Final Presentation

McConnell Dr. and Pine Knoll Dr. Roundabout Design

BETR Engineering
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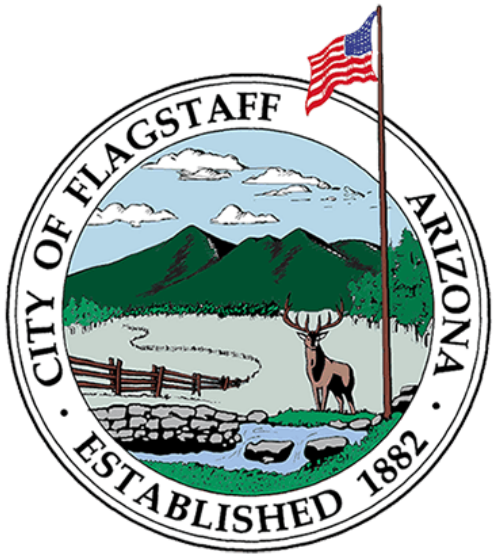
BETR engineering

Introduction

- Background
  - Focus on intersection and effects on I-17 ramp
- Purpose
  - Alleviate congestion at Pine Knoll Dr. and McConnell Dr.
- Client
  - Nate Reisner, ADOT
  - Stakeholders
    - NAU
    - NAIPTA
    - City of Flagstaff

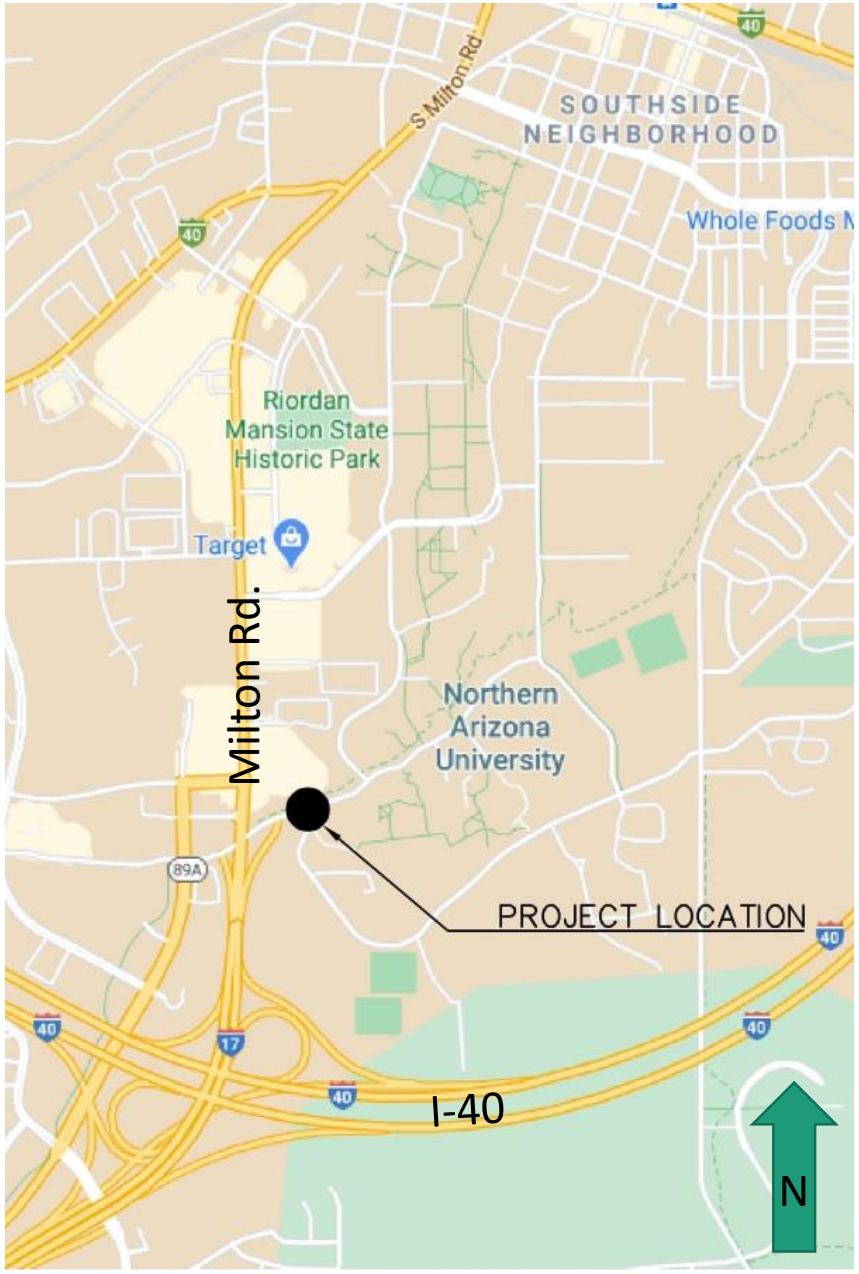
Northern Arizona Intergovernmental Public Transportation Authority, *NAIPTA Logo*. 2017.

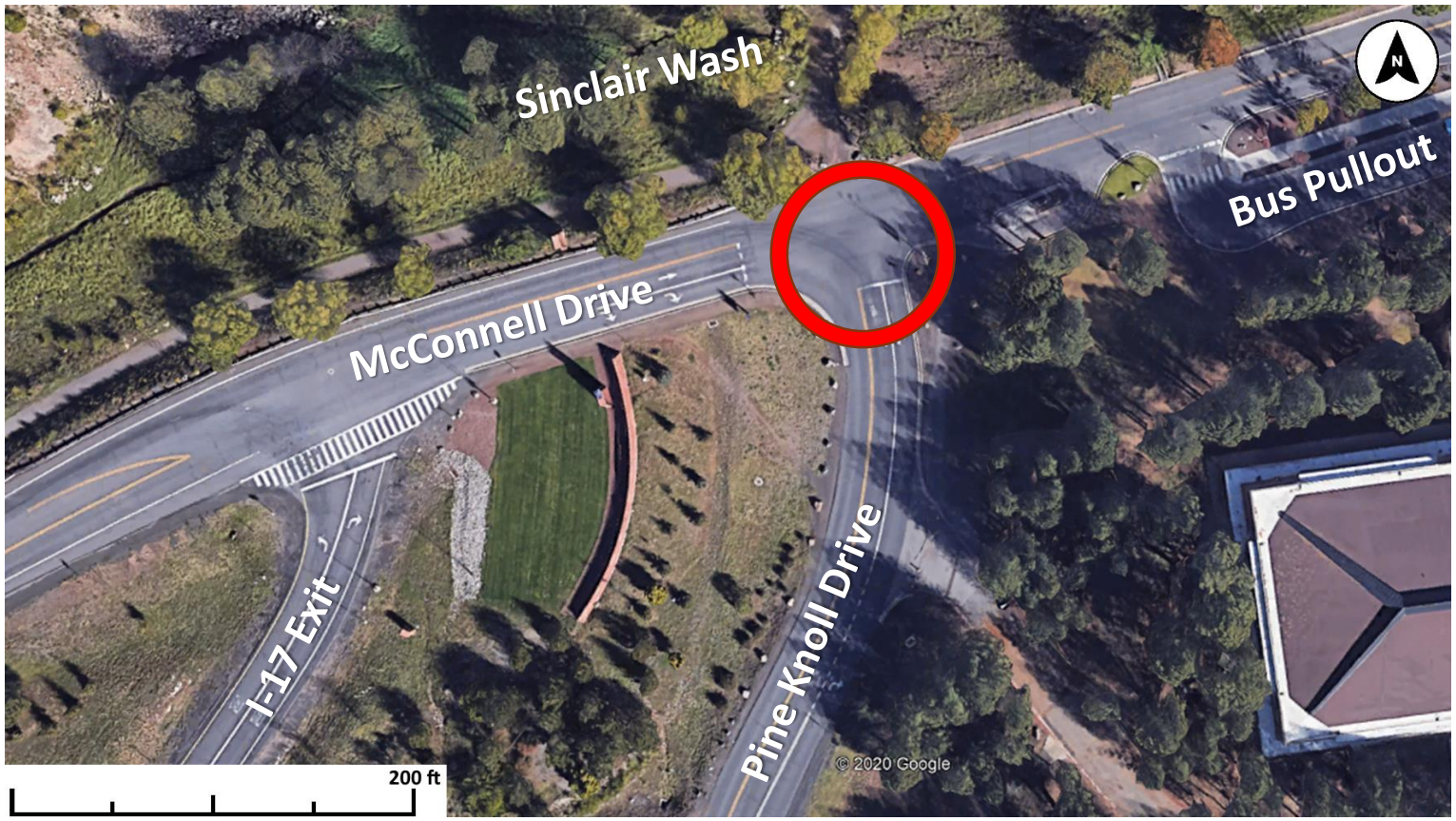


City of Flagstaff, *City of Flagstaff Crest*. 2020.

Arizona Department of Transportation, *ADOT Logo*. 2017.

Northern Arizona University, *NAU Logo*. 2020.


SOUTHSIDE NEIGHBORHOOD
S Milton Rd
Whole Foods M
Riordan Mansion State Historic Park
Target
Milton Rd.
Northern Arizona University
PROJECT LOCATION
I-40
N


Sinclair Wash
Bus Pullout
McConnell Drive
I-17 Exit
Pine Knoll Drive
200 ft
© 2020 Google

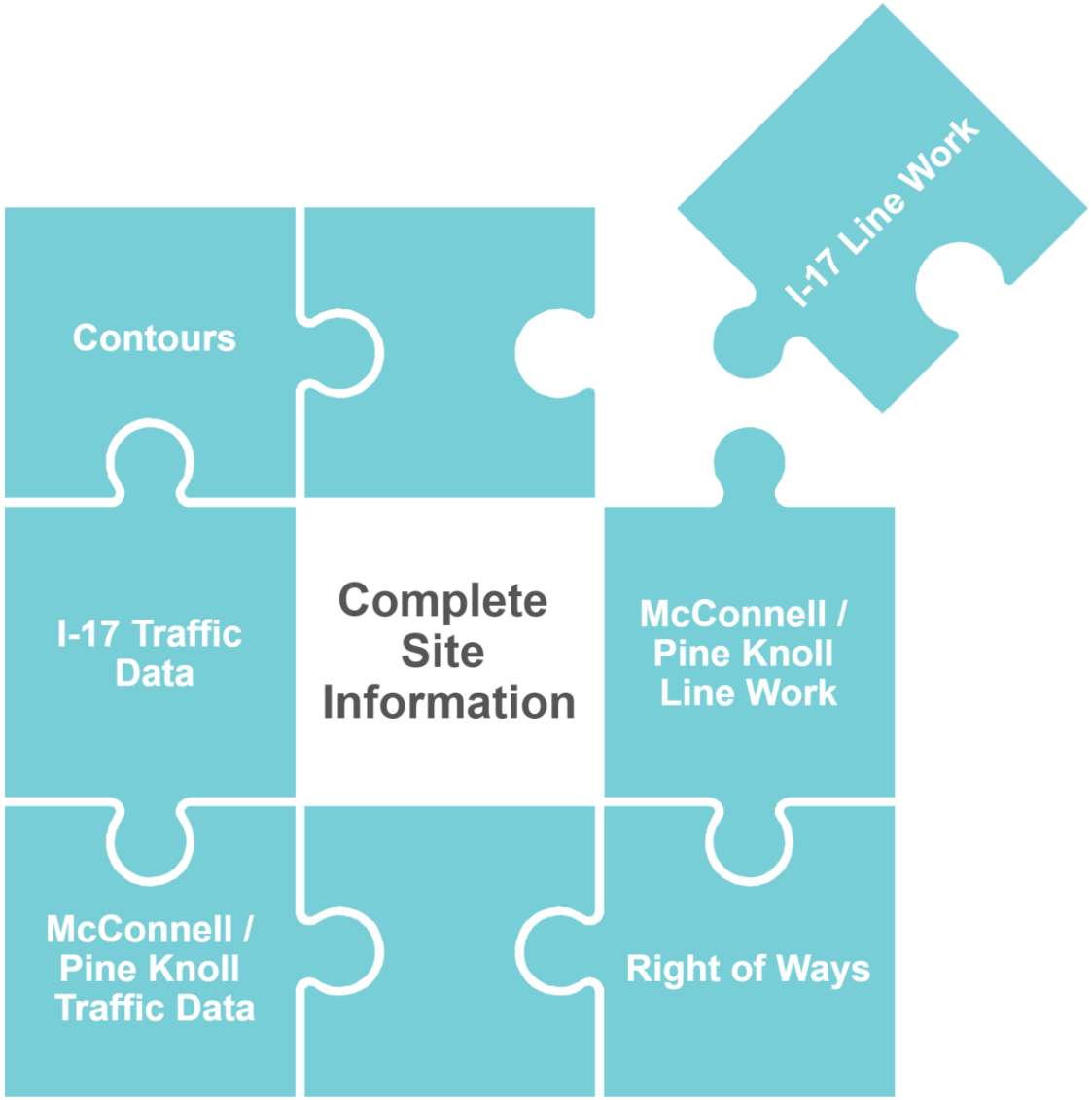
Location

Tasks

- Task 1: Examine Existing Data
- Task 2: Site Investigation
- Task 3: Existing Site Design
- Task 4: Roundabout Design and Check
- Task 5: Signage and Striping
- Task 6: Temporary Traffic Control
- Task 7: Plan Set Production
- Task 8: Drainage Analysis
- Task 9: Traffic Analysis
- Task 10: Evaluate Project Impacts
- Task 11: Project Submittals
- Task 12: Project Management

Examine Existing Data

- Traffic Data
  - City of Flagstaff
- Site Features
  - City of Flagstaff ArcMap database and NAU area
- Right of Ways
  - Coconino County Assessor's office
  - NAU and State of Arizona properties



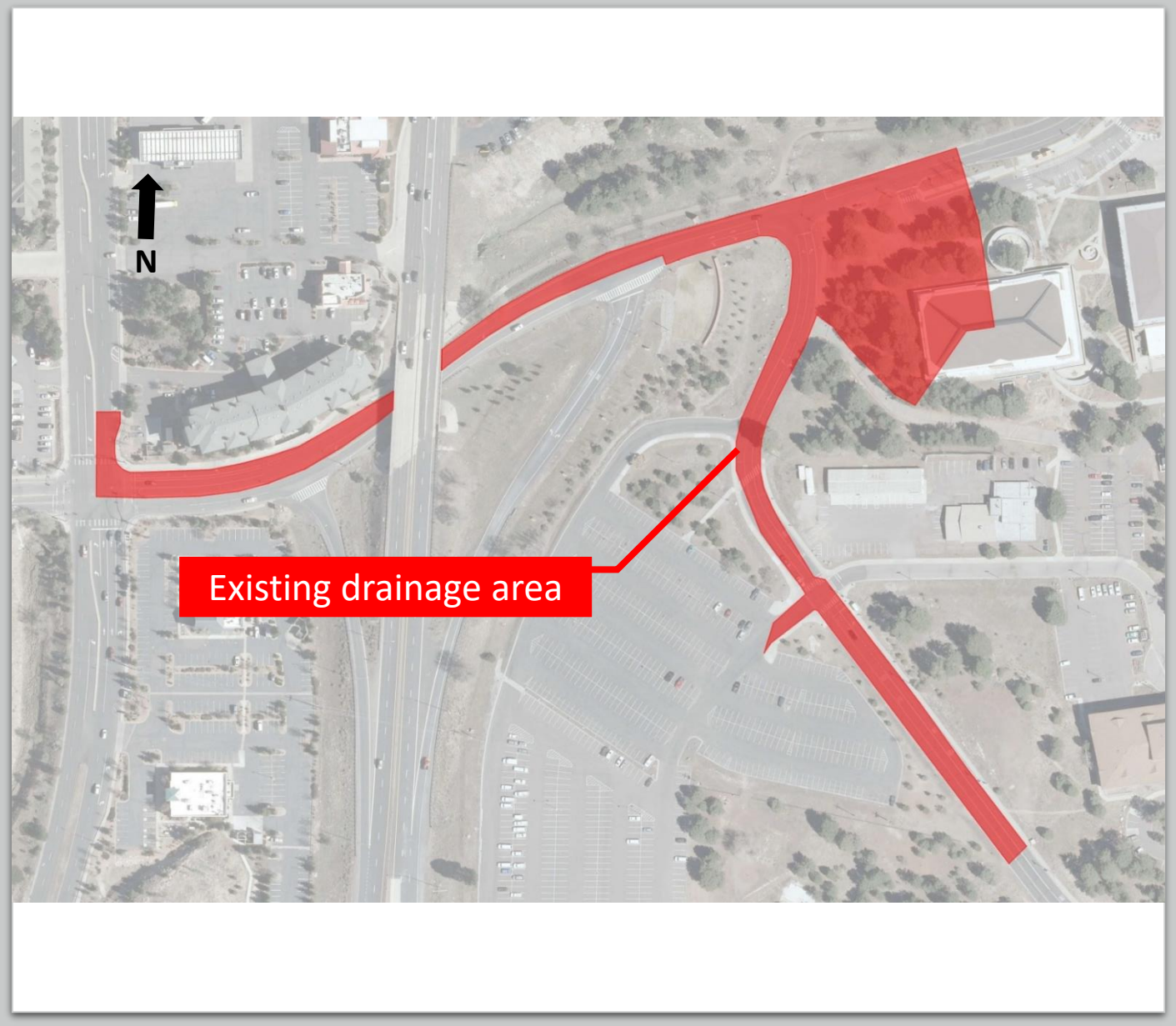
Site Investigation

Existing Site Conditions

- Existing elements of the roadway
- New roadway features

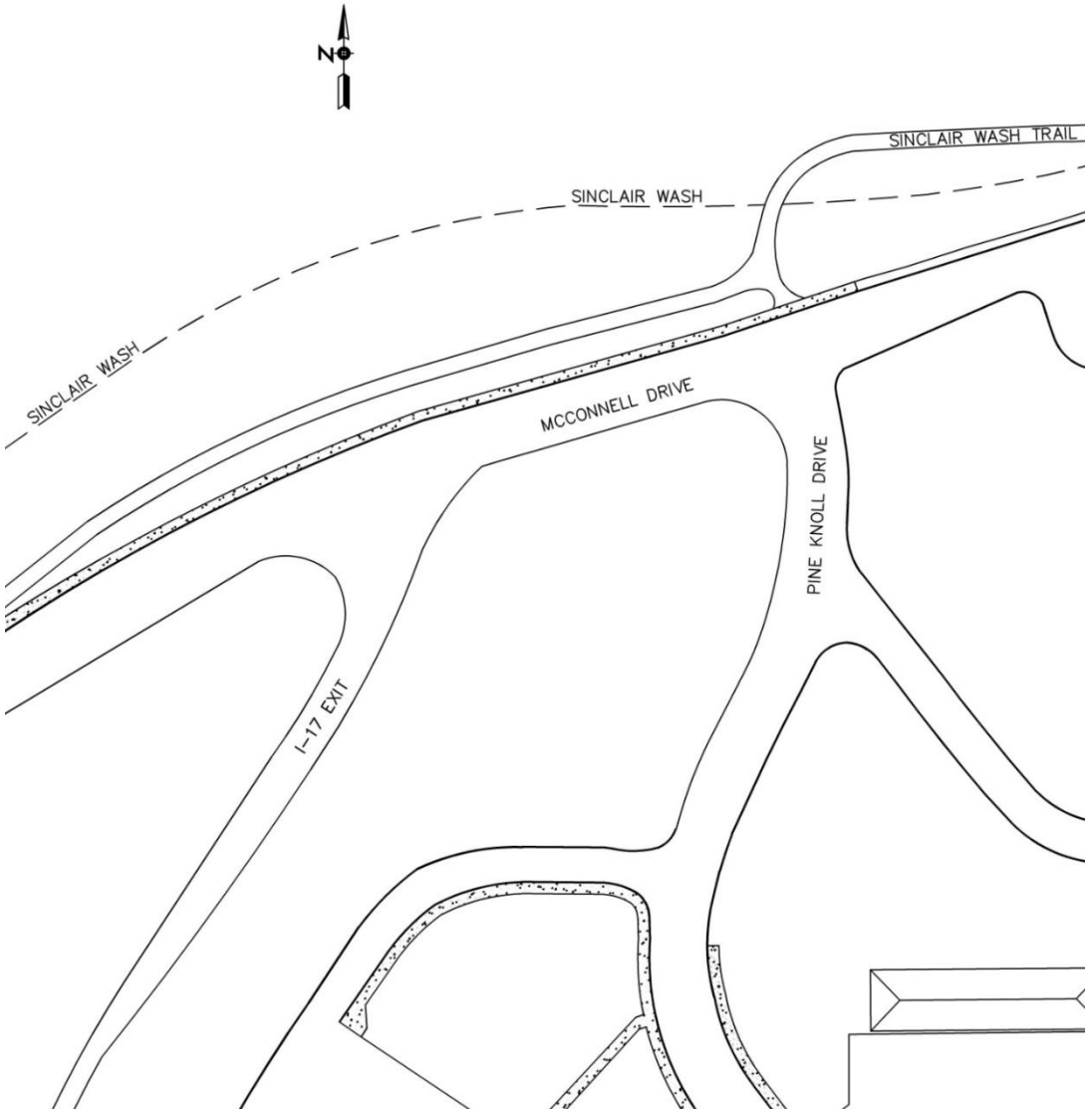
Drainage Map

- Drainage observed during rainstorm
- Approximate drainage areas and drainage outlet



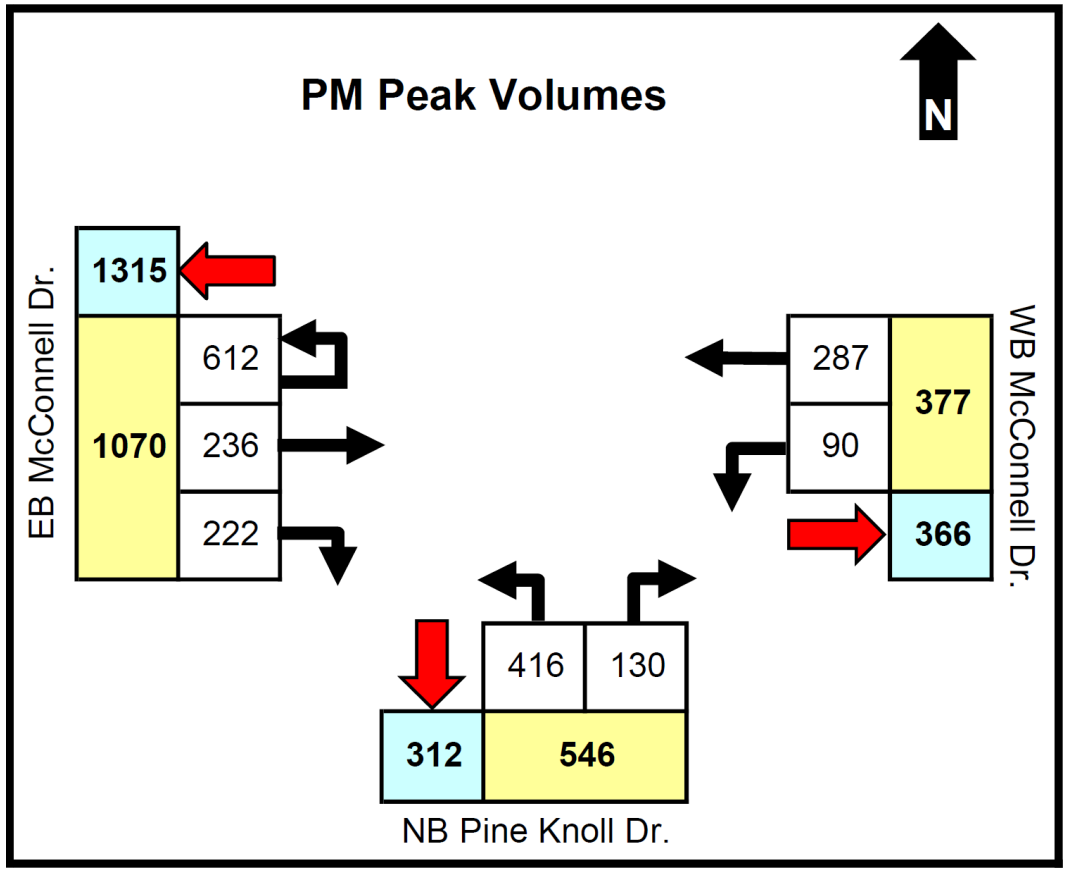
Existing Site Map

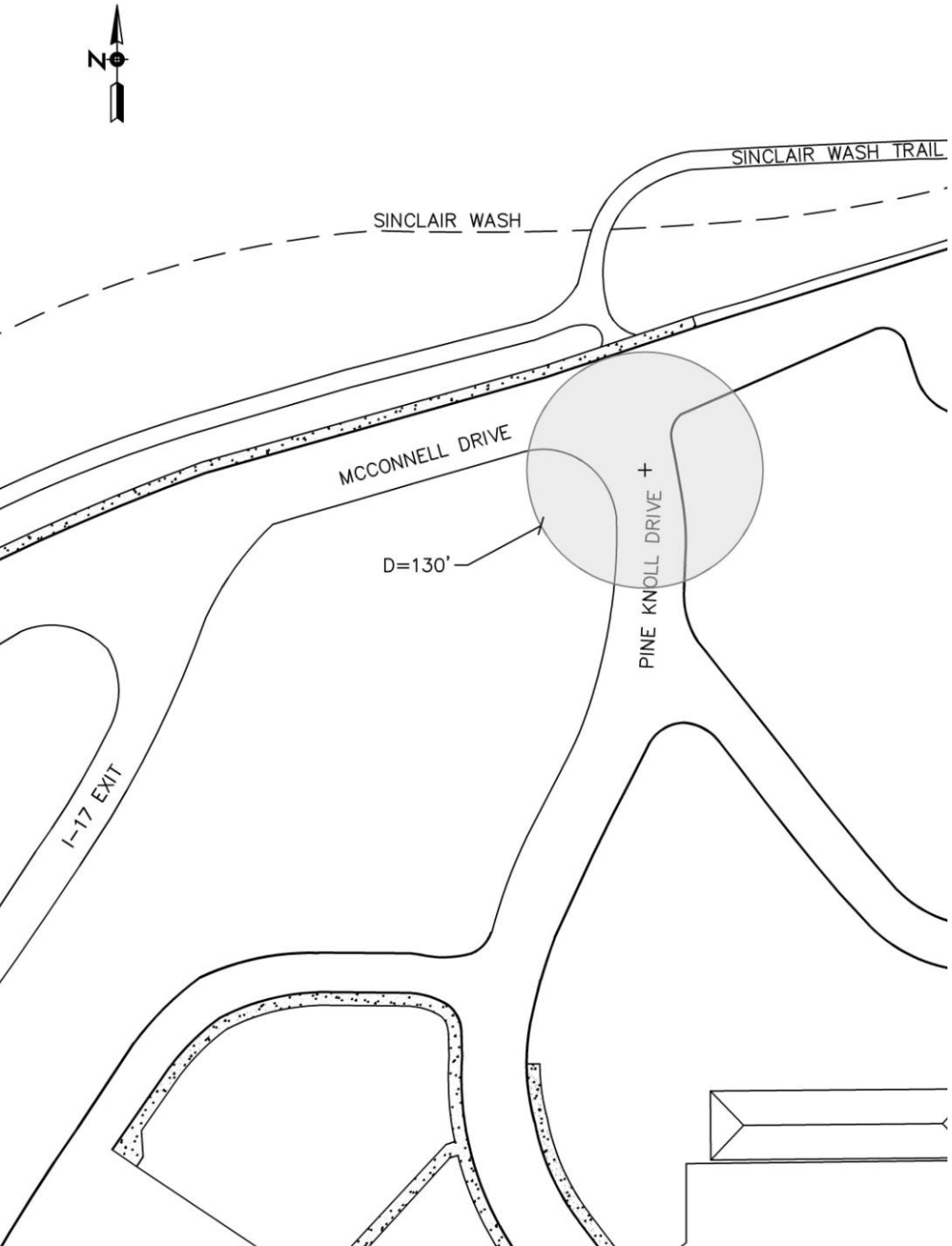
- Majority of linework for intersection area came directly from NAU
- Linework for west of intersection was approximated from aerial image and/or site investigation
- Ground contour data came from the City of Flagstaff GIS data



Traffic Data Manipulation

- Creation of turning movement counts and growing traffic volumes
  - I-17 turning movements added to McConnell Dr./Pine Knoll Dr. roundabout volumes
  - 0.8% Growth rate
    - Calculated from 2007 and 2019 AADT data for area





Preliminary Geometry

Inscribed Circle Diameter

- Recommended range of diameter for roundabout inscribed circle is based on design vehicle (WB-67)

Existing Roadway Centerlines

- Roadway centerlines determined from existing edge-of-pavement lines

Number of Lanes

- Used Rodel models to produce LOS of C or higher

Alternative Development

Volumes

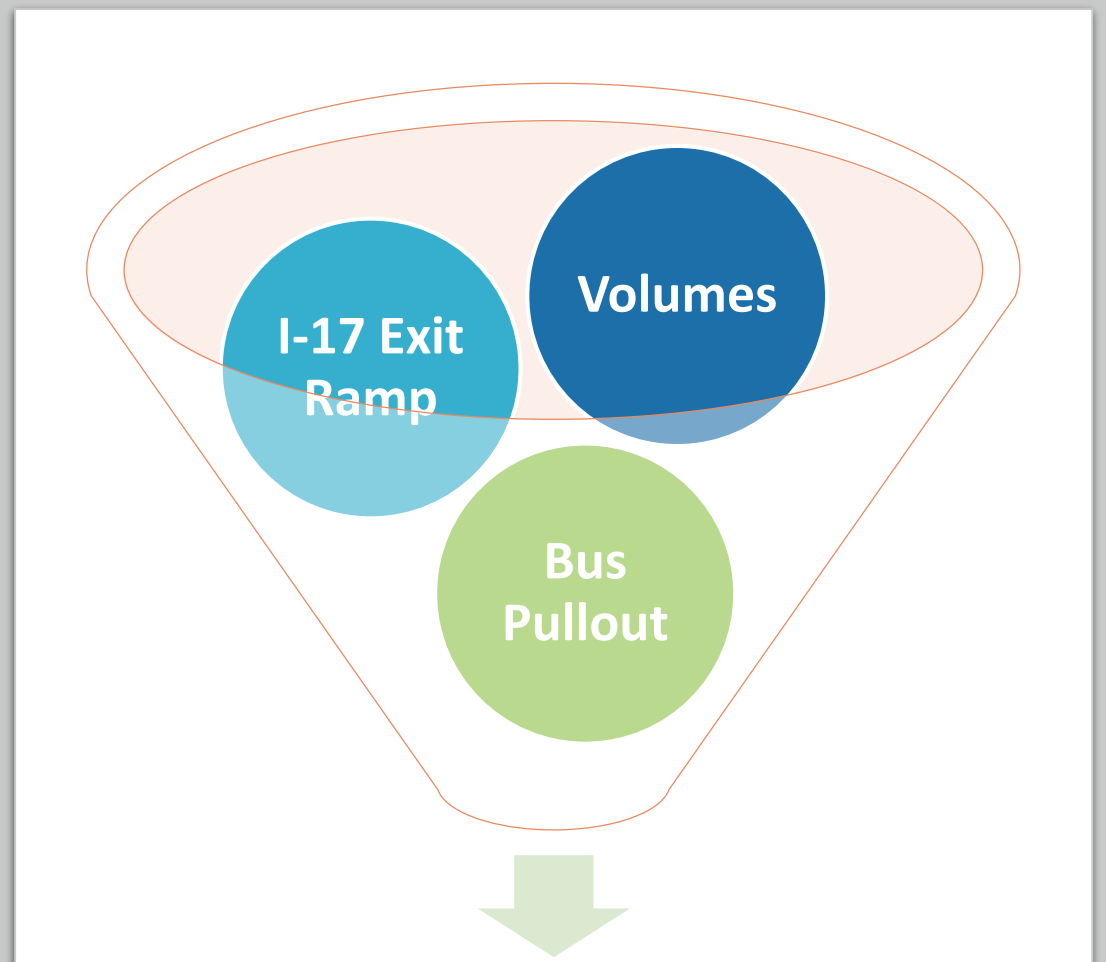
- Grown traffic volumes

I-17 Exit ramp

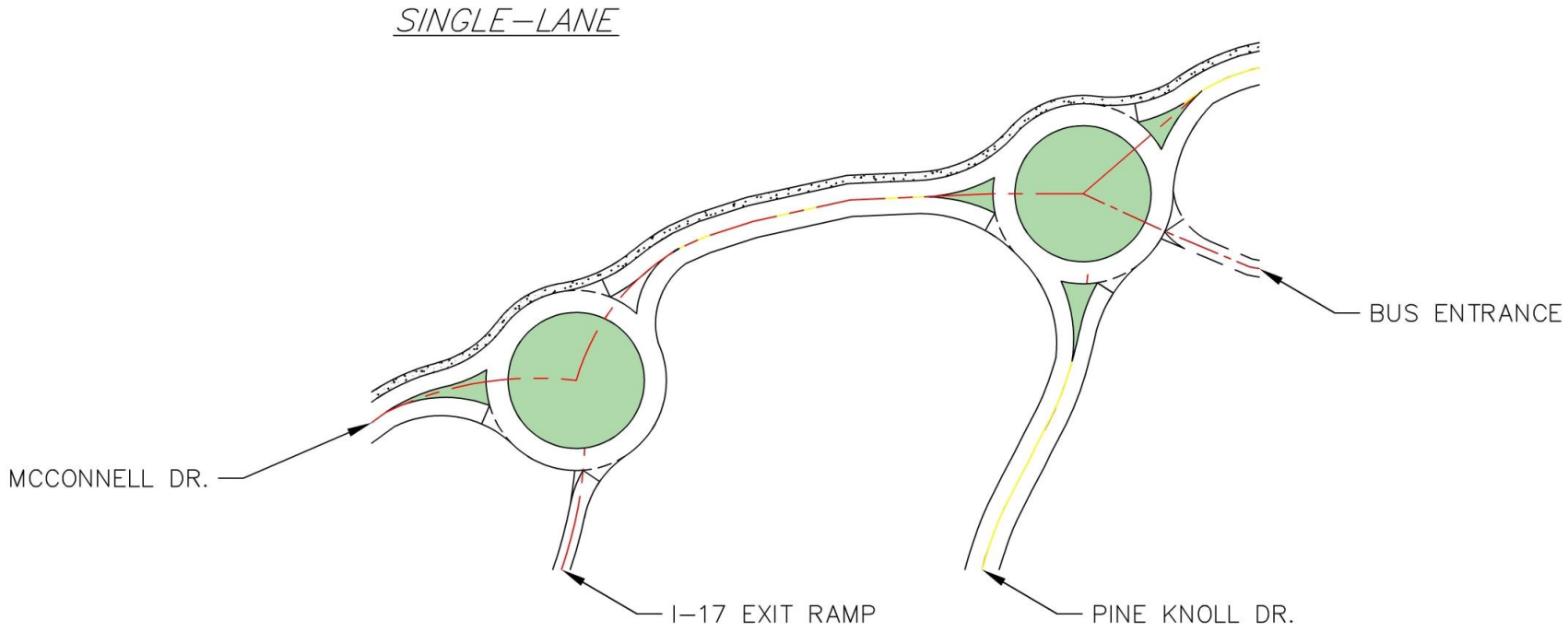
- Ramp traffic was routed through Pine Knoll/McConnell Dr or secondary roundabout

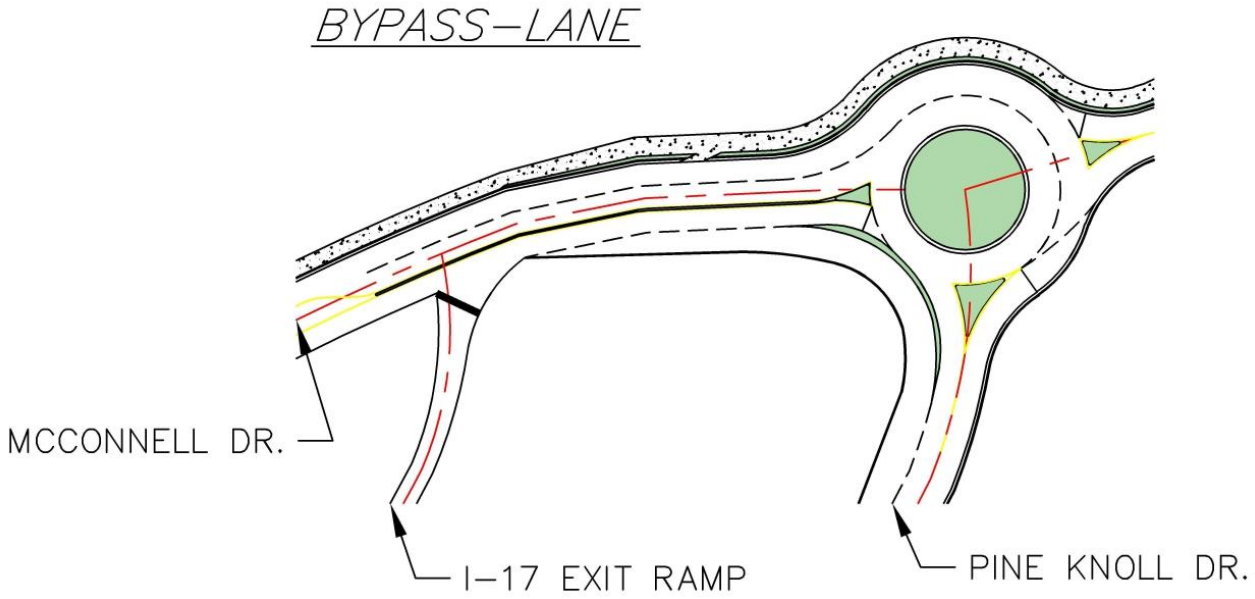
Bus Pullout

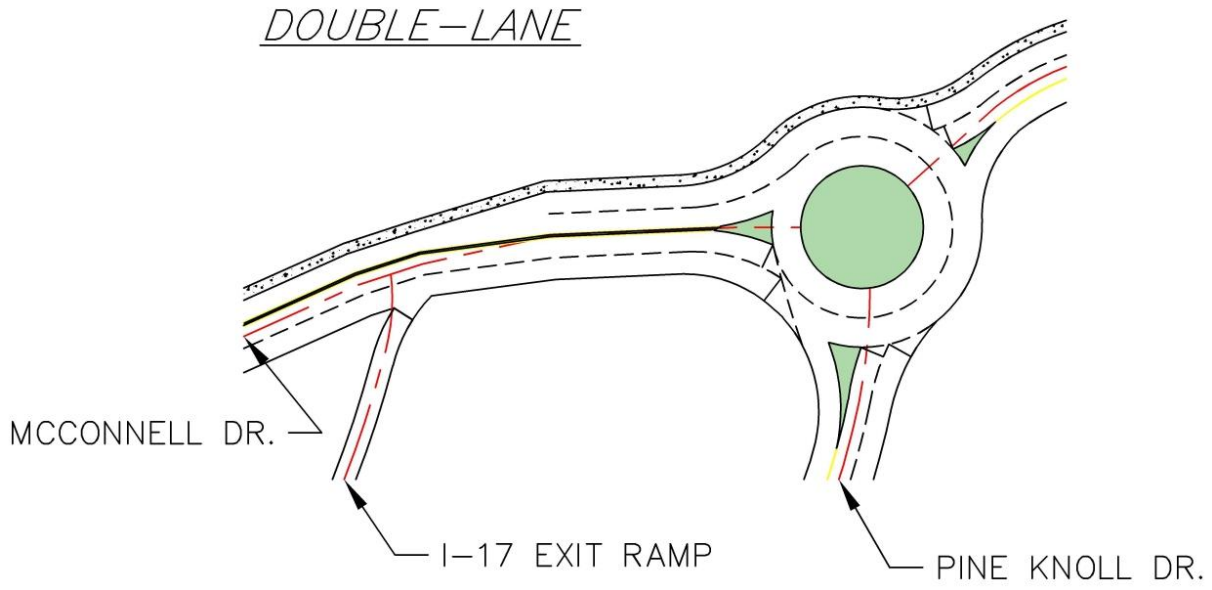
- Inclusion of bus bay design



Alternatives







Decision Matrix Breakdown

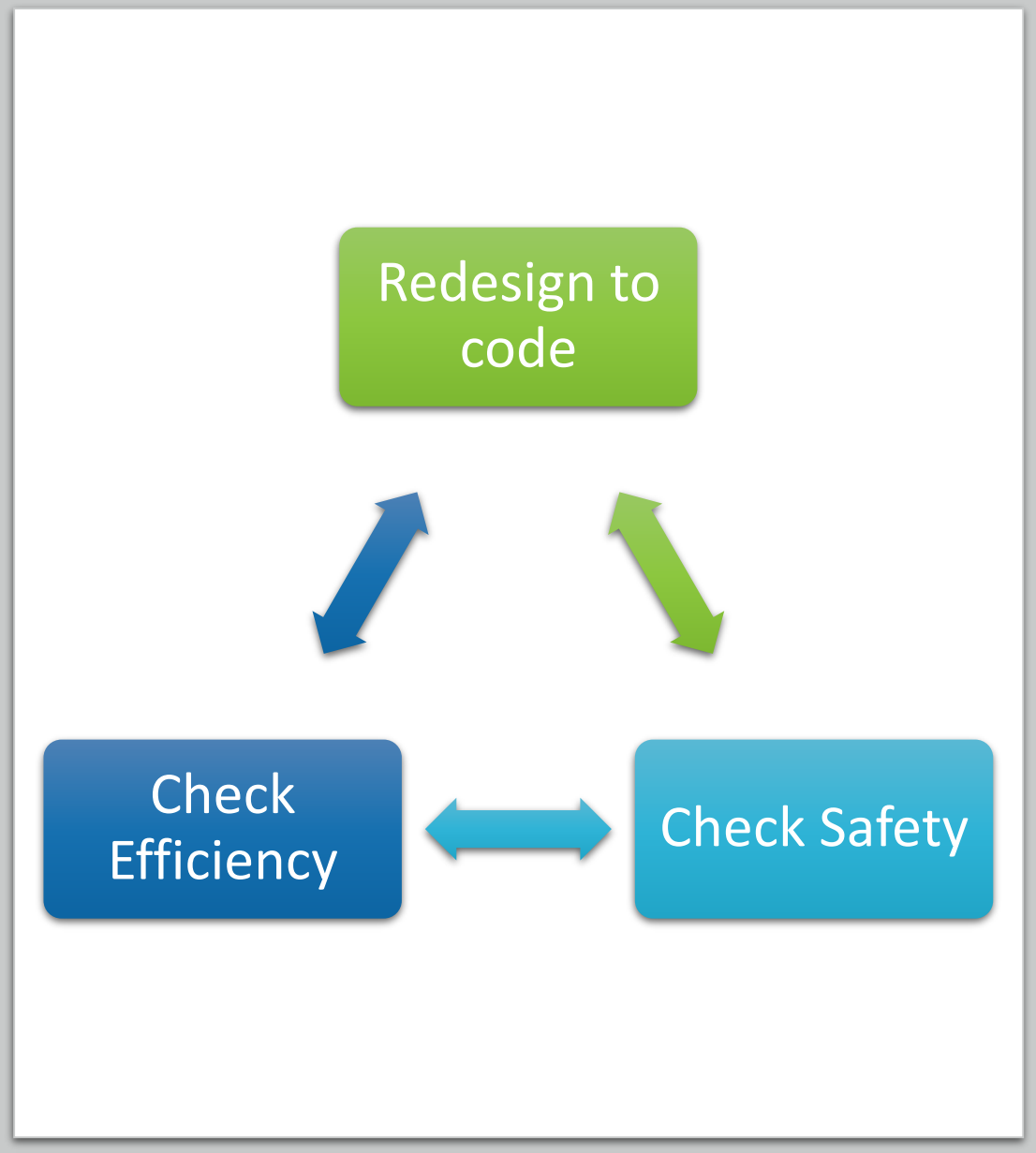
Criterion		Weight	Alternatives		
			Single	Double	Bypass
Relative Cost		25%	Fill =21863 cu ft, Construction = 5759 sq ft	Fill = 11948 cu ft, Construction = 7790 sq ft	Fill = 11711 cu ft, Constuction = 5759 sq ft
Ped. Safety		20%	2 lanes to cross	3 lanes to cross	2 lanes to cross
Likelihood of accidents		15%	6 points of conflict	18 points of conflict	7 points of conflict
LOS		10%	A	A	C
User Interaction	Complexity	15%	2 roundabouts with 1 lane	1 roundabout with 2 lanes	1 roundabout with 1-2 lanes
	Discomfort	5%	100% of vehicles enter a roundabout	100% of vehicles enter a roundabout	88% of vehicles enter a roundabout
	Predictability	10%	3 drivers entering roundabout at once	5 drivers entering roundabout at once	3 drivers entering roundabout at once

Alternative Selection

Criterion		Weight	Alternatives		
			Single	Double	Bypass
Relative Cost		25%	2	3	4
Ped. Safety		20%	4	3	4
Likelihood of accidents		15%	4	1	4
LOS		10%	5	5	3
User Interaction	Complexity	15%	2	2	4
	Discomfort	5%	3	3	4
	Predictability	10%	3	2	3
	Total	100%	3.2	2.7	**3.8**

Roundabout Redesign and Check

- Bypass Lane was chosen through decision matrix
- Redesign began with assessment of Fastest Route safety check
- Cross-check with FHWA guidebook for lane widths, entry angles, and allowable speeds
- The input into Rodel to check efficiency (LOS)

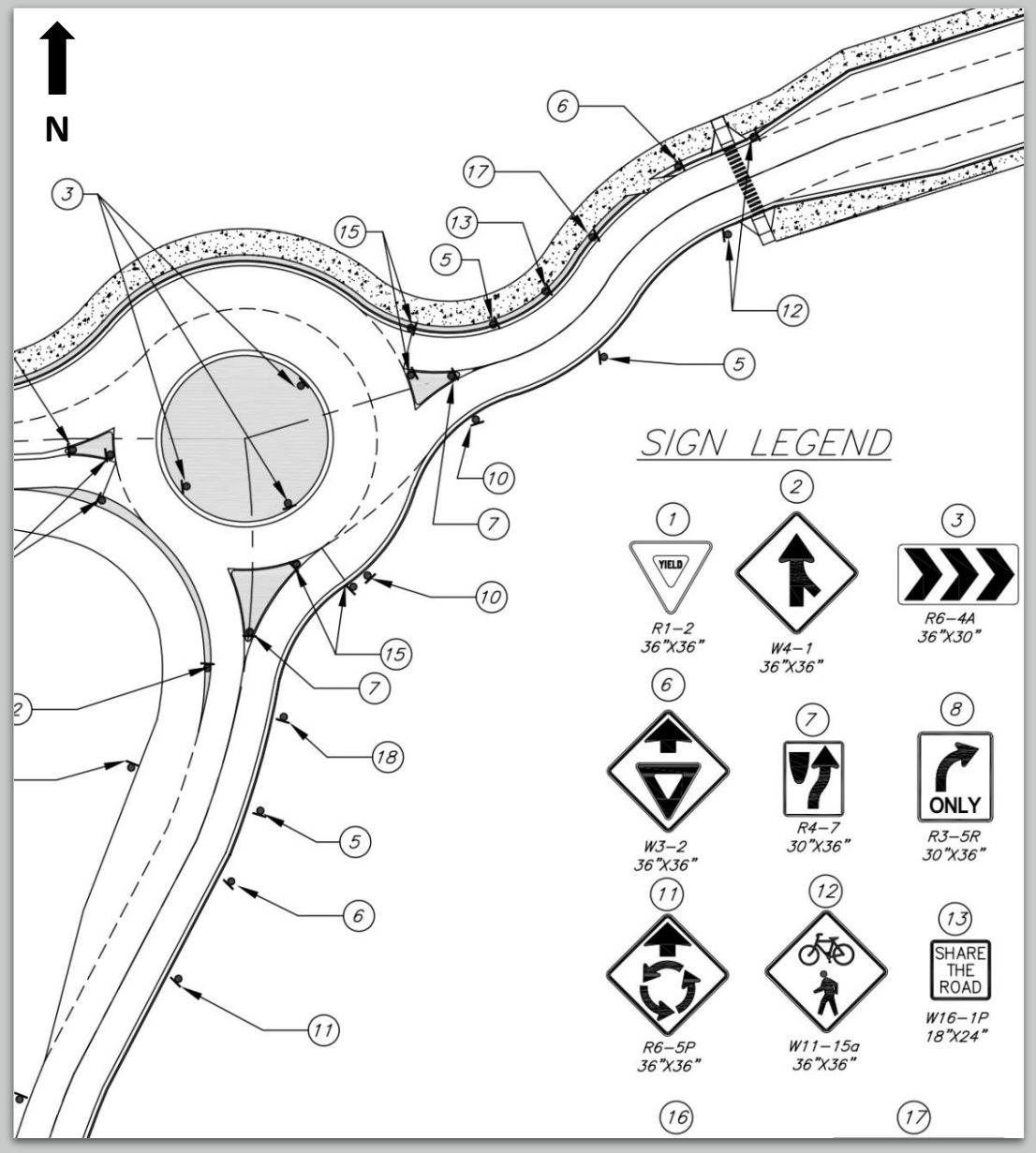


Signing and Striping

Signing and striping requirements were referenced from:

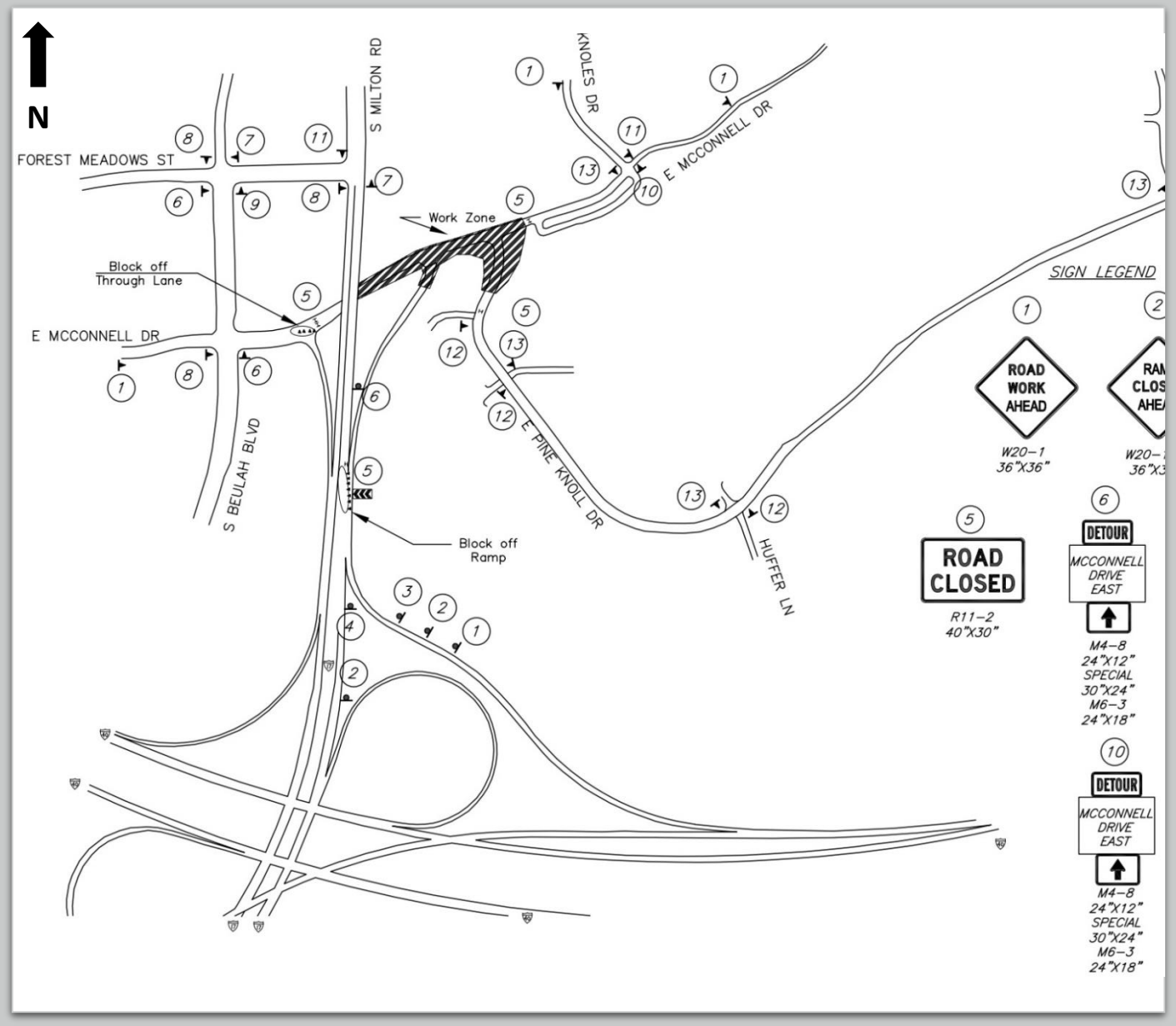
- The City of Flagstaff Engineering Design Standards
- Federal Highway Administration Roundabout Guide
- Manual on Uniform Traffic Control Devices (MUTCD)

Plan set includes sheets detailing the location, size and type of sign or pavement marking to be installed in the completed roundabout.

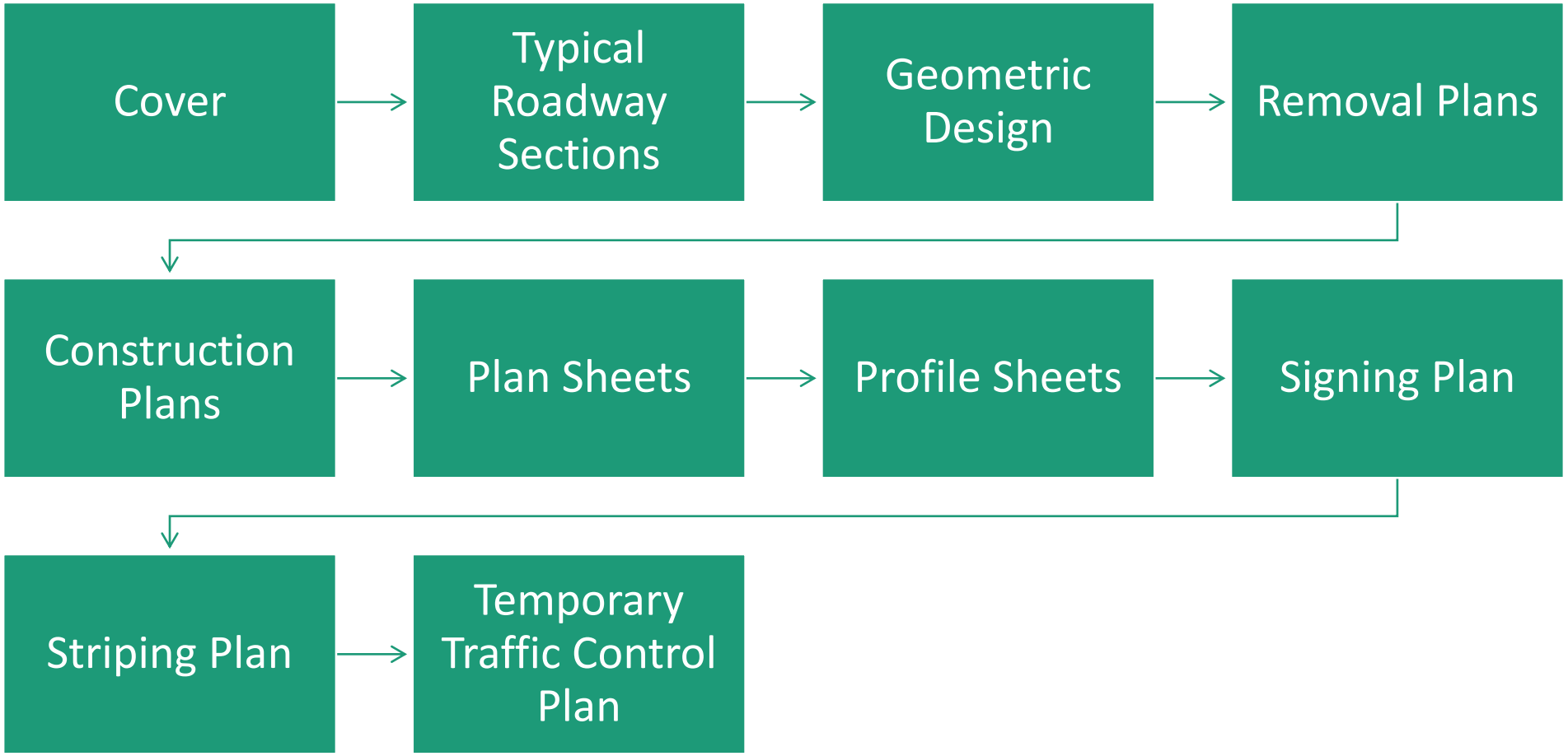


Temporary Traffic Control

- Illustrates closure locations
- Shows locations of temporary signage
- Locations of barriers and signs used to close off the construction zone

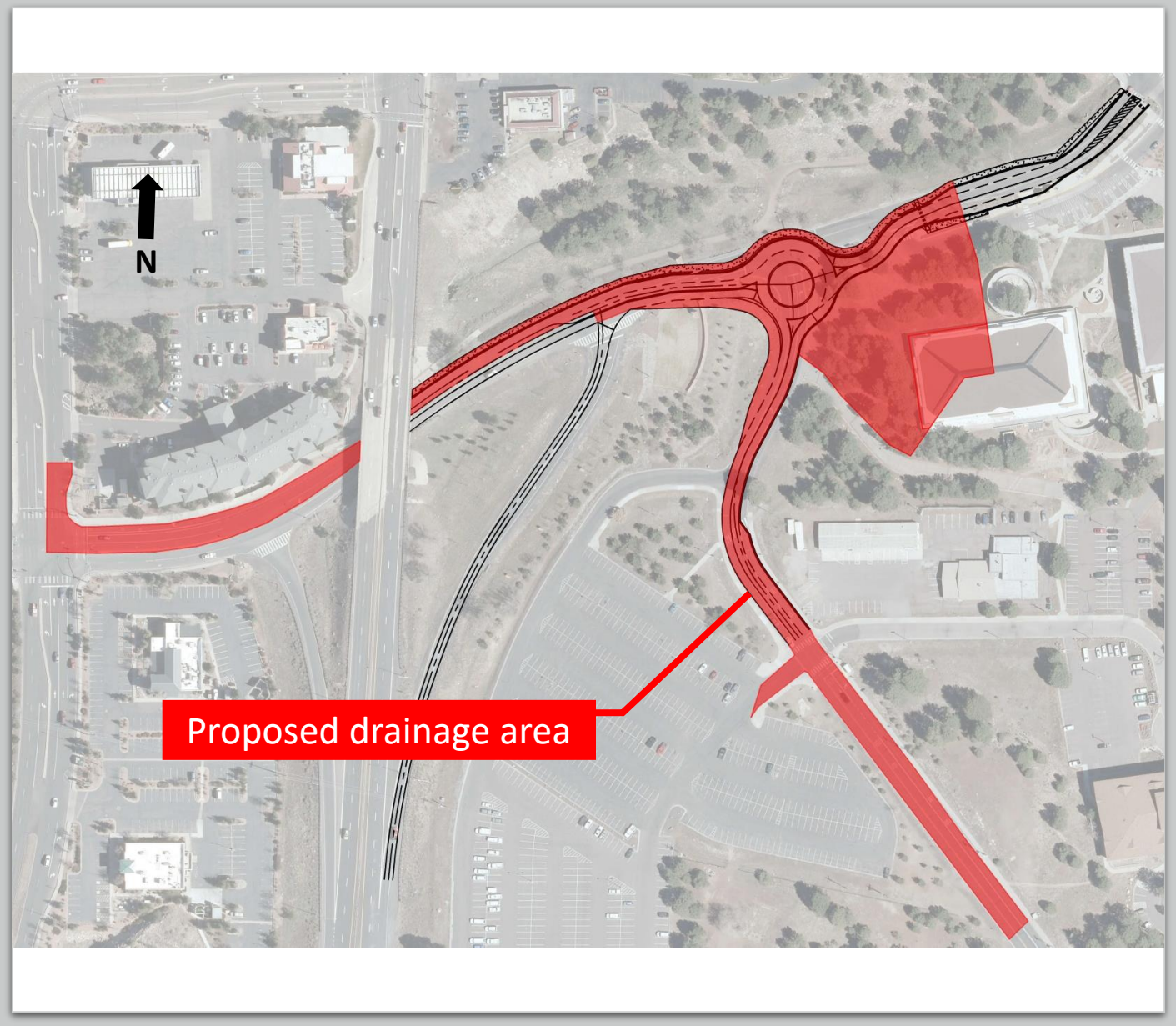


Plan Set Production



Drainage

- Total drainage runoff through intersection determined using the rational method.
- Runoff was calculated using the rainfall intensity values for a storm duration of 5-minutes for both the 10-year and 100-year storm event
- Pre-Development:
  - 10-year: 14.2 cfs
  - 100-year: 26.2 cfs
- Post-Development:
  - 10-year: 15.0 cfs
  - 100-year: 27.7 cfs



Traffic Analysis

- Final geometry added into Rodel
- Overall LOS C for intersection performing at peak hour
- Intersection meets capacity requirements

Leg Names	Level of Service per Leg	Overall Level of Service
McConnell (WB)	B	C
McConnell (EB)	B	
Pine Knoll Dr. (NB)	D	

Project Impacts

Social

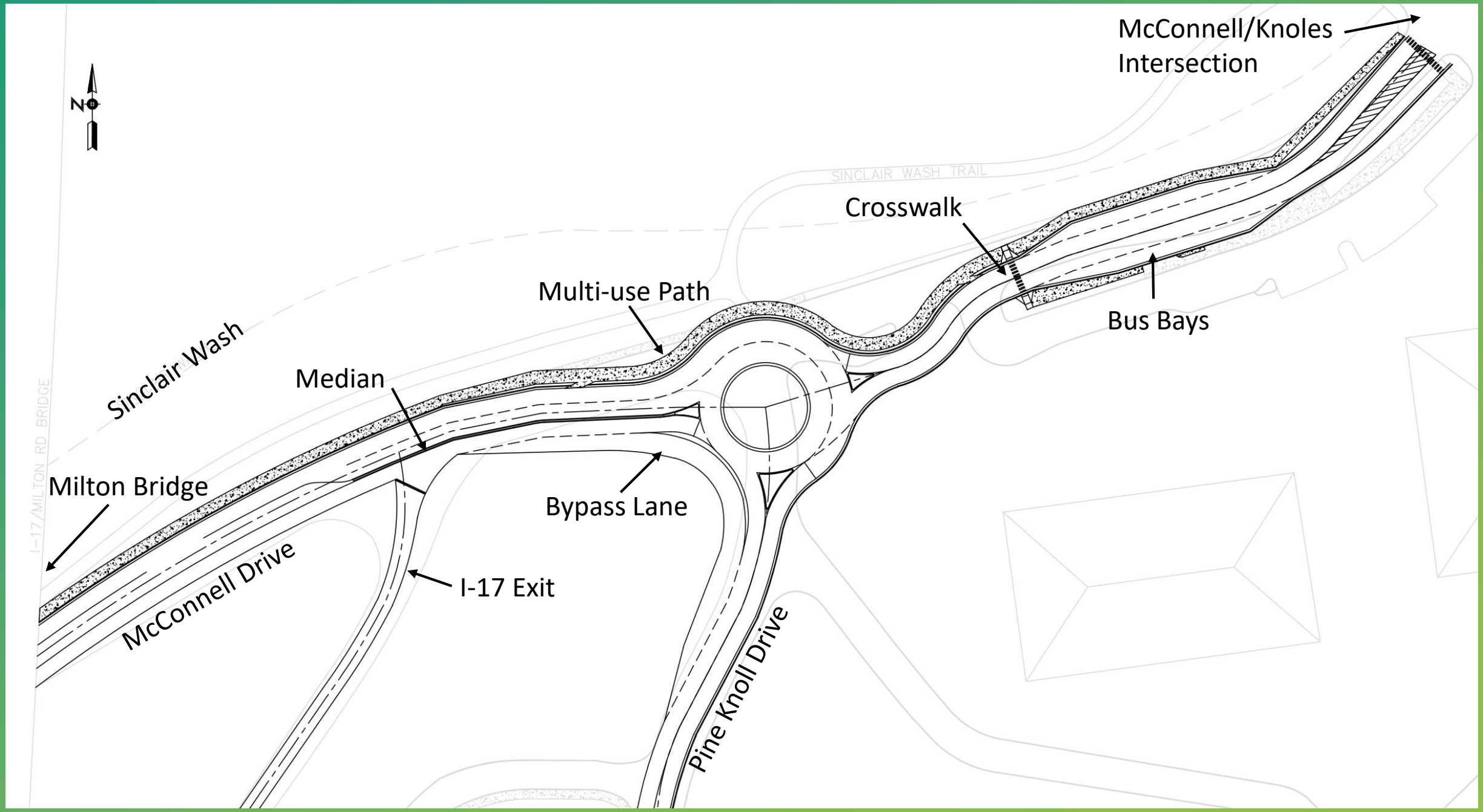
- Community buy-in
- Mobility
- Equitable travel

Economic

- Capital costs
- Maintenance costs
- Costs to society (crashes)

Environmental

- Emissions
- Drainage
- Vegetation

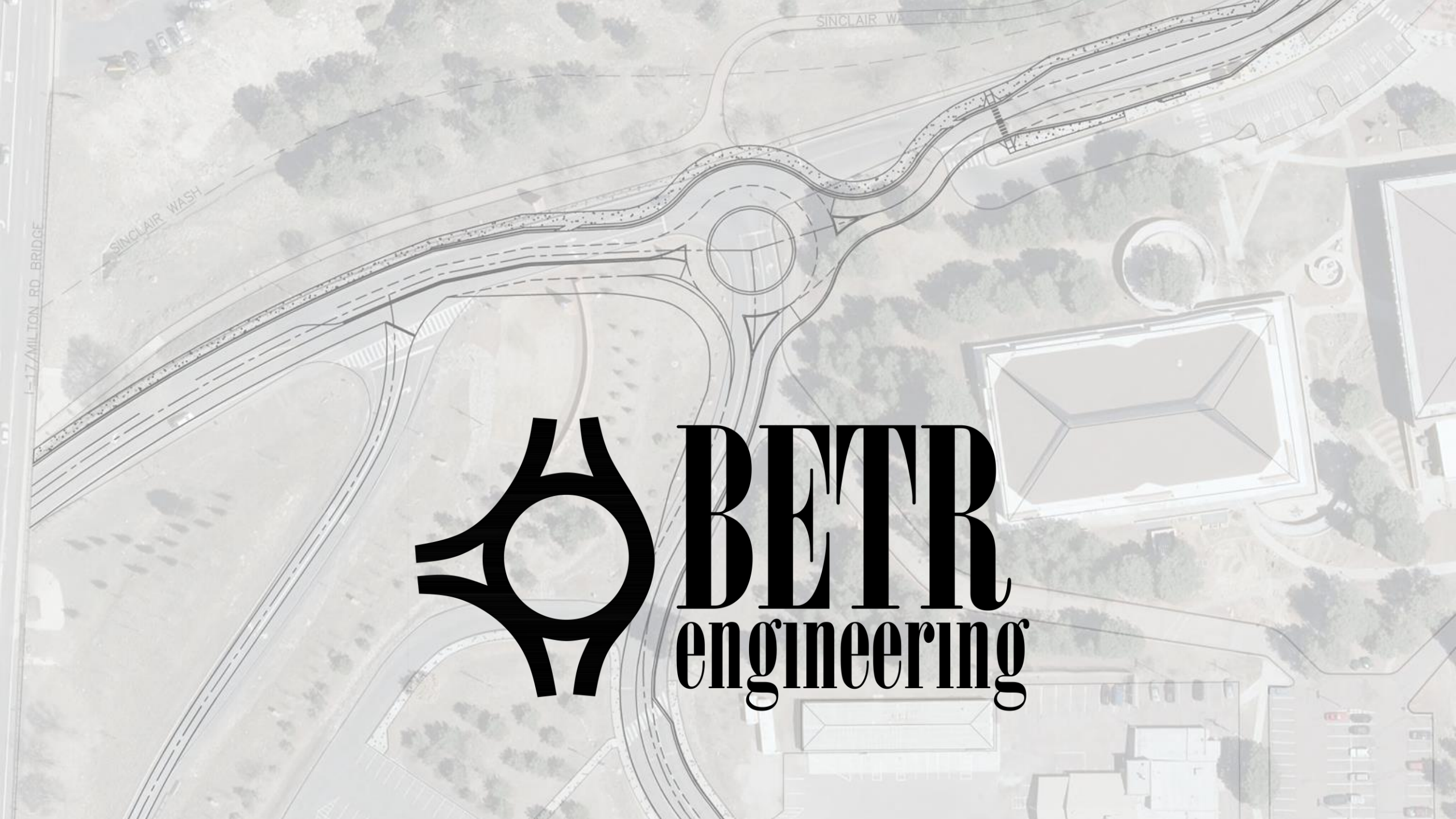

McConnell/Knoles
Intersection
Crosswalk
Multi-use Path
Bus Bays
Sinclair Wash
Median
Milton Bridge
Bypass Lane
McConnell Drive
I-17 Exit
Pine Knoll Drive
SINCLAIR WASH TRAIL
I-17/MILTON RD BRIDGE

Conclusions and Recommendations

- In Conclusion: the presented design meets to project goals of utilizing a roundabout to improve traffic congestion at the site

- Recommendations
  - Existing bus bay: create one-way parking lot by adding curb cut

  - P62 (South Commuter) parking lot entrance: regrade lot entrance to improve slope for drainage and traffic



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