



TECHNICAL MEMORANDUM

TO: Bart Chapman, Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP)
Leonard Massie, Dane County Drainage Board

FROM: Bill Kasch, SEH

DATE: June 10, 2021

RE: CTH AB Interchange – Drainage Impact to Door Creek

Introduction

The Wisconsin Department of Transportation (WisDOT) is planning improvements along United States Highway (USH) 12/18 at Millpond Road and County Trunk Highway (CTH) AB in Dane County. The project proposes to remove the two hazardous at-grade intersections along USH 12/18 and construct a diamond interchange at CTH AB on new alignment with new frontage roads for Millpond Road and Long Drive that extended easterly to CTH AB. Roundabouts will be constructed at the interchange ramp terminals. A project overview map is included as Attachment A.

At a recent meeting between WisDOT, DATCP, and the Dane County Drainage Board, a project overview and drainage patterns were presented. The project area draining to Door Creek will be treated by wet ponds and infiltration basins. The project will reduce peak discharges for the 2-, 10-, 25-, and 100-year design storm events. In addition, total suspended solids (TSS) and total phosphorus (TP) will be reduced by 80% and 55.5%, respectively.

At the meeting, it was stated that flow duration was also a concern. Detention ponds can potentially have extended flow durations following a storm event. For field crops, excess water in the root zone needs to be removed within 24-hours. Per drainage code, drainage boards need to provide DATCP information pertaining to the 10-year and 25-year design storms. The purpose of this technical memorandum is to present project impacts to Door Creek, including peak discharge, flow duration, and water surface elevations for the 10-year and 25-year design storms.

Overall Drainage Patterns

Existing drainage patterns to Door Creek are shown in Sheets 9 to 11 in Attachment B. Drainage Areas labelled C27 and C28 drain to swales on the north and south side of Highway 12/18 before discharging to Door Creek. Proposed drainage patterns are shown in Sheets 20 to 22 in Attachment B. Drainage Areas C5-D and C27-A drain to Pond C, a combination wet pond and

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infiltration basin. Pond C, along with drainage areas C27-B1, C27-B2, and C27-C drain to a swale on the north side of Highway 12/18 before discharging to Door Creek. C28-A and C28-B drain to Pond D, a combination wet pond and infiltration basin. Pond D, along with C28-C1 and C28-C2, drain to a swale on the south side of USH 12/18 before discharging to Door Creek.

Peak Discharge Comparison

Ponds C and D are designed to reduce peak discharges for the 2- through 100-year design storm events. Total peak discharge to Door Creek from the project area is summarized for existing and proposed conditions in Table 1 below:

Table 1 – Comparison of Peak Discharges to Door Creek

| Design Storm Event | Peak Discharges (cfs) | |
|--------------------|-----------------------|---------------------|
| | Existing Conditions | Proposed Conditions |
| 2-year | 12.5 | 6.03 |
| 10-year | 32.6 | 22.0 |
| 25-year | 49.8 | 31.7 |
| 100-year | 83.6 | 51.2 |

Flow Duration Comparison

Hydrographs comparing existing and proposed conditions are shown in Figures 1 and 2 below. Figure 1 shows discharges to the north side of a 12 ft x 8 ft box culvert under USH 12/18.

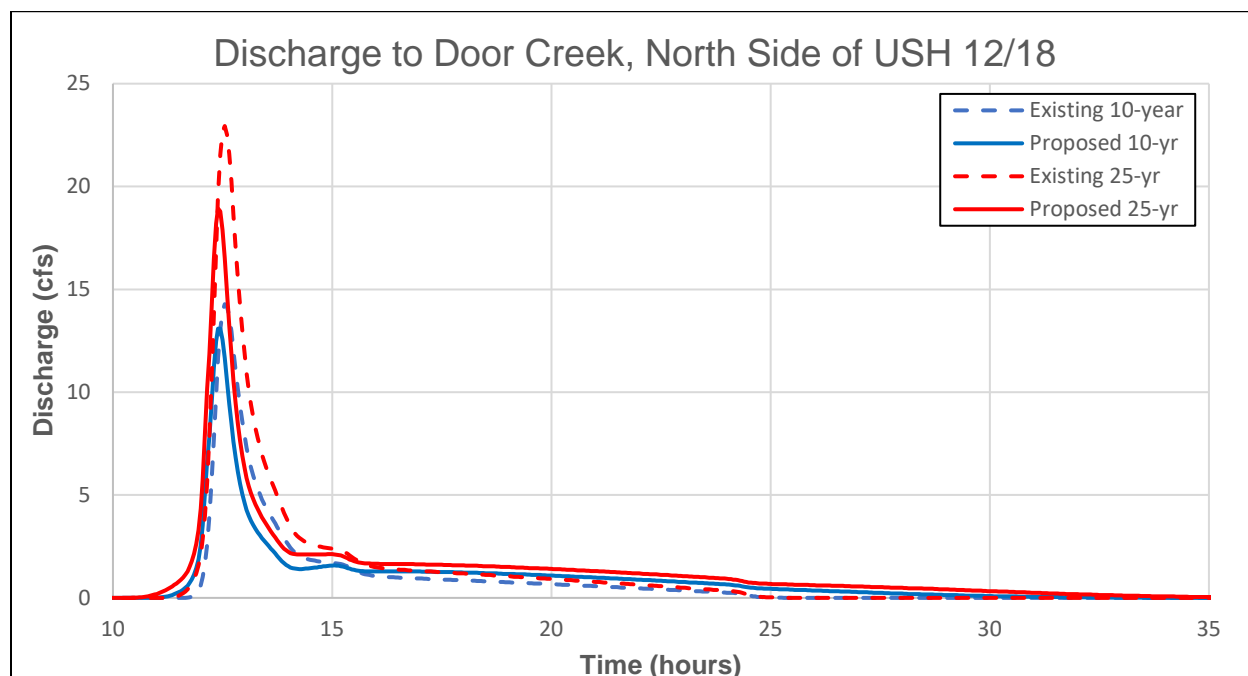


Figure 1 – Hydrographs to North Side of 12 ft x 8 ft Box Culvert

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Discharges for the 10-year and 25-year design storm event are lower when comparing proposed to existing conditions until approximately 15.6 hours. After 15.6 hours, the proposed discharge is at most 0.7 cfs greater than existing for the 25-year design storm event. At 34 hours (approximately 24 hours after runoff begins), discharges for the 10- and 25-year design storm are 0 and 0.07 cfs, respectively.

Figure 2 shows discharges to the south side of a 12 ft x 8 ft box culvert under USH 12/18. Similar to north side discharges, proposed discharges are less than existing discharges until approximately 15.5 hours into the design storm. The proposed discharge is greater than the existing discharge by at most 0.6 cfs for the 25-year storm.

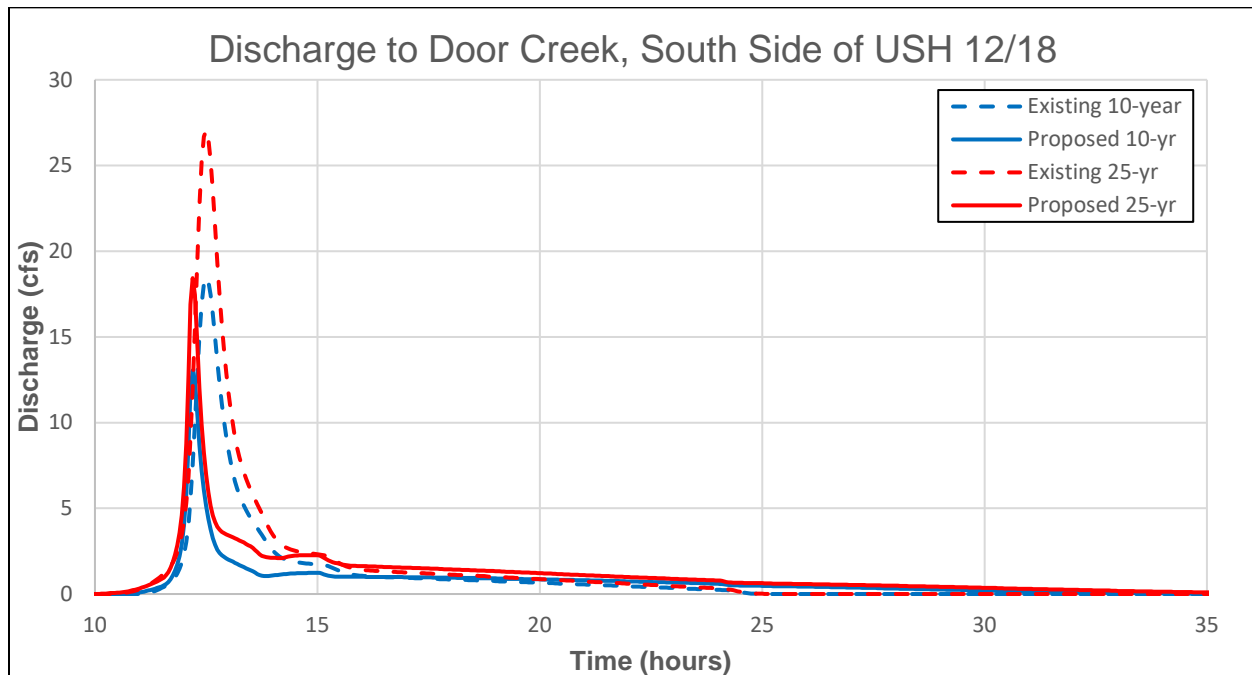


Figure 2 – Hydrographs to South Side of 12 ft x 8 ft Box Culvert

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The rating curve for the 12 ft x 8 ft box culvert is shown as Figure 3 below. At low flows, an increase in 0.6 cfs results in less than 0.002 feet of additional headwater for the 12 ft x 8 ft box culvert.

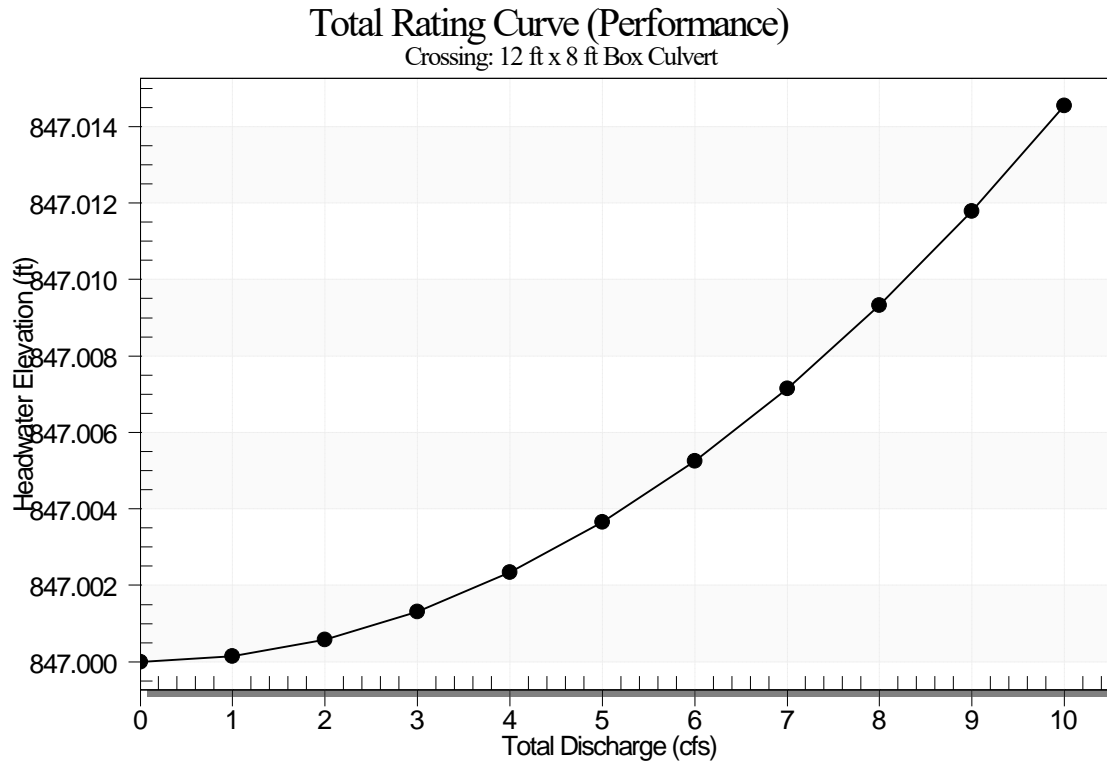


Figure 3 – 12 ft x 8 ft Box Culvert Rating Curve

Conclusion

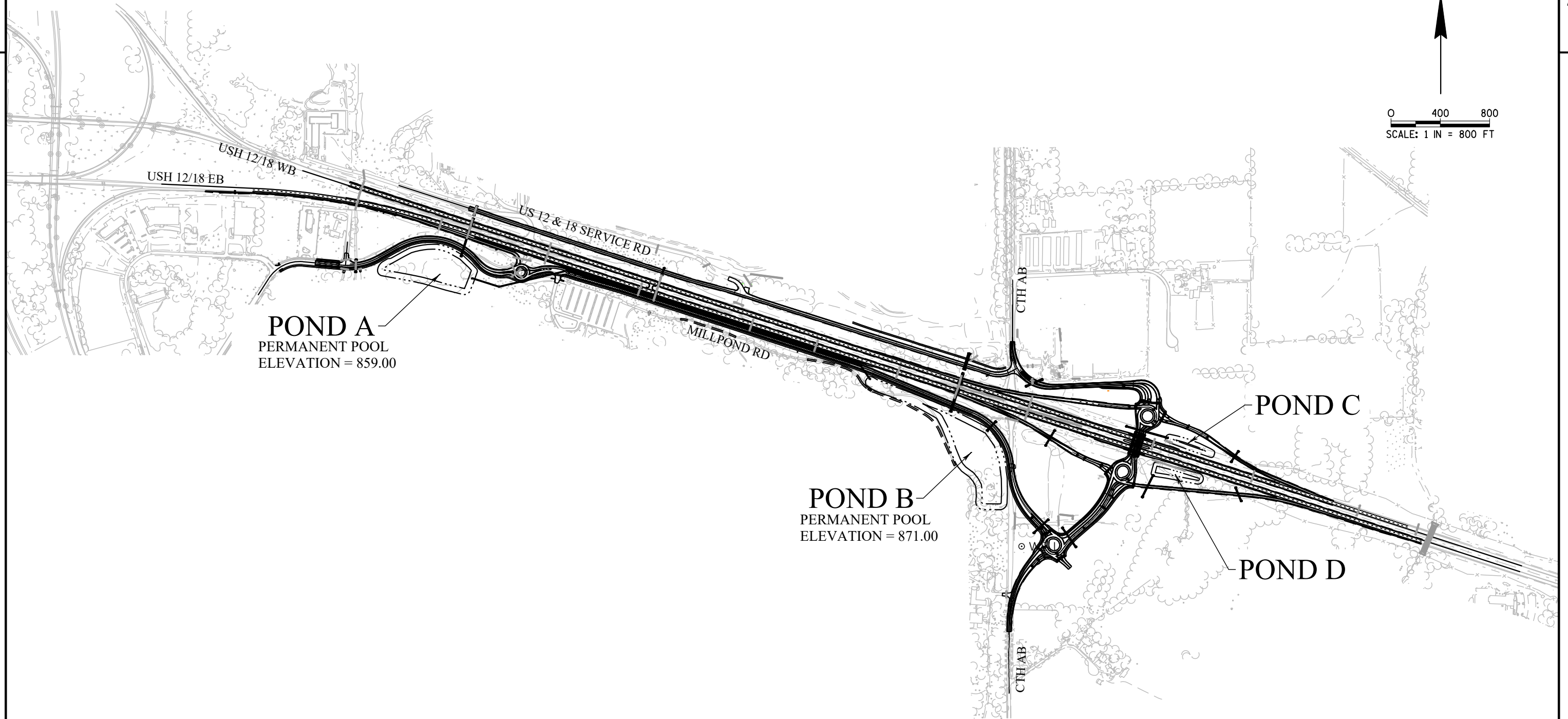
Peak discharges, flow durations, and headwater impacts to a 12 ft x 8 ft box culvert were analyzed for Door Creek. Proposed peak discharges are below the existing peak discharges for the 2-, 10-, 25-, and 100-year design storm events. Flow durations are extended for proposed conditions, but increases are less than 0.7 cfs when comparing post-project to existing conditions. Discharges fall to less than 0.2 cfs 24 hours after runoff is initiated. A 0.6 cfs increase in discharge to a 12 ft x 8 ft box culvert will result in a negligible increase in headwater.

Attachments

- Attachment A – Project Overview Map
- Attachment B - Existing and Proposed Drainage Maps

Attachment A

Project Overview



PROJECT NO: 3080-01-75/76

HWY: CTH AB

COUNTY: DANE

OVERVIEW

SHEET

1 OF 10

E

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LAYOUT NAME - Overview

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PLOT BY : SEH

PLOT NAME :

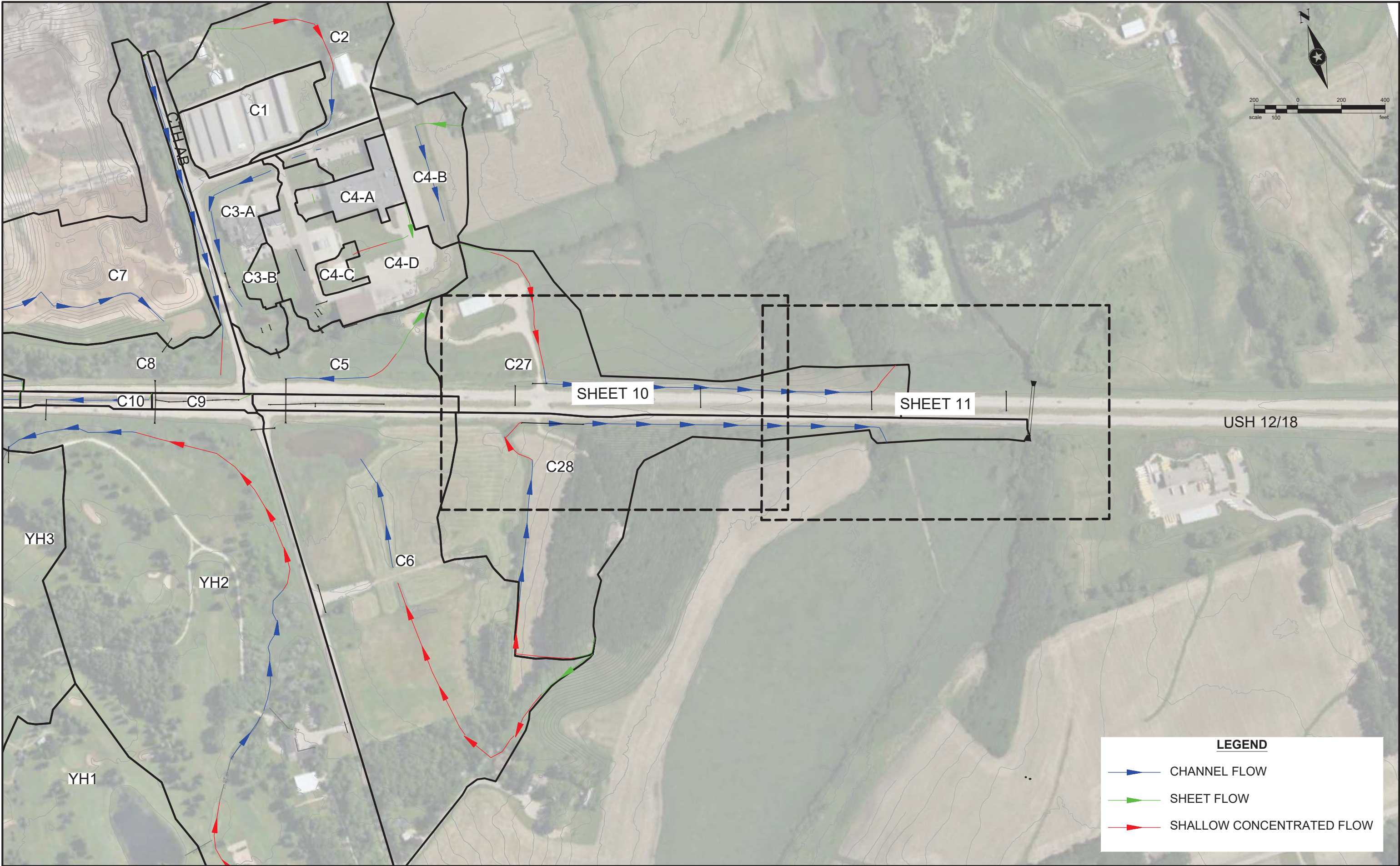
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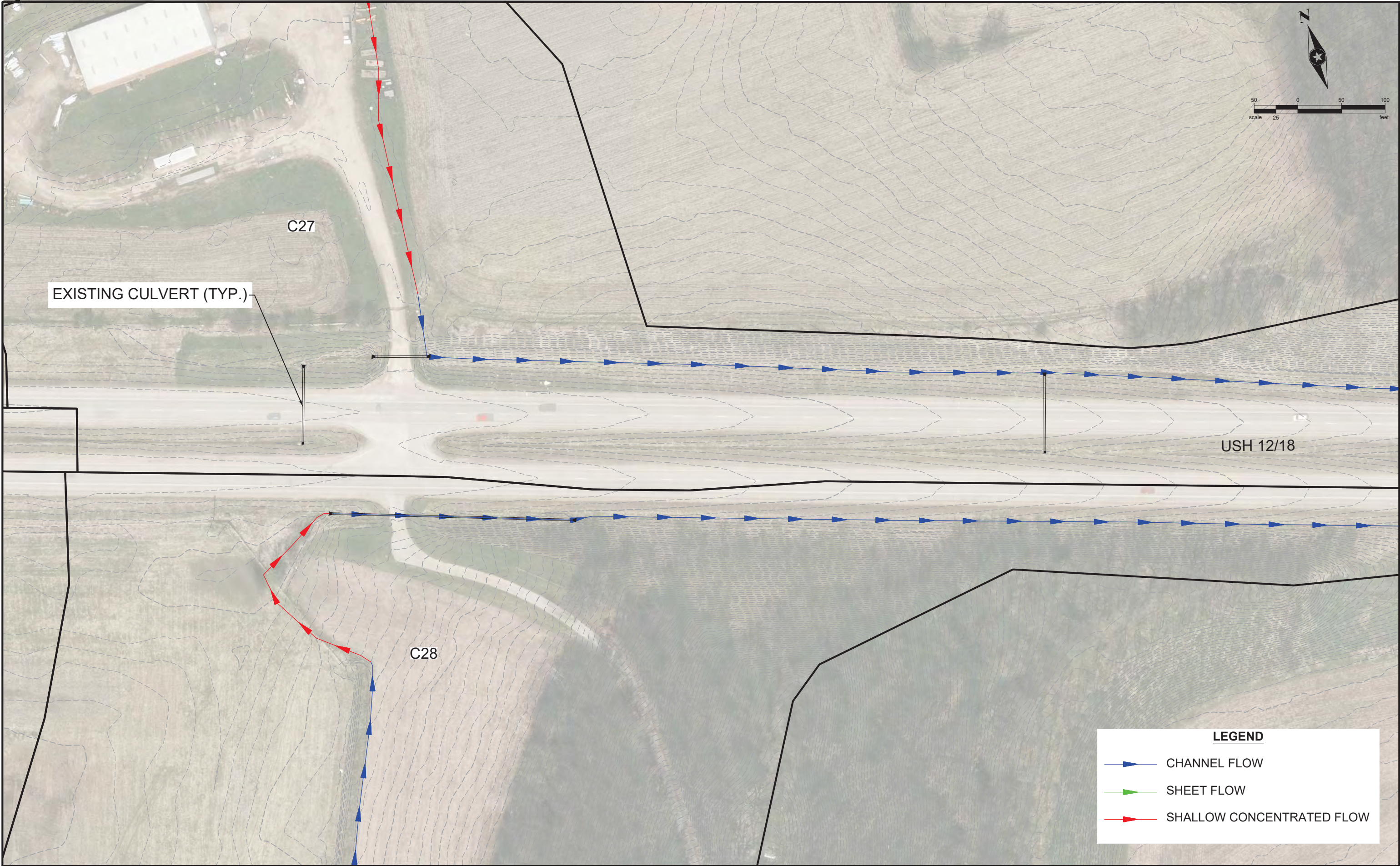
Attachment B

Existing and Proposed Drainage Maps

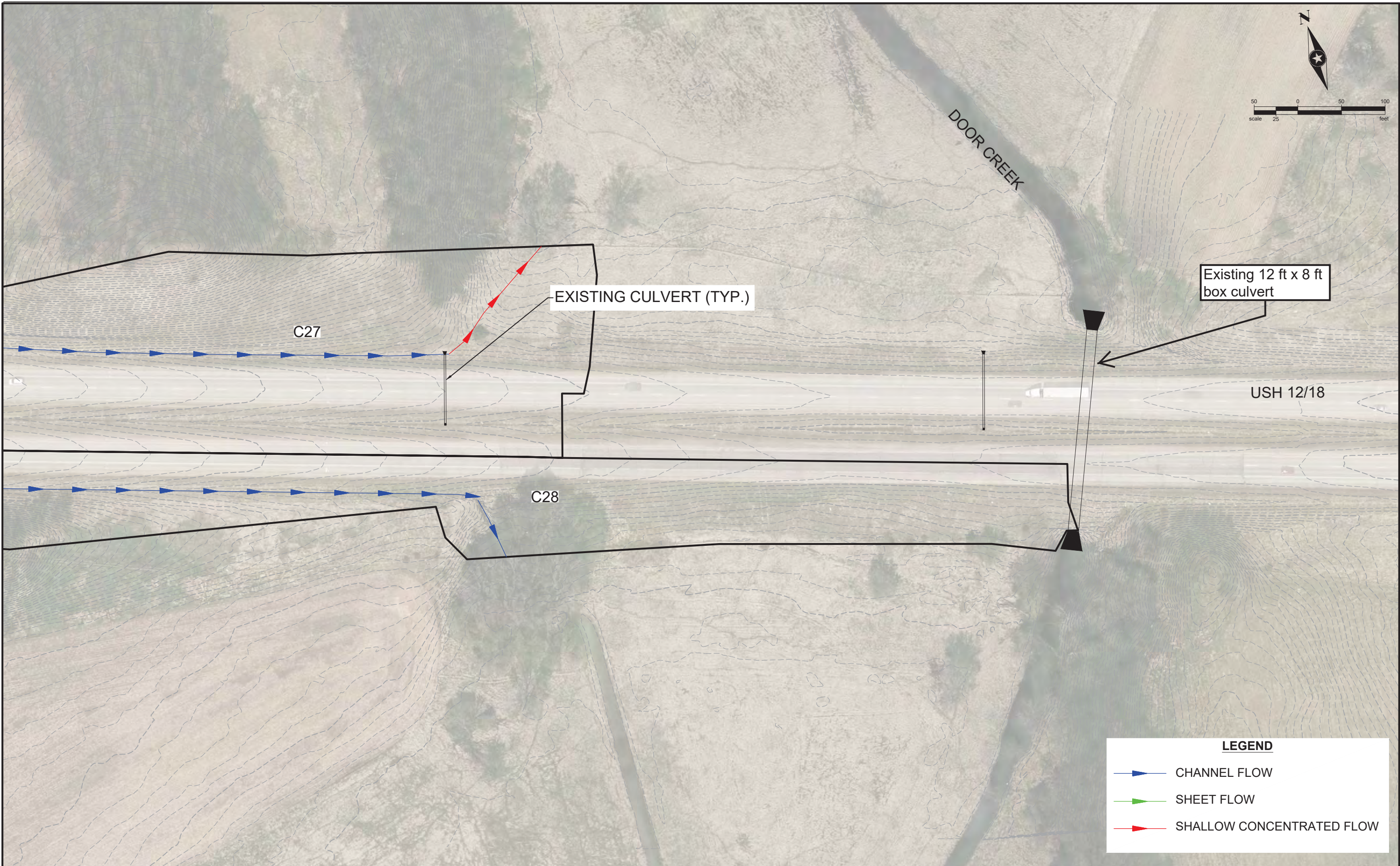
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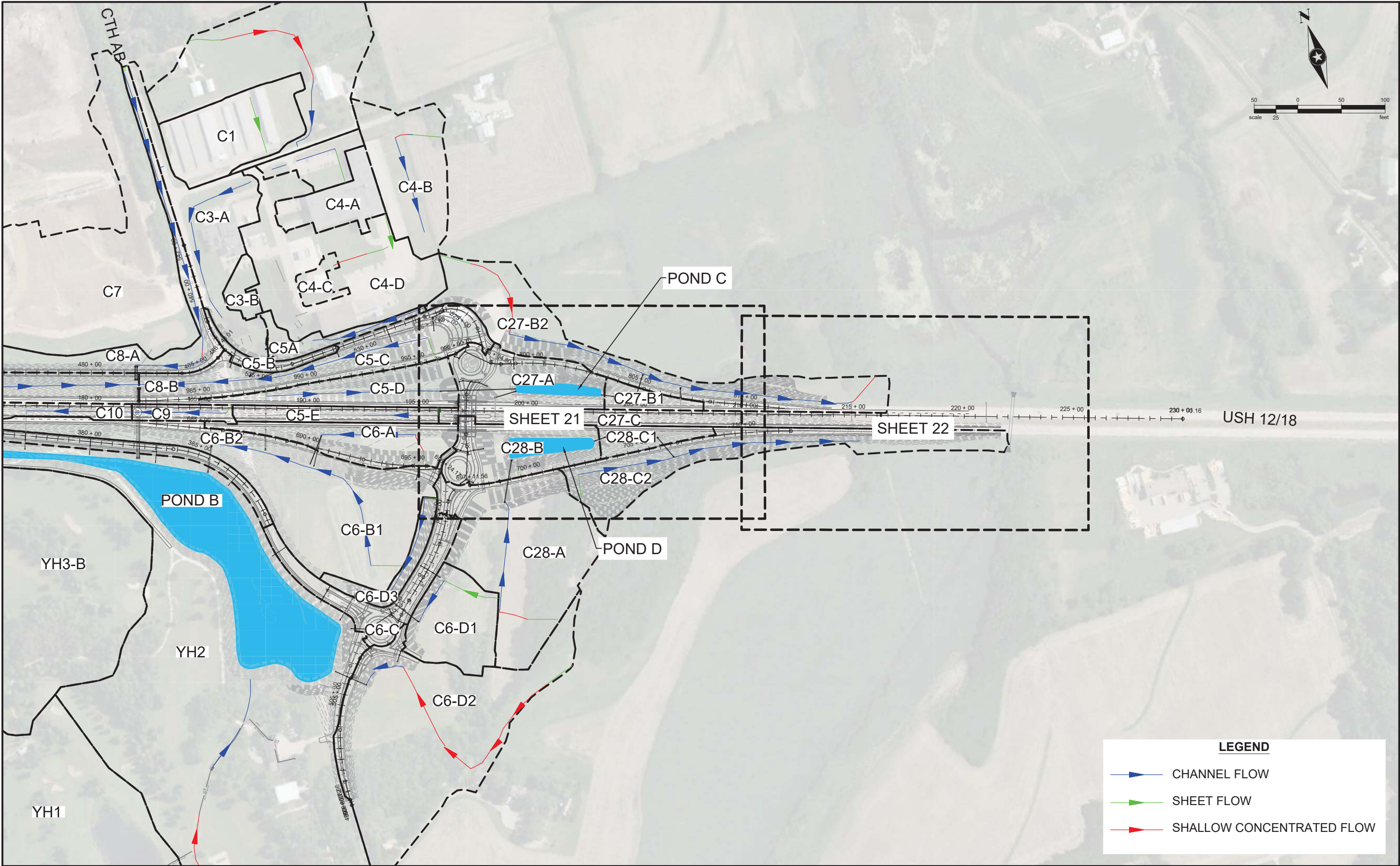
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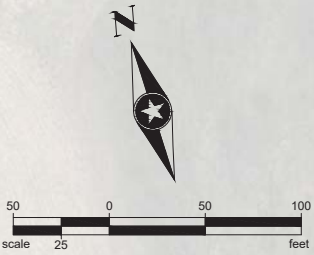
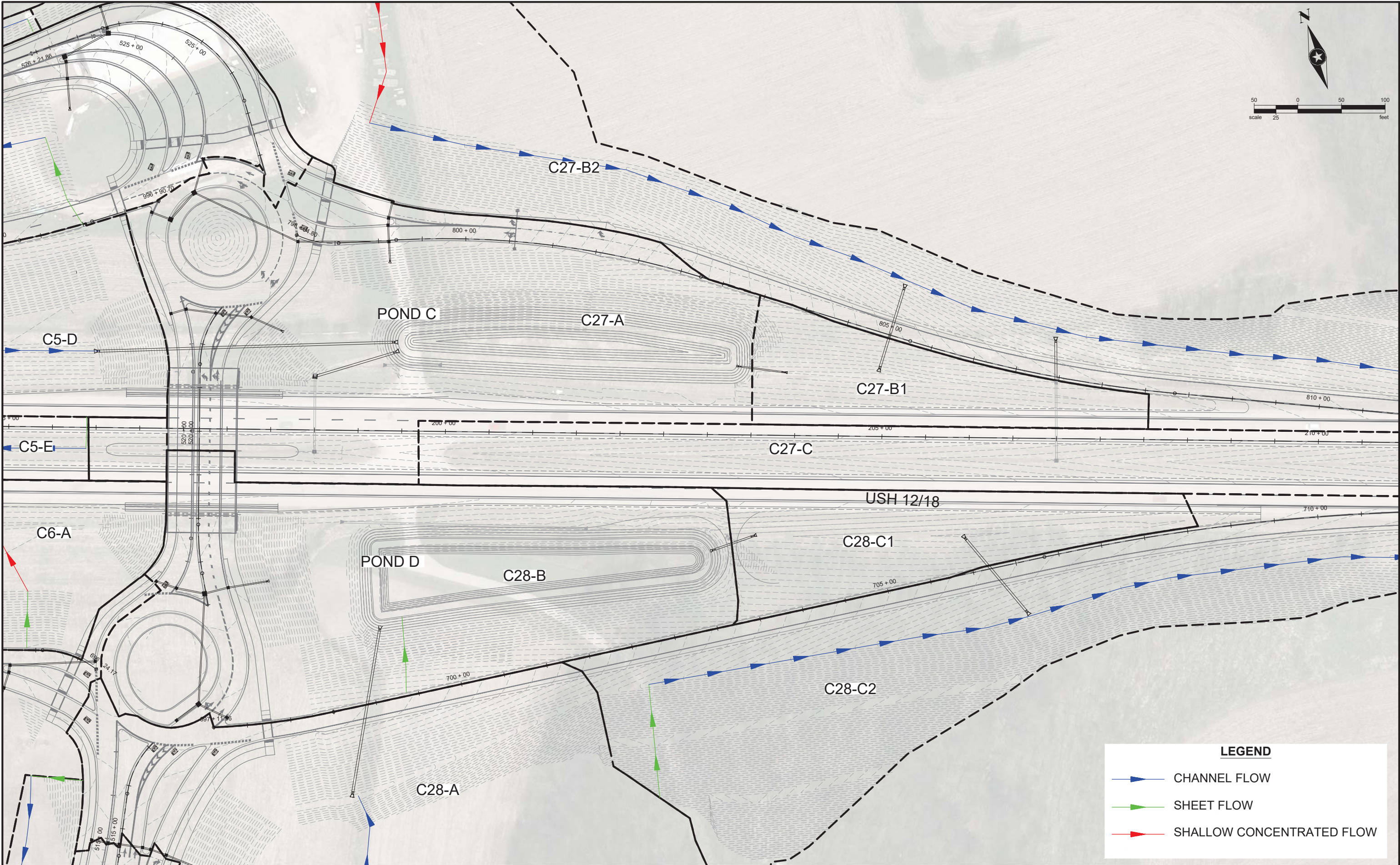
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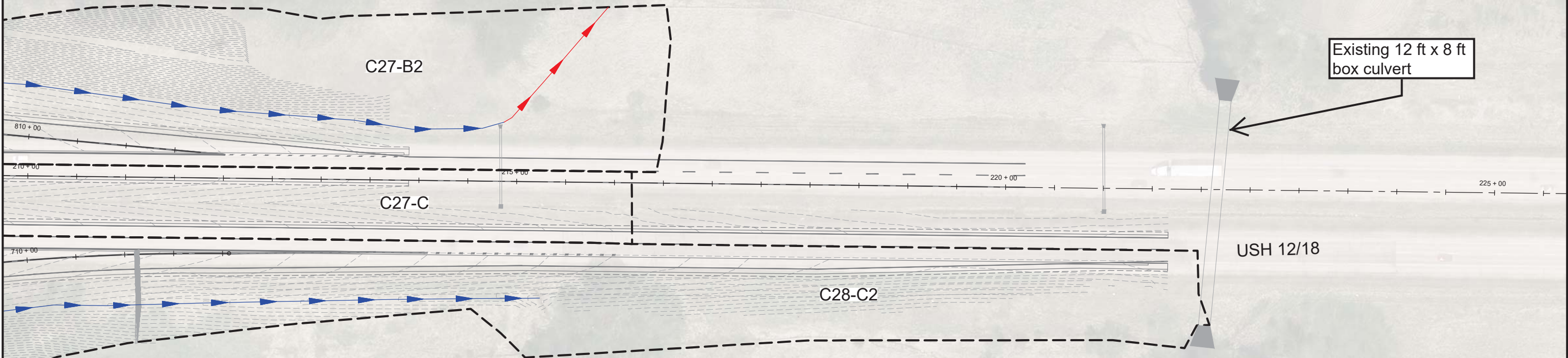
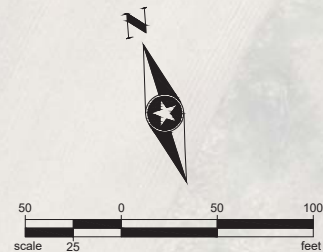


LEGEND

CHANNEL FLOW

SHEET FLOW

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Existing 12 ft x 8 ft
box culvert

USH 12/18

LEGEND

- CHANNEL FLOW
- SHEET FLOW
- SHALLOW CONCENTRATED FLOW