Properly Planning for Drainage

Decision Making in the Practical Design Era

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Engineers ■ Architects ■ Planners

Overview

1. 4-inch vs. 6-inch Curbs
2. Separating a Combined Sewer
3. Substandard Storm Sewer Outfalls
4. Drainage for DDIs
5. Regional Design Differences

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4-inch vs. 6-inch Curbs

4-inch vs. 6-inch Curbs in Limited Access Facilities

4-inch curb vs. 6-inch curb

- Have wide shoulders with curbed pavement
- Often spread not the limit, but rather depth below top of curb
- 4-inch curb is preferred, but there may be some flexibility to use 6" and therefore, fewer inlets

4-inch vs. 6-inch Curbs

Columbus Project: 6-inch curb

- There was not a history of flooding or high water
- Reduced the number of inlets needed
- Reduced construction time, cost

Akron Project: 4-inch curb

- There is a history of high water and flooding
- High water is a function of HGL issue in combined sewer
- Given these issues, it was felt that even though the issue is an HGL issue, reducing the number of inlets would not be appropriate, so 4-inch curb was used

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Combined Sewer: To Separate, or Not to Separate?

Is it Feasible to Separate a Combined Sewer?

Akron Project: Not Feasible!

- Over a mile beyond the project limits in every direction to make it to a water course of sufficient size to outlet a storm sewer
- A storm sewer would be competing with the combined sewer for the same vertical window to meet minimum grades
- Utility conflicts would be sizeable in every direction
- It was ultimately determined to stay connected to the combined sewer

Is it Feasible to Separate a Combined Sewer?

Cleveland Project: Feasible!

- Project was close to the Cuyahoga River
- An adjacent project had already separated and its outfall passed through the project limits
- There was adequate capacity in the new outfall to accommodate the project
- Had to provide a BMP to meet L&D requirements

Is it Feasible to Separate a Combined Sewer?

Cleveland Project: Feasible!

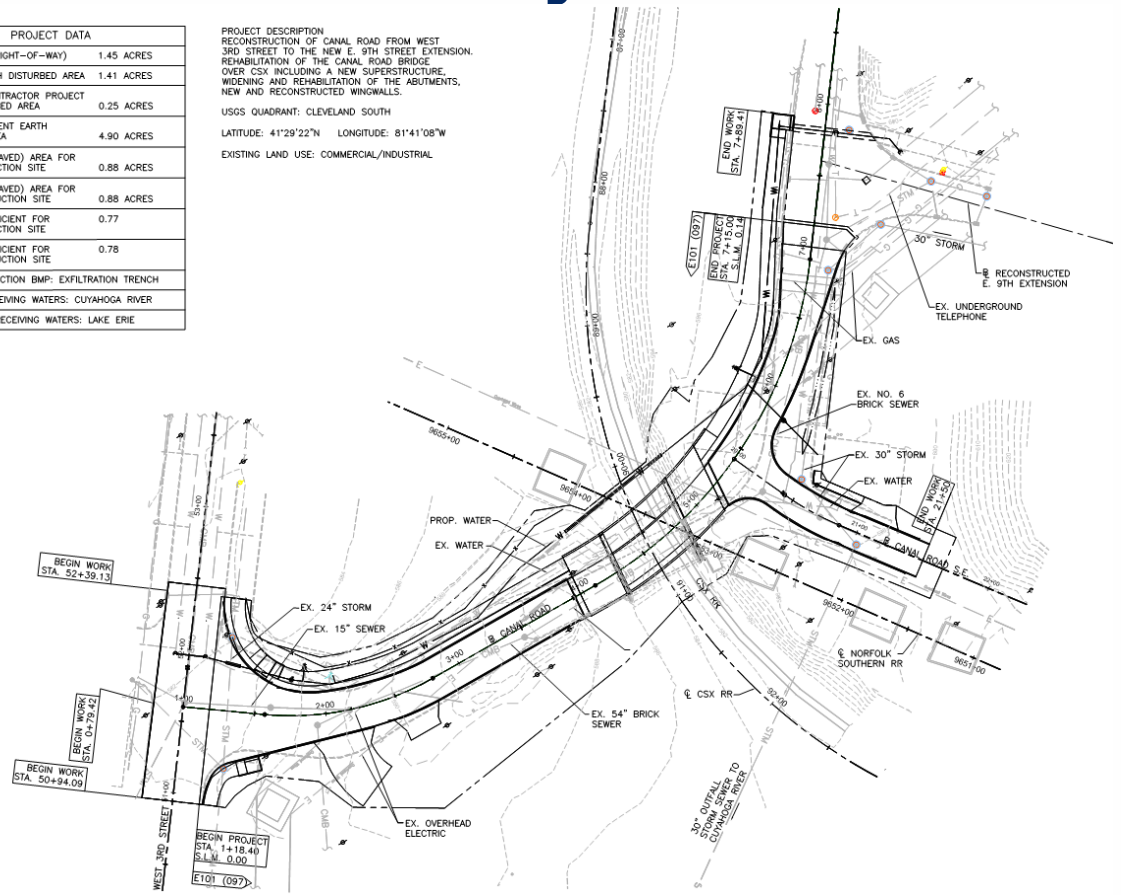
PROJECT DATA	
TOTAL AREA (RIGHT-OF-WAY)	1.45 ACRES
PROJECT EARTH DISTURBED AREA	1.41 ACRES
ESTIMATED CONTRACTOR PROJECT EARTH DISTURBED AREA	0.25 ACRES
NOTICE OF INTENT EARTH DISTURBED AREA	4.90 ACRES
IMPERVIOUS (PAVED) AREA FOR PRE-CONSTRUCTION SITE	0.88 ACRES
IMPERVIOUS (PAVED) AREA FOR POST-CONSTRUCTION SITE	0.88 ACRES
RUNOFF COEFFICIENT FOR PRE-CONSTRUCTION SITE	0.77
RUNOFF COEFFICIENT FOR POST-CONSTRUCTION SITE	0.78
POST CONSTRUCTION BMP: EXFILTRATION TRENCH	
IMMEDIATE RECEIVING WATERS: CUYAHOGA RIVER	
SUBSEQUENT RECEIVING WATERS: LAKE ERIE	

PROJECT DESCRIPTION
RECONSTRUCTION OF CANAL ROAD FROM WEST 3RD STREET TO THE NEW E. 9TH STREET EXTENSION. REHABILITATION OF THE CANAL ROAD BRIDGE OVER CSX INCLUDING A NEW SUPERSTRUCTURE, WIDENING AND REHABILITATION OF THE ABUTMENTS, NEW AND RECONSTRUCTED WINGWALLS.

USGS QUADRANT: CLEVELAND SOUTH

LATITUDE: 41°29'22"N LONGITUDE: 81°41'08"W

EXISTING LAND USE: COMMERCIAL/INDUSTRIAL



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3

Outfalls

Standard Outfalls on Local Project

Non-LA drainage systems come into being by many different avenues:

- Added by a property owner with no engineered design
- Designed with less conservative criteria in the past

Standard Outfalls on Local Project

Examples of substandard outfalls:

- 36-inch culvert outlet to a ditch and that ditch was closed in by dual 12-inch pipes that the owner built a garage over
- Box culvert and the downstream culvert on private property was a 24-inch

Standard Outfalls on Local Project

What do you do?

- Make the client aware of the issue
- Can downstream improvements be made?
- Is detention an option?
- Is there a future project that is planned to address the issue?
- Can you route the flow differently?

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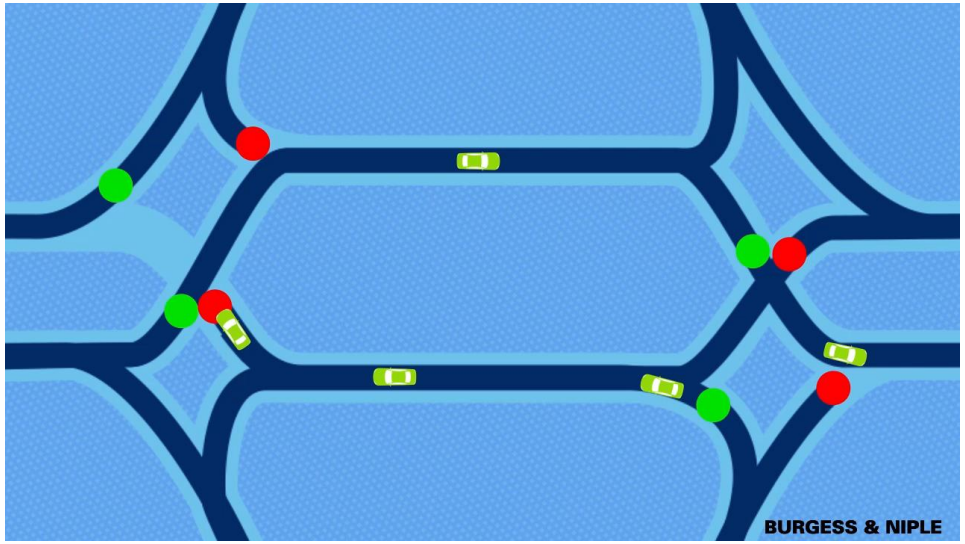
Drainage Design for DDIs

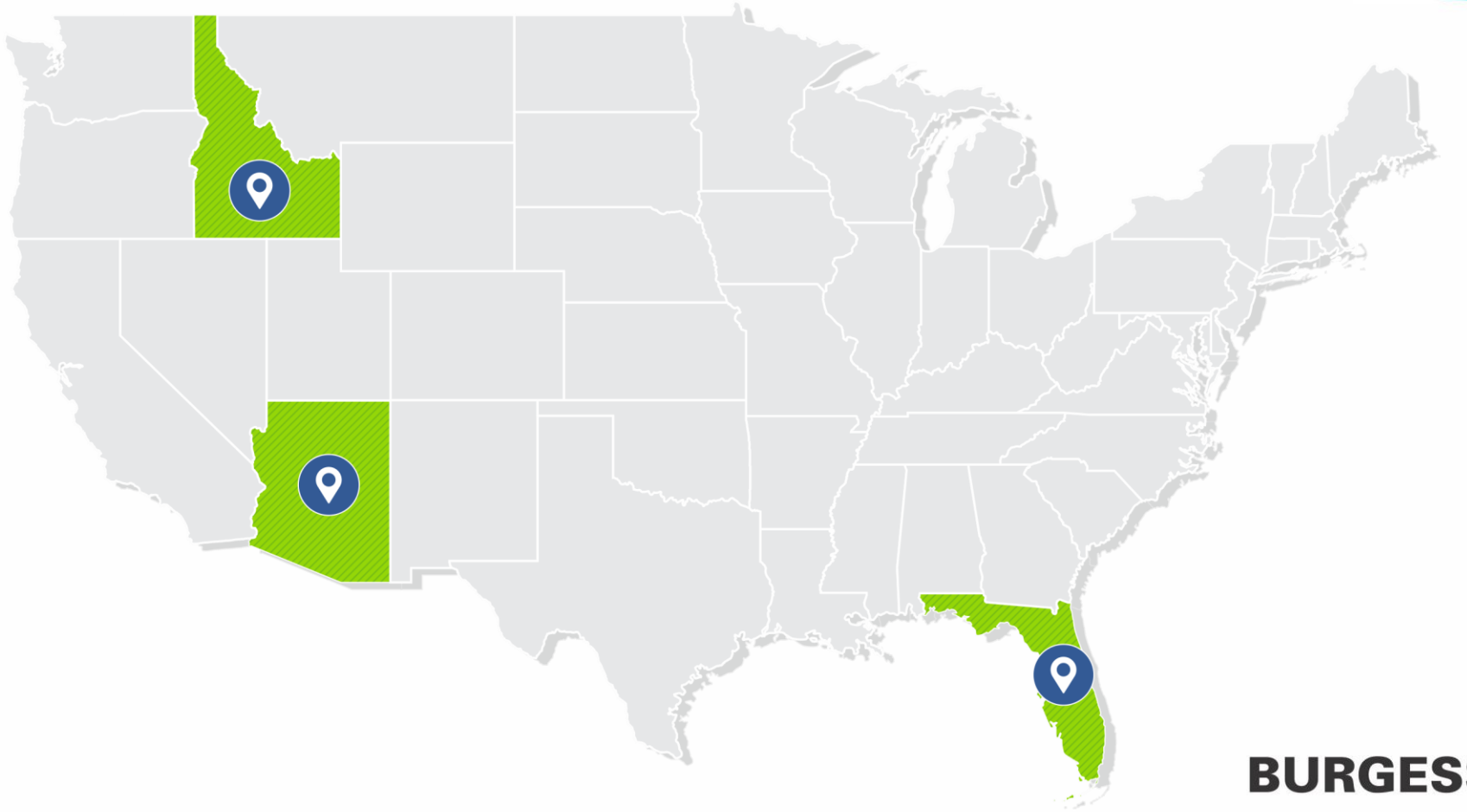
Diverging Diamond Interchanges (DDIs)

- Geometrics of DDI require unfamiliar maneuvering
- Long splitter islands
- Pick up the water at any super or cross slope transition
- Snow melt



Design Differences Around the Country

Design Differences Around the Country



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Design Differences Around the Country

Florida

- Very flat ditch grades
- Inlet spacing based on constant intensity (4 inches per hour)
- Two feet/second velocity on sewers
- Very strict permit process
- Much higher rainfall intensity

Design Differences Around the Country

Arizona

- Less frequent rain events
- Emphasis on retaining/infiltrating water rather than conveying
- Conveyance routed to washes

Design Differences Around the Country

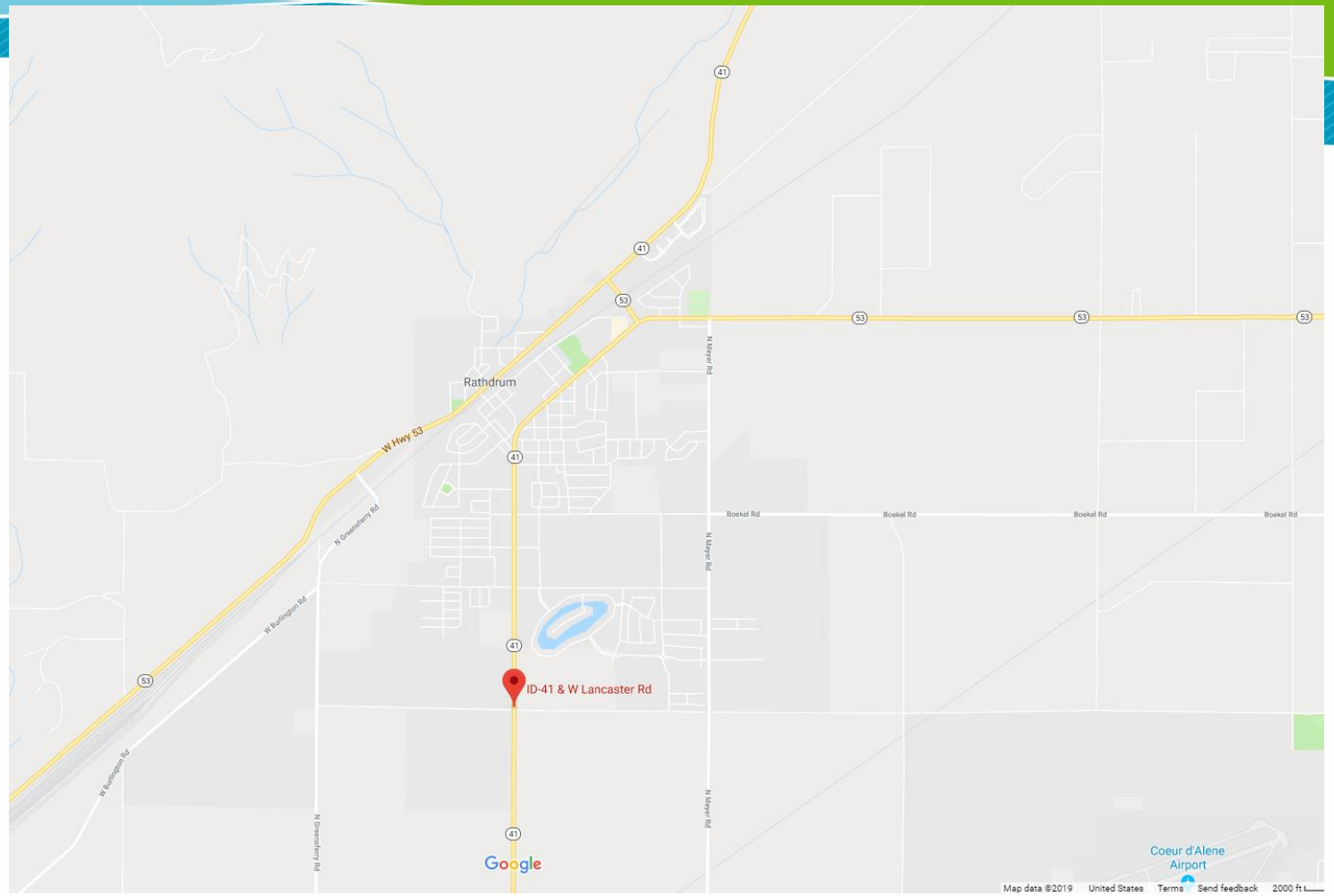
Idaho

- Extreme variability across the state
- Worked on a project where the infiltration rate was over **300 inches per hour**. *(That is not a typo!)*
- Aquifer dependent

Design Differences Around the Country

Idaho

- Infiltration wells
- Disappearing surface water



Map Data: © 2019 Google

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Questions?

Thank You!