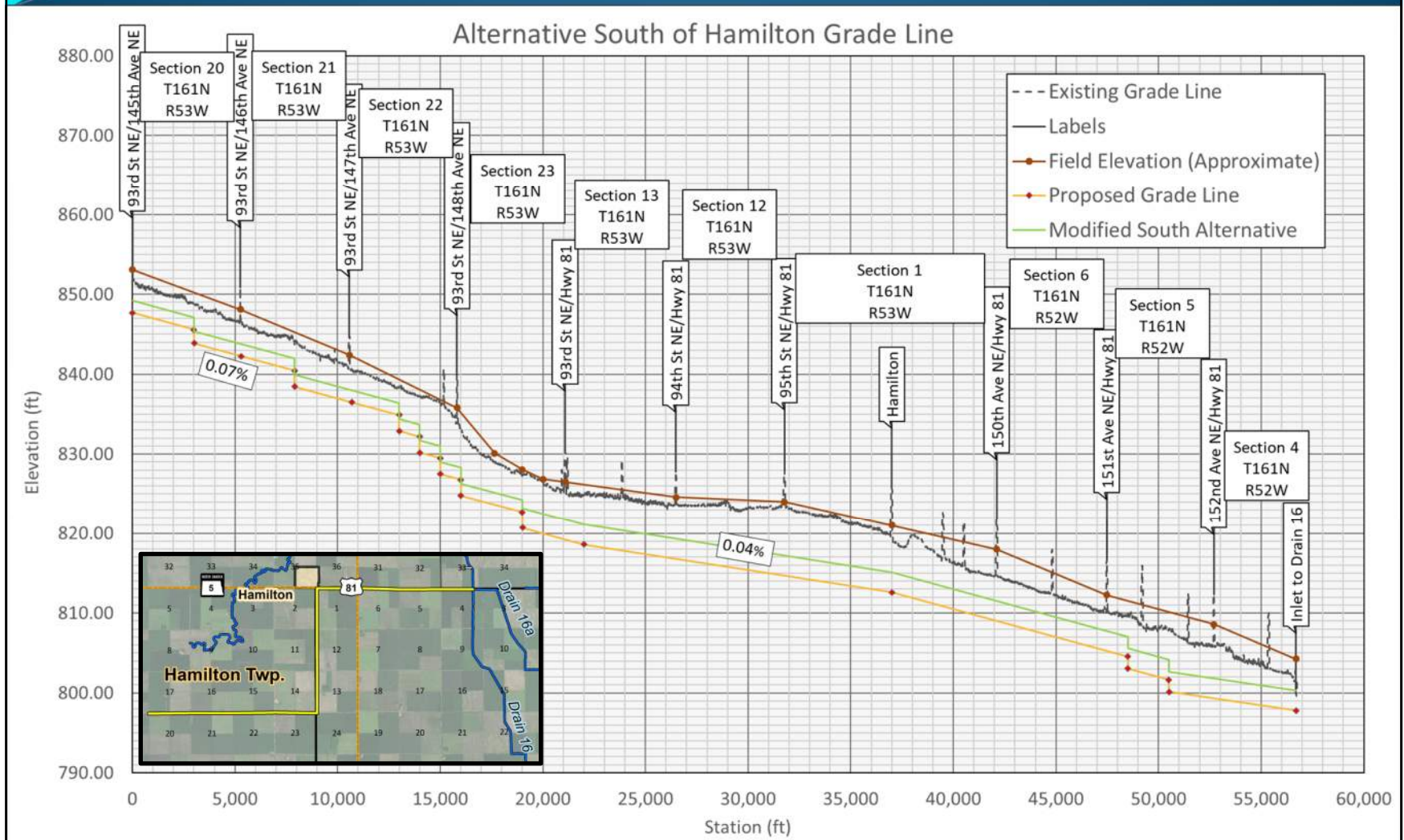
Proposed Alignment – South Hamilton Lateral and Modified Drain 64



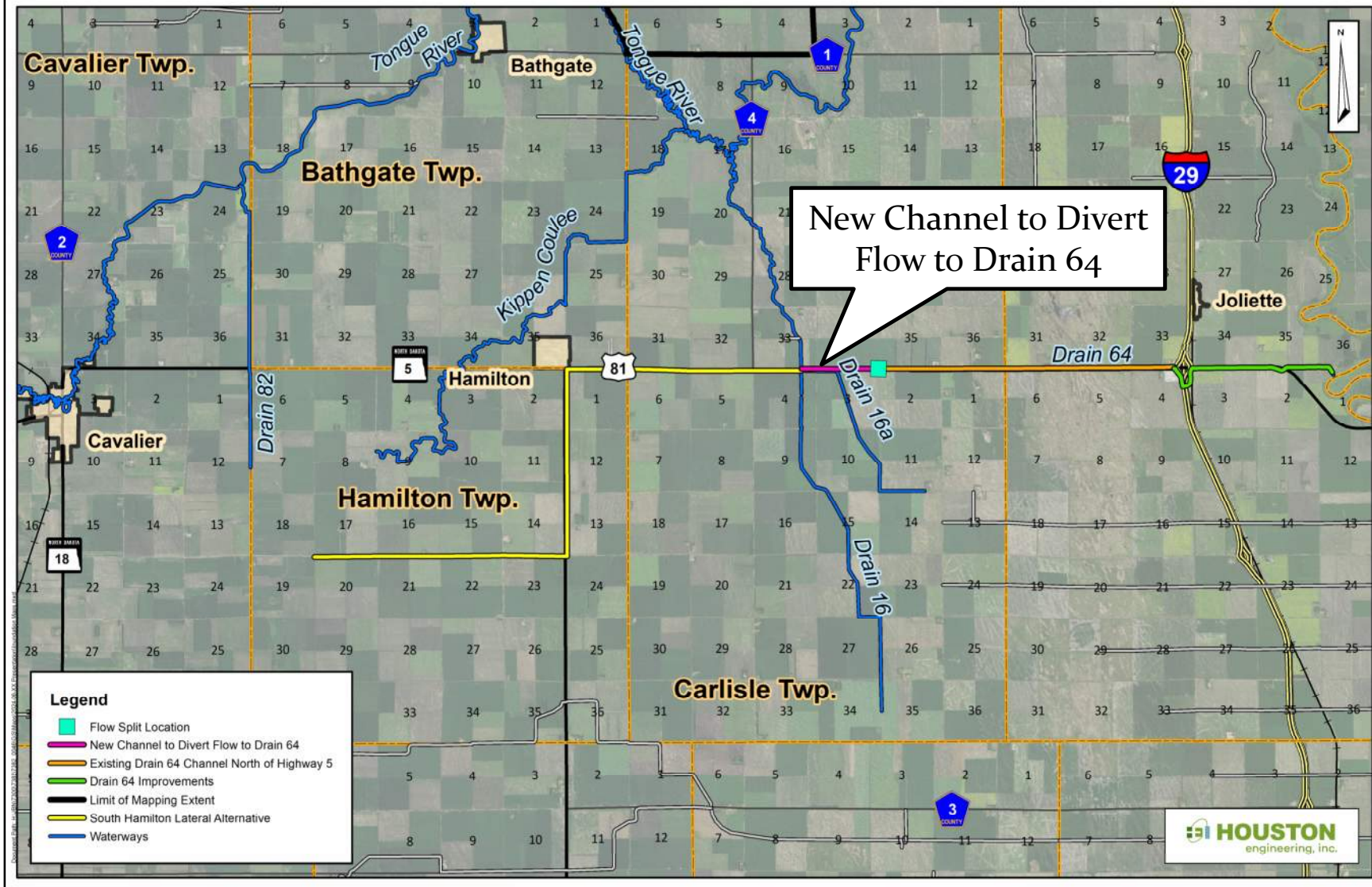
Proposed Grade Line - Drain 16 Lateral



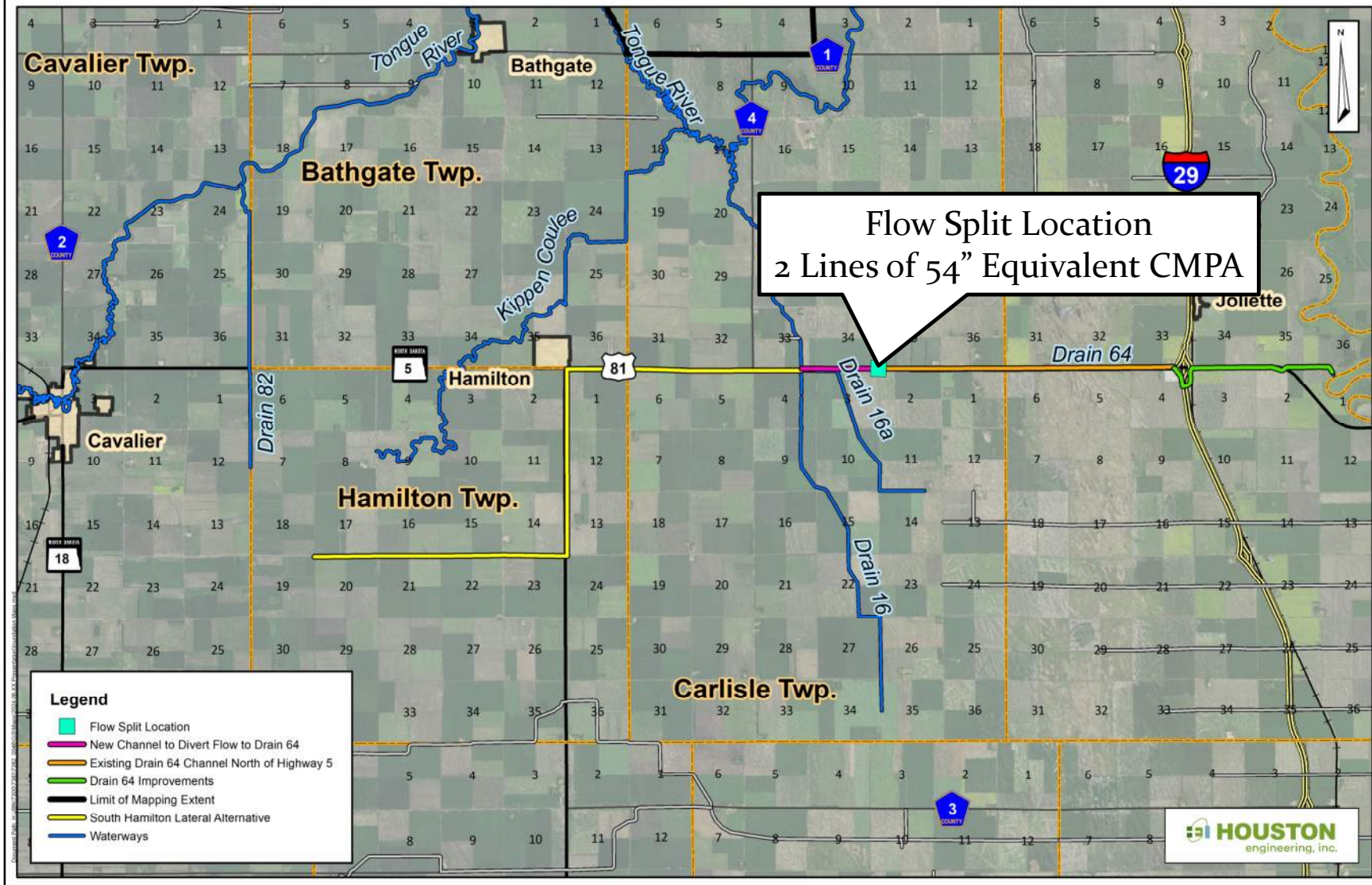
Proposed Grade Line - Drain 16 Lateral



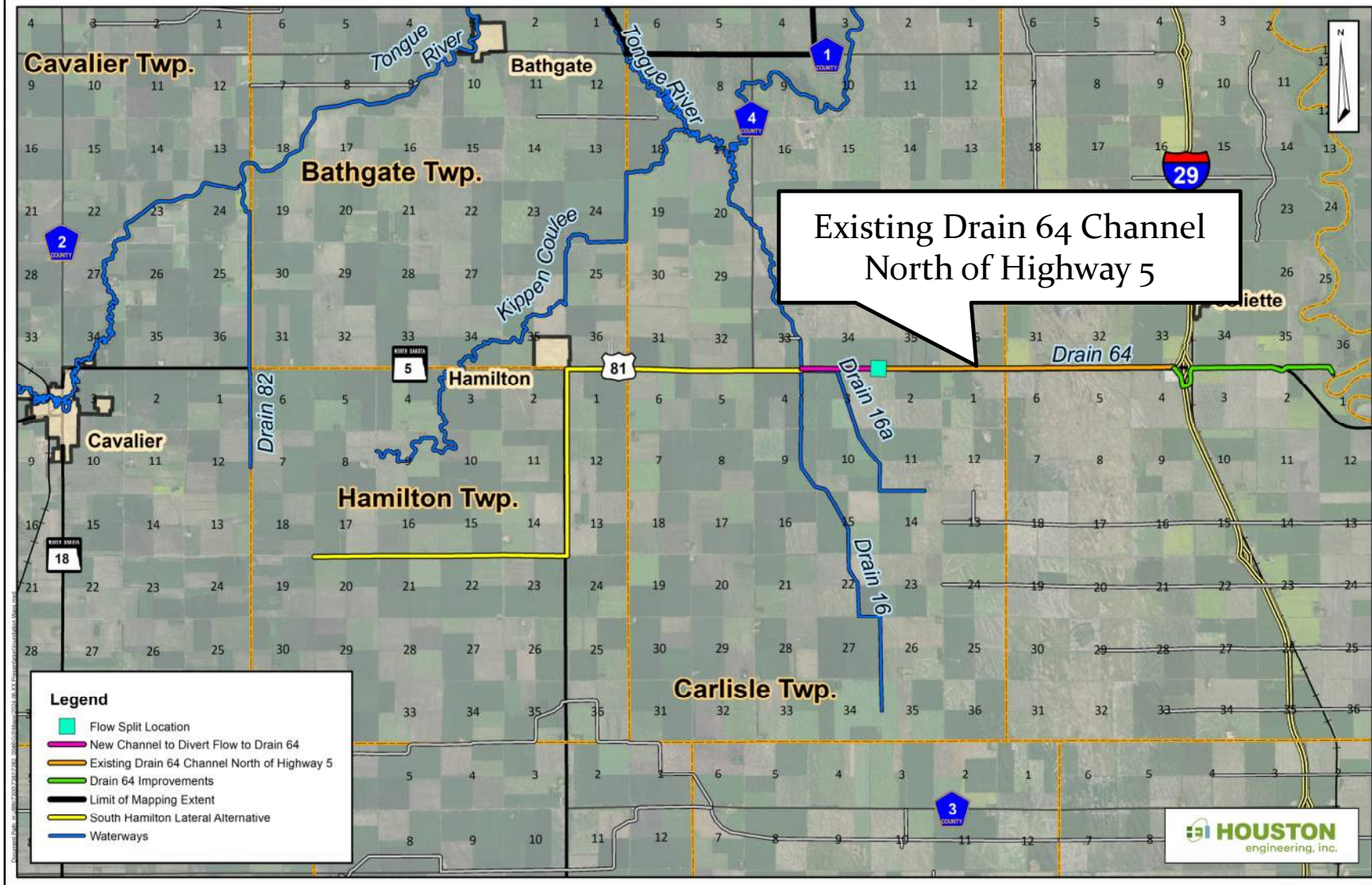
Proposed Alignment - Drain 64



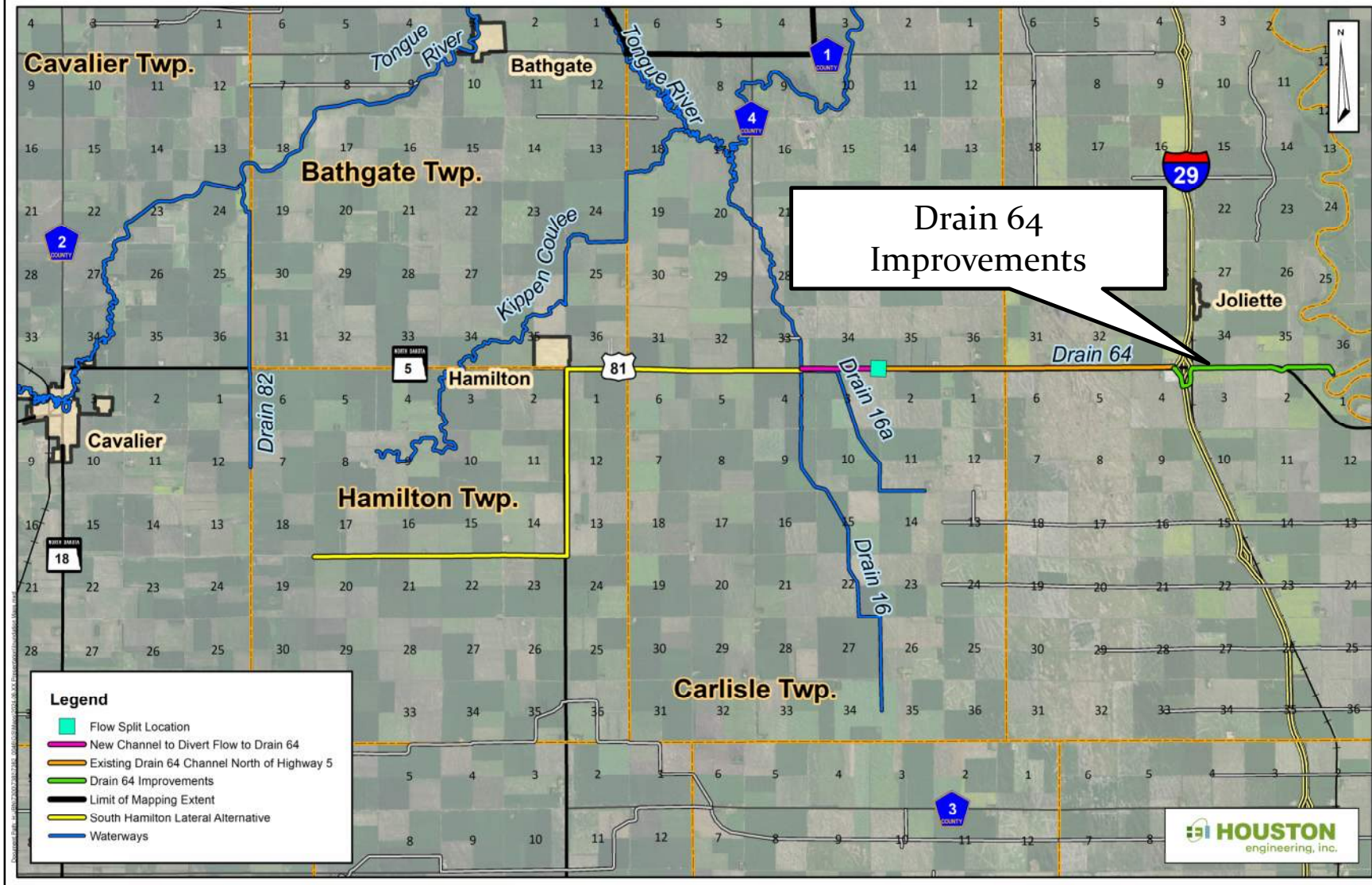
Proposed Alignment - Drain 64



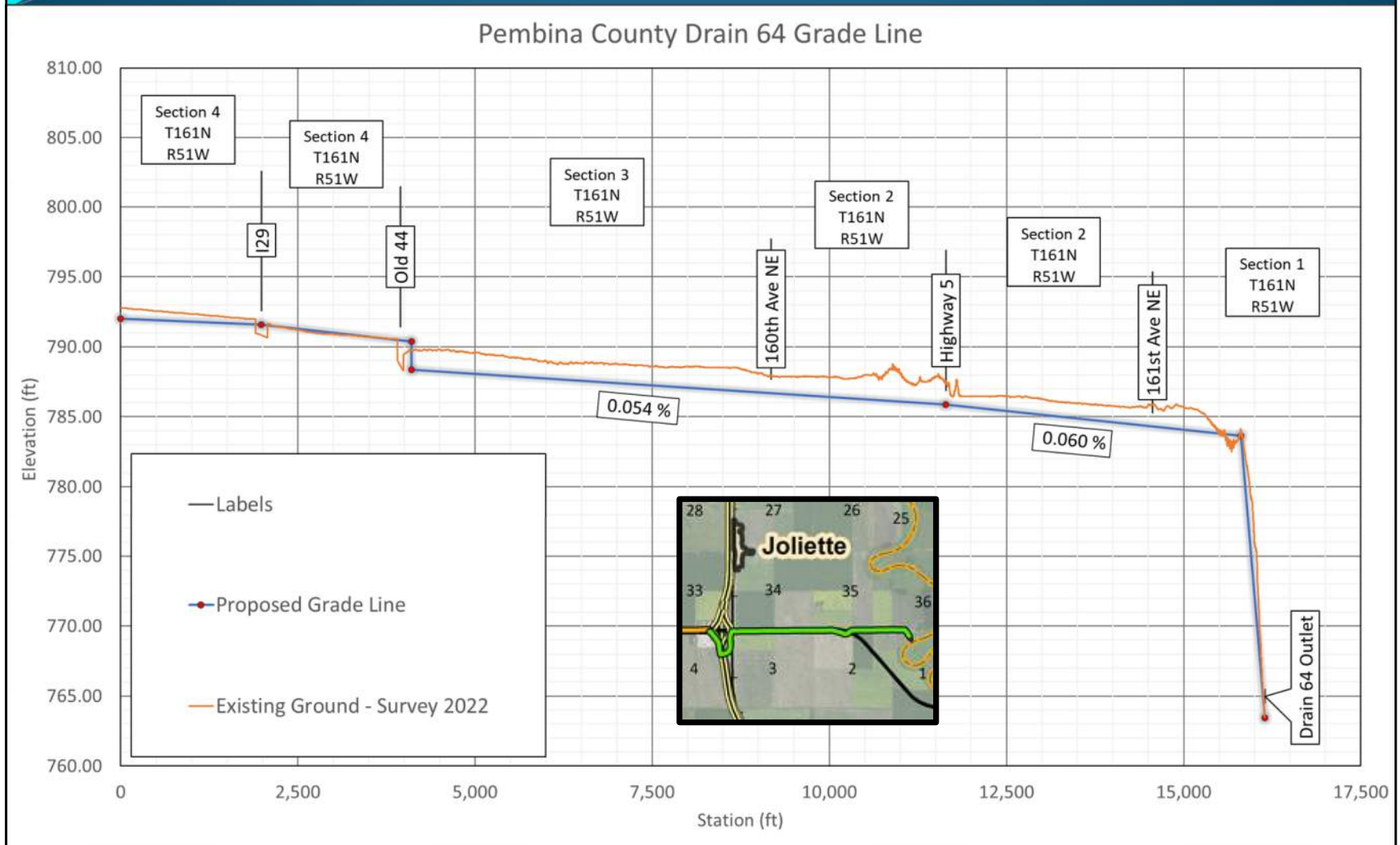
Proposed Alignment - Drain 64



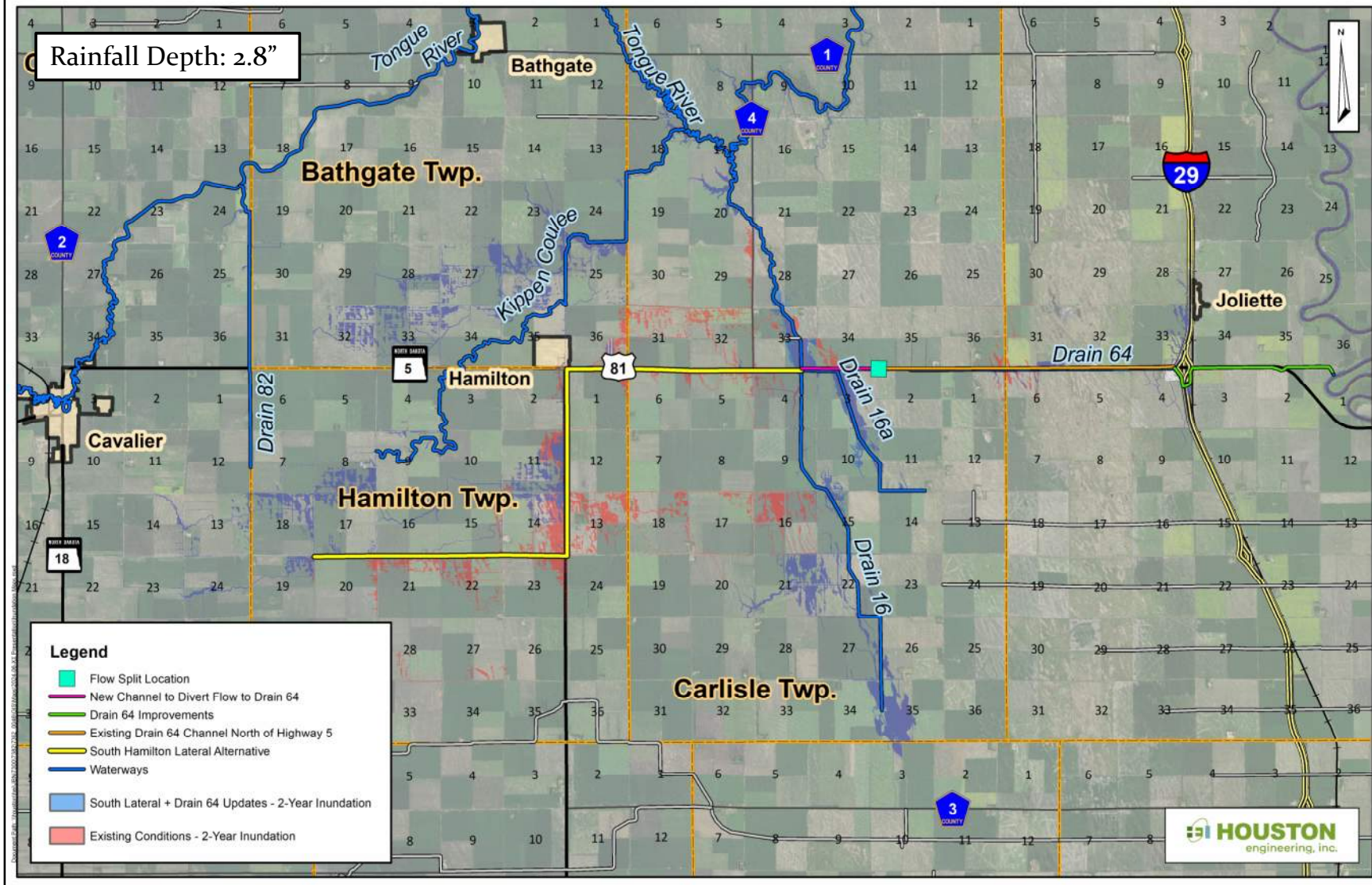
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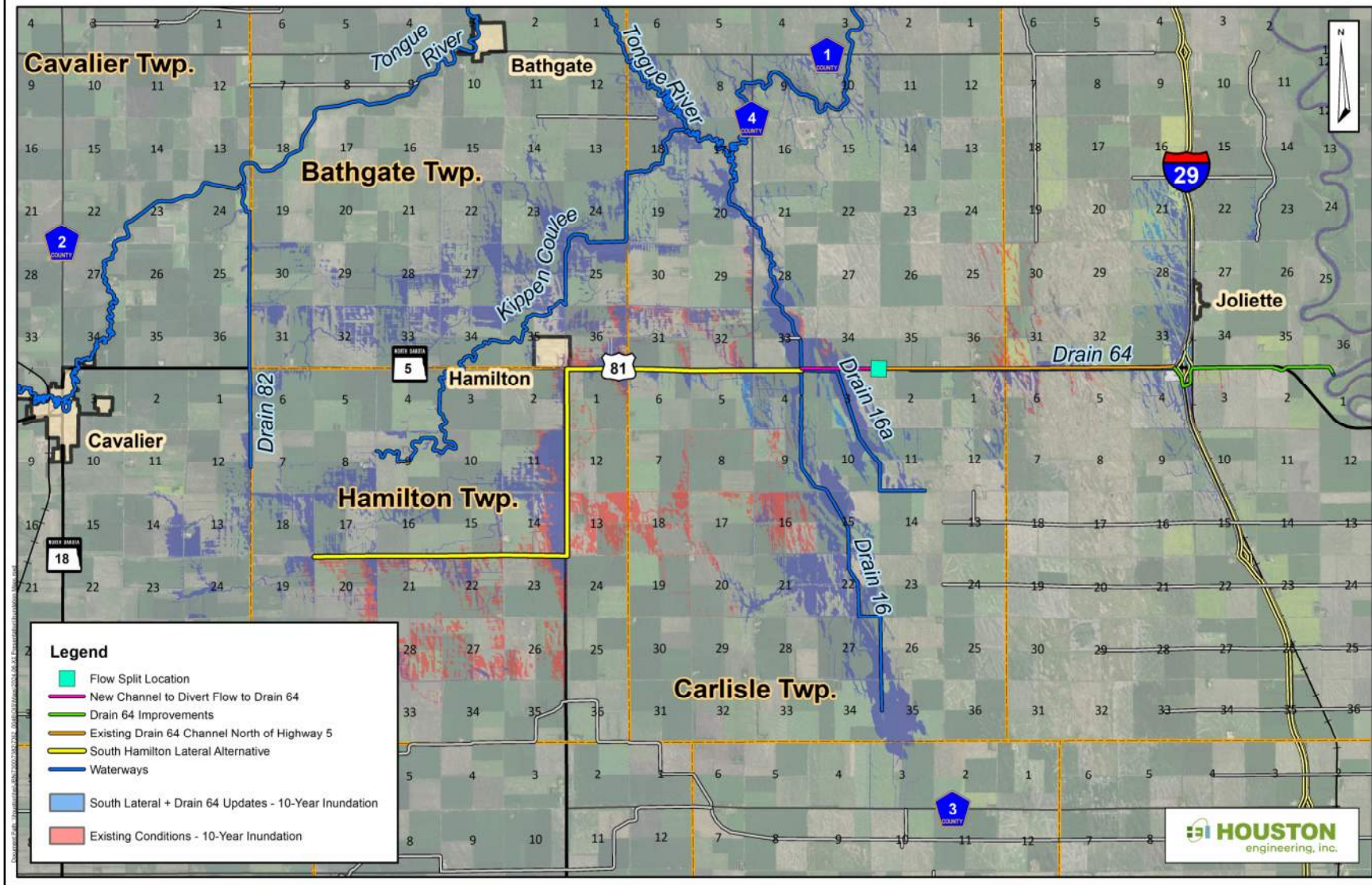
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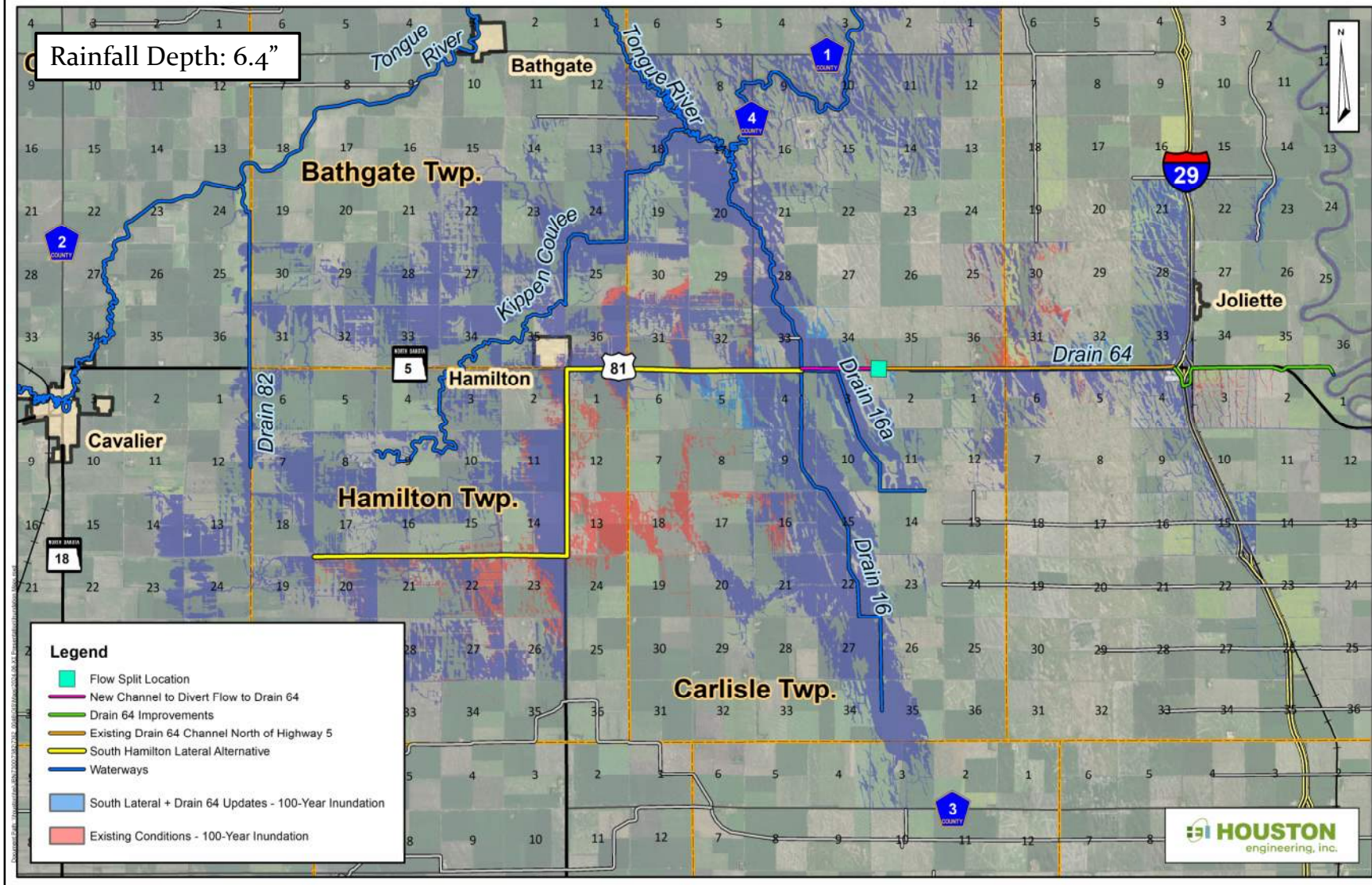
Inundation Review – Existing Conditions: 2-year Event



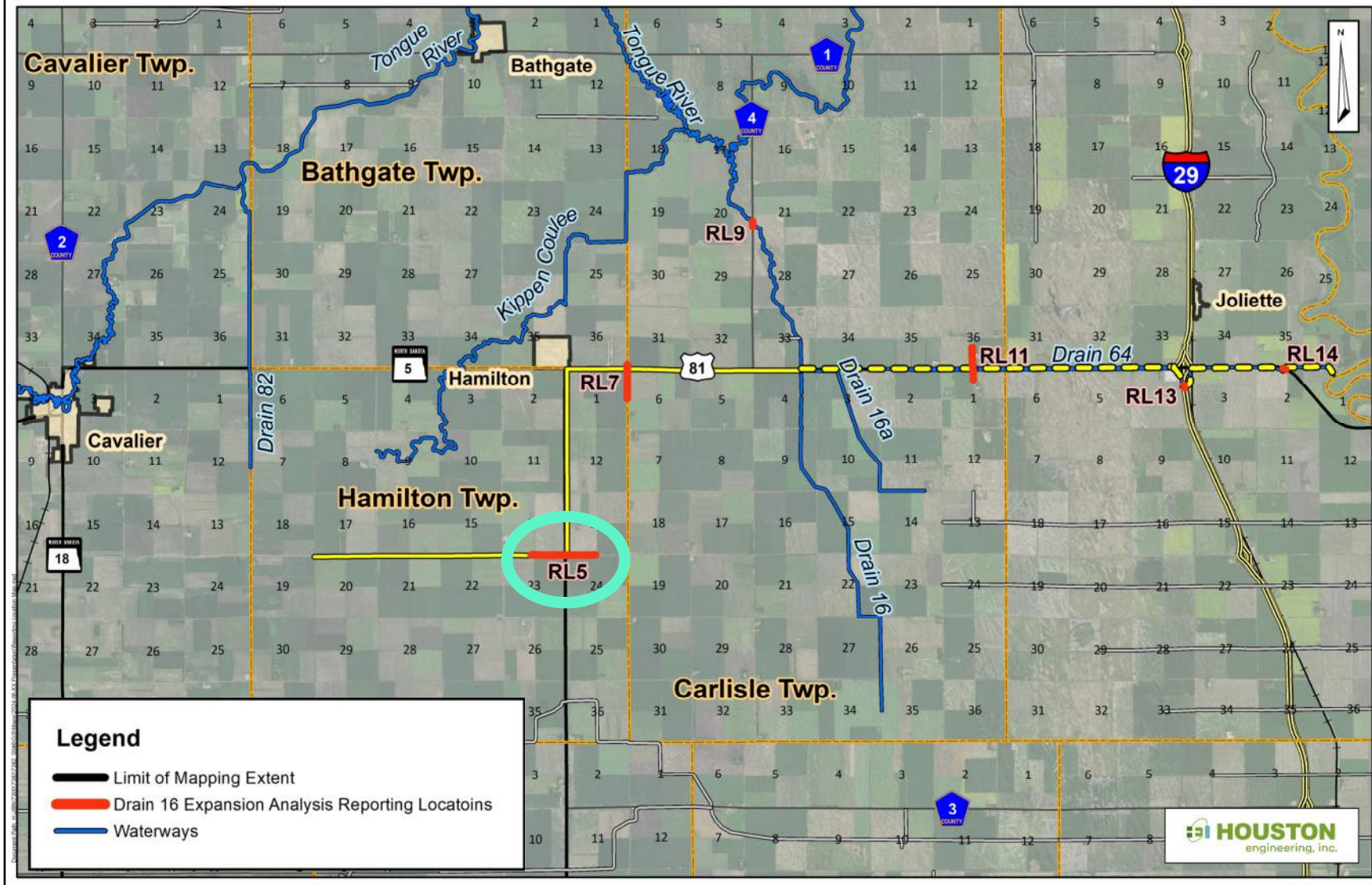
Inundation Review – Existing Conditions: 10-year Event



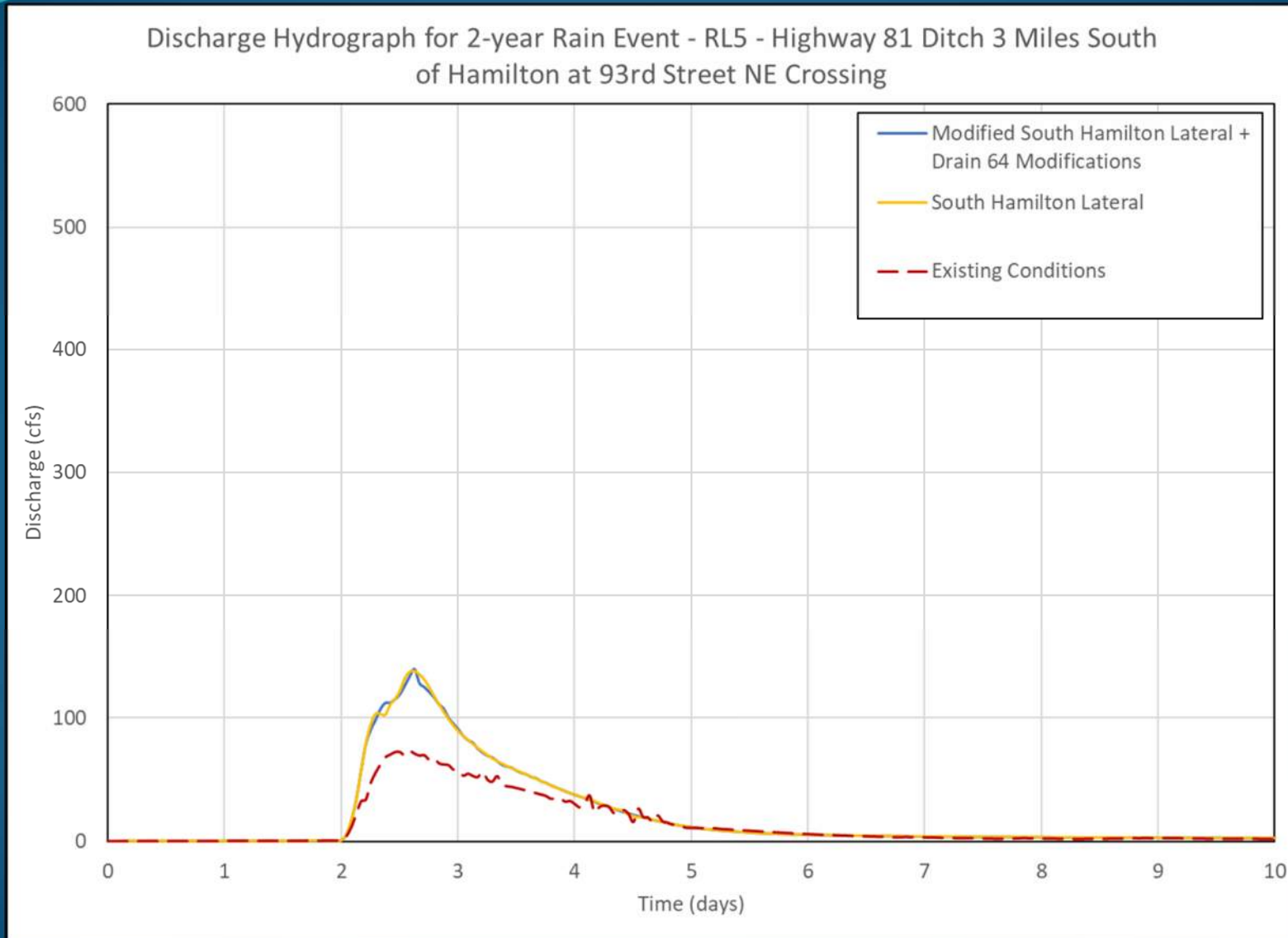
Inundation Review – Existing Conditions: 100-year Event



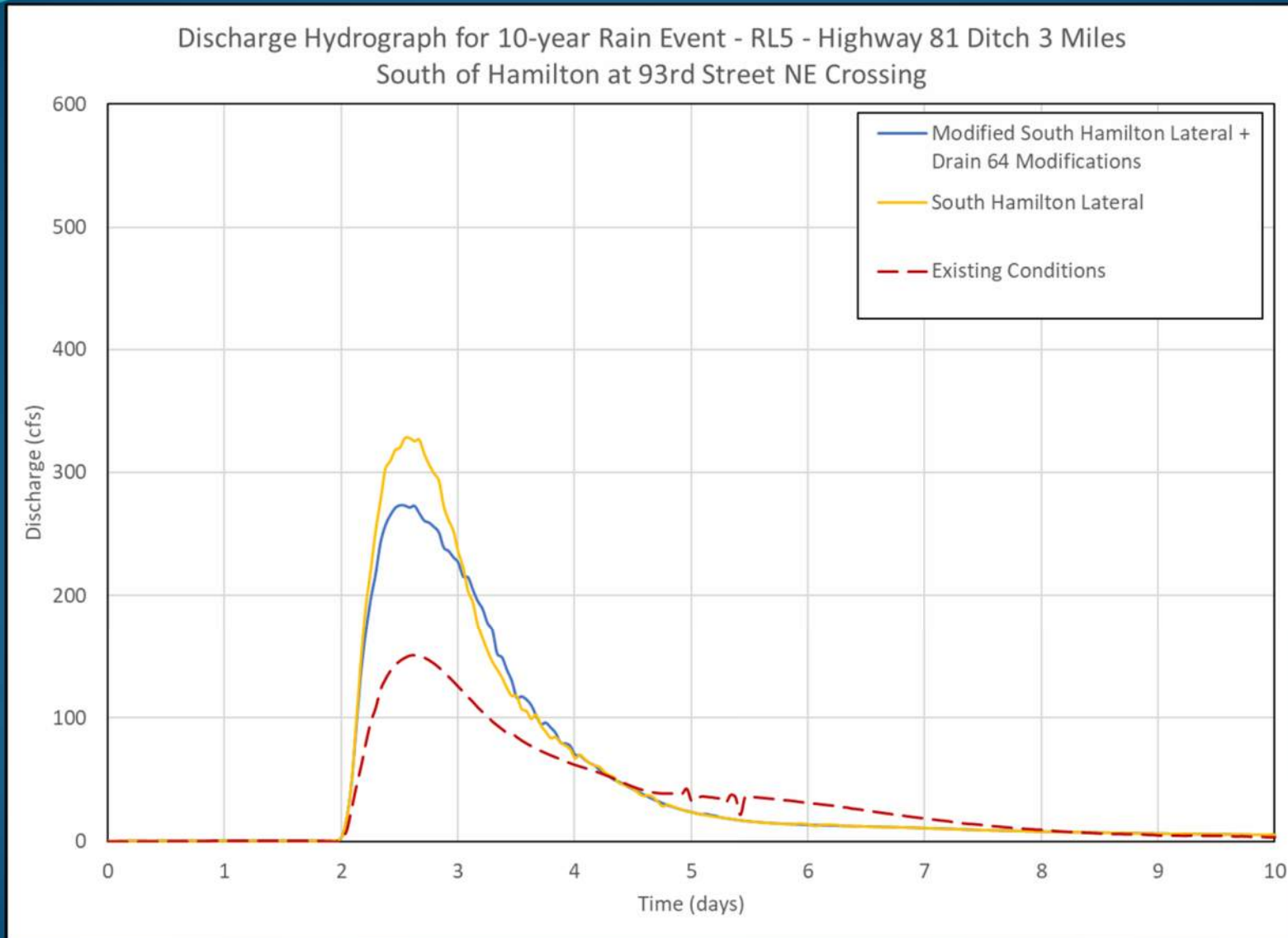
Reporting Locations



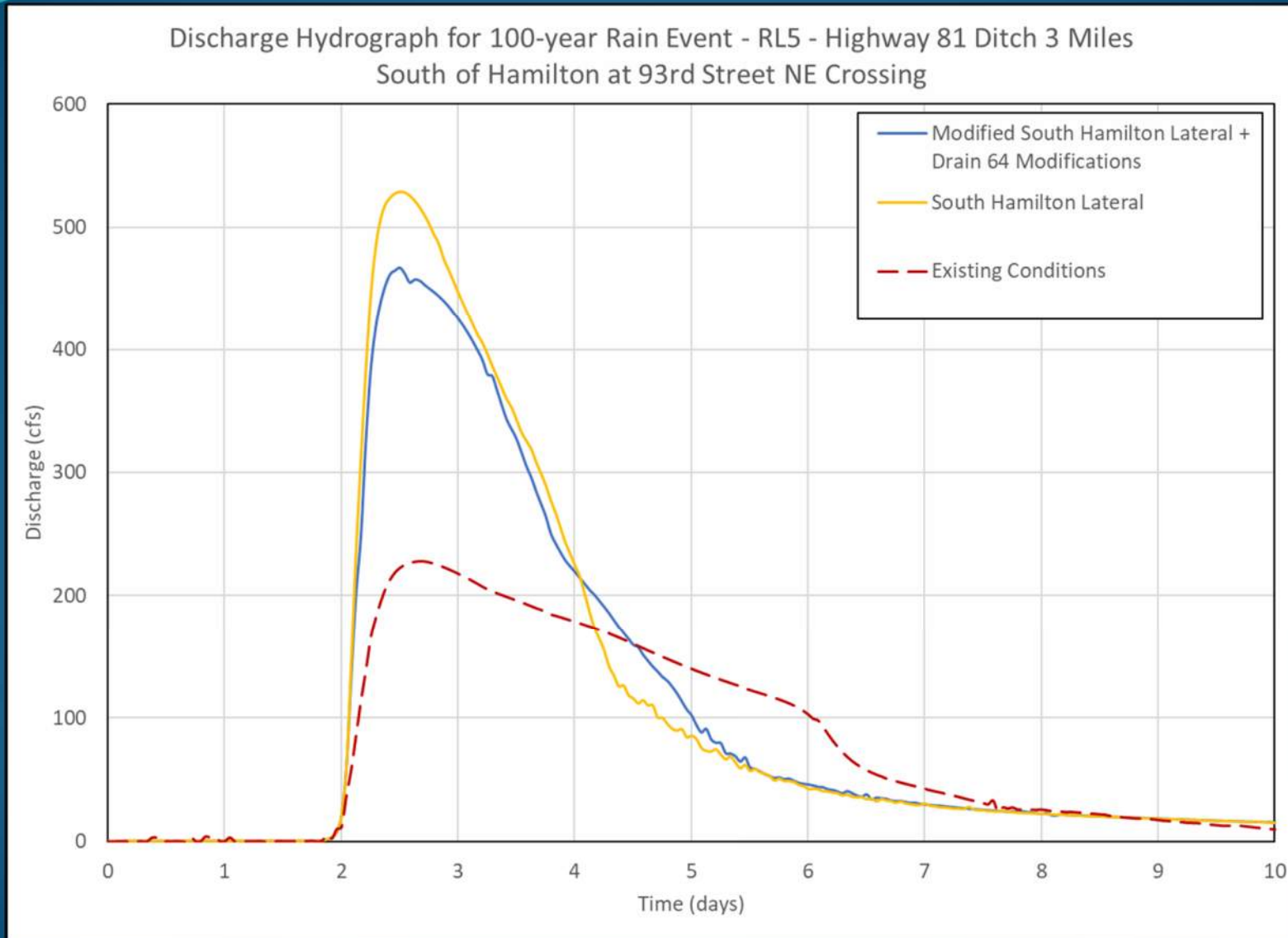
Discharge Hydrograph Review



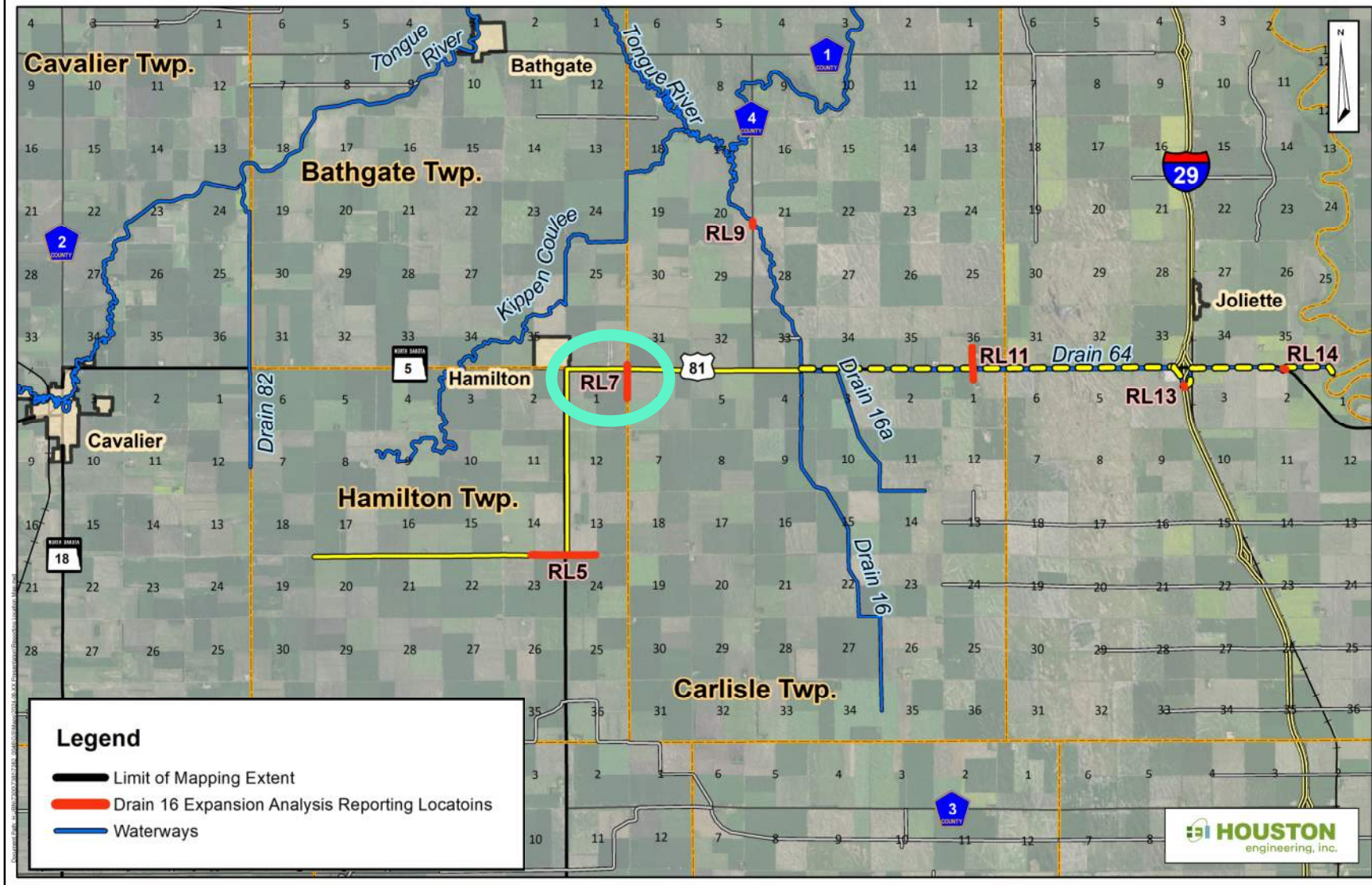
Discharge Hydrograph Review



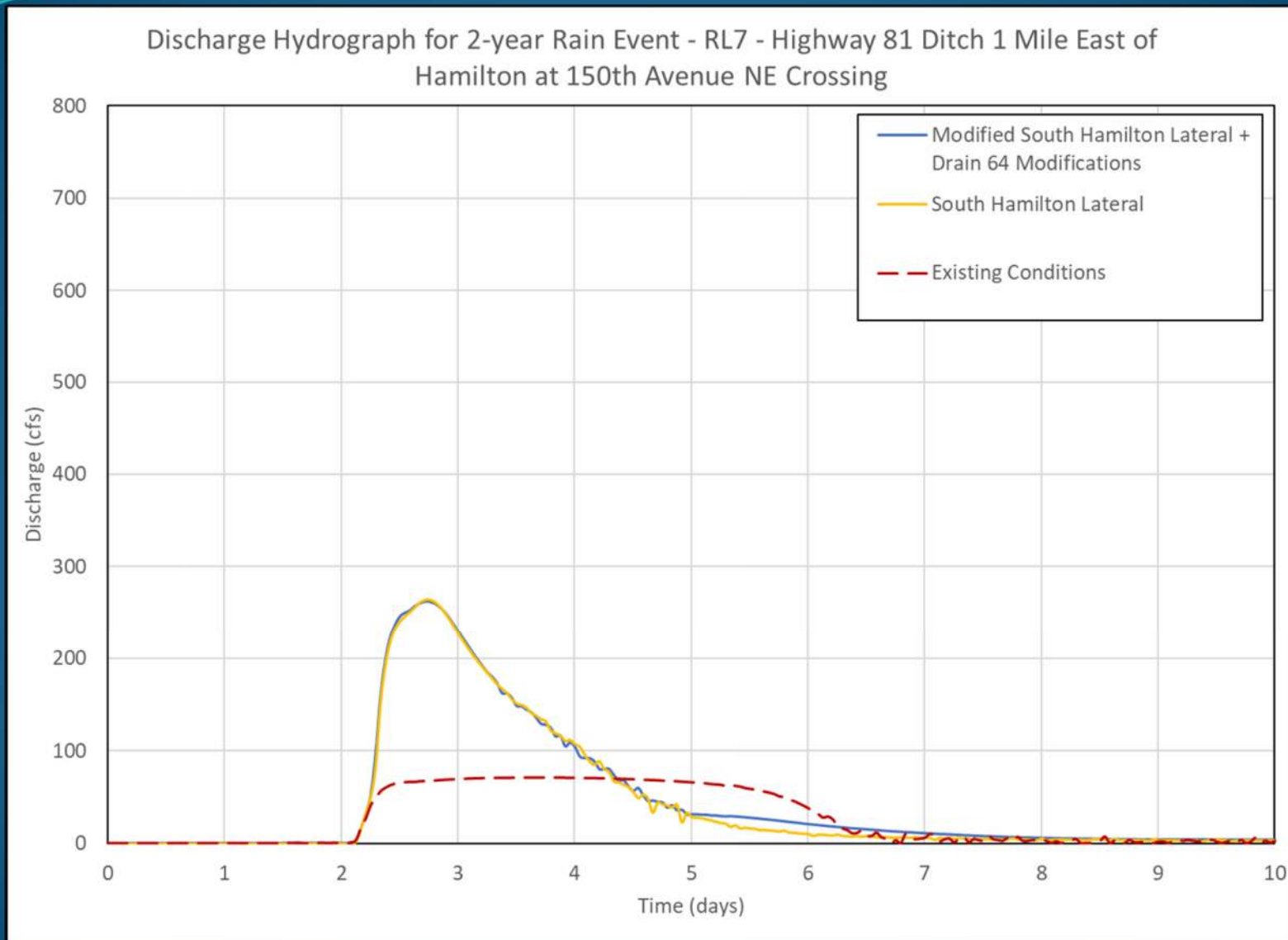
Discharge Hydrograph Review



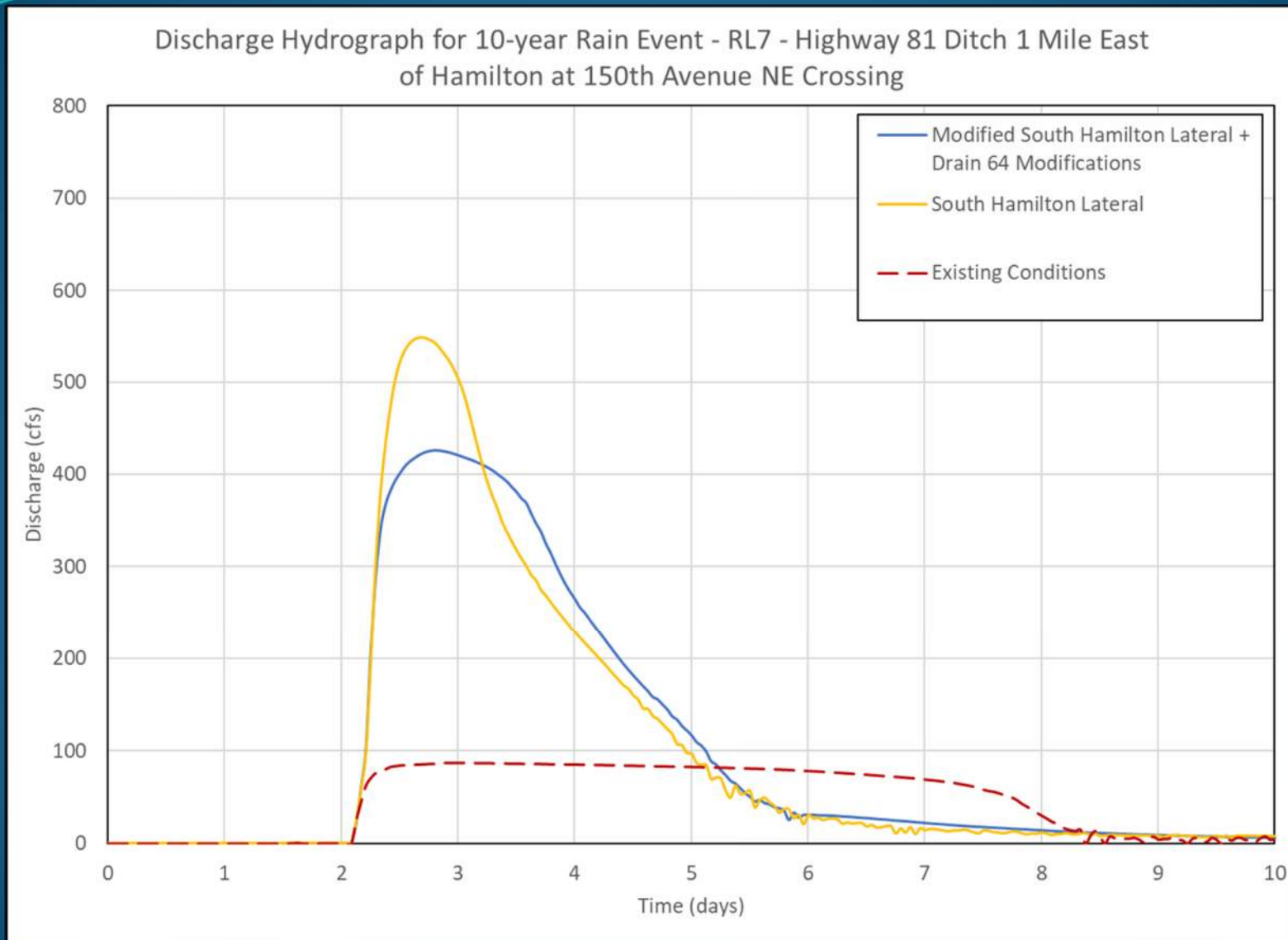
Reporting Locations



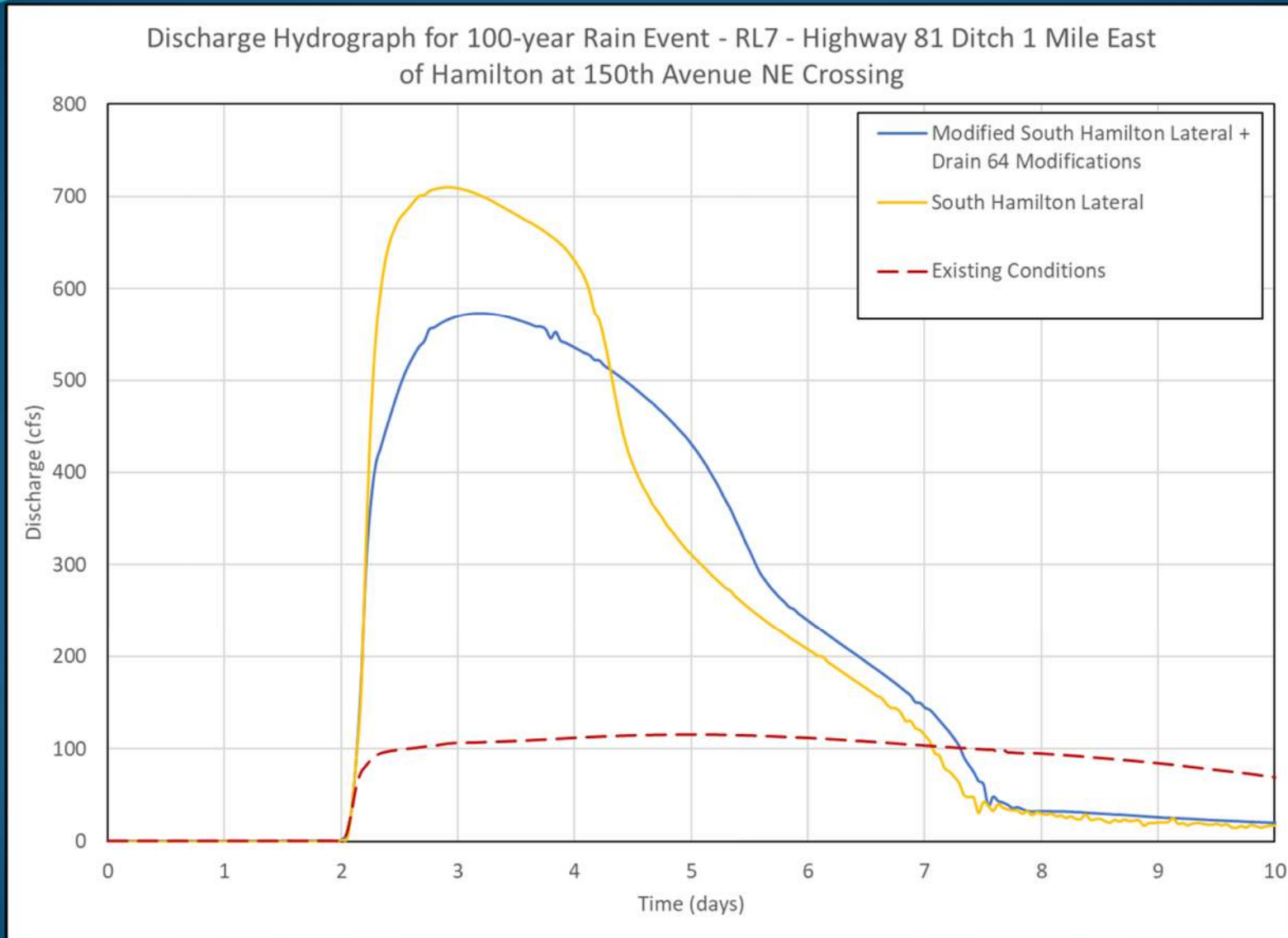
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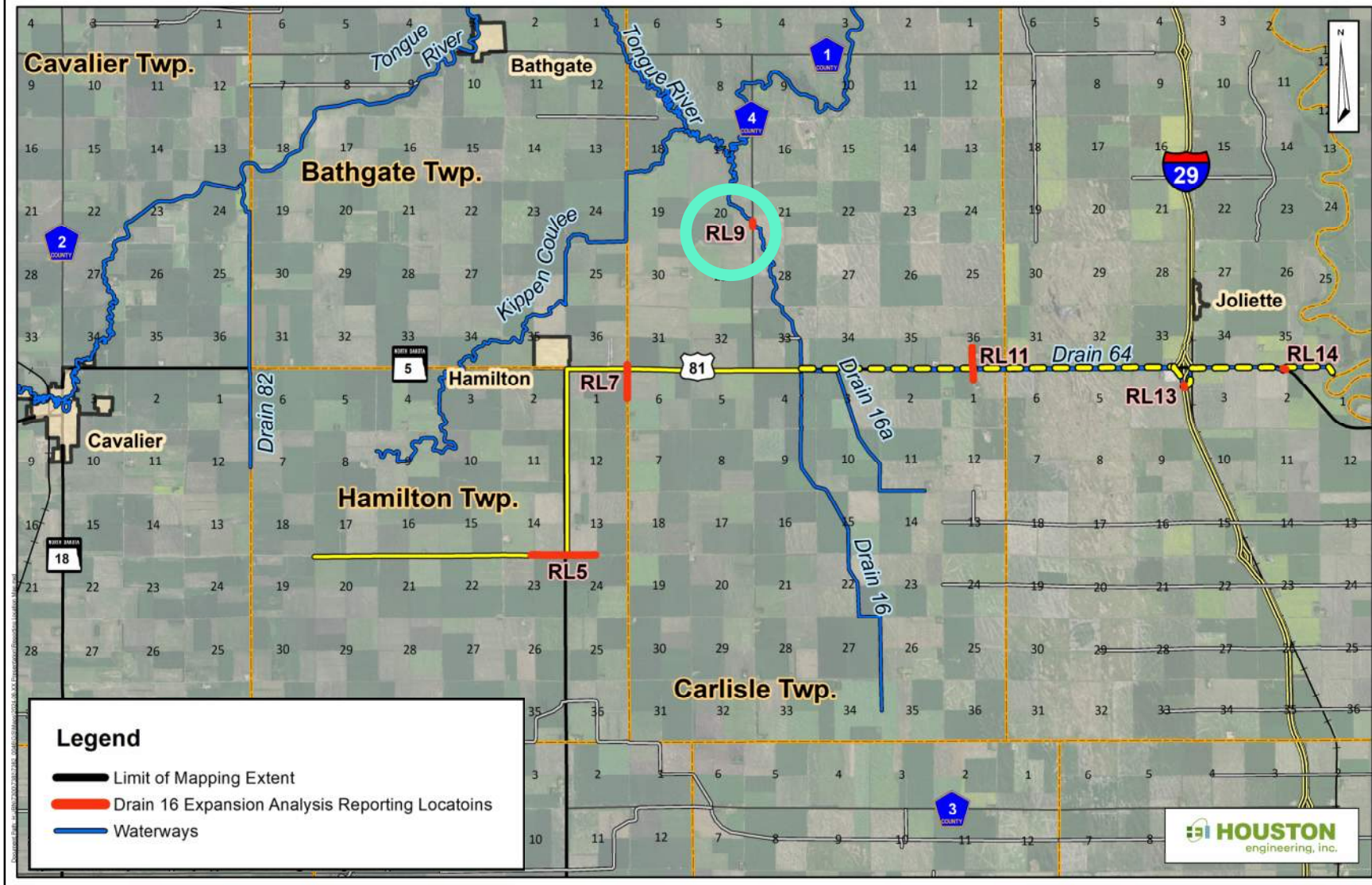
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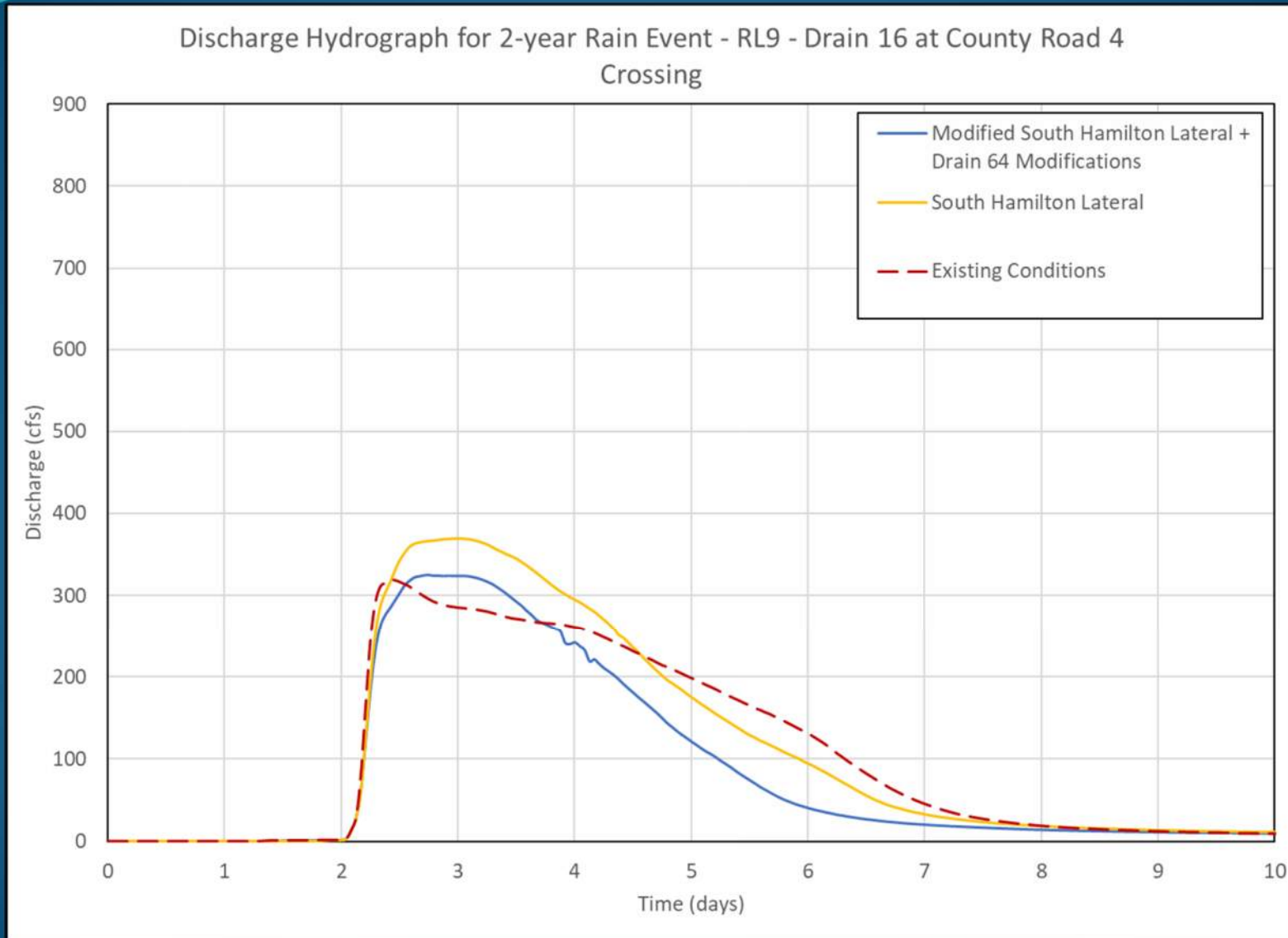
Discharge Hydrograph Review



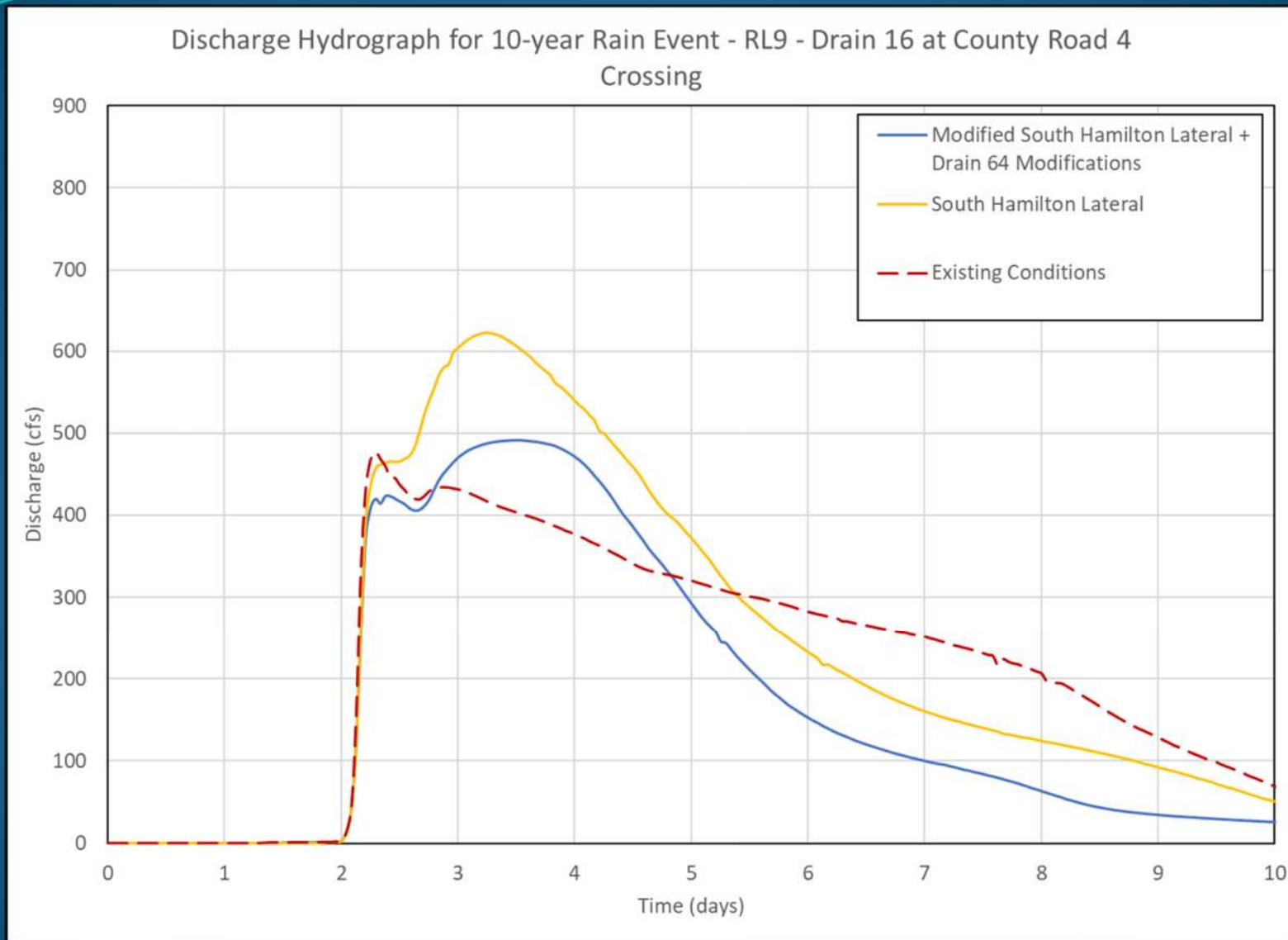
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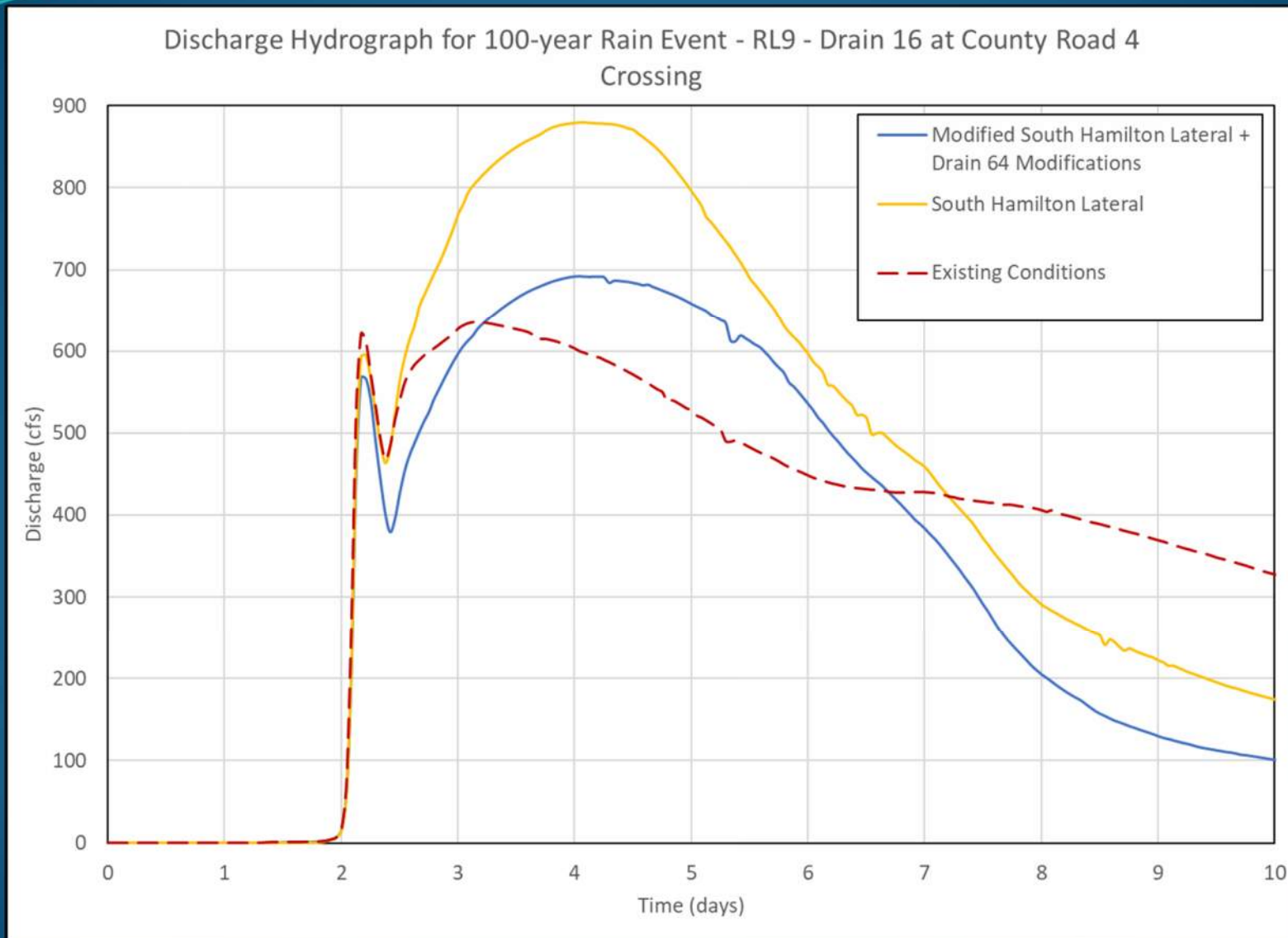
Discharge Hydrograph Review



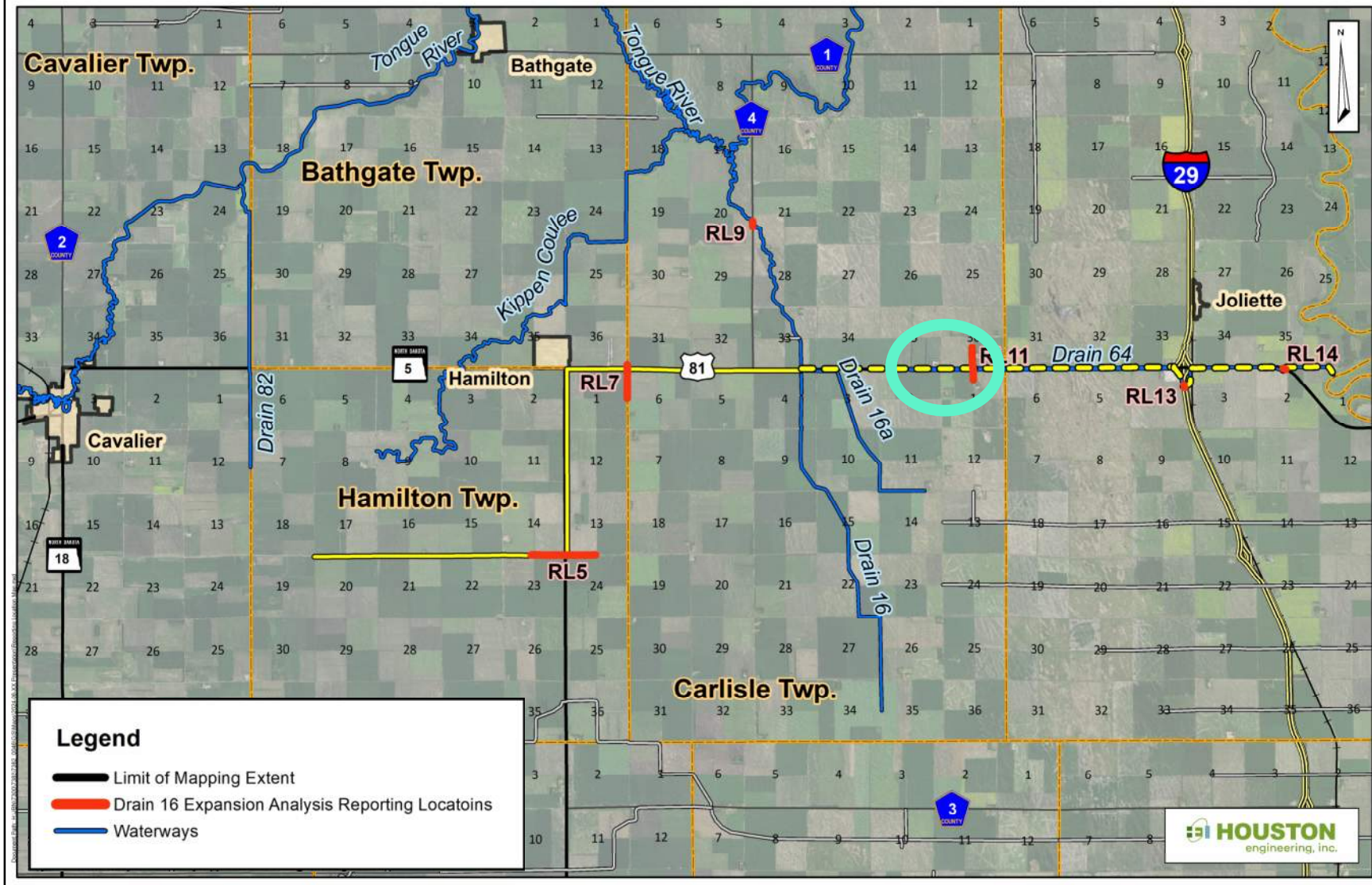
Discharge Hydrograph Review



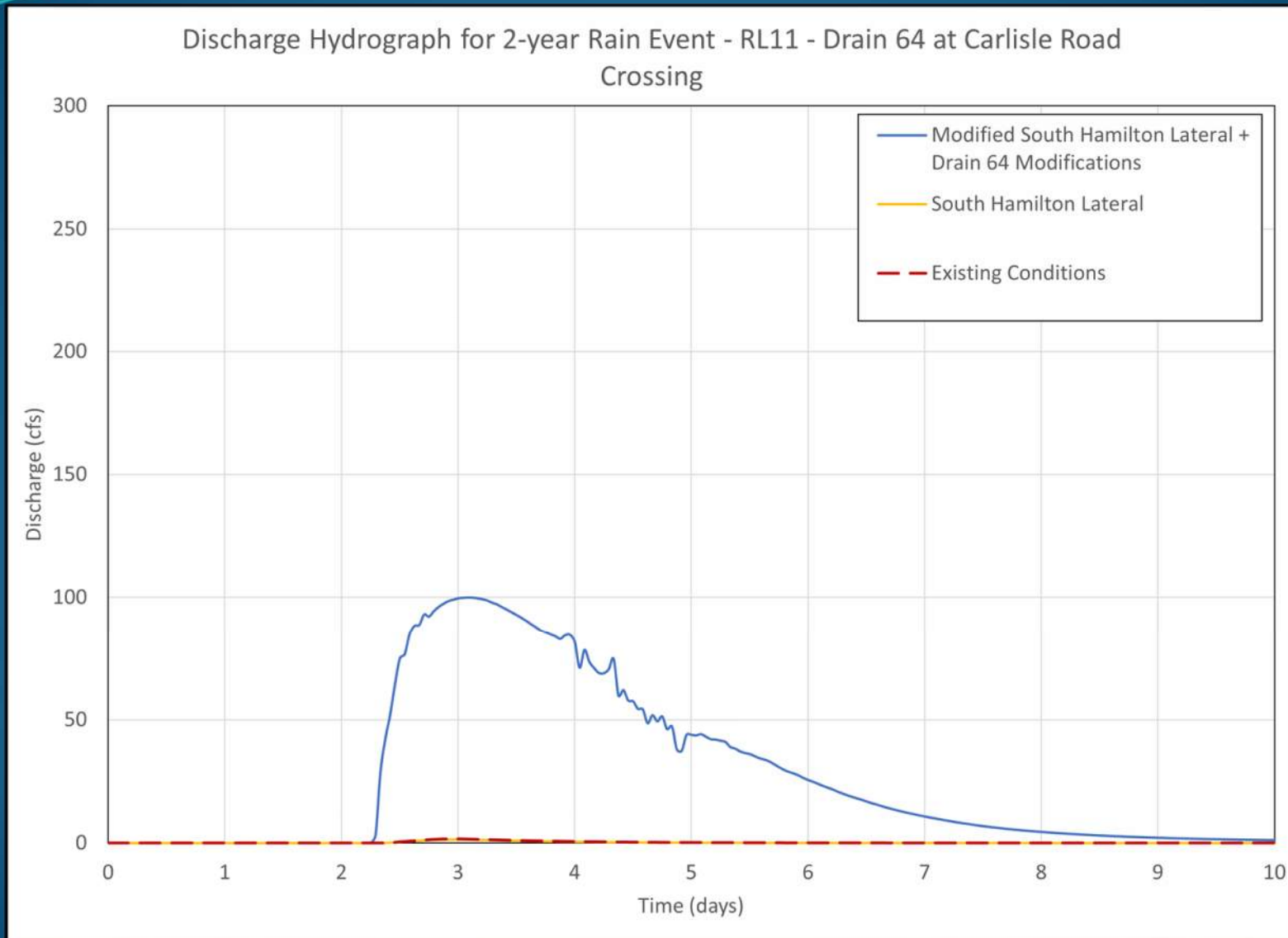
Discharge Hydrograph Review



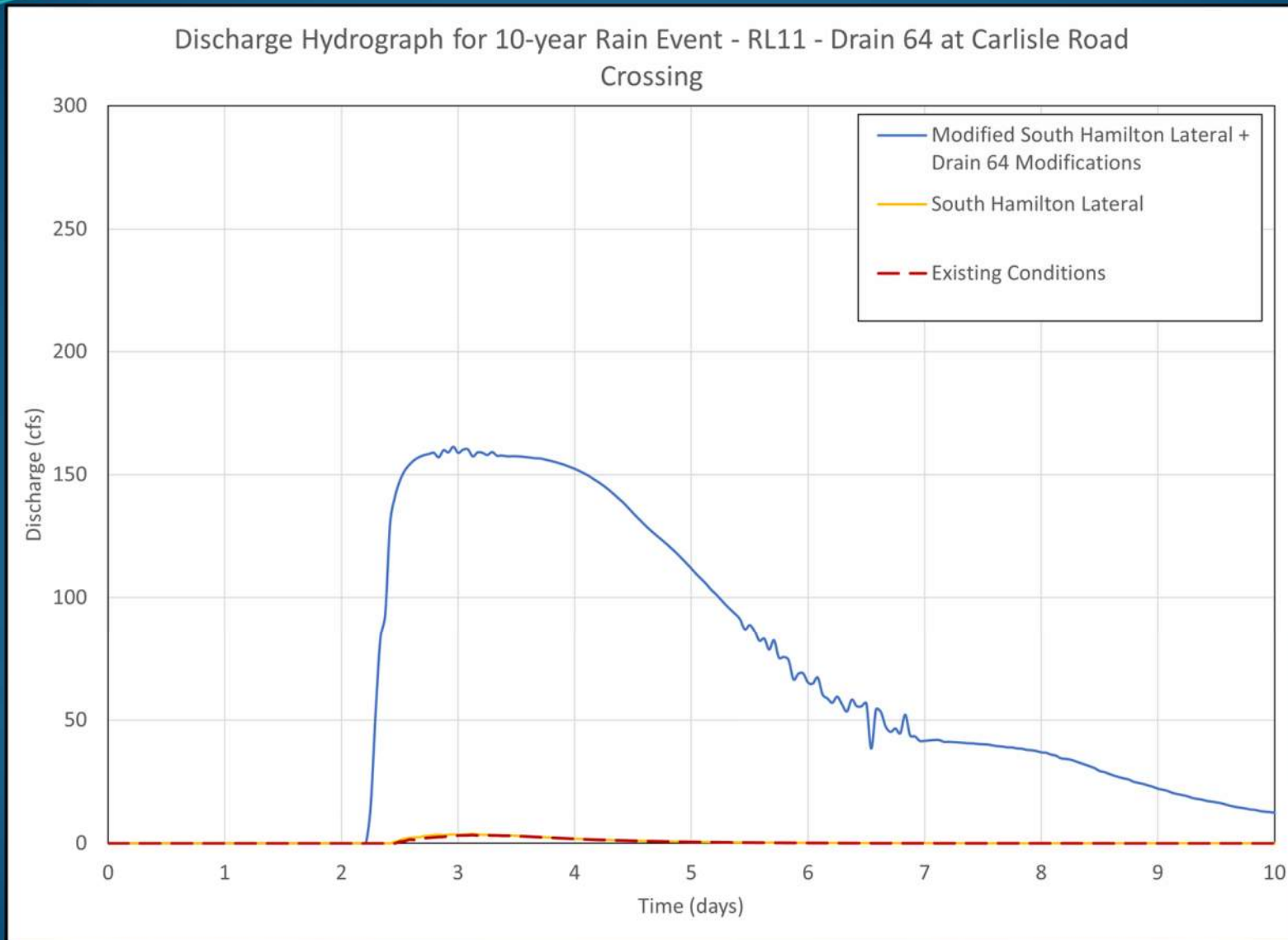
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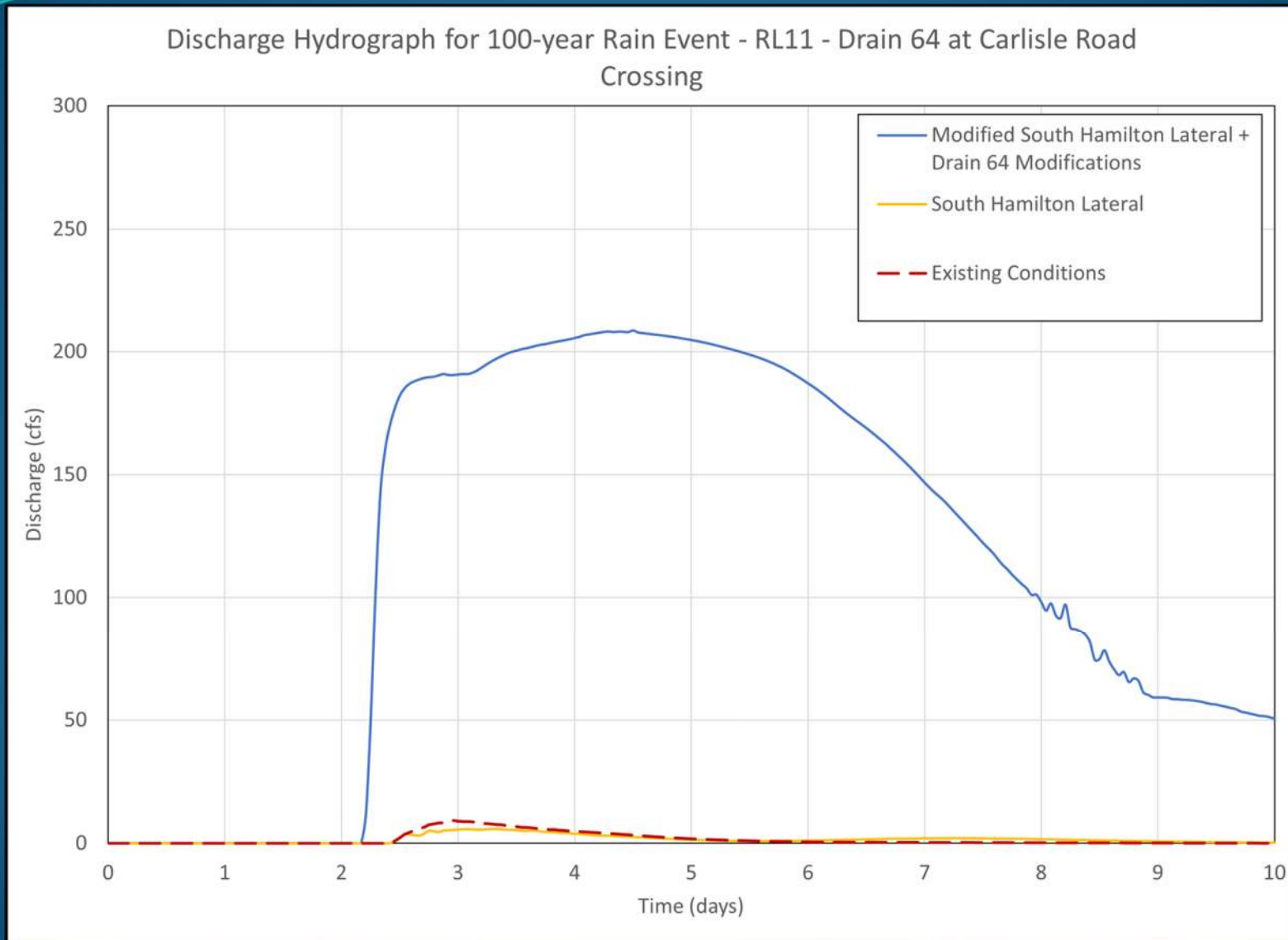
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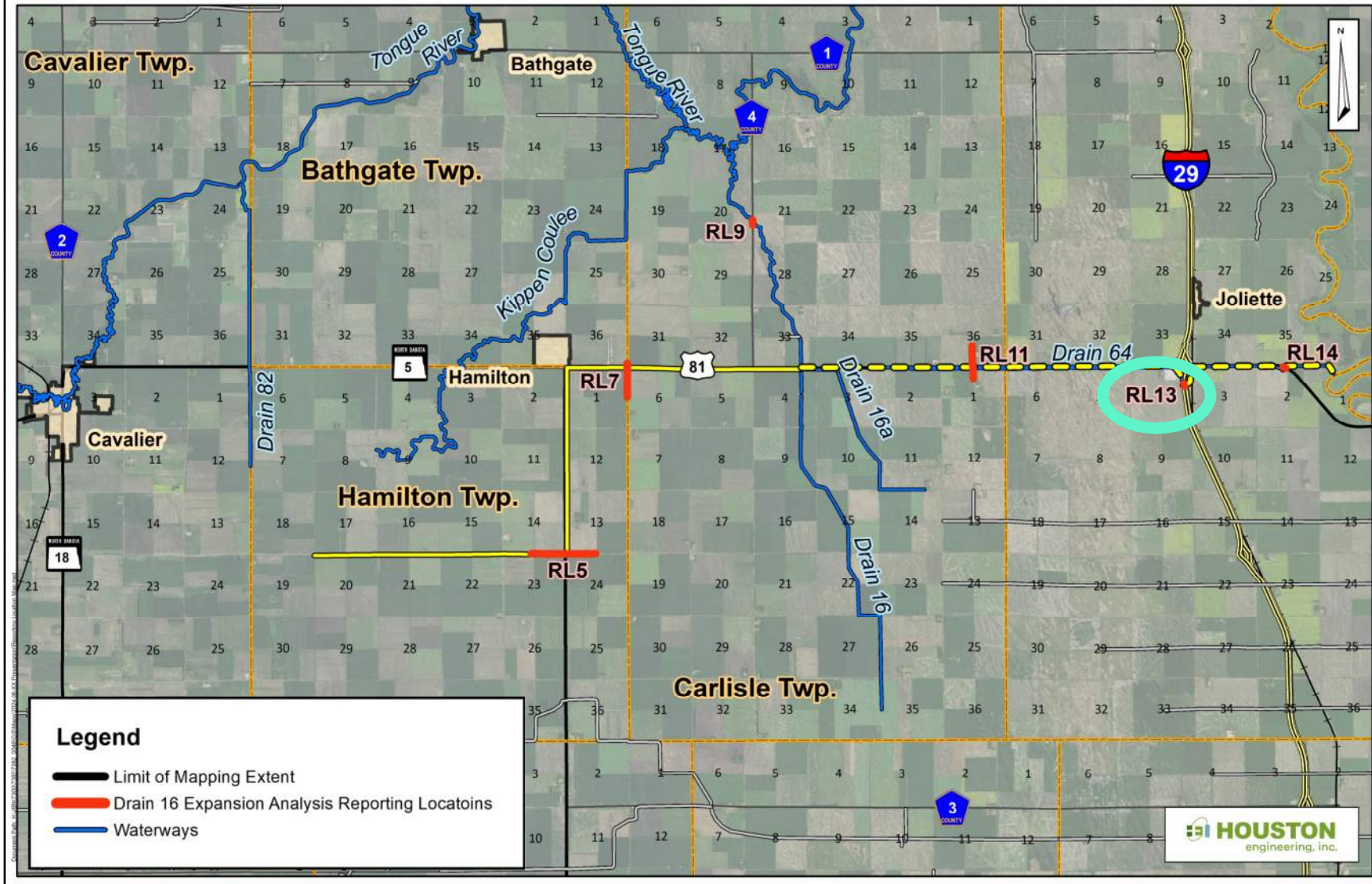
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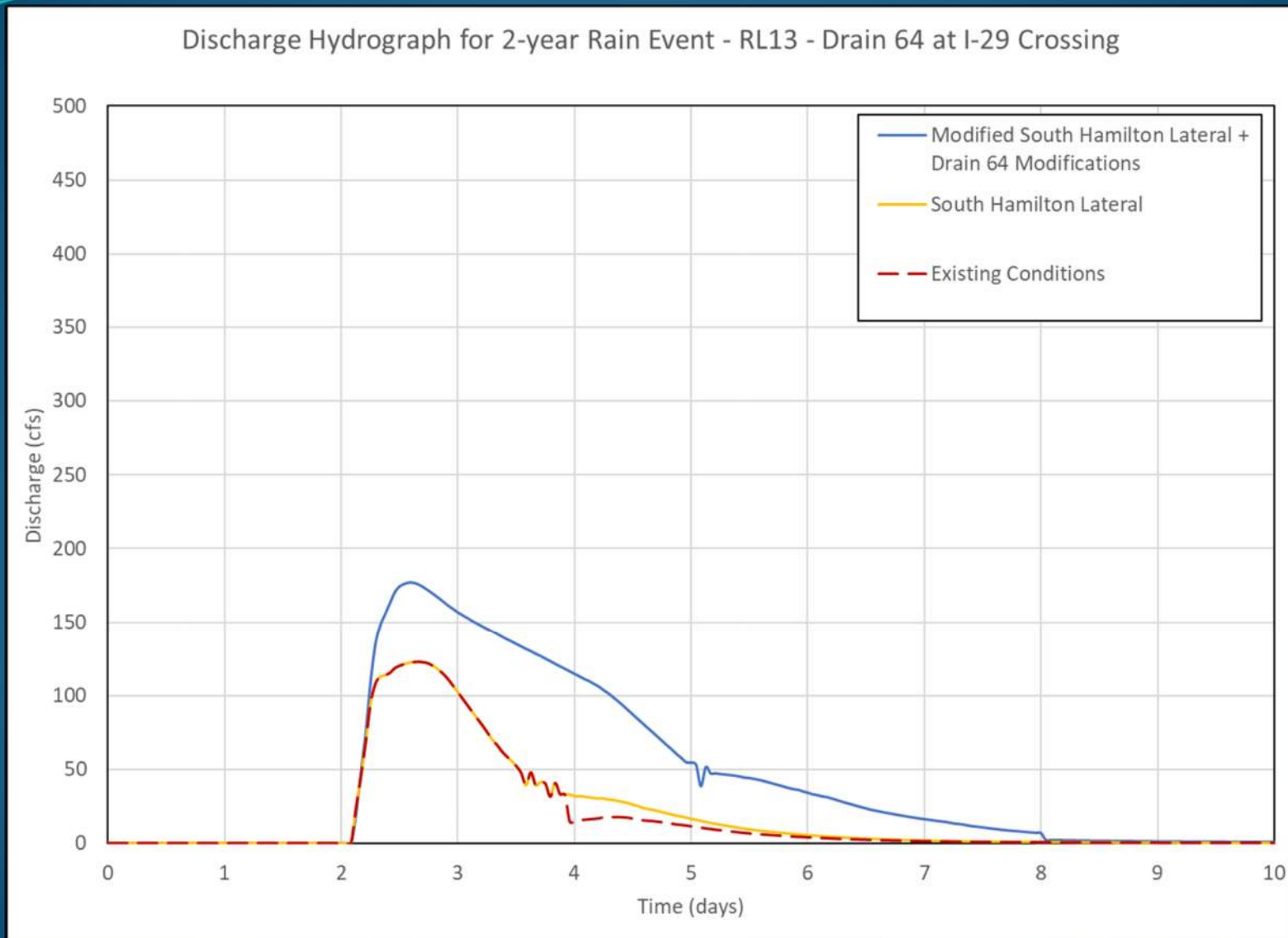
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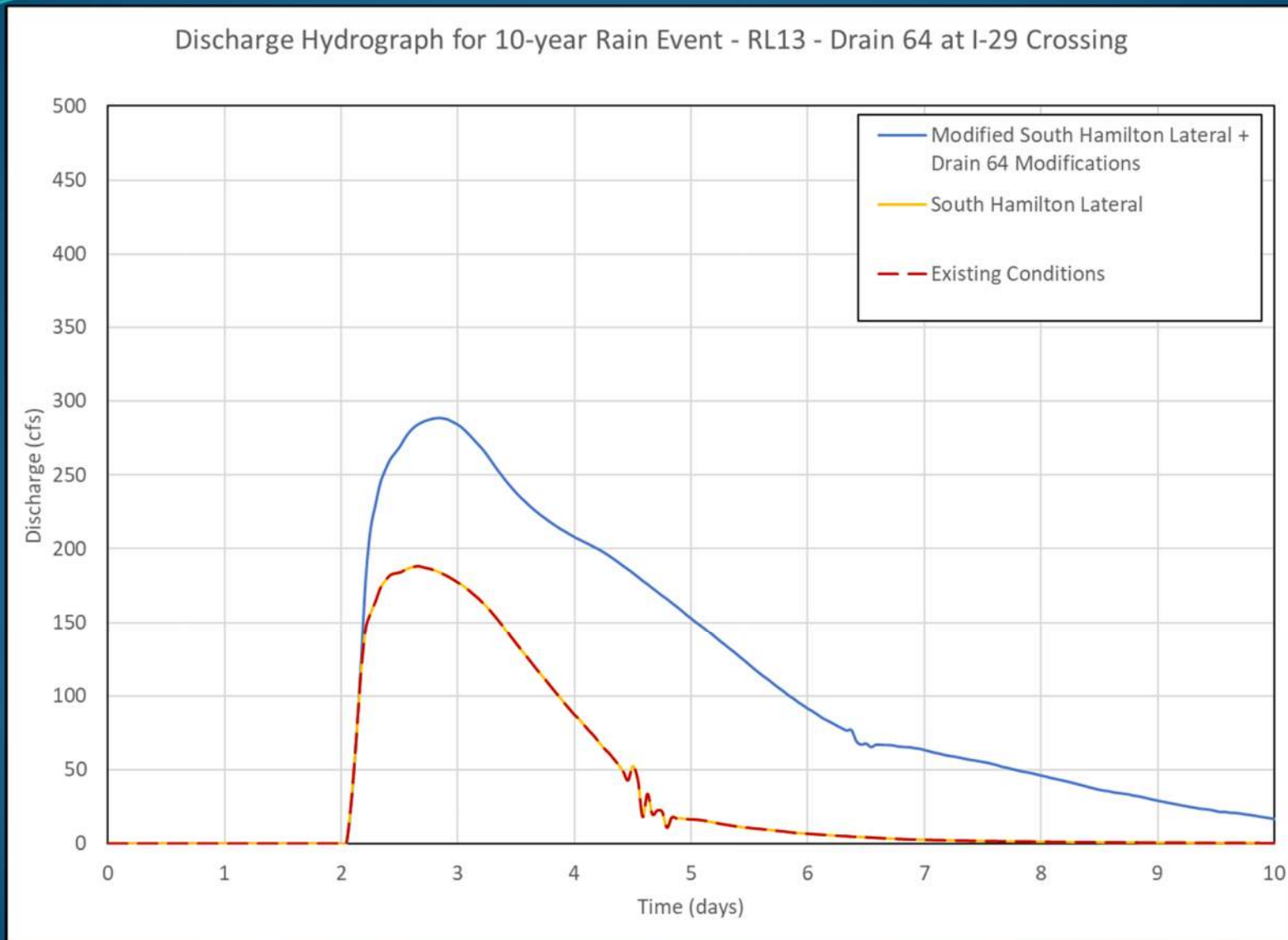
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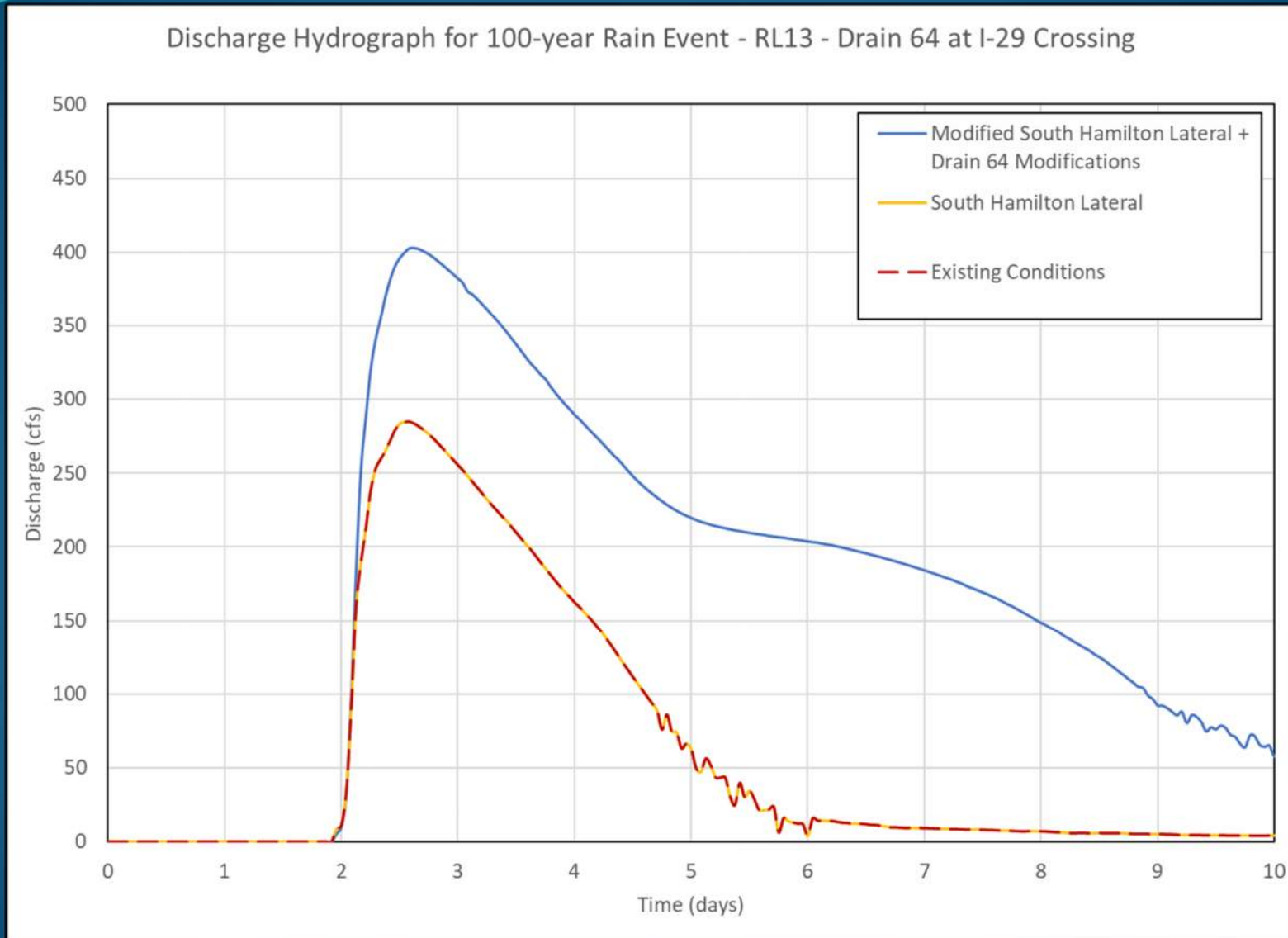
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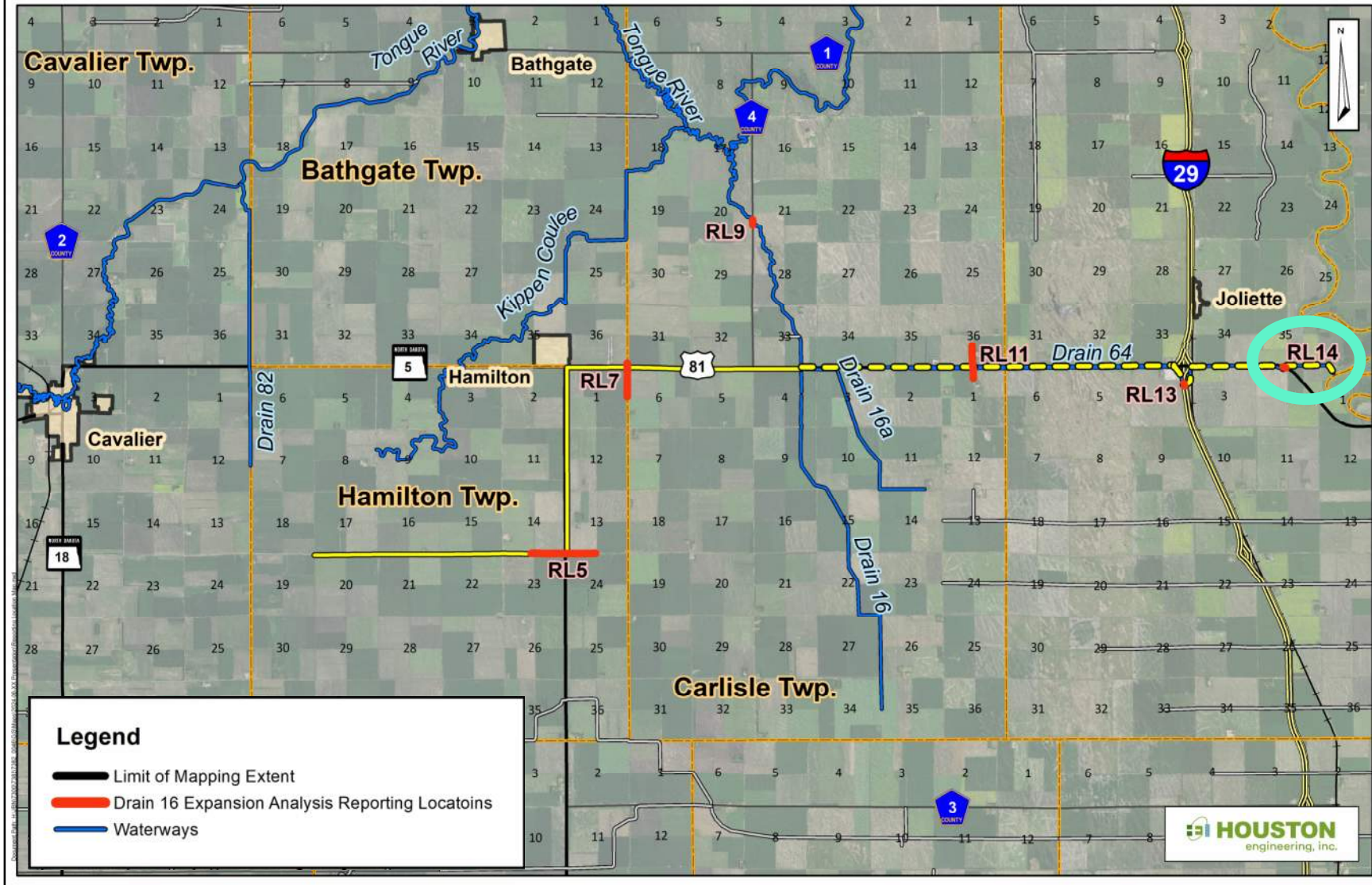
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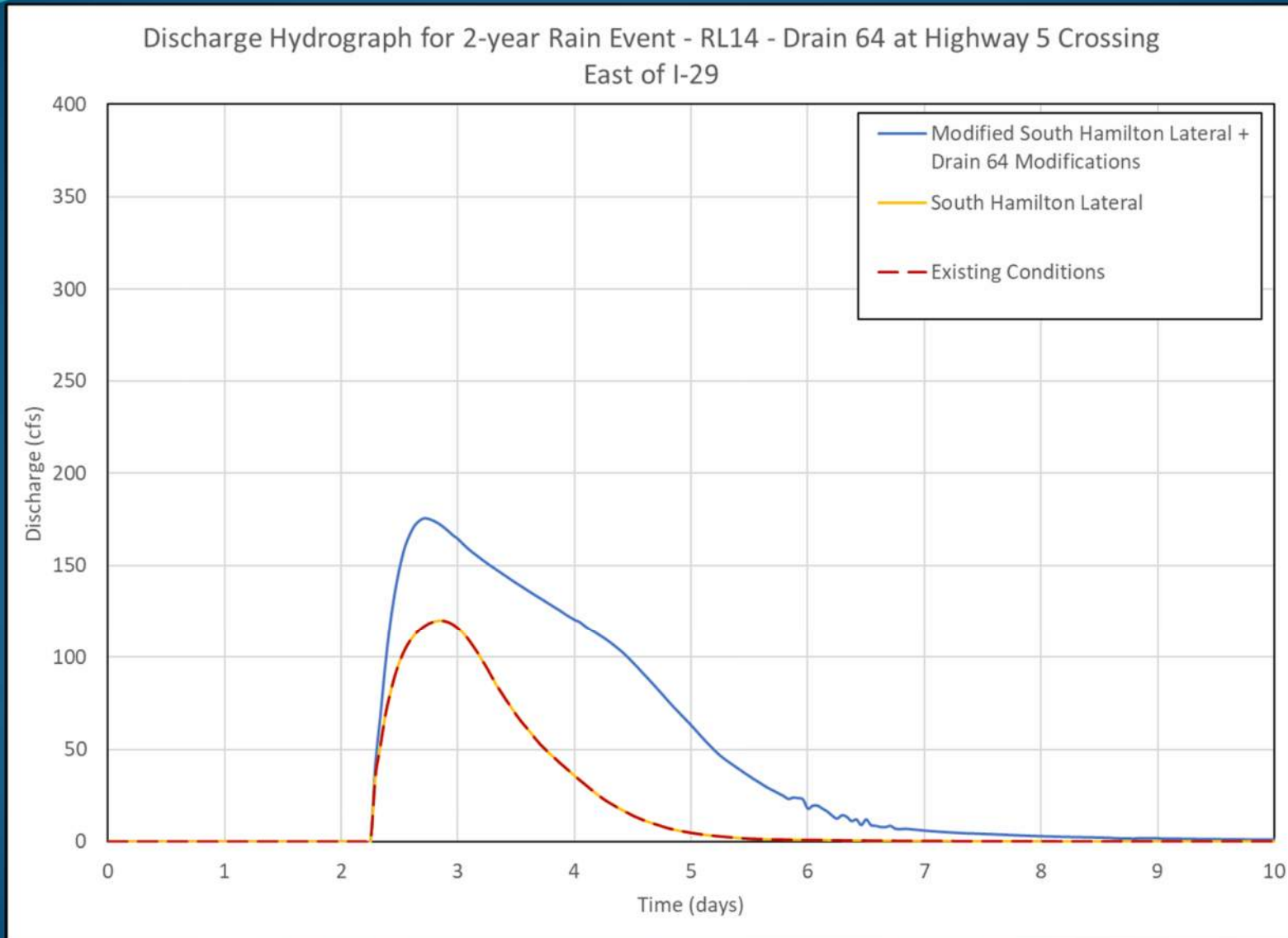
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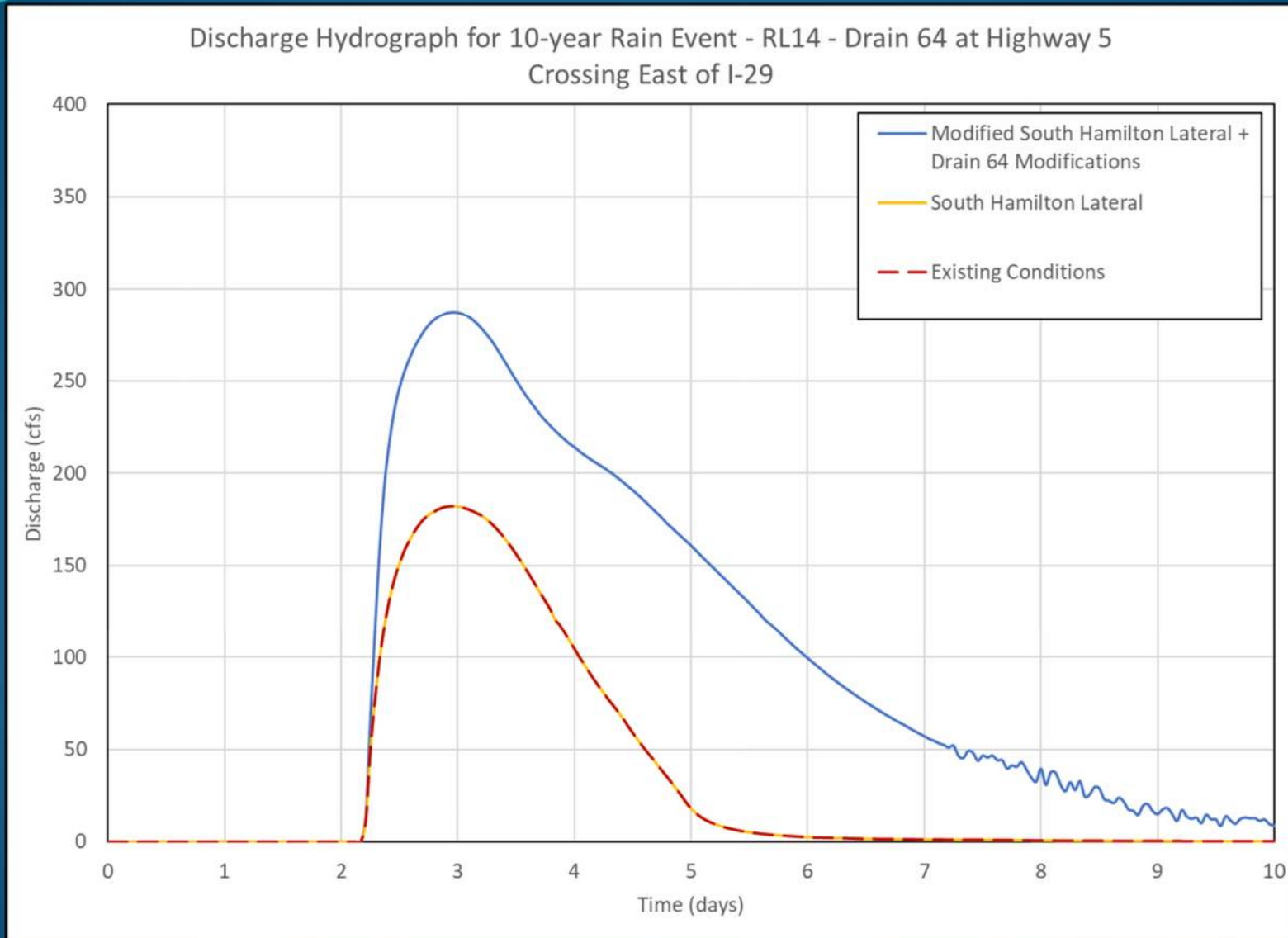
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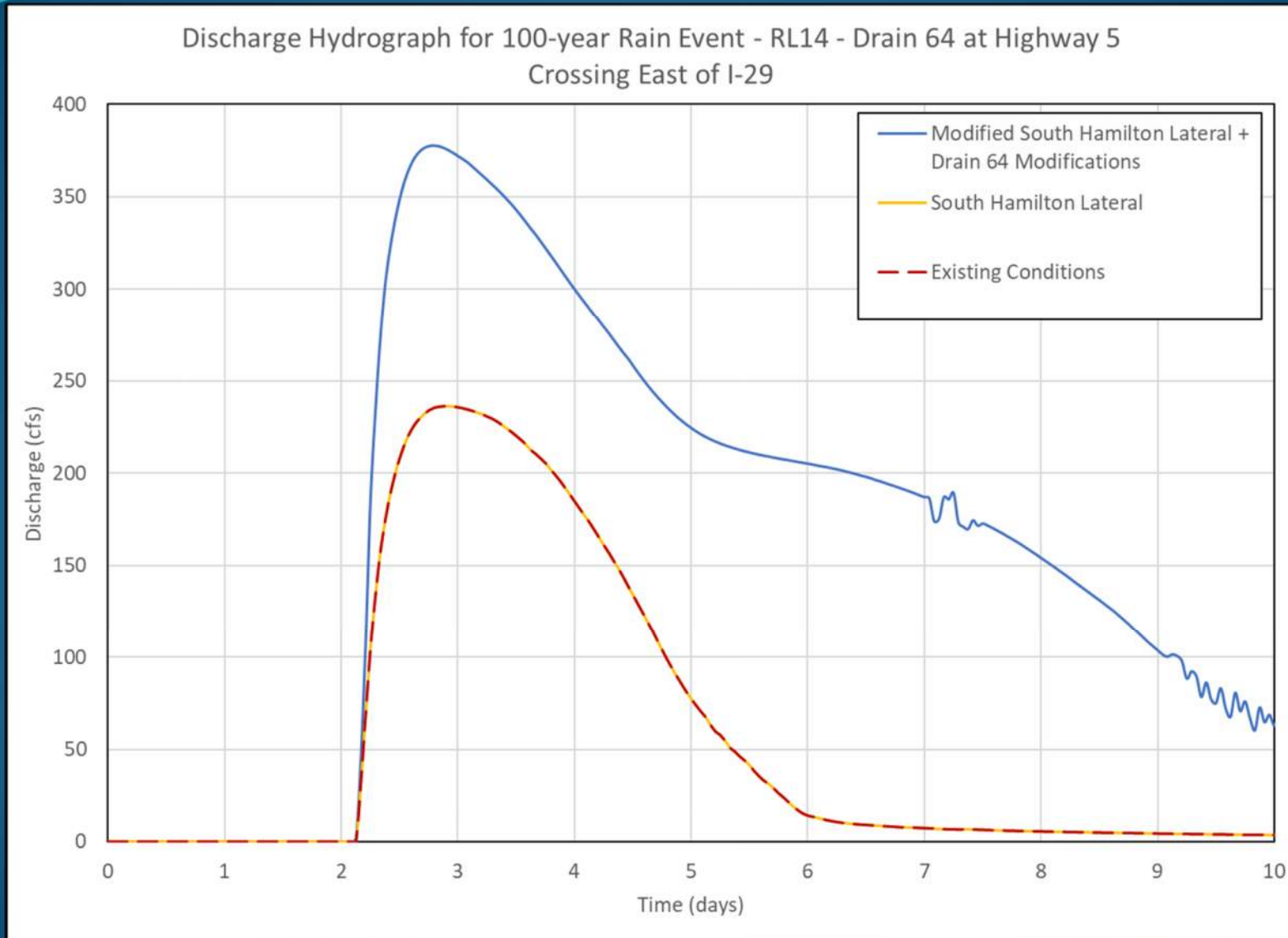
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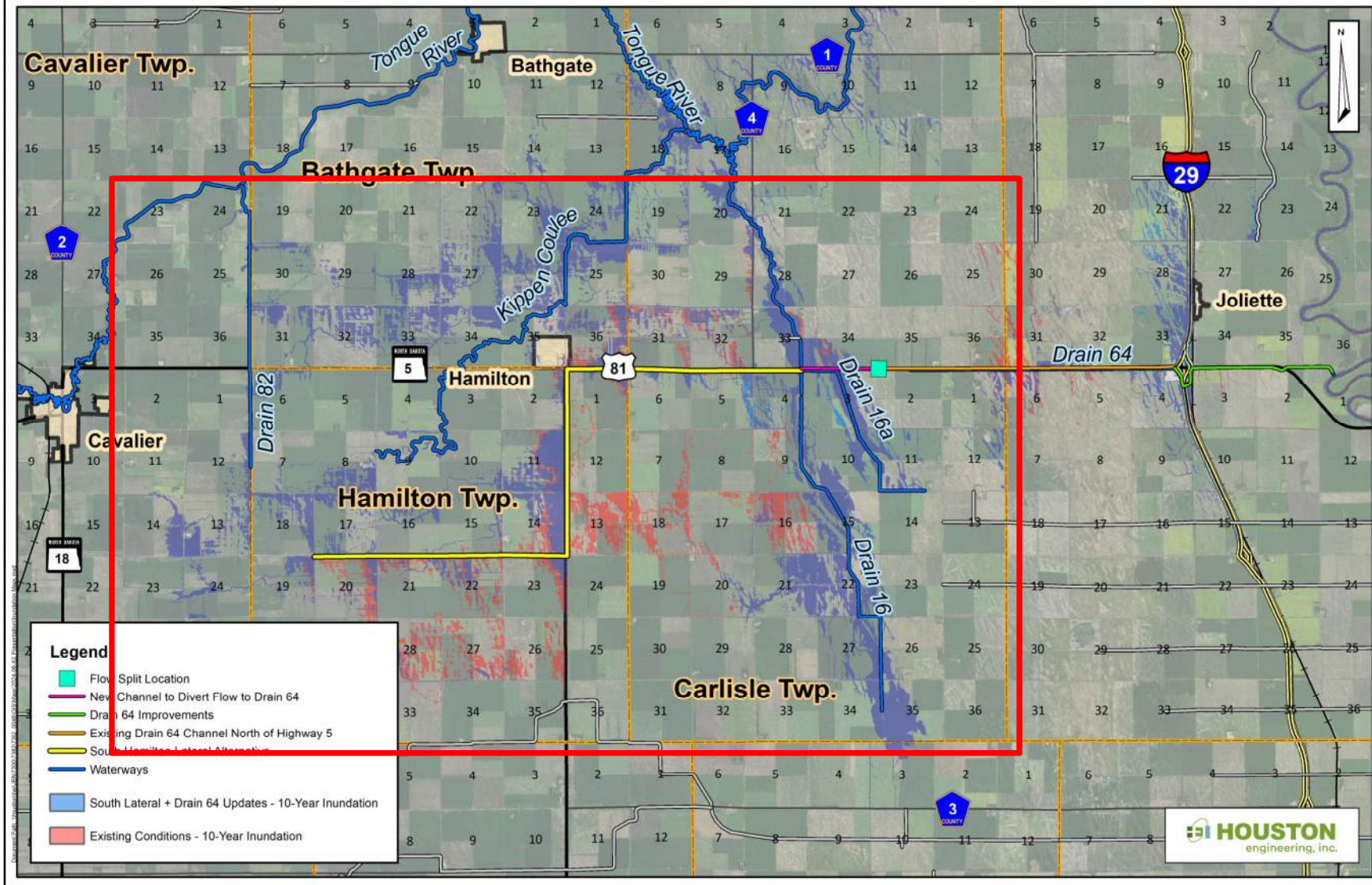
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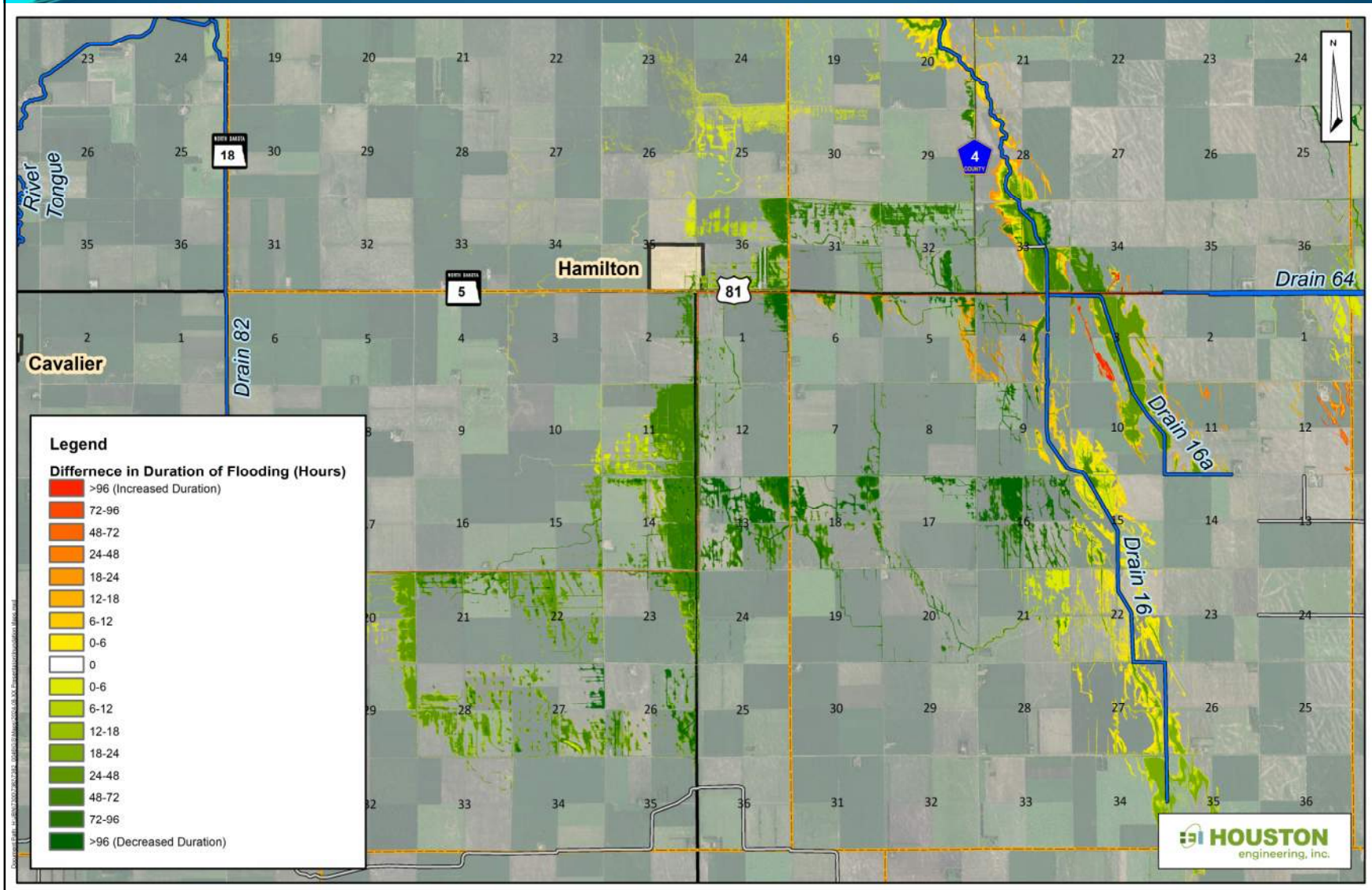
Discharge Hydrograph Review



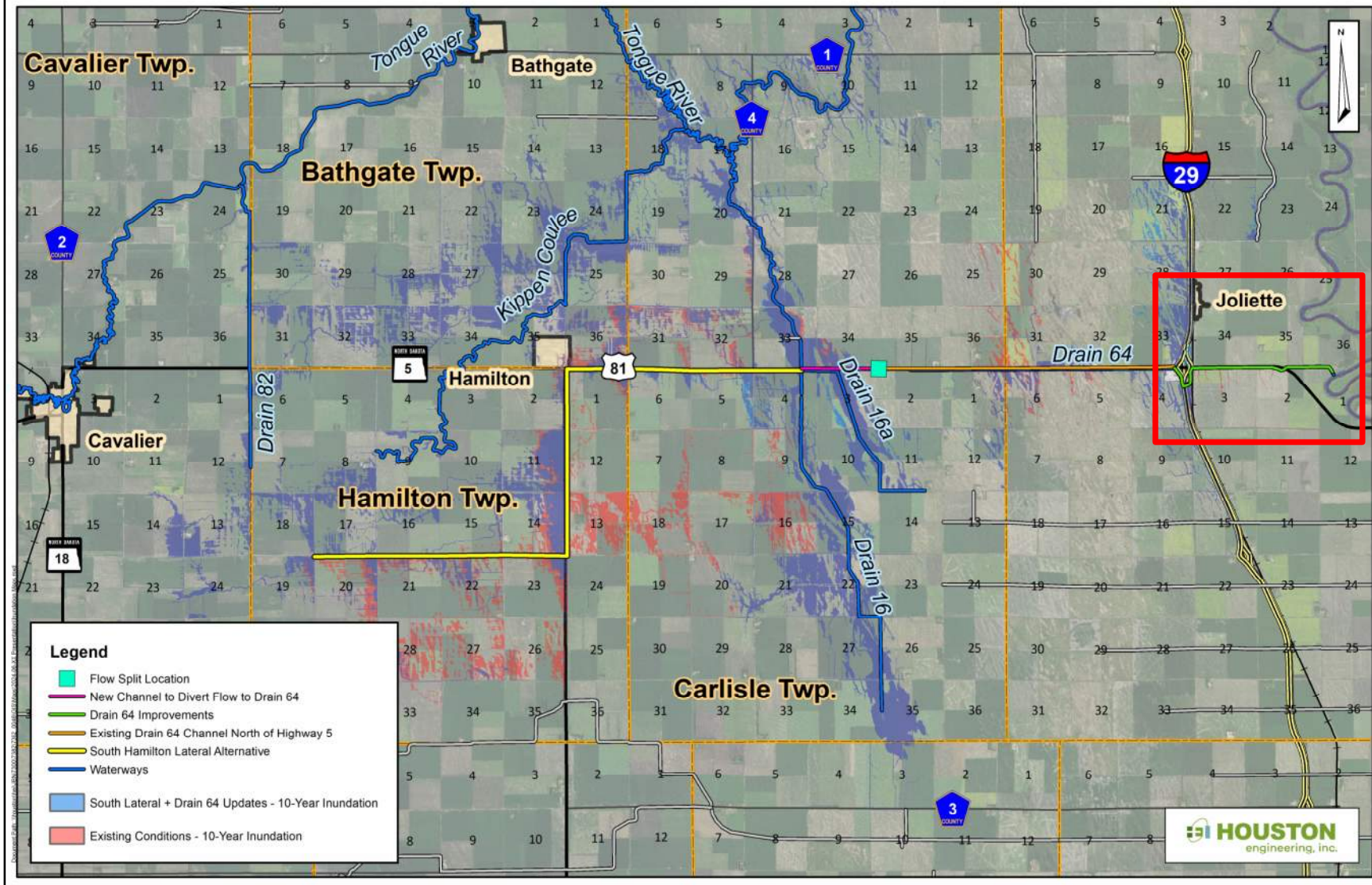
Inundation Review – Existing Conditions: 10-year Event



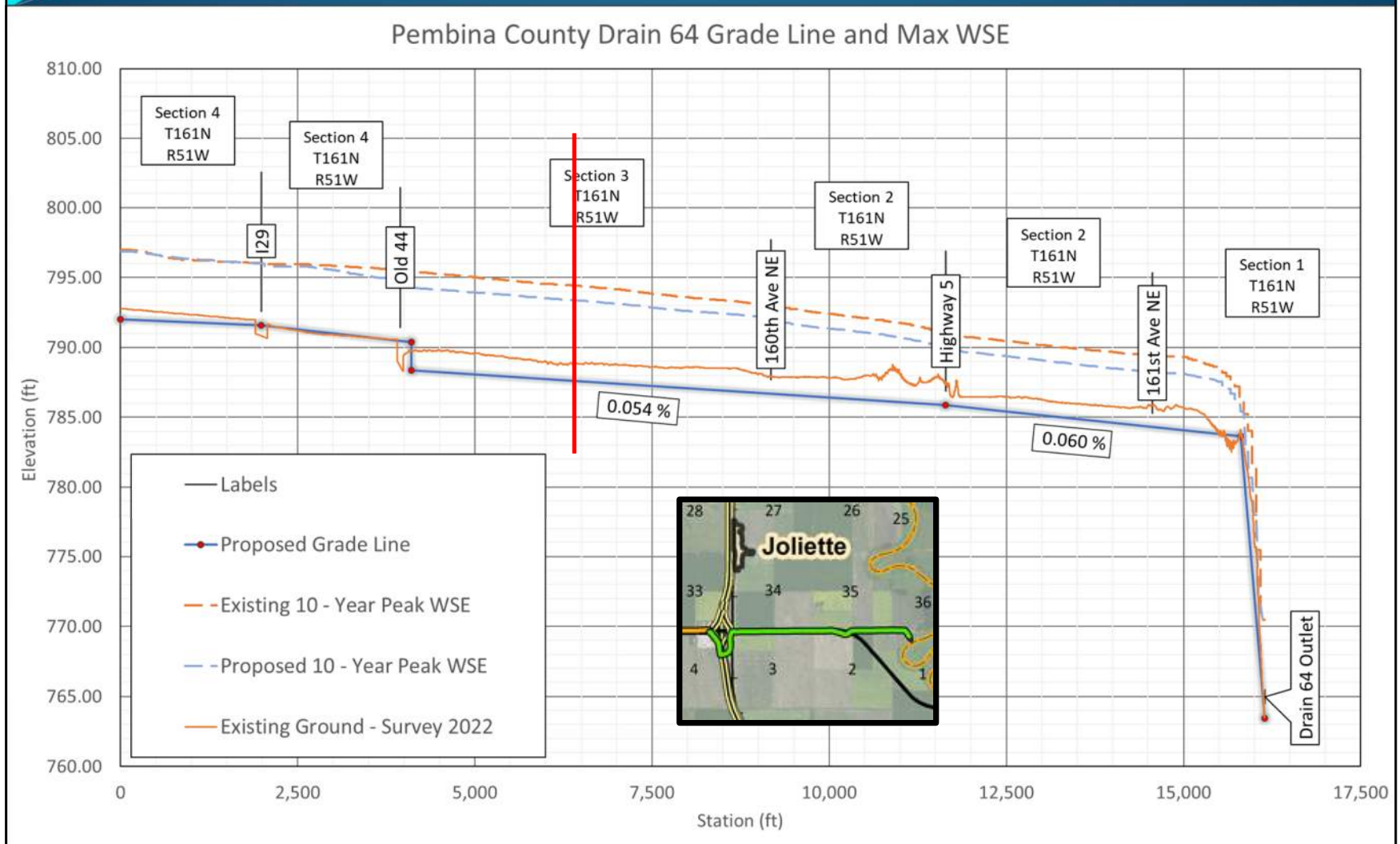
Drain 16 Flood Duration Review – 10-Year Event



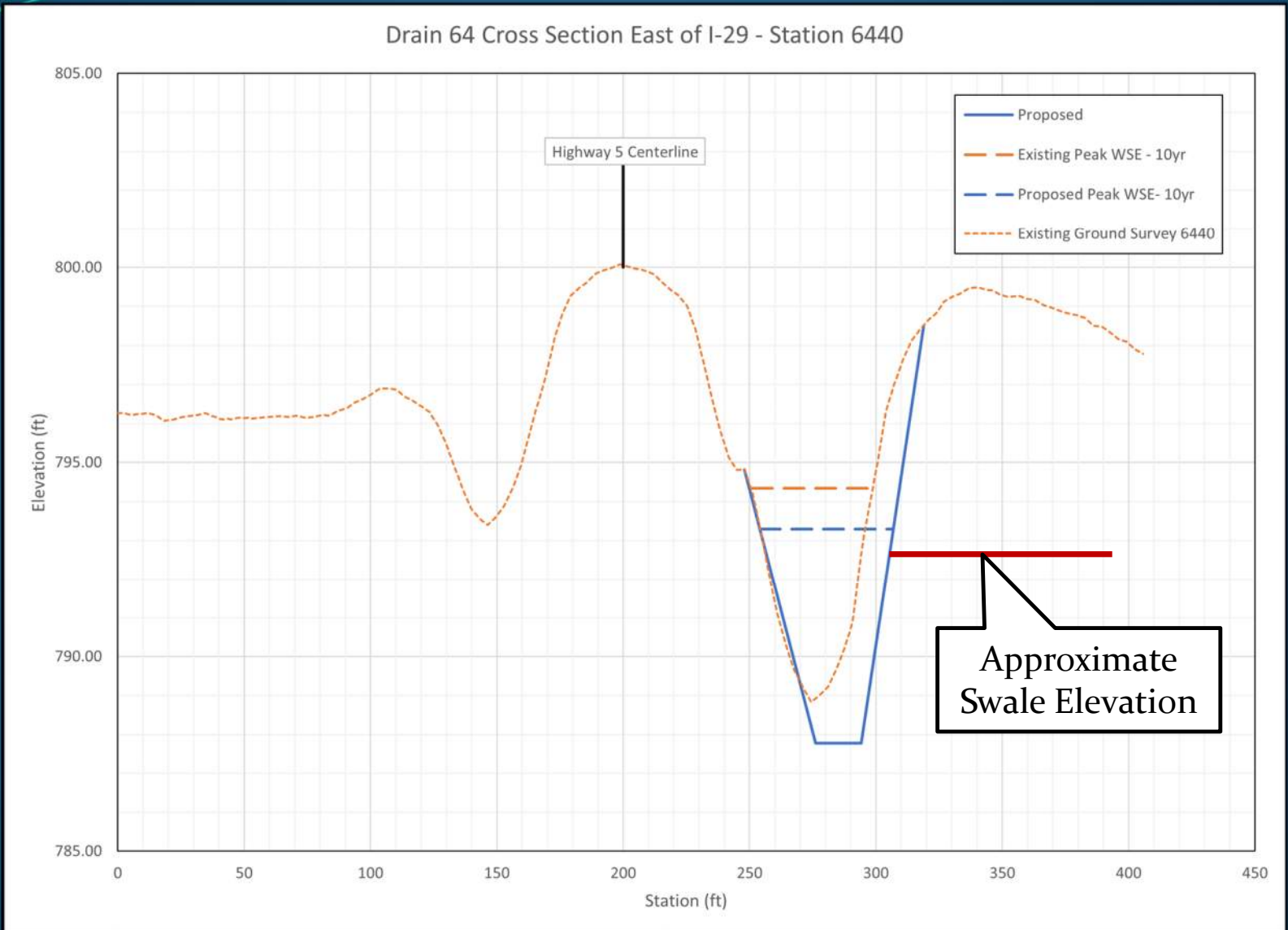
Inundation Review – Existing Conditions: 10-year Event



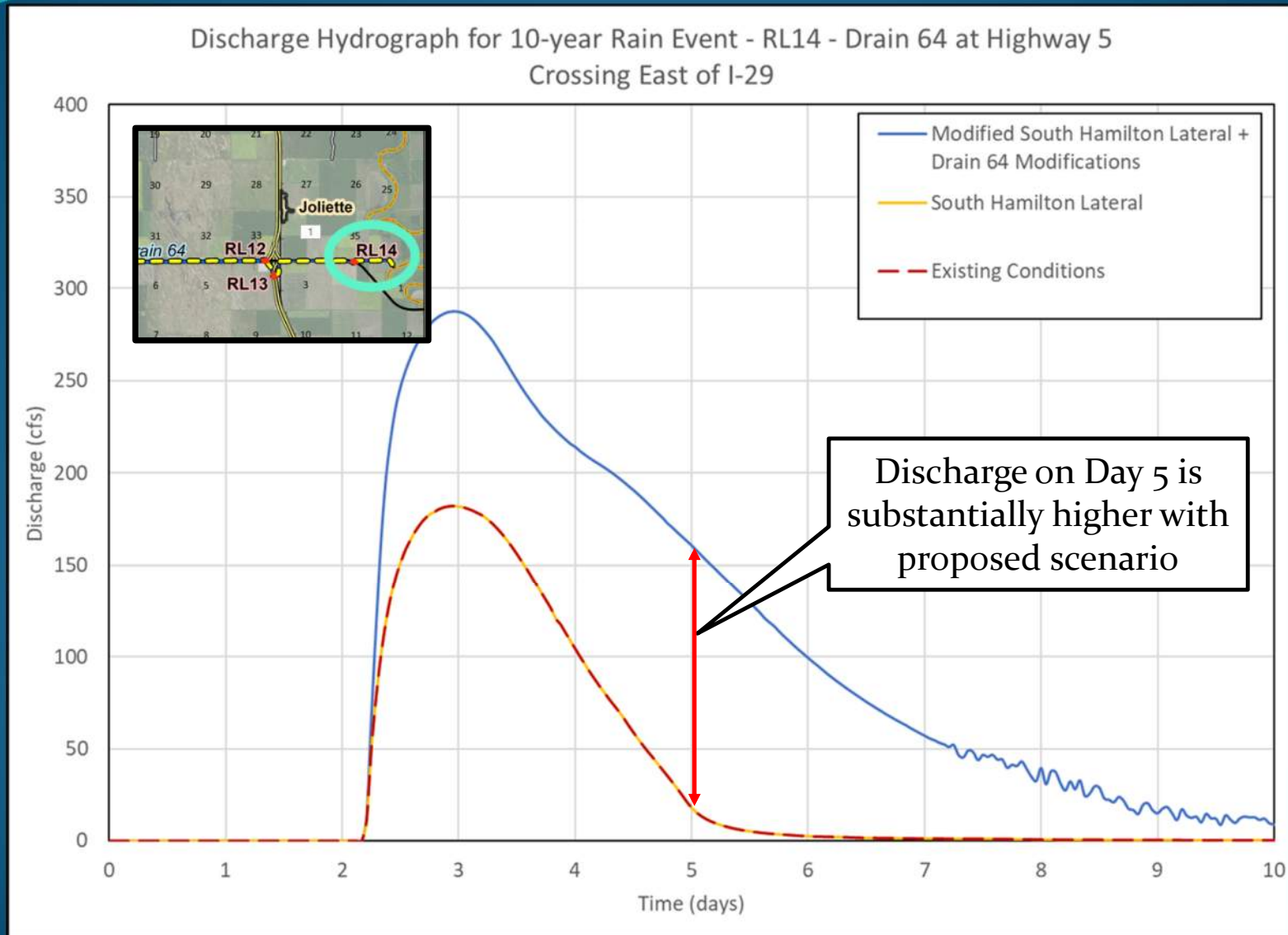
Proposed Grade Line - Water Surface Profile



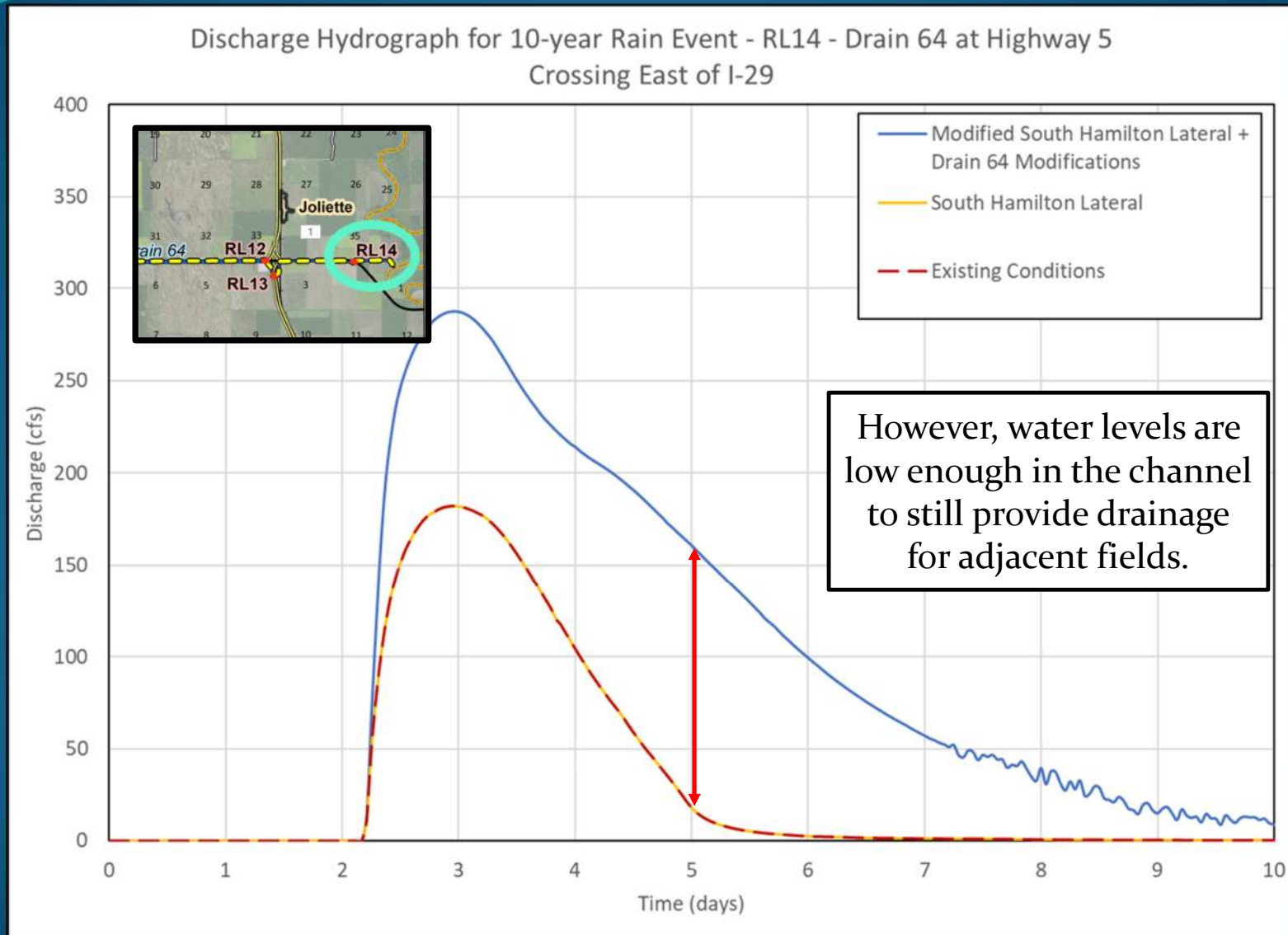
Proposed Cross Section - Water Surface Elev.



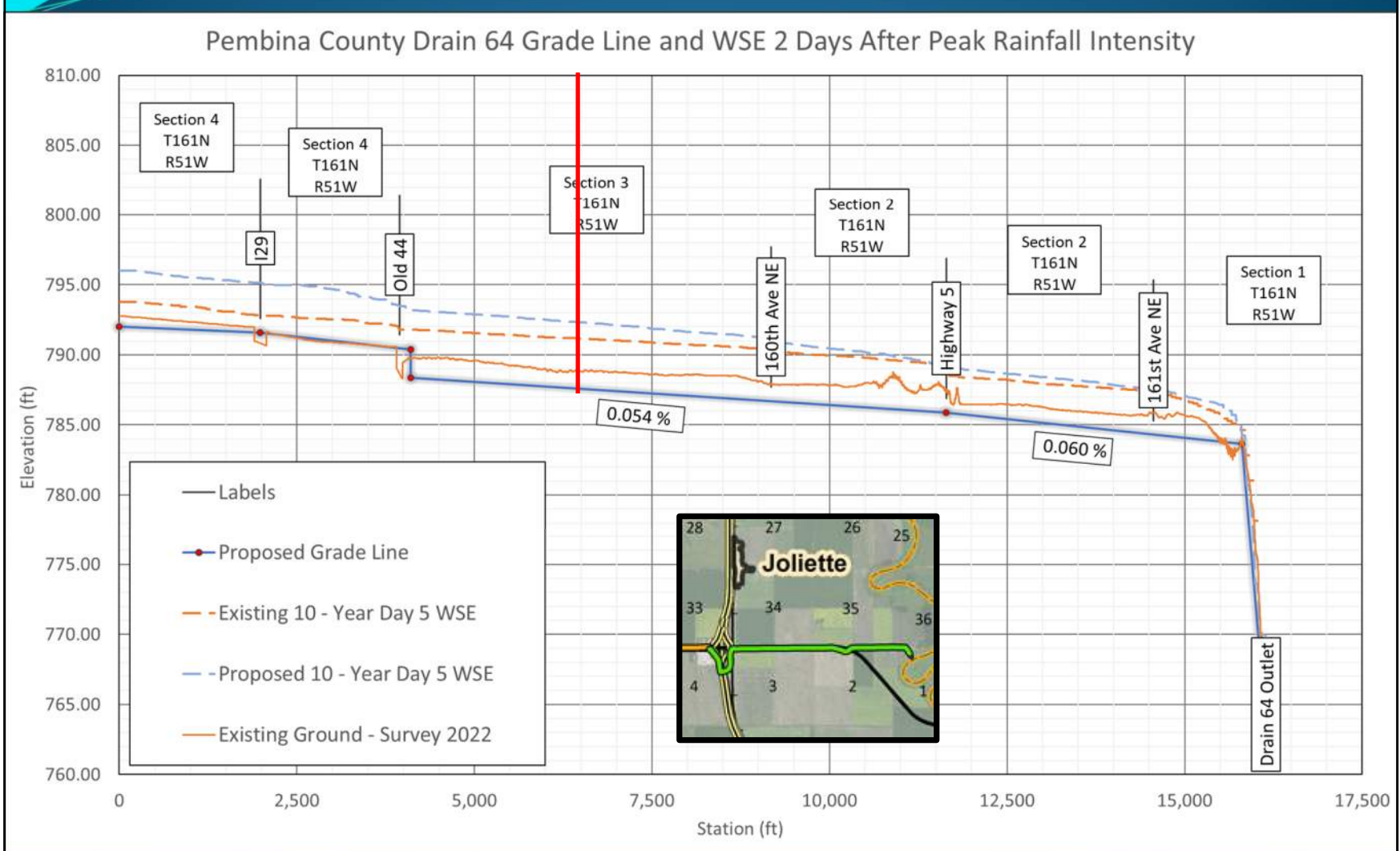
Discharge Hydrograph Review



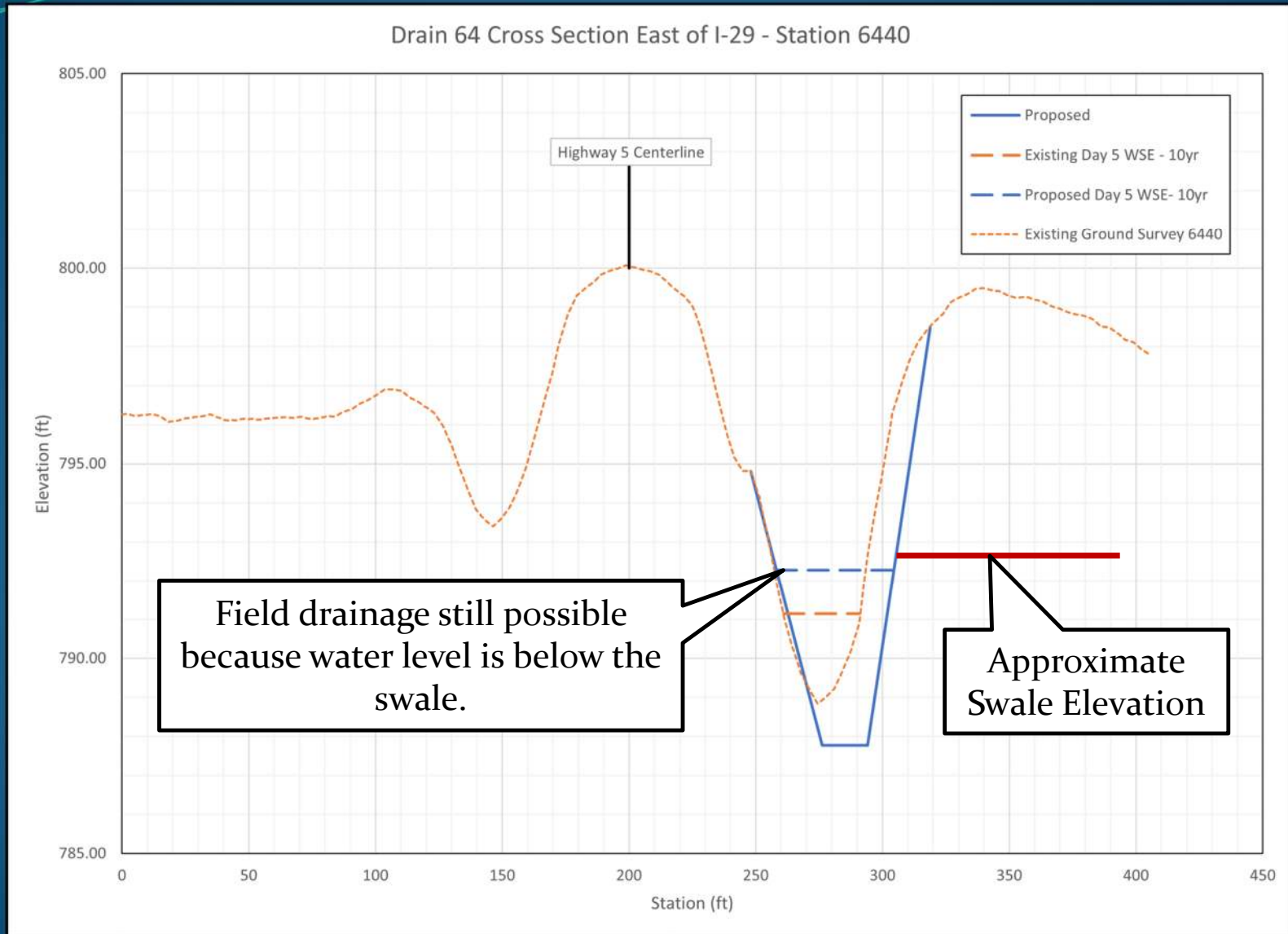
Discharge Hydrograph Review



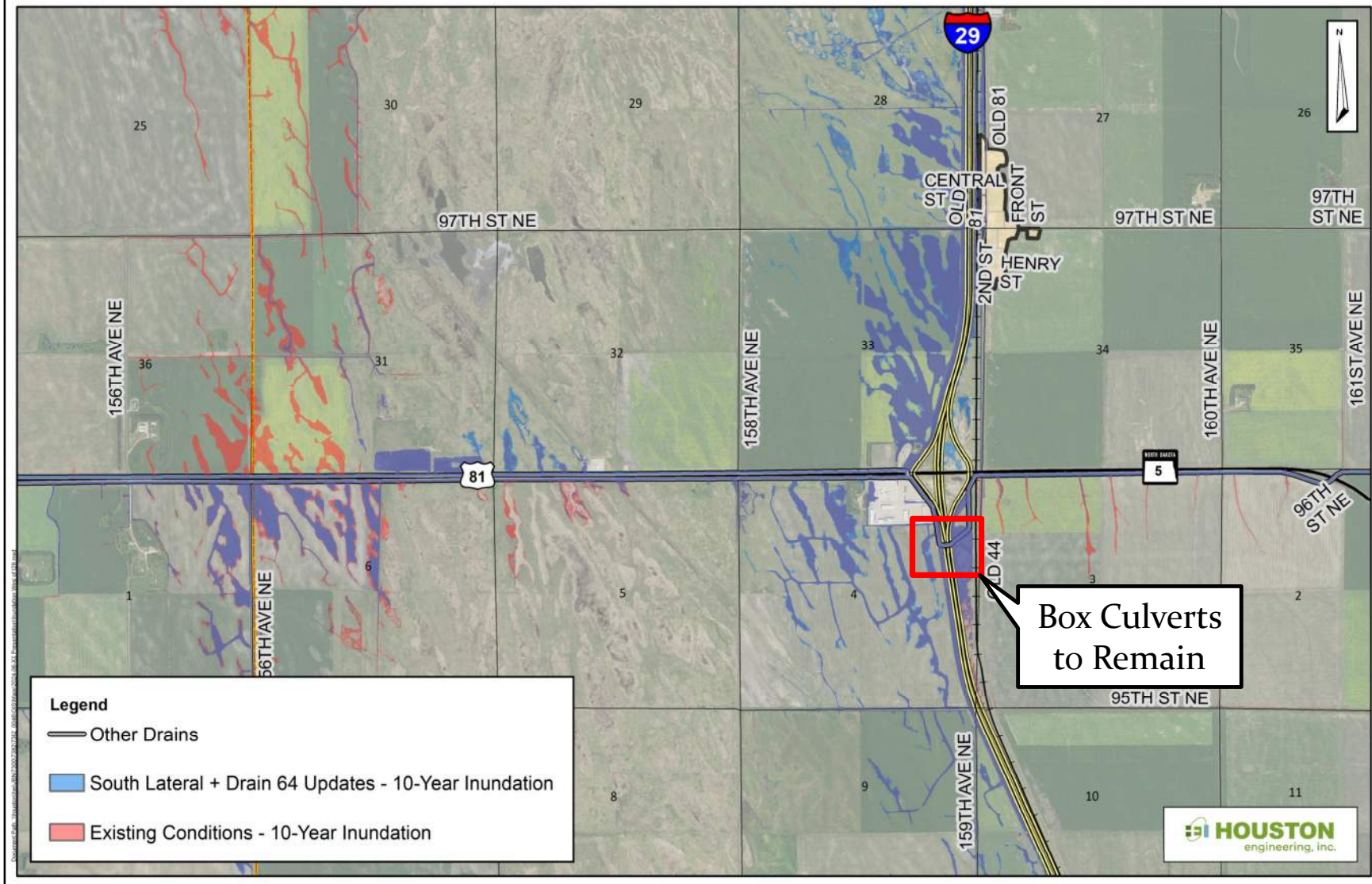
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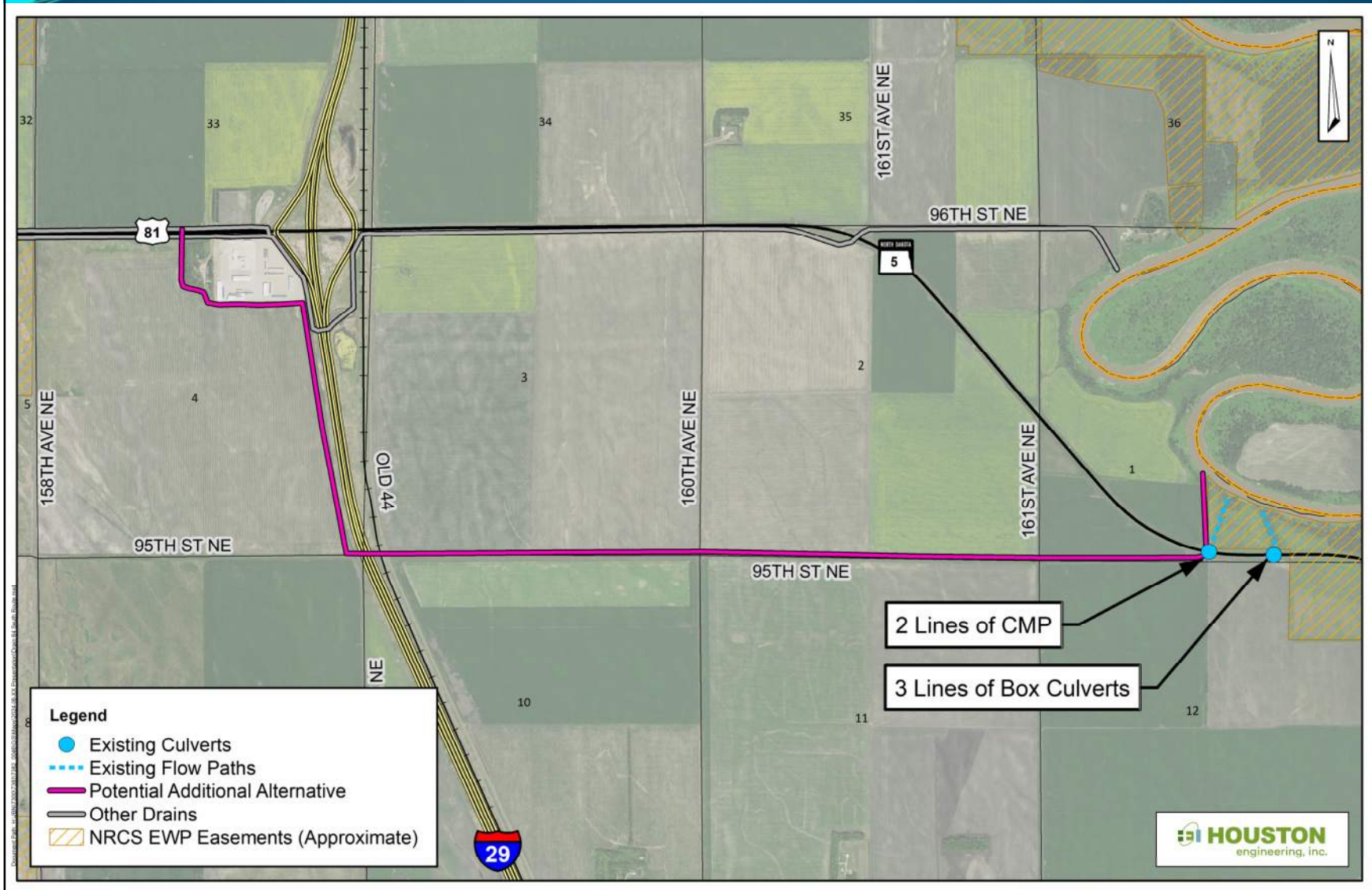
Proposed Cross Section - Water Surface Elev.



Inundation West of I-29



Potential Alternative Route to be Analyzed



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)

Public Participation

- **Next Steps**

- Finalize preferred alternative.
- Develop concept design of preferred alternative

Estimated Costs

- PCWRD would pursue cost share through the North Dakota Department of Water Resources
 - Up to 45% cost share for construction and engineering
- Potentially utilize NDDOT funds for highway crossings
- Total construction cost estimated to be \$14,500,000 to \$16,500,000
- Total project cost estimated to be \$19,000,000 to \$22,000,000
 - Non-construction costs include land rights (permanent and temporary right-of-way acquisition), engineering, and permitting
- Costs with full project cost being assessed locally:

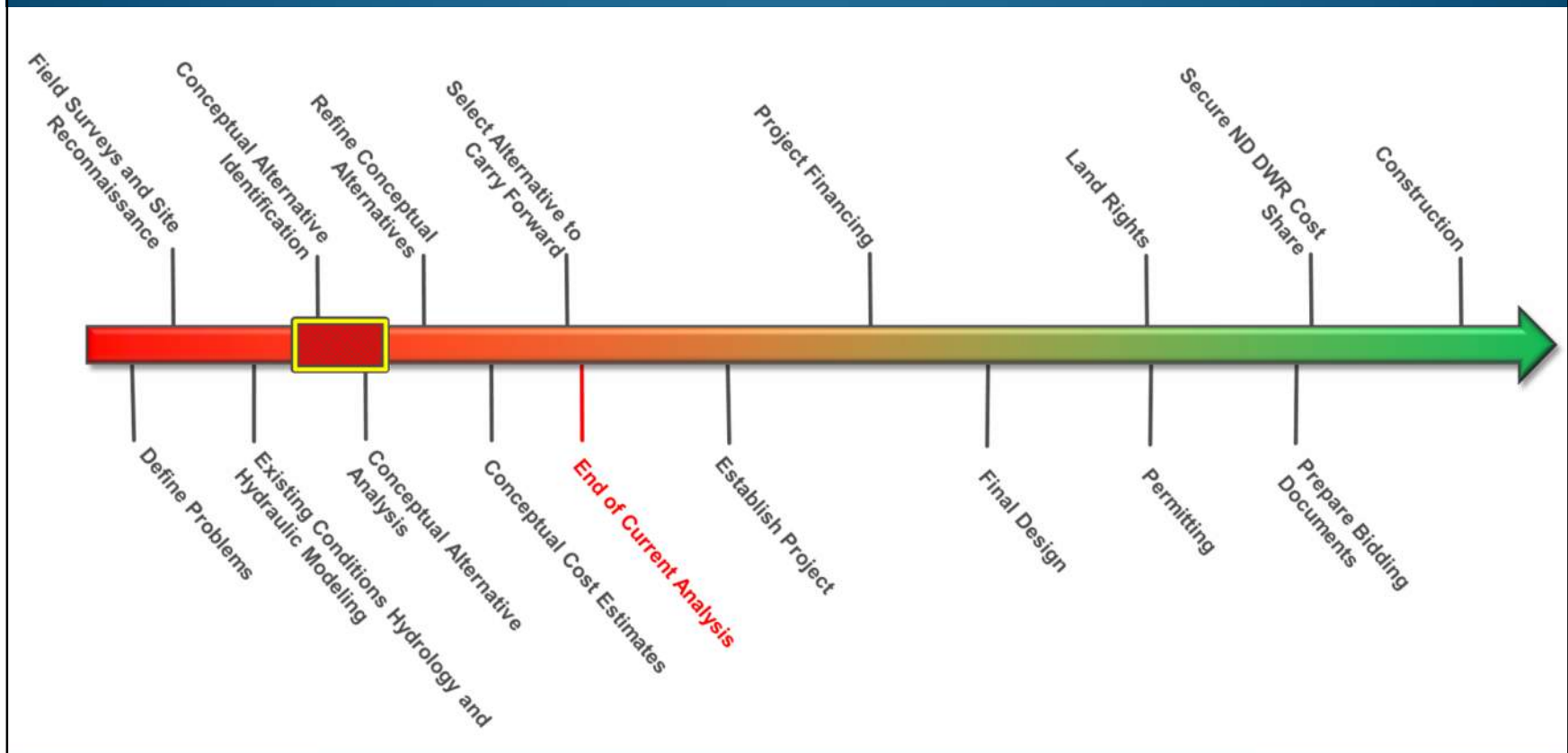
Area Description	Area (Ac)	Total Cost Per Acre
Existing Drain 16 Assessment Area	32,500	\$600 - \$660
Full Drain 16 Watershed	48,500	\$400 - \$450

Estimated Costs

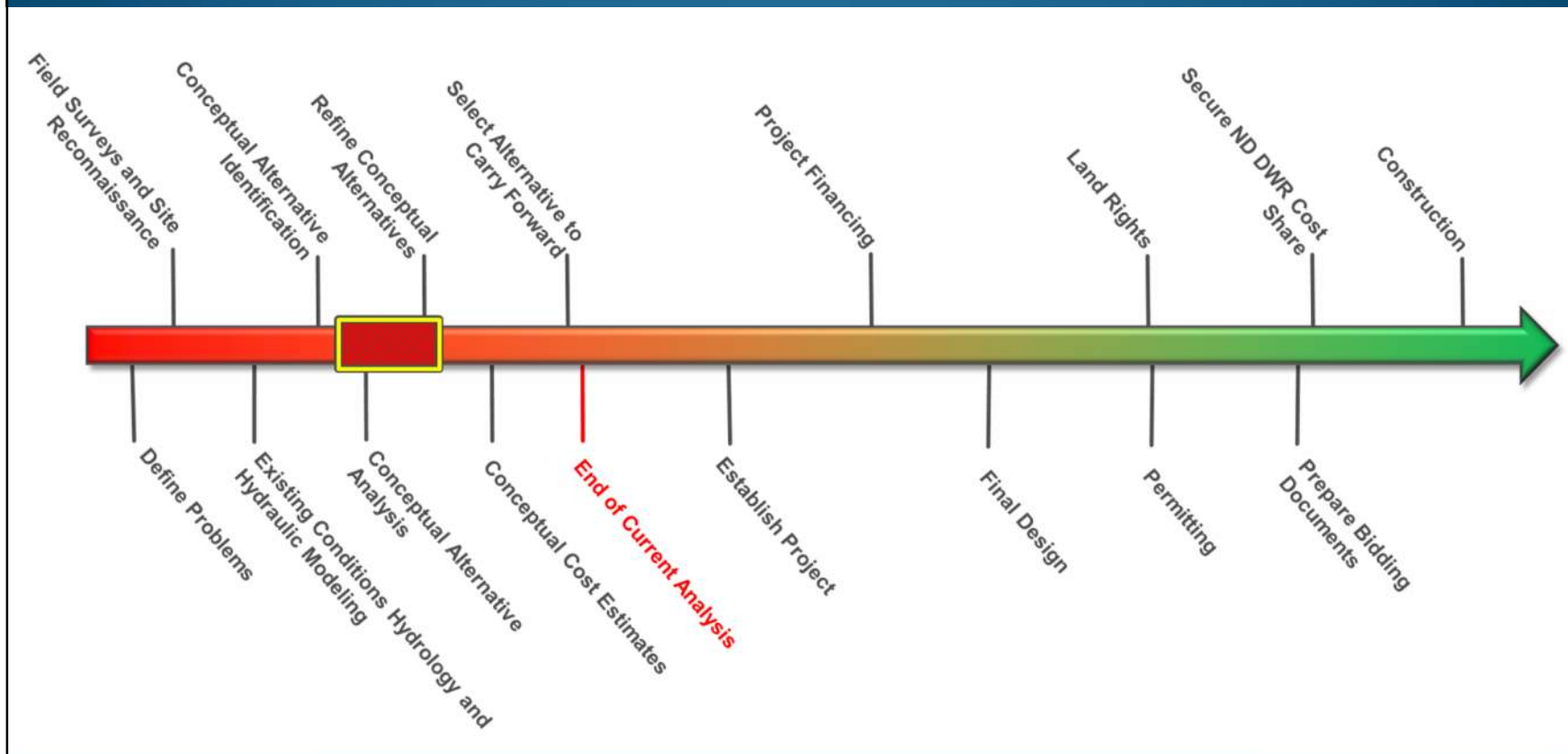
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 - Non-construction costs include land rights (permanent and temporary right-of-way acquisition), engineering, and permitting
- Costs with all cost share components secured:

Area Description	Area (Ac)	Total Cost Per Acre
Existing Drain 16 Assessment Area	32,500	\$340 - \$380
Full Drain 16 Watershed	48,500	\$230 - \$260

Project Timeline - Previous Meeting



Project Timeline



COMMENT SHEET

Pembina County Drain 16 Expansion Analysis Alternatives Review – 2

Public Meeting – March 28th, 2024

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

(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, APRIL 26, 2024, using the email/mail instructions above. Completed forms may also be dropped off at the Pembina County Water Resource District office.

Thank You!!



- Comment sheets available at the public meeting on March 28th and on PCWRD website.
- Map of watershed is provided on the reverse side.
- Submit comments by April 26th, 2024.