The Cannon Drive Levee:
Flood Protection at The Ohio State University

2019 ASFPM Conference

May 23, 2019

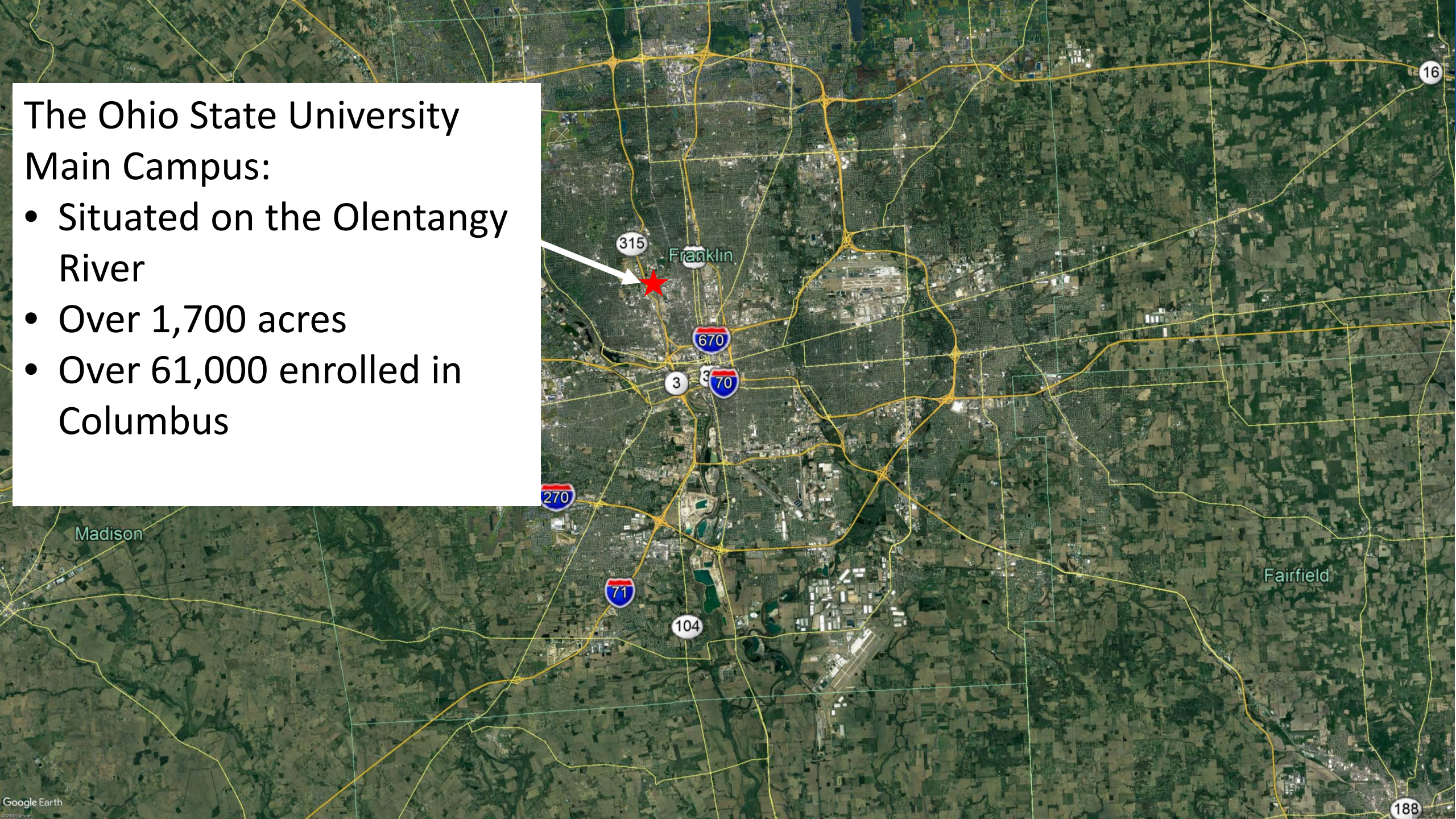
…or,

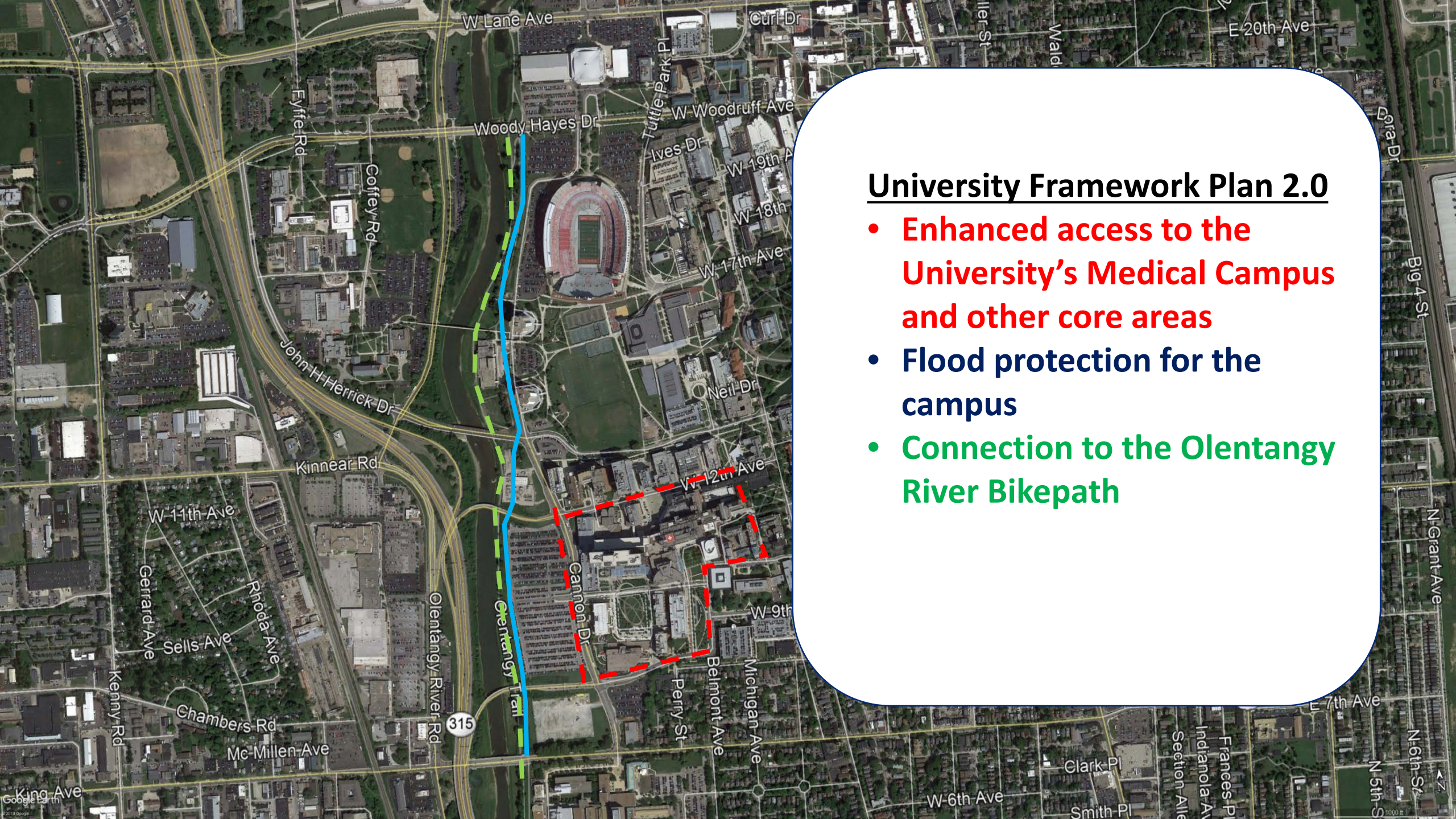
Is a Levee Really a Levee if You Can't See it?

Portage
Windsor
Lake Erie
Erie
Gary
South Bend
Toledo
Cleveland
Indiana
Ohio
Fort Wayne
Akron
Youngstown
Mansfield
Lafayette
Kokomo
Pittsburgh
Altoona
Pennsylvania
Muncie
Columbus
Indianapolis
Dayton
Ohio
Terre Haute
Indiana
Cincinnati
West Virginia
Harrisonburg
Charleston
Louisville
Staunton
Frankfort
Lexington

The Ohio State University Main Campus:

- Situated on the Olentangy River
- Over 1,700 acres
- Over 61,000 enrolled in Columbus





University Framework Plan 2.0

- Enhanced access to the University's Medical Campus and other core areas
- Flood protection for the campus
- Connection to the Olentangy River Bikepath

Project Goals: Cannon Drive

- Create a north-south gateway and connection between Lane and King Ave
- No impact to the SR 315 exit ramp capacity
- Provide a 500-year level of flood protection
- Levee recognized by NFIP
- Create 12 acres of developable land
- Green infrastructure
- Olentangy River to be part of an open space amenity
- Relocate Franklin Main
- Minimize impacts to AEP distribution systems

Other Project Considerations

- Transportation Needs
- OSU WMC Expansion
- Maintenance of Traffic
- Park Development
- Landscaping
- Utility Coordination
- Medical Center and Battelle Access
- Engineered Levee
- NFIP Acceptance (CLOMR/LOMR)
- ODNR Approval
- Columbus Approval
- Environmental Covenant Modification
- Section 404 Permit (USACE)
- NPDES Stormwater NOI (OEPA)
- Columbus Stormwater Drainage Manual Compliance
- Scheduling and permitting timelines

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Project Stakeholders

THE OHIO STATE UNIVERSITY

OHIO DEPARTMENT OF NATURAL RESOURCES

AEP AMERICAN ELECTRIC POWER

THE CITY OF COLUMBUS
ANDREW J. GINTHER, MAYOR

U.S. DEPARTMENT OF HOMELAND SECURITY FEMA

BATTELLE

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

US Army Corps of Engineers®

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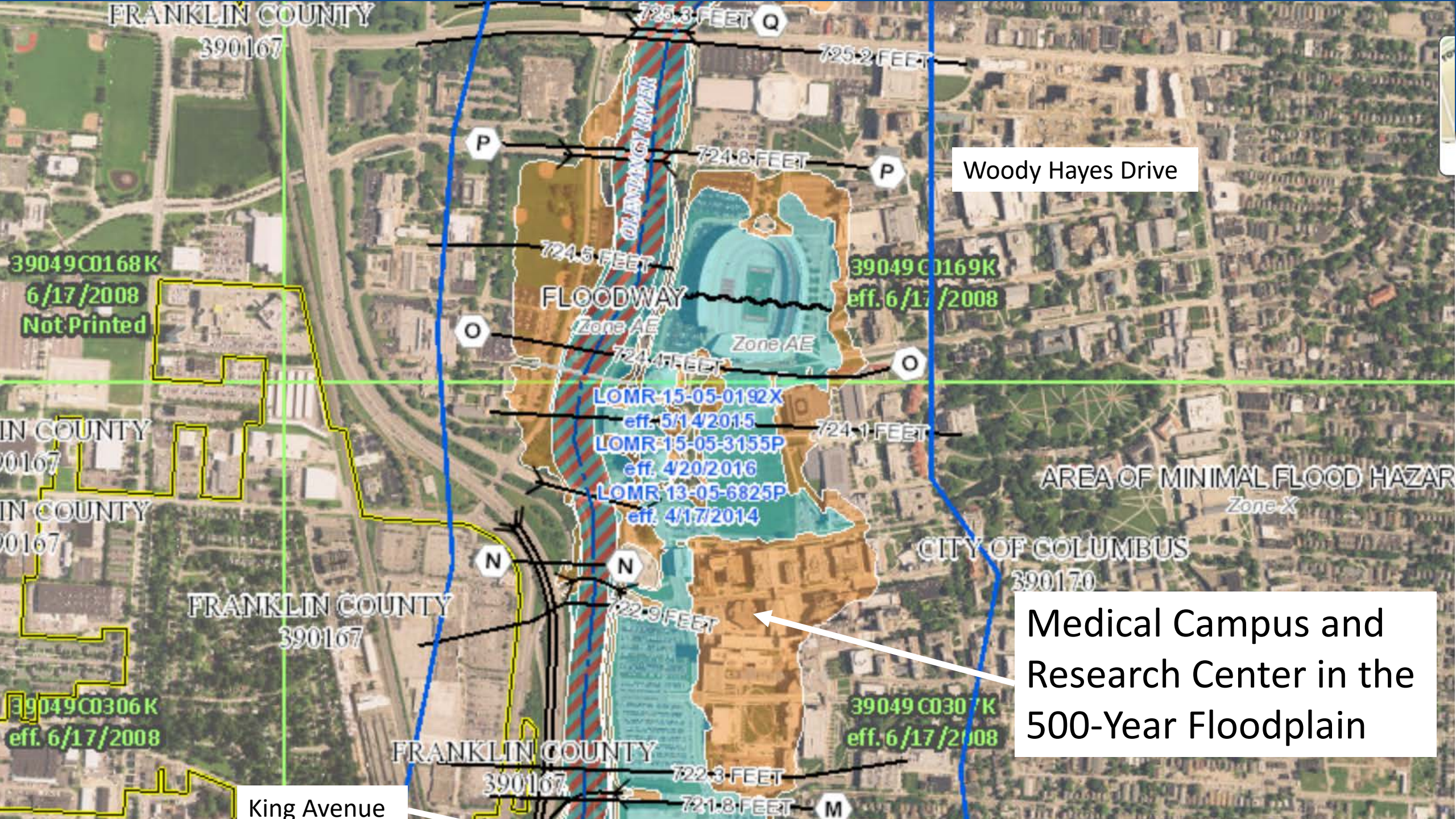
FRANKLIN COUNTY
390167
725.3 FEET
Q
725.2 FEET
P
724.8 FEET
P
Woody Hayes Drive
OLENTANGY RIVER
724.5 FEET
39049C0168K
6/17/2008
Not Printed
FLOODWAY
Zone AE
39049C0169K
eff. 6/17/2008
O
Zone AE
724.4 FEET
O
LOMR 15-05-0192X
eff. 5/14/2015
LOMR 15-05-3155P
eff. 4/20/2016
LOMR 13-05-6825P
eff. 4/17/2014
724.1 FEET
AREA OF MINIMAL FLOOD HAZAR
Zone X
CITY OF COLUMBUS
390170
N
N
722.9 FEET
FRANKLIN COUNTY
390167
Medical Campus and Research Center in the 500-Year Floodplain
39049C0306K
eff. 6/17/2008
39049C0307K
eff. 6/17/2008
FRANKLIN COUNTY
390167
722.3 FEET
721.8 FEET
M
King Avenue

Fifth Avenue Dam Removal

- Precursor project
- Restored free flowing bankfull channel with connected floodplain bench
- Grading and landscaping connectivity to Cannon Drive project
- Provided updated hydraulic model for Olentangy River

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Historical Flood Protection

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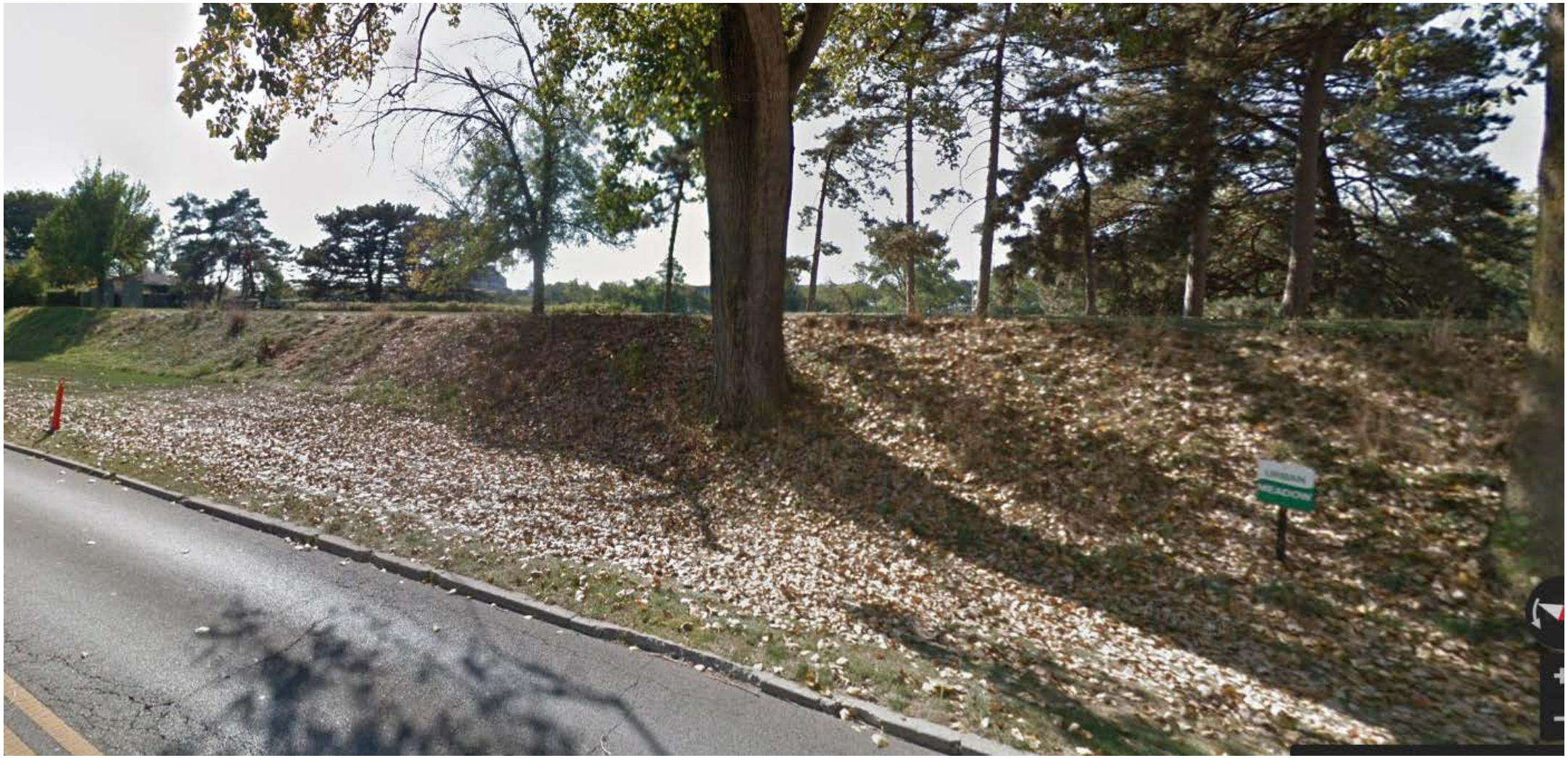
Historical Flood Protection



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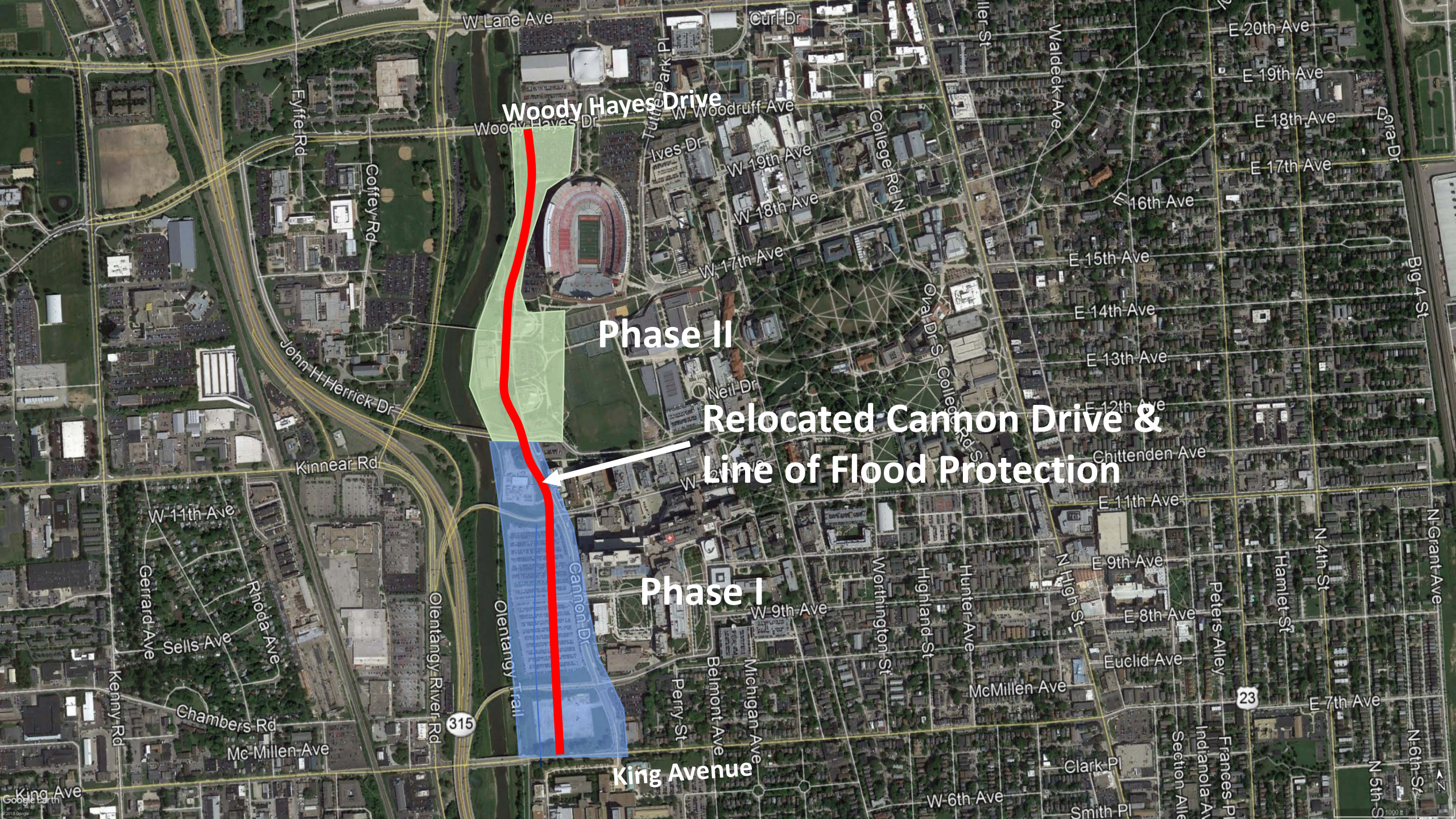
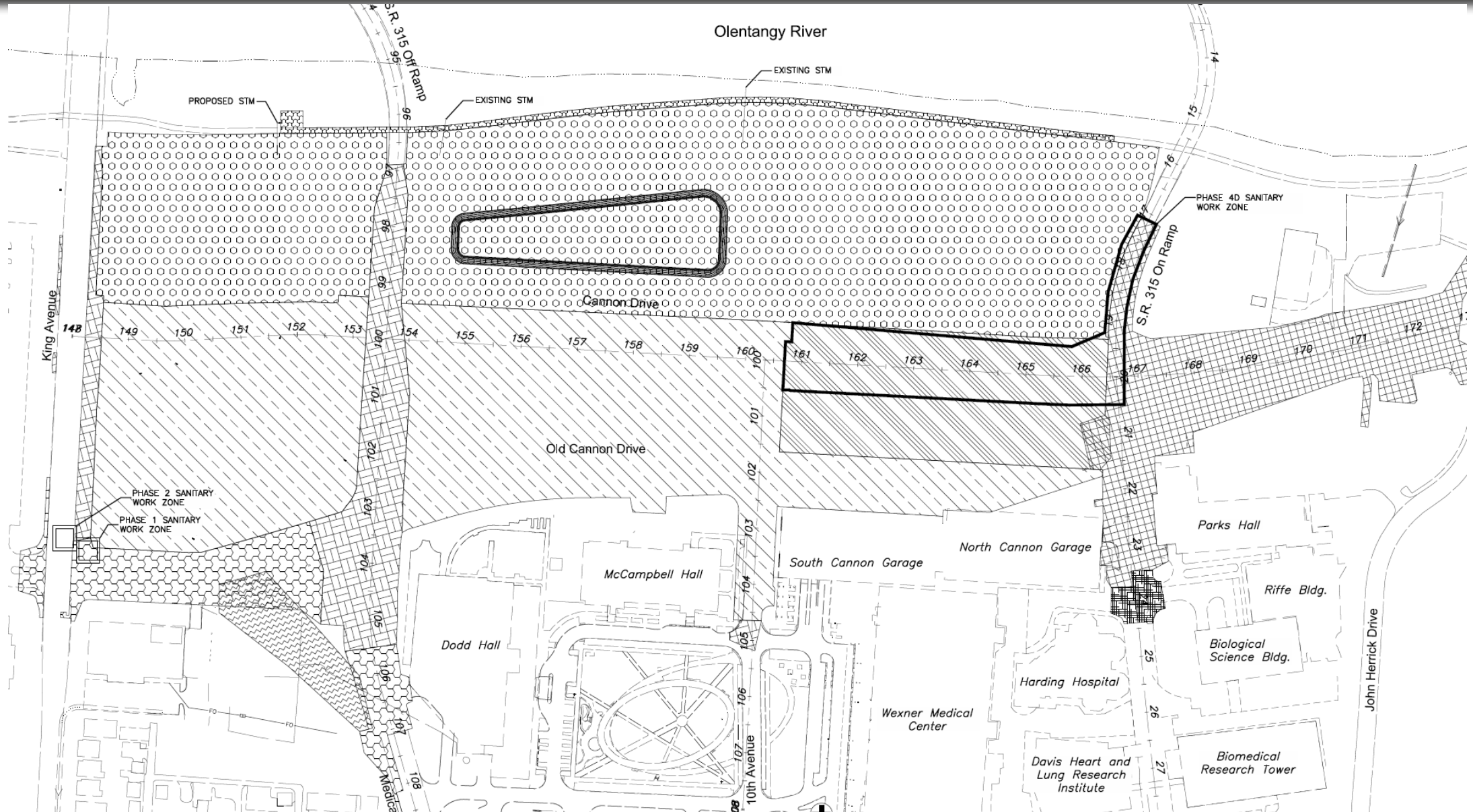

Woody Hayes Drive
Phase II
Relocated Cannon Drive &
Line of Flood Protection
Phase I
King Avenue
W Lane Ave
Curl Dr
Woody Hayes Dr
W Woodruff Ave
Ives Dr
W 19th Ave
W 18th Ave
W 17th Ave
College Rd N
Oval Dr S
College Rd S
Neil Dr
Eyffe Rd
Coffey Rd
John H Herrick Dr
Kinnear Rd
W 11th Ave
Gerrard Ave
Sells Ave
Rhoda Ave
Kenny Rd
Chambers Rd
Mc Millen Ave
King Ave
Olentangy River Rd
Olentangy Trail
Cannon Dr
W 9th Ave
Perry St
Belmont Ave
Michigan Ave
Worthington St
Highland St
Hunter Ave
N High St
McMillen Ave
W 6th Ave
Clark Pl
Smith Pl
Euclid Ave
E 8th Ave
E 9th Ave
E 11th Ave
Chittenden Ave
E 12th Ave
E 13th Ave
E 14th Ave
E 15th Ave
E 16th Ave
E 17th Ave
E 18th Ave
E 19th Ave
E 20th Ave
E 7th Ave
Waldeck Ave
Dora Dr
Big 4 St
N Grant Ave
N 4th St
Hamlet St
Peters Alley
Indianola Ave
Frances Pl
Section Alley
N 5th St
N 6th St
315
23

Construction Phasing & MOT



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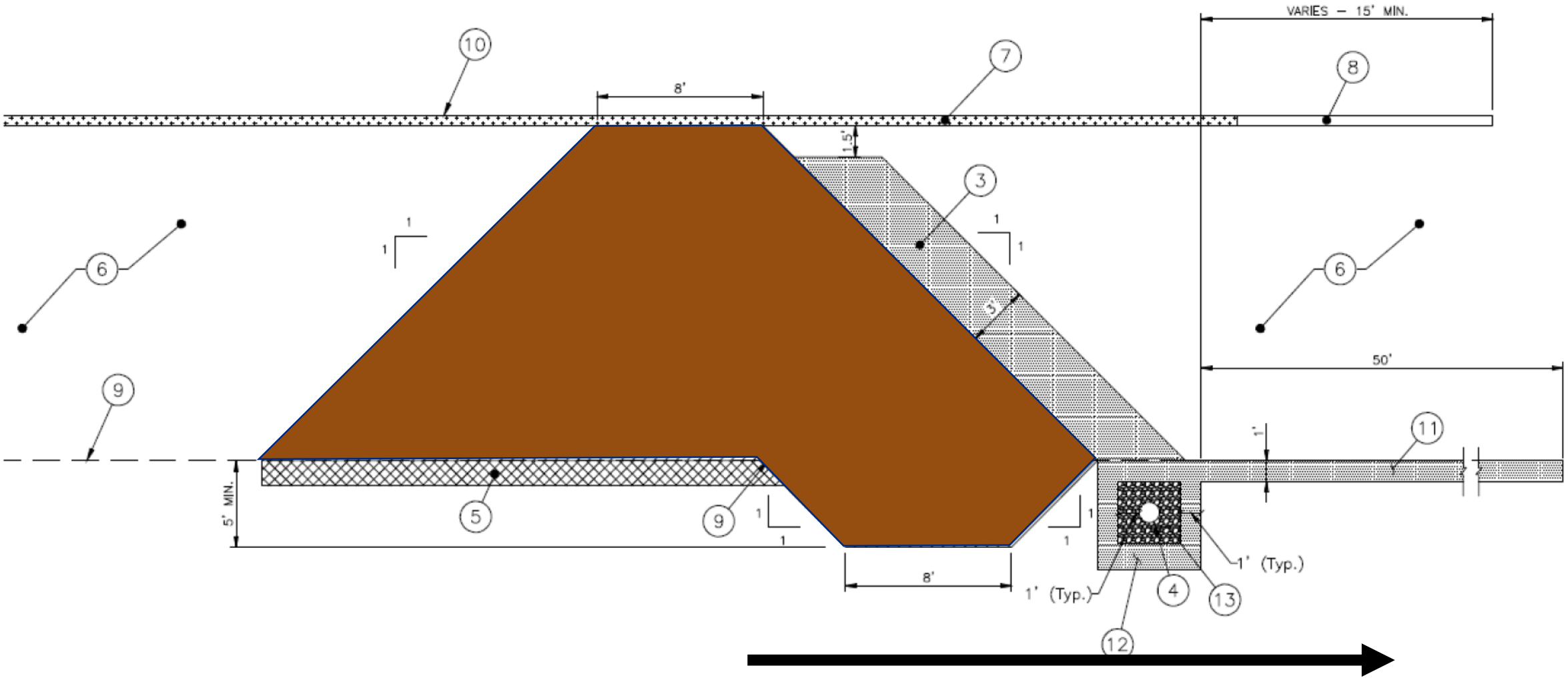
Levee Section



Land Side of Levee

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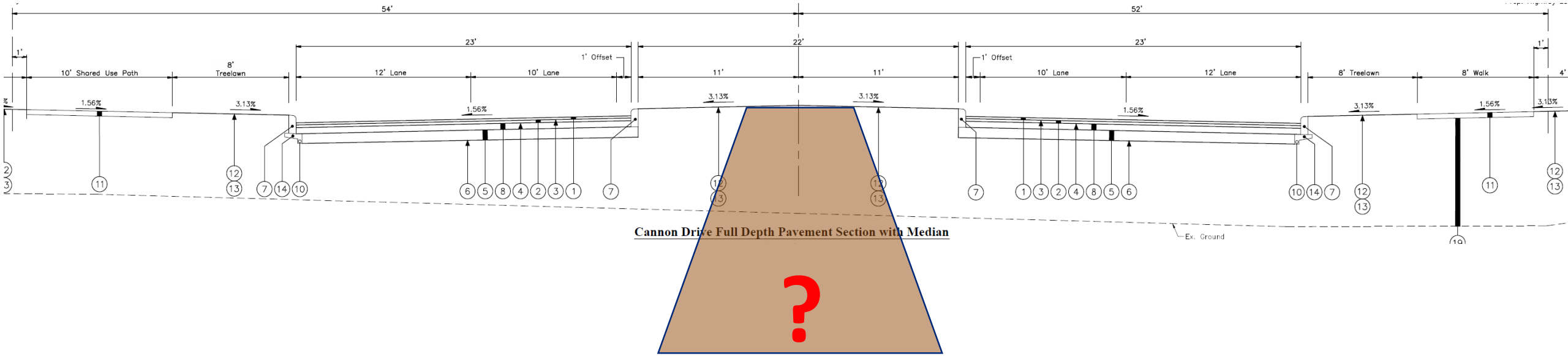
Roadway Section



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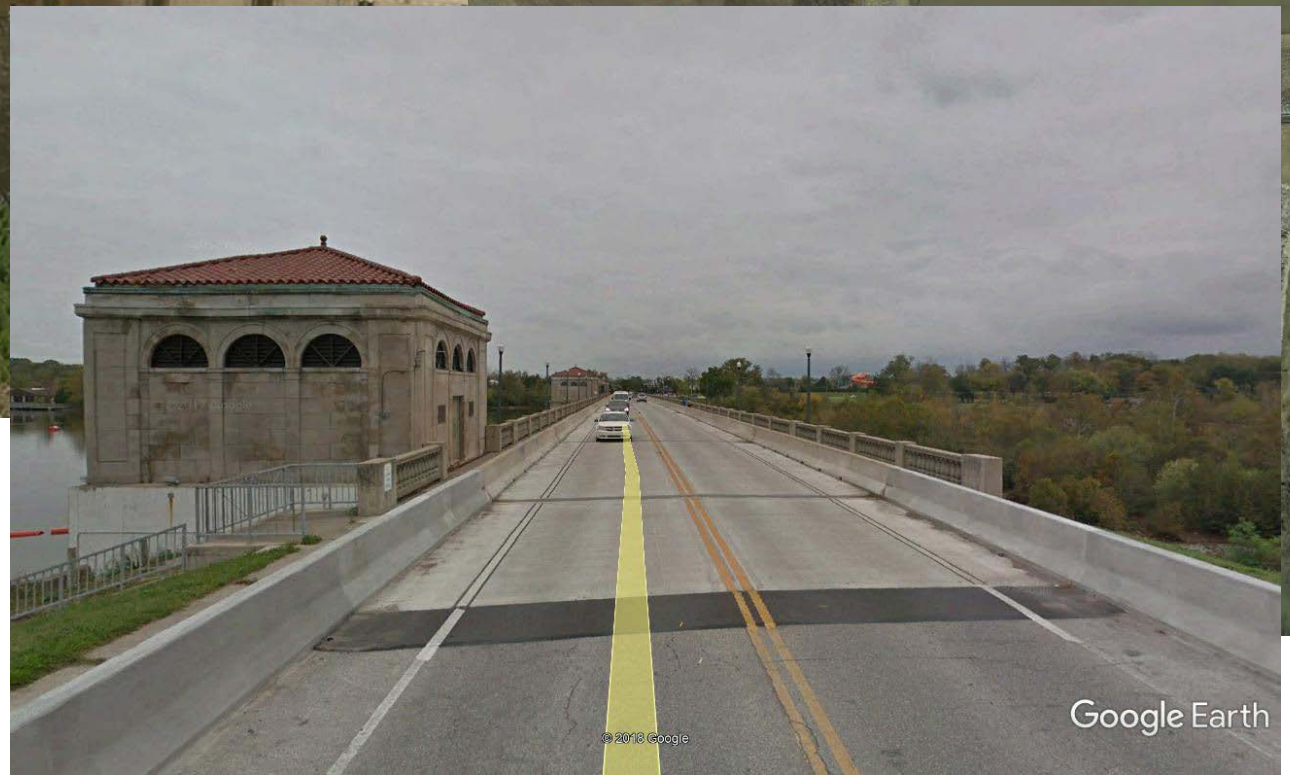
Examples of Roadways Constructed on Dams



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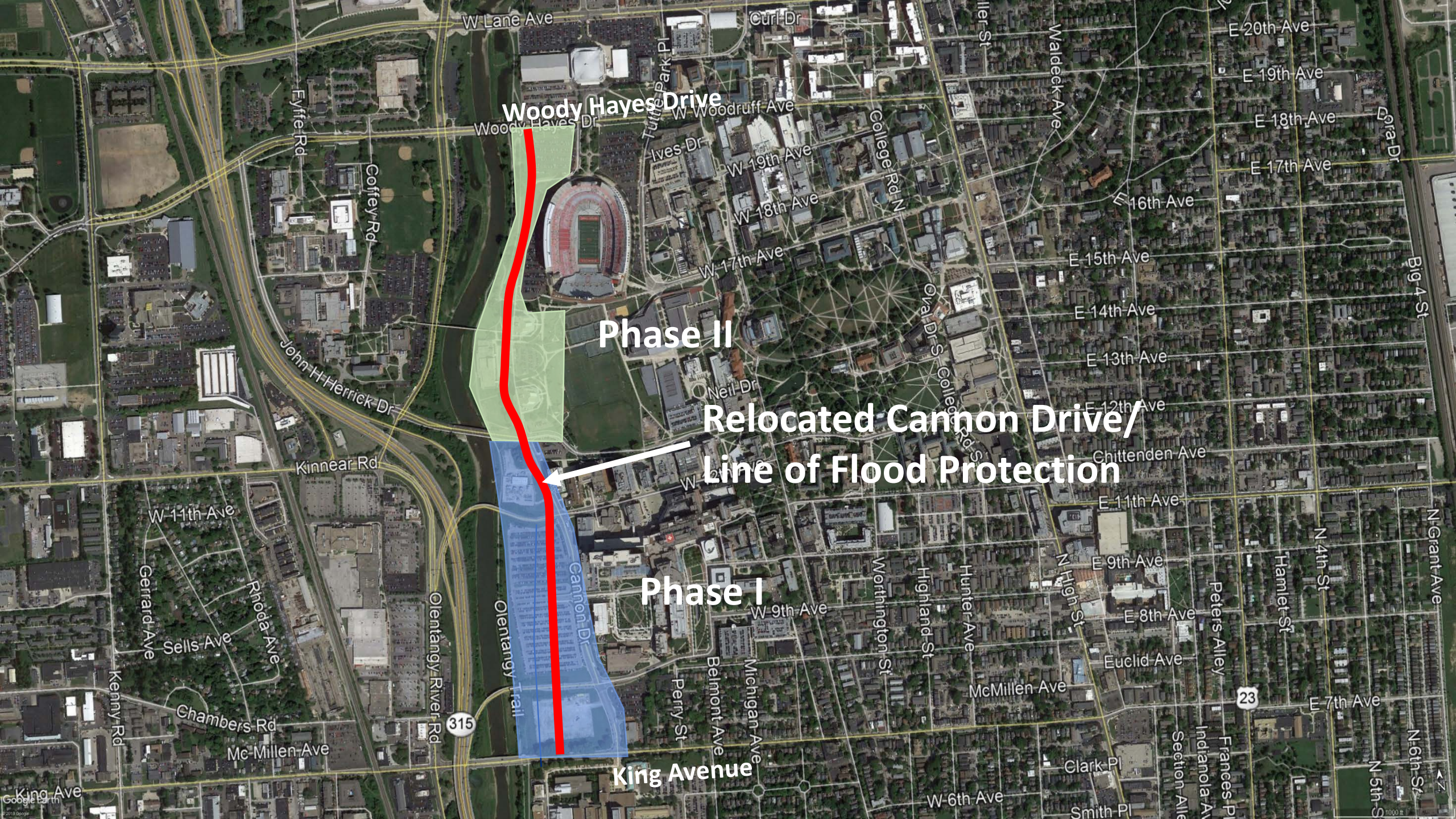
Images: Bing Maps, Google Earth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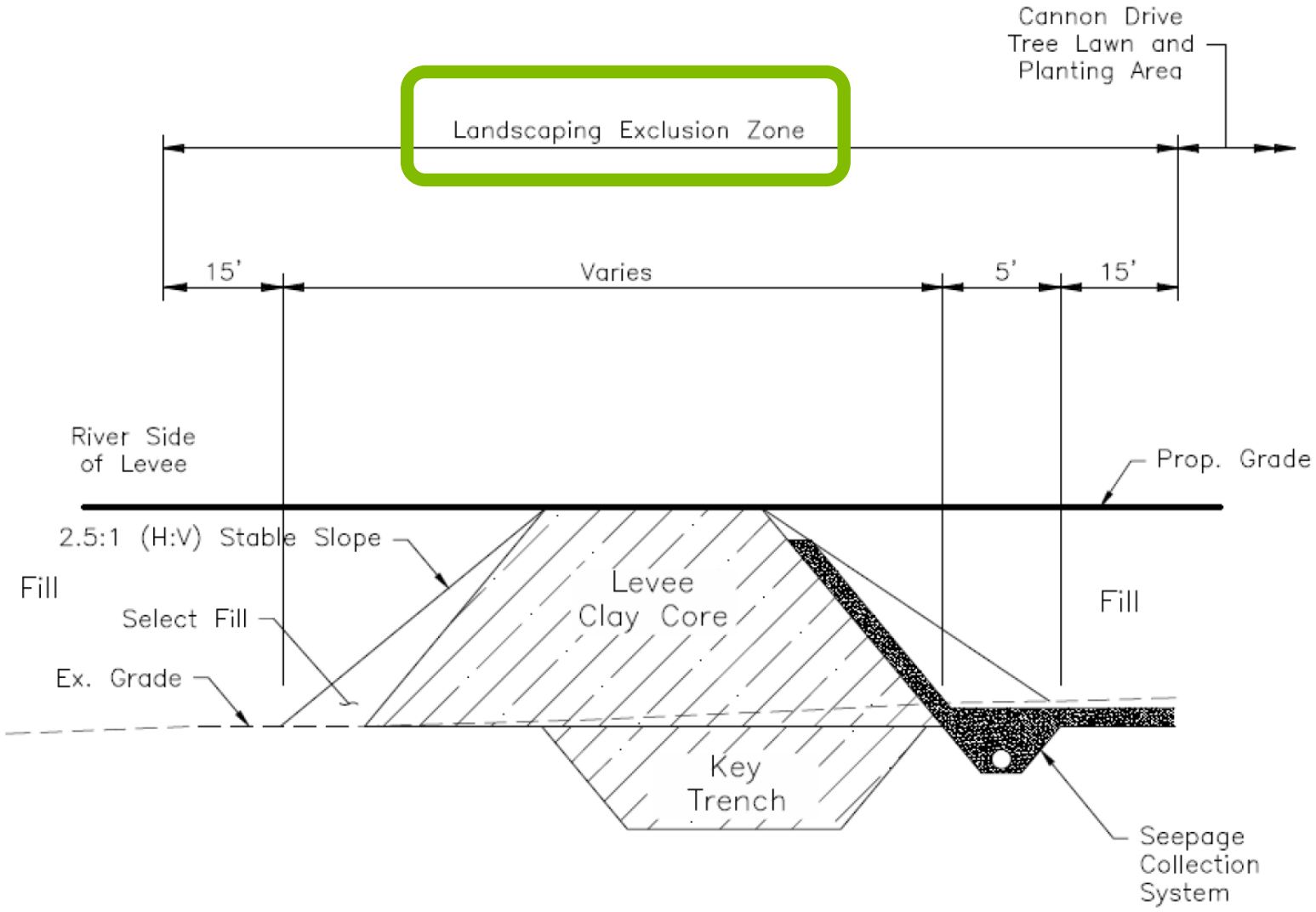
23
Google Earth

Levee Vegetation Limitations – USACE ETL 110-2-583



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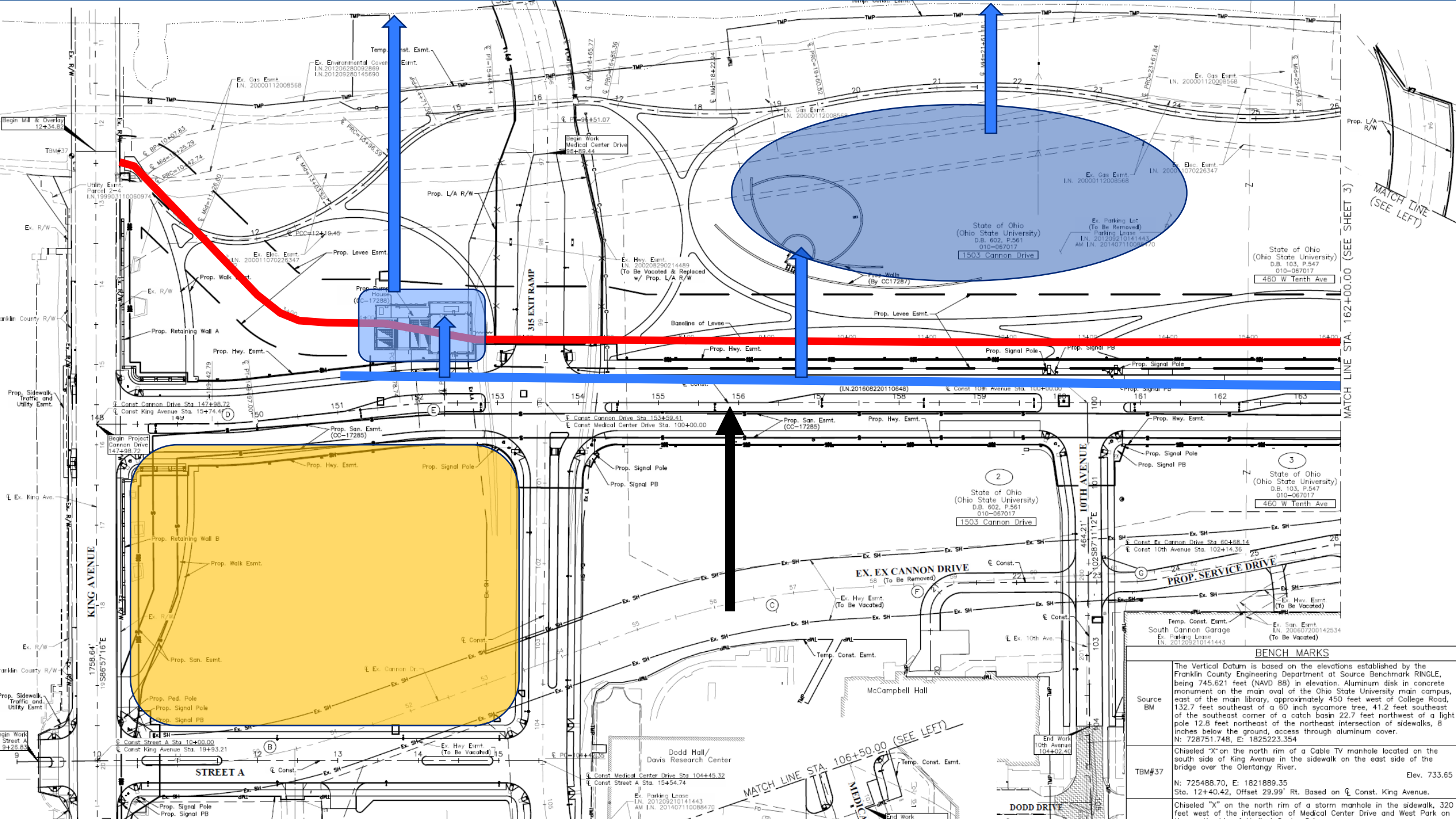

BENCH MARKS

Source BM	The Vertical Datum is based on the elevations established by the Franklin County Engineering Department at Source Benchmark RINGLE, being 745.621 feet (NAVD 88) in elevation. Aluminum disk in concrete monument on the main oval of the Ohio State University main campus, east of the main library, approximately 450 feet west of College Road, 132.7 feet southeast of a 60 inch sycamore tree, 41.2 feet southeast of the southeast corner of a catch basin 22.7 feet northwest of a light pole 12.8 feet northeast of the northeast intersection of sidewalks, 8 inches below the ground, access through aluminum cover. N: 728751.748, E: 1825223.354
TBM#37	Chiseled "X" on the north rim of a Cable TV manhole located on the south side of King Avenue in the sidewalk on the east side of the bridge over the Olentangy River. Elev. 733.65 N: 725488.70, E: 1821889.35 Sta. 12+40.42, Offset 29.99' Rt. Based on ℄ Const. King Avenue.
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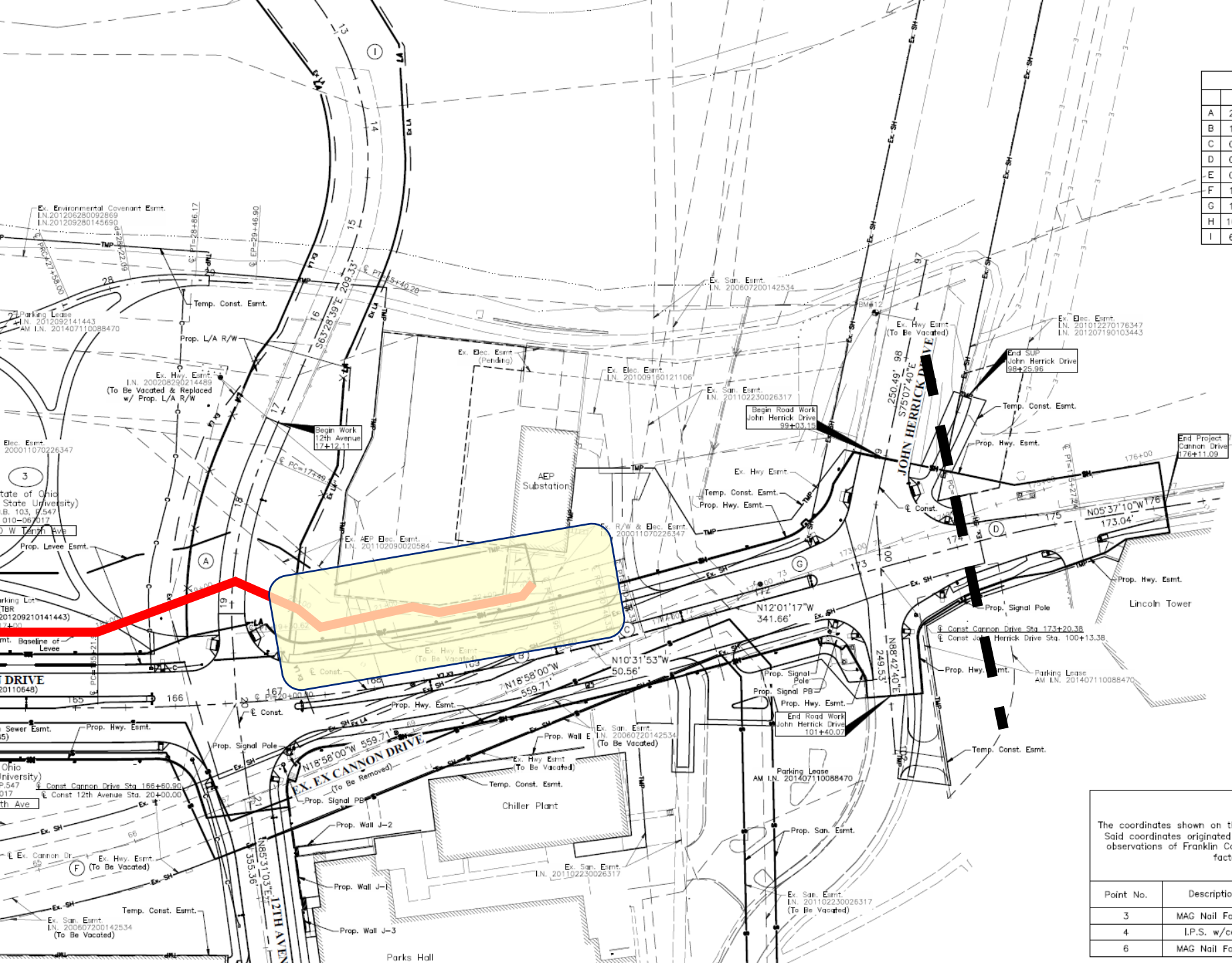


CURVE DATA								
	DELTA	RADIUS	TANGENT	LENGTH	EXTERNAL	MIDDLE	FILLET AREA	RADIUS POINT
A	26°44'29"	388.00'	92.23'	181.09'	10.81'	10.52'	652	17+49.53, 388.00' Lt.
B	13°42'43"	1980.00'	238.06'	473.85'	14.26'	14.16'	2252	169+95.76, 1980.00' Lt.
C	02°58'49"	500.04'	13.01'	26.01'	0.17'	0.17'	1	170+55.71, 500.04' Lt.
D	06°24'07"	1013.56'	56.68'	113.25'	1.58'	1.58'	60	174+13.99, 1013.56' Rt.
E	03°09'27"	7306.56'	201.39'	402.67'	2.77'	2.77'	372	24+36.04 7306.56' Rt.
F	19°04'53"	1432.39'	240.74'	477.03'	20.09'	19.81'	3193	66+86.00, 1432.39' Lt.
G	13°28'06"	1432.39'	169.13'	336.71'	9.95'	9.88'	1117	72+45.71, 1432.39' Rt.
H	101°01'26"	50.00'	60.86'	88.16'	28.63'	18.20'	830	25+93.13, 50.00' Rt.
I	65°54'26"	265.76'	172.28'	305.70'	50.95'	42.76'	5163	12+34.50, 265.76' Rt.

BENCH MARKS CONTINUED	
TBM#5	Chiseled square at a corner of sidewalk at the northeast corner of parking garage, east of Cannon, south of 12th Street. Elev. 719.696 N: 727329.22, E: 1822673.58 Sta. 23+67.63, Offset 62.15' Rt. Based on ℄ Const. Prop. 12th Avenue.
TBM#12	Chiseled square on the southeast wing wall of bridge over Olentangy River on south side of John H. Herrick Drive. Elev. 721.56 N: 728020.20, E: 1821941.99 Sta. 97+61.89, Offset 39.25' Rt. Based on ℄ Const. John Herrick Drive.

BASIS OF BEARINGS

The bearings shown on these plans were transferred from a field traverse originating from and tying to Franklin County Survey Control Monuments, including MORLAN and TACKETT, and is based on the Ohio State Plane Coordinate System, South Zone as per NAD 83.

BASIS OF STATIONING

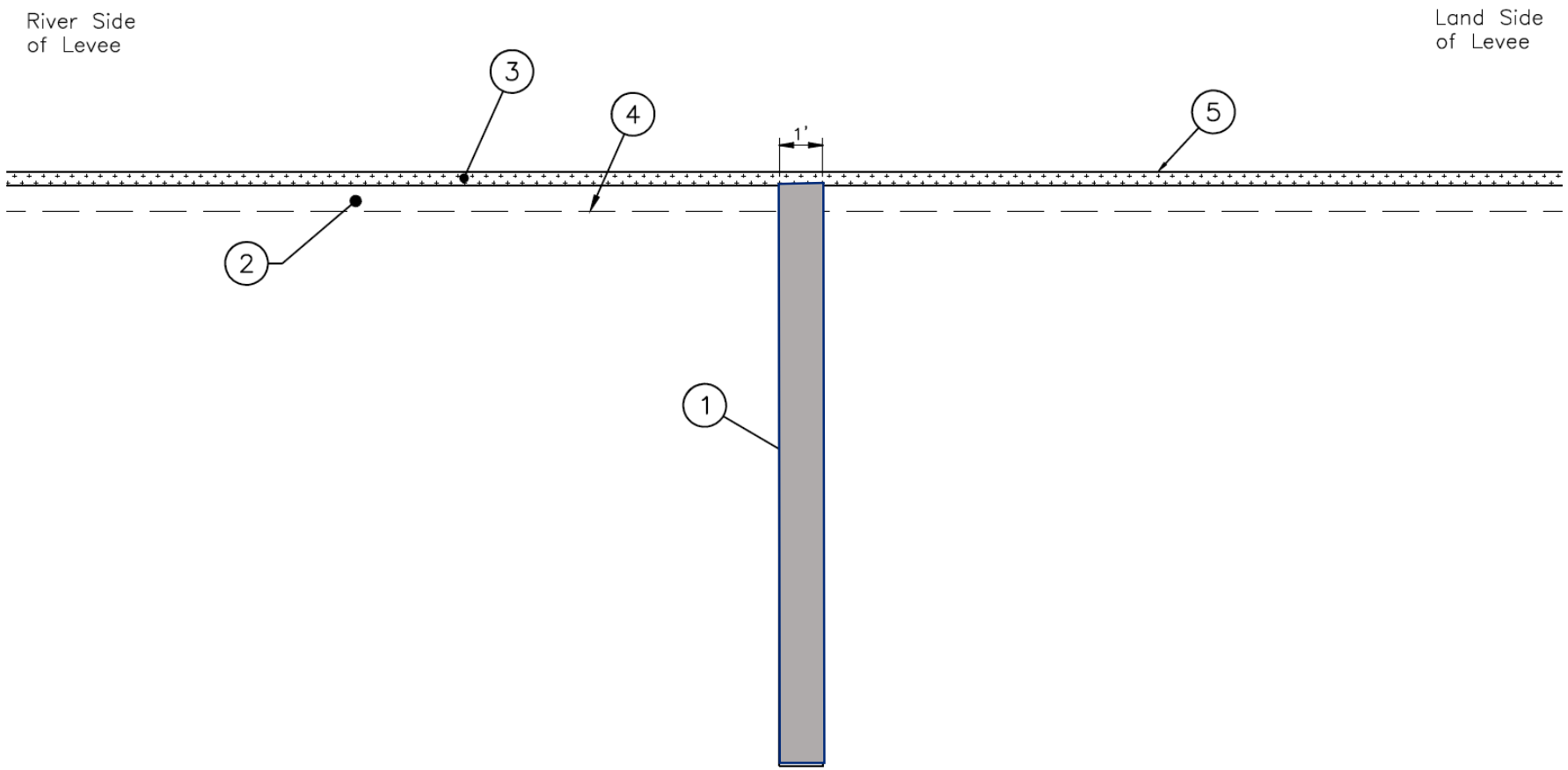
The stationing of Cannon Drive is established with a set station of 147+98.72 at the centerline of King Avenue. The stationing of Dodd Drive is established with a set station of 10+00.00 at the centerline of King Avenue. The stationing of King Avenue is established with a set station of 15+74.46 at the centerline of Cannon Drive. The stationing of Medical Center Drive is established with a set station of 100+00.00 at the centerline of Cannon Drive. The stationing of 10th Avenue is established with a set station of 100+00.00 at the centerline of Cannon Drive. The stationing of 12th Avenue is established with a set station of 20+00.00 at the centerline of Cannon Drive. The stationing of John Herrick Drive is established with a set station of 100+13.38 at the centerline Cannon Drive.

Horizontal Control

The coordinates shown on this map are based on the Ohio State Plane Coordinate System, South Zone, NAD 83 (1986). Said coordinates originated from a field traverse which was tied (referenced) to said coordinate system by Static GPS observations of Franklin County Engineering Department monuments COC4-83, and RINGLE. The grid to ground scale factor (1.0000367691) was applied at the location of point number 201.

Point No.	Description	Northing (Ground)	Easting (Ground)	Station/Offset
3	MAG Nail Found	727417.07	1822649.45	23+59.22, 28.57' Lt. Based on Prop. 12th Ave
4	I.P.S. w/cap	727428.16	1822432.88	21+41.39, 56.78' Lt. Based on Prop. 12th Ave
6	MAG Nail Found	726386.34	1822447.76	156+96.53, 200.33' Rt. Based on Prop. Cannon Dr

Jet Grout Seepage Barrier



JET GROUT SEEPAGE BARRIER LEVEE TYPICAL SECTION

Sta 0+28 to Sta 0+55

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Jet Grout Seepage Barrier

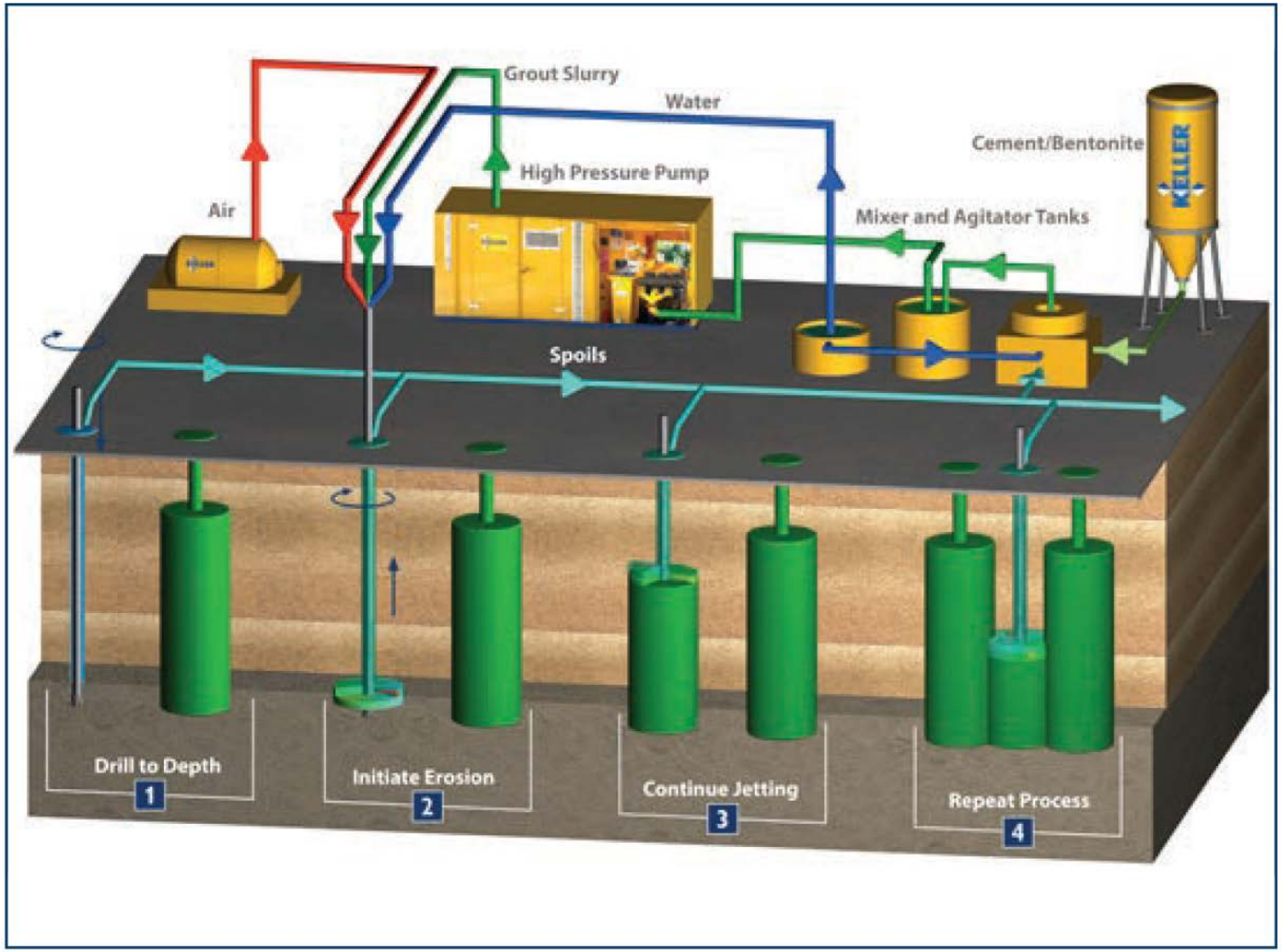

Image: Haywood Baker

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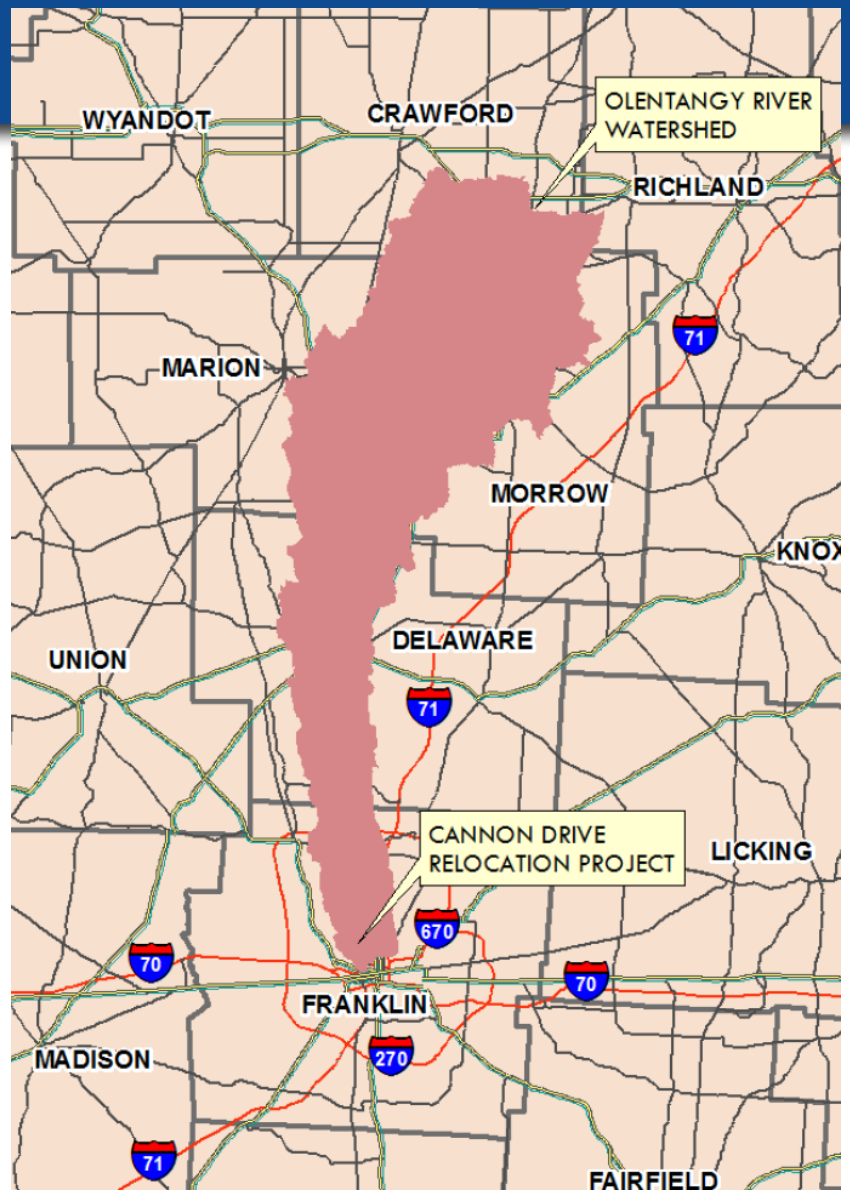
Riverine H&H

- 543 sq. mi. watershed
- FEMA model revised after 5th Ave Dam Removal
- Hydrology influenced by Delaware Dam
- Peak discharge rates based on USGS Gaging Station in Worthington
- SWMM model prepared to validate FEMA flows
- Revised HEC-RAS 1-D analysis
- **Levee final design based on FEMA 500 year streamflow plus two foot freeboard to address uncertainty concerns**



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Interior Drainage System - JPA

- Likelihood of local rain event and Olentangy River flood occurring simultaneously
- Review of historical rainfall data and stream gage records
- Analysis determined weak correlation

River Flood Frequency	Interior Design Storm Event	24-Hour Rainfall Depth	HGL Elevation at POI	Joint Probability of Occurrence
1-year	500-year	7.17”		500-year
5-year	100-year	5.63”		500-year
10-year	50-year	5.02”		500-year
50-year	10-year	3.74”		500-year
100-year	5-year	3.24”		500-year
500-year	1-year	2.20”		500-year

Interior Drainage System – Phase 1 Routing

- SWMM analysis
- Routing to detention basin under river low flow condition
- Under river high flow condition, weir opens at pump station to divert flow
- Box culvert (8’x5’) in Cannon Drive provides conveyance and storage

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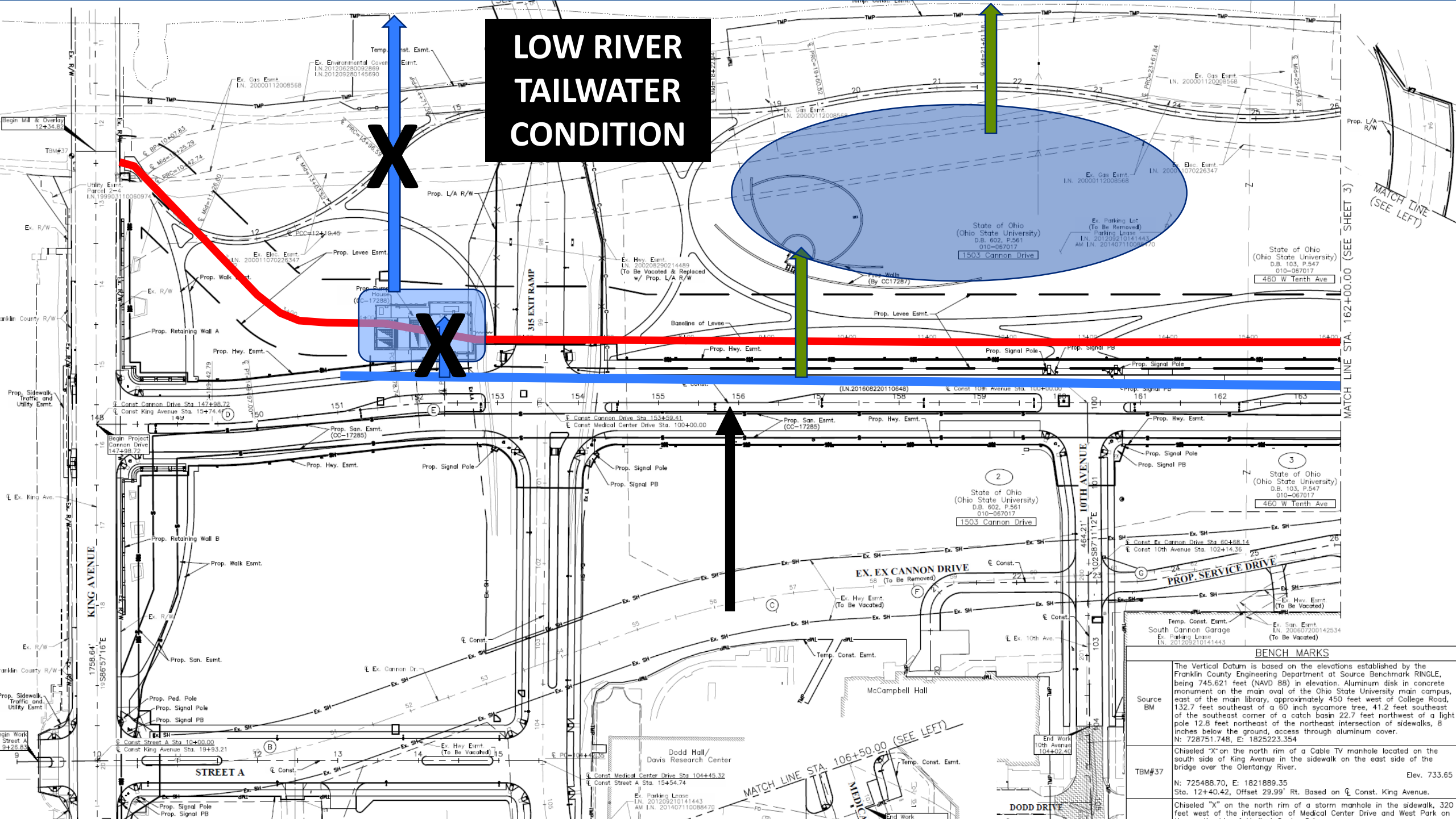
LOW RIVER TAILWATER CONDITION



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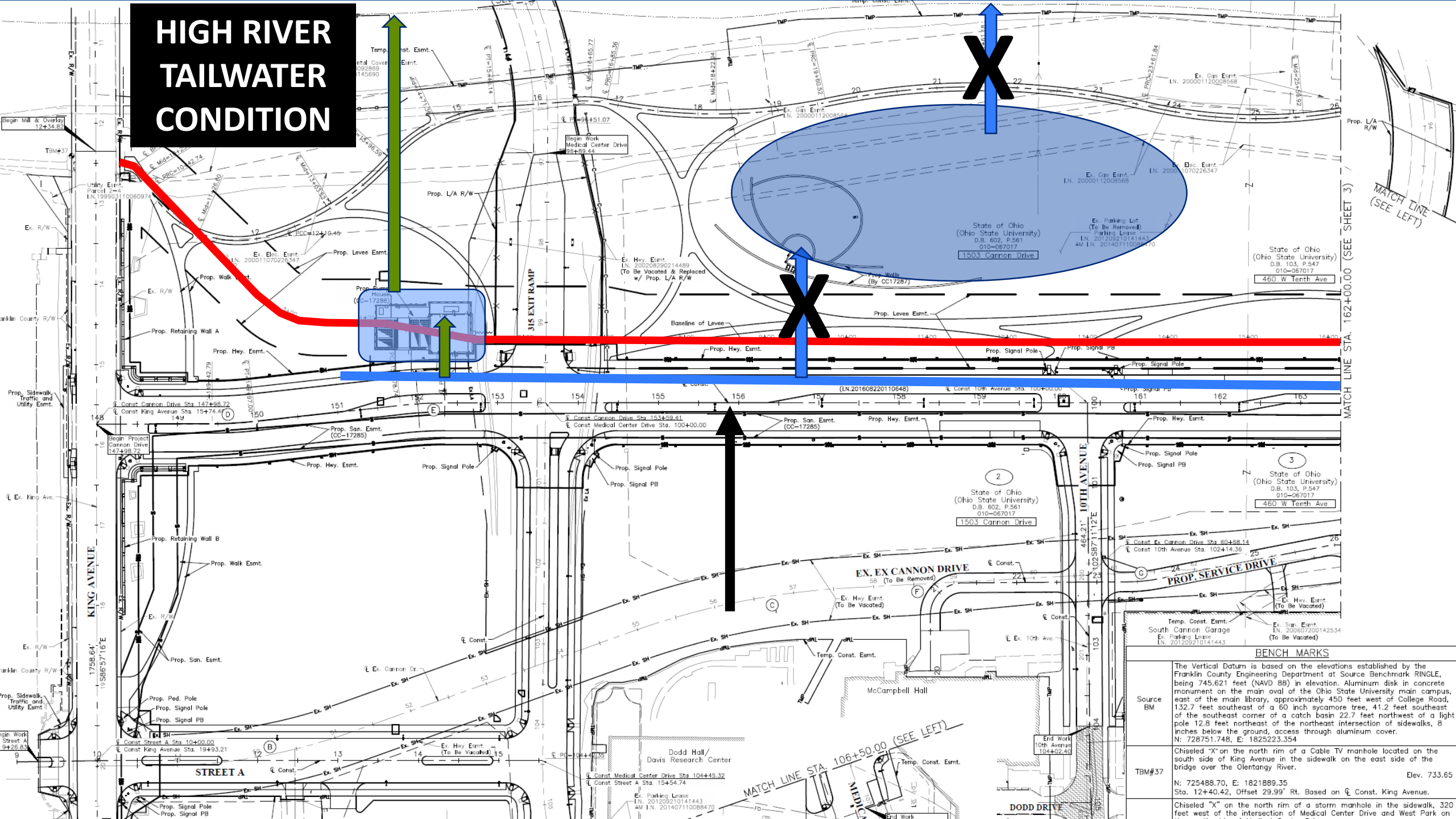
HIGH RIVER TAILWATER CONDITION



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Interior Drainage System – Phase 1 Pump Station

- Maximum capacity = 120 cfs (77 MGD)
  - 3 duty pumps; 2 submersible pumps
- Primary electrical feed with natural gas backup generator

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Levee Review – State of Ohio

ODNR Levee Construction Permit

- Preliminary Design Report: Phase 1 & 2
- Final Design Report: Phase 1 only in 2017
- Permit issued for Phase 1 construction: September 2017

Levee Review – Federal

Conditional Letter of Map Revision

- Phase 1: Issued Feb. 2017
- Phase 2: Revised CLOMR
- LOMR to be filed upon completion of Phase 2
- NFIP 65.10 compliance
  - Freeboard (7 to 8 feet provided for 100 year flood)
  - Closures (Checkmate backflow valves)
  - Scour protection
  - Embankment Stability, Seepage, & Settlement
  - Interior drainage analysis
  - Operation and Maintenance Plan

Project Schedule

PHASE 1	PHASE 2
Under Construction Completion December 2019	In Design Phase Construction TBD

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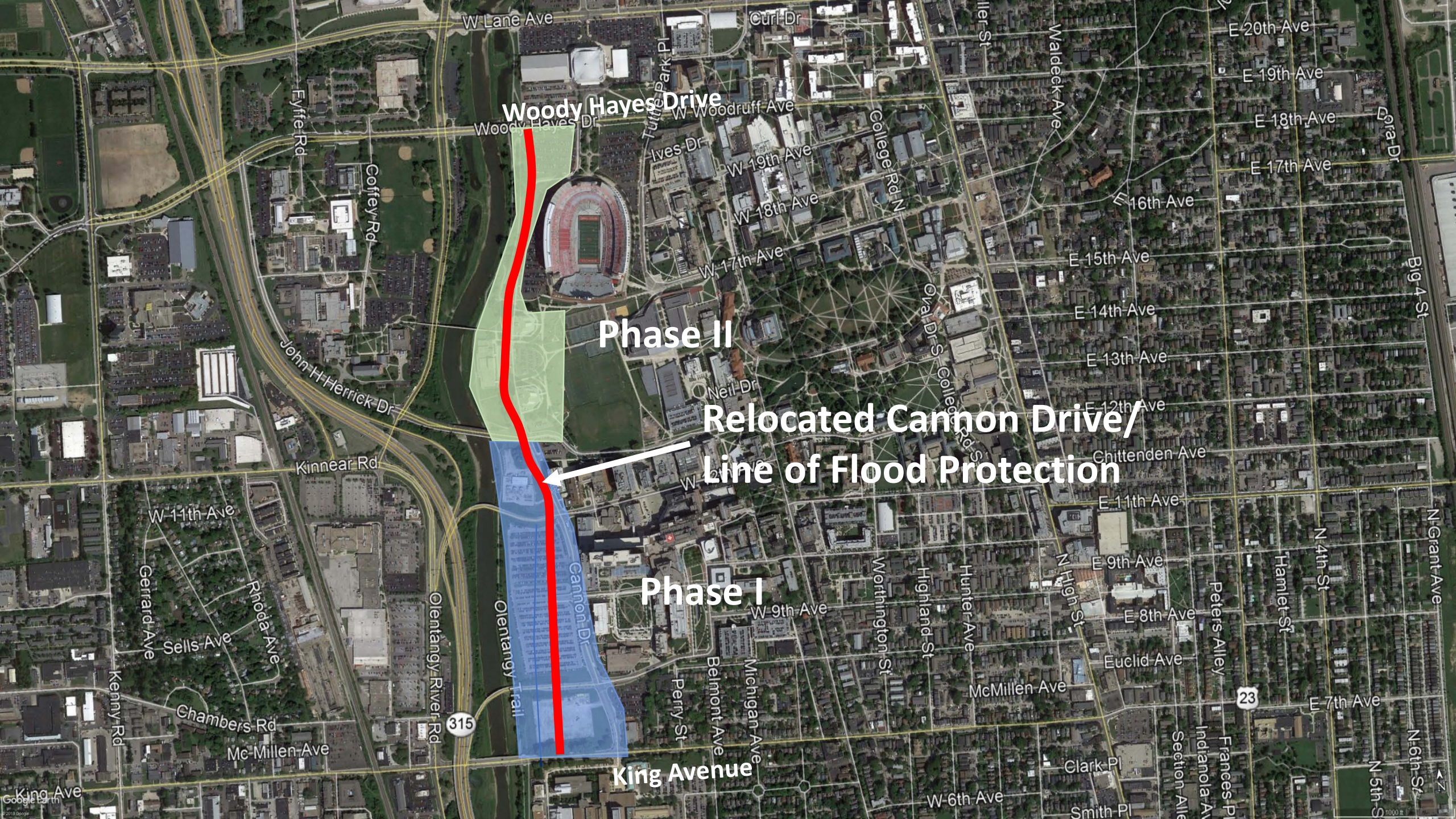
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Google Earth

480
Dodd Rehabilitation Hospital

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Phase 2 – Existing Conditions

Phase 2 – Proposed Conditions

Phase 2 – Proposed Conditions

Project Partners

The Ohio State University

EMH&T

MKSK

Affiliated Engineers

The Columbus Architectural Studio

The City of Columbus
Andrew J. Ginther, Mayor

Resource International

TRI-TECH
Built On Integrity

Trans Associates

Advanced Engineering Consultants