WEST CARROLLTON RIVER PARK

DRAWINGS TO SUPPORT THE CMAR EFFORT BY THE CITY OF WEST CARROLLTON

NOVEMBER 2025

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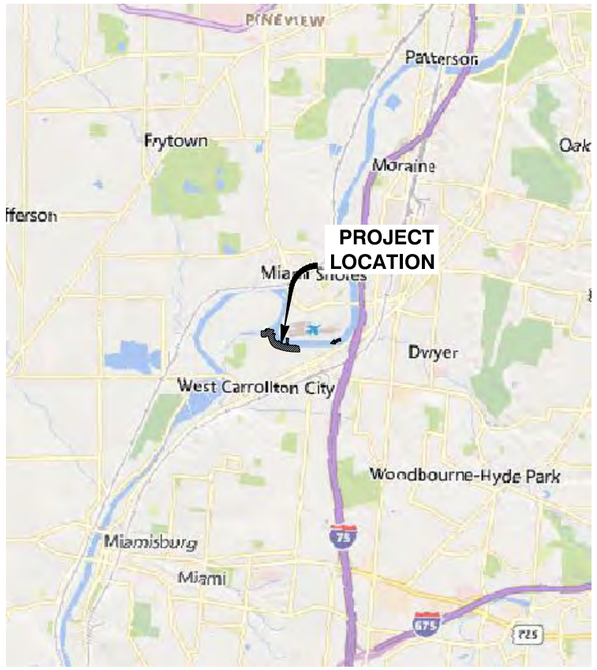
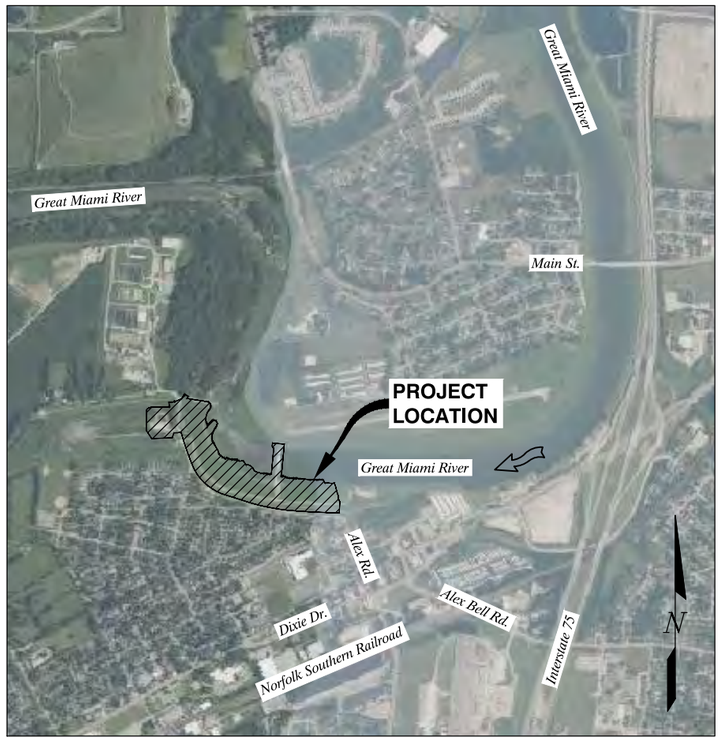


VICINITY MAP

SCALE: 1"=5000'



LOCATION MAP

SCALE: 1"=1000'

- APPROVALS -

CITY OF WEST CARROLLTON:

	DATE		DATE
	DATE		DATE
	DATE		DATE

NOTE

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NOT FOR CONSTRUCTION

DESIGN TEAM:

MULLER ENGINEERING COMPANY

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

GENERAL

TITLE SHEET

DATE 11/14/2025

DRAWING NO. G-1

SHEET NO. 1 OF 52

PLOTTED: 11/10/2025 7:36:31 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_TITLE & INDX.DWG

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MULLER ENGINEERING COMPANY

WEST CARROLLTON

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WEST CARROLLTON RIVER PARK

GENERAL

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DATE 11/14/2025

DRAWING NO. G-2

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ABBREVIATIONS:

APPROX - APPROXIMATELY
CL - CENTER LINE
CCD - CITY AND COUNTY OF DENVER
CFS - CUBIC FEET PER SECOND
C & G - CURB AND GUTTER
C G & SW - CURB, GUTTER, & SIDEWALK
CH - CURB HEAD
CIP- CORRUGATED IRON PIPE (WATER)
CPM. - CAPITAL PROJECTS MANAGEMENT
DIP - DUCTILE IRON PIPE (WATER)
DT- DECIDUOUS TREE
DWD - DENVER WATER DEPARTMENT
E - EAST
EF - EACH FACE
E.G.L. - ENERGY GRADE LINE
EOA - EDGE OF ASPHALT
EQ - EQUALLY SPACED
ES - EACH SIDE
EX- EXISTING
EW - EACH WAY
FG - FINAL GRADE
FL - FLOW LINE
FO - FIBER OPTIC LINE
G - GAS
H.G.L. - HYDRAULIC GRADE LINE
HP - HIGH POINT
I - INLET
INV. - INVERT
LF- LINEAR FEET
LP - LOW POINT
MH - MANHOLE
MJ- MECHANICAL JOINT
N - NORTH
NTS - NOT TO SCALE
OHE - OVERHEAD ELECTRIC LINE
PL - PROPERTY LINE
PVC - POLY VINYL CHLORIDE
q - DESIGN FLOW
Qfull - FULL FLOW CAPACITY
RCBC - REINFORCED CONCRETE BOX CULVERT
RCP - REINFORCED CONCRETE PIPE
R.L. - RANGE LINE
S - SOUTH
STM - STORM SEWER
SS - SANITARY SEWER
SW - SIDEWALK
TC EL. - TOP OF CURB ELEVATION
TELE- TELEPHONE LINE
TOB - TOP OF BOULDER/BLOCK
TOC - TOP OF CONCRETE
T.O.P. - TOP OF PIPE
T.O.W. - TOP OF WALL
TYP. - TYPICAL
UE - UNDERGROUND ELECTRIC LINE
U.N.O. - UNLESS NOTED OTHERWISE
VCP - VITRIFIED CLAY PIPE
W - WEST
WAT - WATER
WMD - WASTEWATER MANAGEMENT DIVISION
WSEL - WATER SURFACE ELEVATION

SURVEY FEATURES LEGEND:

EASEMENT LINE
PROPERTY LINE (NOT R.O.W.)
R.O.W. LINE

EXISTING FEATURES LEGEND:

EXISTING STREET LIGHT
EXISTING UTILITY/POWER POLE
EXISTING GUY WIRE
EXISTING TRAFFIC POLE
EXISTING ELECTRIC METER
EXISTING ELECTRIC BOX
EXISTING FIRE HYDRANT
EXISTING WATER VALVE
EXISTING WATER MH
EXISTING WATER METER
EXISTING STREET SIGN
EXISTING POST
EXISTING BUS BENCH
EXISTING MAIL BOX
EXISTING TELEPHONE MH
EXISTING IRRIGATION BOX
EXISTING TREE
EXISTING SHRUB
PROJECT CONTROL
EXISTING WATER LINE
EXISTING RECYCLED WATER LINE
EXISTING GAS LINE
EXISTING STORM LINE W/MANHOLE
EXISTING SANITARY LINE W/MANHOLE
EXISTING UNDERGROUND ELECTRIC
EXISTING OVERHEAD ELECTRIC
EXISTING FIBER OPTIC
EXISTING FENCE
EXISTING SWALE
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
ABANDON IN PLACE
EXISTING DIRECTION OF SURFACE FLOW

PROPOSED FEATURES LEGEND:

PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
PROPOSED CURB & GUTTER
PROPOSED LIMITS OF CONSTRUCTION
PROPOSED FENCE
PROPOSED WATERLINE
PROPOSED SURFACE DRAINAGE SWALE
PROPOSED RECYCLED WATERLINE
PROPOSED WATER VALVE
PROPOSED LANDSCAPING
PROPOSED CONCRETE SURFACE
PROPOSED DECORATIVE CONCRETE SURFACE
PROPOSED PERMEABLE CONCRETE PAVERS
PROPOSED FULL DEPTH ASPHALT SURFACE
PROPOSED ASPHALT PAVEMENT MILLING AND OVERLAY
PROPOSED TRUNCATED SIDEWALK DOME PANEL
PROPOSED GREEN INFRASTRUCTURE LANDSCAPING
PROPOSED COBBLE
PROPOSED CURB RAMP
PROPOSED DIRECTION OF SURFACE FLOW
BORE/TEST HOLE LOCATION
SPOT ELEVATION

CHANNEL FEATURES LEGEND:

PROPOSED CHANNEL TOE
PROPOSED 5-YR WSEL
PROPOSED 100-YR WSEL

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NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

GENERAL

LEGEND AND ABBREVIATIONS

DATE 11/14/2025
DRAWING NO. G-3
SHEET NO. 3 OF 52

GENERAL NOTES:

1. ALL MATERIALS AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION BY THE CITY OF WEST CARROLLTON. THE CITY RESERVES THE RIGHT TO ACCEPT OR REJECT ANY SUCH MATERIALS AND WORKMANSHIP THAT DOES NOT CONFORM TO ITS STANDARDS AND SPECIFICATIONS.

2. ALL WORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. CONTRACTOR WILL HAVE THE PLAN SET AND CONTRACT DOCUMENTS ON-SITE WHILE WORK IS IN PROGRESS.

3. THE CONTRACTOR SHALL CONTACT THE OHIO UTILITIES PROTECTION SERVICES (811) AND OTHER AFFECTED UTILITIES TO LOCATE UNDERGROUND FACILITIES AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF CONSTRUCTION. CONTRACTOR SHALL POTHOLE AND SURVEY THE LOCATION AND ELEVATION OF ALL EXISTING UTILITIES THAT MAY BE AFFECTED BY CONSTRUCTION PRIOR TO START OF CONSTRUCTION.

4. CONTRACTOR SHALL CONTACT UTILITY POLE OWNERS THAT HAVE POLES WITHIN THE CONSTRUCTION LIMITS. CONTRACTOR SHALL COORDINATE WITH POLE OWNERS REGARDING TEMPORARY SUPPORT REQUIREMENTS.

5. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND CITY PROJECT MANAGER, AT LEAST 24 HOURS PRIOR TO STARTING WORK AND 24 HOURS PRIOR TO EACH DESIRED AND REQUIRED INSPECTION.

6. PROJECT FACILITIES ARE TO BE LOCATED BASED ON THE SURVEY COORDINATES, ELEVATIONS, DIMENSIONS, AND/OR GEOMETRIC DESIGN DATA PROVIDED ON THE DRAWINGS. ADDITIONAL INFORMATION IS AVAILABLE UPON REQUEST FROM MULLER ENGINEERING COMPANY, INC.

7. CONTRACTOR SHALL FIELD VERIFY THE LOCATION (HORIZONTAL AND VERTICAL) AT CONNECTIONS TO ALL EXISTING INFRASTRUCTURE. THIS INFORMATION SHALL BE COLLECTED AND SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO FABRICATION AND/OR PRIOR TO INSTALLATION OF ANY NEW FACILITIES SHOWN ON THESE CONTRACT DRAWINGS. THE ENGINEER WILL DETERMINE IF ANY MINOR MODIFICATIONS TO THE NEW FACILITIES SHOWN ON THE CONTRACT DRAWINGS ARE NECESSARY SUCH AS HORIZONTAL AND VERTICAL ADJUSTMENTS.

8. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE ENGINEER OF ANY CONSTRUCTION PROBLEMS DUE TO CHANGED CONDITIONS OR DESIGN ERRORS ENCOUNTERED BY THE CONTRACTOR. THE CONTRACTOR AND ENGINEER WILL WORK TOGETHER TO REVISE THE PLANS PRIOR TO ANY FURTHER CONSTRUCTION RELATED TO THAT PORTION OF THE WORK. ANY IMPROVEMENTS NOT CONSTRUCTED IN ACCORDANCE WITH THE APPROVED PLANS, OR THE APPROVED REVISED PLANS, SHALL BE REMOVED AND THE IMPROVEMENTS SHALL BE RECONSTRUCTED AT NO COST TO THE PROJECT.

9. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR THE JOB SITE UNDER CONSTRUCTION, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS AND INCLUDES TRAFFIC CONTROL IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES. THE CITY'S REVIEW OF PLANS AND CONSTRUCTION IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE SAFETY MEASURES IN, ON , OR NEAR THE CONSTRUCTION SITE.

10. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR PROVIDING STABLE EXCAVATIONS AND TEMPORARY SLOPES AND FOR SATISFYING ALL APPLICABLE OSHA, FEDERAL, STATE, AND LOCAL REGULATIONS. TEMPORARY EXCAVATIONS SHALL PROVIDE, AT MINIMUM, THE TRENCH DIMENSIONS AND CLEARANCES SHOWN OR SPECIFIED. TEMPORARY CONSTRUCTION SLOPES SHALL BE SLOPED, SHORED, SHEETED, AND/OR BRACED IN ACCORDANCE WITH STABILITY REQUIREMENTS AND APPLICABLE REGULATIONS, AND SHALL BE NO STEEPER THAN THE SLOPES SHOWN OR SPECIFIED WITHOUT THE APPROVAL OF THE ENGINEER. ANY SUCH APPROVALS BY THE ENGINEER WILL NOT RELIEVE THE CONTRACTOR FROM SOLE RESPONSIBILITY FOR PROVIDING STABLE EXCAVATIONS AND TEMPORARY SLOPES.

11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCEPTANCE AND CONTROL OF ALL SURFACE AND SUBSURFACE DRAINAGE AND GROUNDWATER ENTERING THE PROJECT AREA DRY OF STANDING WATER AND SHALL KEEP THE EXCAVATION AREAS FREE FROM STORM RUNOFF.

12. EXISTING FACILITIES NOT INDICATED TO BE REMOVED SHALL BE PROTECTED IN PLACE OR REMOVED AND REPLACED IN KIND, AS APPROVED BY ENGINEER, MHFD PROJECT MANAGER, AND ADAMS COUNTY PROJECT MANAGERS.

13. EARTHWORK SHALL BE COMPLETE IN PLACE WITH ALL EXCESS MATERIAL HAULED OFF-SITE. COMPACTION REQUIREMENTS SHALL BE 95% OF THE MAXIMUM DRY DENSITY PER AASHTO T180 & ASTM D1557 MODIFIED PROCTOR. MOISTURE REQUIREMENTS WILL BE WITHIN 2% OF THE OPTIMUM MOISTURE CONTENT. TESTS MAY BE PERFORMED BY THE OWNER FOLLOWING METHODS OUTLINED IN AASHTO T310. IF A FAILED TEST IS RECEIVED THEN THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST OF THE TEST AND ANY CORRECTIVE ACTIONS NECESSARY.

14. FOR CLARITY, ITEMS SHOWN FOR REMOVAL ON THE DEMOLITION AND REMOVAL PLANS MAY NOT BE SHOWN ON SUBSEQUENT SHEETS.

15. IF HEAVY EQUIPMENT TO BE USED ON THE PROJECT HAS PREVIOUSLY BEEN USED IN ANOTHER STREAM, RIVER, LAKE, POND, OR WETLAND, ONE OF THE FOLLOWING DISINFECTION PRACTICES IS NECESSARY PRIOR TO CONSTRUCTION TO PREVENT THE SPREAD OF NEW ZEALAND MUD SNAILS, ZEBRA MUSSELS, QUAGGA MUSSELS, WHIRLING DISEASE, AND ANY OTHER AQUATIC INVASIVE SPECIES INTO THIS DRAINAGE. THESE PRACTICES ARE ALSO NECESSARY AFTER PROJECT COMPLETION, PRIOR TO THE EQUIPMENT BEING USED IN ANOTHER STREAM, RIVER, LAKE, POND, OR WETLAND:
   A. REMOVE ALL MUD AND DEBRIS FROM EQUIPMENT (TRACKS, TURRETS, BUCKETS, DRAGS, TEETH, ETC.) AND SPRAY / SOAK EQUIPMENT IN A 1:15 SOLUTION OF SPARQUAT INSTITUTIONAL CLEANER AND WATER. KEEP EQUIPMENT MOIST FOR AT LEAST 10 MINUTES OR
   B. REMOVE ALL MUD AND DEBRIS FROM EQUIPMENT (TRACKS, TURRETS, BUCKETS, DRAGS, TEETH, ETC.) AND SPRAY / SOAK EQUIPMENT WITH WATER GREATER THAN 140 DEGREES FAHRENHEIT FOR AT LEAST 10 MINUTES.
   CLEAN HAND TOOLS, BOOTS, AND ANY OTHER EQUIPMENT THAT WILL BE USED IN THE WATER WITH ONE OF THE ABOVE OPTIONS AS WELL. THE COST OF DISINFECTING EQUIPMENT AND TOOLS SHALL BE INCIDENTAL TO THE PROJECT AND BE INCLUDED IN THE COST OF THE WORK.

17. THE MIGRATORY BIRD TREATY ACT (MBTA) PROTECTS MIGRATORY BIRDS AND THEIR NESTS AND EGGS. FOR PROJECTS THAT COULD POTENTIALLY HAVE AN IMPACT, THE FOLLOWING CONDITIONS APPLY:
   A. TREE TRIMMING/REMOVAL: TREE TRIMMING AND/OR REMOVAL ACTIVITIES SHALL BE COMPLETED BEFORE BIRDS BEGIN TO NEST OR AFTER THE YOUNG HAVE FLEDGED. IN COLORADO, MOST NESTING AND REARING ACTIVITIES OCCUR BETWEEN APRIL 1 AND AUGUST 31. HOWEVER, SINCE SOME BIRDS NEST AS EARLY AS FEBRUARY, A NESTING BIRD SURVEY SHALL BE CONDUCTED BY A BIOLOGIST 2 WEEKS (MAX.) BEFORE ANY TREE TRIMMING OR REMOVAL ACTIVITIES BEGIN.
   B. BRIDGE/BOX CULVERT WORK: BRIDGE OR BOX CULVERT WORK THAT MAY DISTURB NESTING BIRDS SHALL BE COMPLETED BEFORE BIRDS BEGIN TO NEST OR AFTER THE YOUNG HAVE FLEDGED. NO BRIDGE OR BOX CULVERT WORK MAY TAKE PLACE BETWEEN APRIL X AND AUGUST X. IF WORK ACTIVITIES ARE PLANNED BETWEEN THESE DATES, NESTS SHALL BE REMOVED (BEFORE NESTING BEGINS) AND APPROPRIATE MEASURES TAKEN TO ASSURE NO NEW NESTS ARE CONSTRUCTED. FAILURE TO REMOVE AND KEEP NESTS FROM BECOMING ESTABLISHED MAY POSTPONE PROJECT CONSTRUCTION.
   C. CLEARING/GRUBBING ACTIVITIES: CLEARING AND GRUBBING OF VEGETATION THAT MAY DISTURB GROUND NESTING BIRDS SHALL BE COMPLETED BEFORE BIRDS BEGIN TO NEST OR AFTER THE YOUNG HAVE FLEDGED. IF WORK ACTIVITIES ARE PLANNED BETWEEN APRIL 1 AND AUGUST 31, VEGETATION SHALL BE REMOVED AND/OR TRIMMED TO A HEIGHT OF SIX (6) INCHES OR LESS PRIOR TO APRIL 1. ONCE VEGETATION HAS BEEN REMOVED AND/OR TRIMMED, APPROPRIATE MEASURES, I.E. REPEATED MOWING/TRIMMING, SHALL BE IMPLEMENTED TO ASSURE VEGETATION DOES NOT GROW MORE THAN SIX (6) INCHES. FAILURE TO MAINTAIN VEGETATION HEIGHT OF SIX (6) INCHES OR LESS MAY POSTPONE PROJECT CONSTRUCTION.
   D. BIRDS OF PREY: FOR BIRDS OF PREY THAT COULD POTENTIALLY NEST NEAR THE PROJECT SITE, PLEASE CONTACT THE CDOT R-4 BIOLOGIST AND/OR REFER TO THE COLORADO PARKS AND WILDLIFE'S "RECOMMENDED BUFFER ZONES AND SEASONAL RESTRICTIONS FOR COLORADO RAPTORS" GUIDELINES AVAILABLE AT COLORADO PARKS AND WILDLIFE DISTRICT OFFICE.

GENERAL NOTES CONTINUED:

17. PERMIT REQUIREMENTS:

    A.

18. CONSTRUCTION PARKING AND STAGING SHALL BE COORDINATED WITH THE CITY OF WEST CARROLLTON.

19. FLOODPLAIN NOTES:
    A. PROJECT IS LOCATED WITHIN ZONE AE FLOODPLAIN AS SHOWN ON FEMA FIRM MAP NUMBER 39113C0242E, REVISED JANUARY 6, 2025.

VOID-FILLED RIPRAP NOTES:

1. THE COLOR OF RIPRAP AND VOID-FILL MATERIALS USED TO FILL THE RIPRAP VOIDS SHALL BE LIGHT GRAY AND/OR TAN AND SHALL BE UNIFORM. SAMPLES OF RIPRAP AND VOID-FILL MATERIALS SHALL BE SUBMITTED FOR THE REVIEW AND APPROVAL OF THE ENGINEER AND OWNER PRIOR TO CONSTRUCTION.

2. ELEVATION TOLERANCE FOR THE VOID-FILLED RIPRAP SHALL BE 0.10 FEET. THICKNESS OF VOID-FILLED RIPRAP SHALL BE NO LESS THAN THICKNESS SHOWN AND NO MORE THAN 2-INCHES GREATER THAN THE THICKNESS SHOWN.

3. WHERE "VOID-FILLED RIPRAP" IS DESIGNATED ON THE CONTRACT DRAWINGS, RIPRAP SHALL BE MIXED WITH THE MATERIALS AT THE ASSOCIATED PROPORTIONS LISTED IN THE TABLE BELOW TO FILL THE VOIDS OF THE RIPRAP:

TABLE 1 - VOID FILLED RIPRAP

VOID-FILLED RIPRAP APPROXIMATE PROPORTIONS (LOADER BUCKETS)				MATERIAL TYPE	MATERIAL DESCRIPTION
TYPE L	TYPE M	TYPE H	TYPE VH		
			7	RIPRAP	TYPE VH RIPRAP (D_{50}=24")
		7		RIPRAP	TYPE H RIPRAP (D_{50}=18")
	6	1	1	RIPRAP	TYPE M RIPRAP (D_{50}=12")
6				RIPRAP	TYPE L RIPRAP (D_{50}=9")
	3	3	3	VOID-FILL MATERIAL	7-INCH MINUS CRUSHED ROCK SURGE (100% PASSING 7-INCH SIEVE, 80-100% PASSING 6-INCH SIEVE, 35-50% PASSING 3-INCH SIEVE, 10-20% PASSING 1.5-INCH SIEVE)
1	1	1	1	VOID-FILL MATERIAL	2 TO 4-INCH VTC ROCK (ANGULAR) (100% PASSING 4-INCH SIEVE, 50-70% PASSING 3-INCH SIEVE, 0-10% PASSING 2-INCH SIEVE), (FRACTURED FACE, ALL SIDES)
1	1.5	1.5	1.5	VOID-FILL MATERIAL	4-INCH MINUS PIT RUN SURGE (ROUND RIVER ROCK AND SAND, WELL GRADED, 90-100% PASSING 4-INCH SIEVE, 70-80% PASSING 1.5-INCH SIEVE, 40-60% PASSING 3/8-INCH SIEVE, 10-30% PASSING #16 SIEVE).
1	1.5	1.5	1.5	VOID-FILL MATERIAL	TYPE II BEDDING
1	1	1	1	VOID-FILL MATERIAL	NATIVE TOPSOIL
TOP LAYER FOR EXPOSED VOID-FILLED RIPRAP				COBBLE	ADDITIONAL 4 TO 12-INCH COBBLE SHALL BE ADDED TO THE SURFACE OF THE EXPOSED VOID-FILLED RIPRAP (COVERING APPROXIMATELY 60% OF THE SURFACE) PRIOR TO COMPACTION. COBBLE SHALL BE FULLY COMPACTED INTO THE VOID FILLED RIPRAP.

NOTE:
MIX PROPORTIONS AND MATERIAL GRADATIONS ARE APPROXIMATE AND ARE SUBJECT TO ADJUSTMENT BY THE ENGINEER. NO ADJUSTMENT IN UNIT PRICE FOR VOID-FILLED RIPRAP WILL BE ALLOWED BASED ON MODIFICATIONS TO THE MIX PROPORTIONS.

4. THE RIPRAP AND VOID-FILL MATERIALS SHALL BE THOROUGHLY MIXED PRIOR TO PLACEMENT AND SHALL BE INSTALLED AND COMPACTED SO THAT A DENSE, INTERLOCKED LAYER OF RIPRAP AND VOID-FILL MATERIAL IS PROVIDED WITH RIPRAP VOIDS COMPLETELY FILLED. THE LOOSE MATERIAL SHALL BE PLACED IN A SINGLE LIFT OF SUFFICIENT HEIGHT SUCH THAT FINAL GRADE WILL BE ACHIEVED UPON COMPACTION. IF THE COMPACTED MATERIAL IS BELOW FINAL GRADE, PLACEMENT OF ONLY THE SMALLER VOID-FILL MATERIALS TO ACHIEVE FINAL GRADE WILL NOT BE PERMITTED. SEGREGATION OF MATERIALS SHALL BE AVOIDED AND IN NO CASE SHALL THE COMBINED MATERIAL CONSIST PRIMARILY OF THE VOID-FILL MATERIALS. THE DENSITY AND INTERLOCKING NATURE OF RIPRAP IN THE MIXED MATERIAL SHALL ESSENTIALLY BE THE SAME AS IF THE RIPRAP WAS PLACED WITHOUT FILLING THE VOIDS.

5. PRIOR TO COMPACTION THE IN PLACE VOID-FILLED RIPRAP SHALL BE WATERED TO WASH THE FINE MATERIAL DOWN TO THE VOIDS AT THE LOWER PORTION OF THE MIX. THIS PROCESS SHALL BE REPEATED DURING COMPACTION AT THE DIRECTION OF THE ENGINEER. ADDITIONAL 4-INCH MINUS PIT RUN SURGE SHALL BE ADDED AS NEEDED.

6. COMPACTION OF THE VOID-FILLED RIPRAP SHALL BE PERFORMED BY WHEEL ROLLING WITH HEAVY RUBBER-TIRED EQUIPMENT (E.G., FRONT END LOADER). THE MOISTURE CONTENT OF THE MIXTURE SHALL BE AT OPTIMUM CONDITIONS PRIOR TO COMPACTION AND WATER SHALL BE ADDED, AS NECESSARY, AT THE DIRECTION OF THE ENGINEER.

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WEST CARROLLTON

WEST CARROLLTON RIVER PARK

GENERAL

GENERAL NOTES

DATE 11/14/2025

DRAWING NO. G-4

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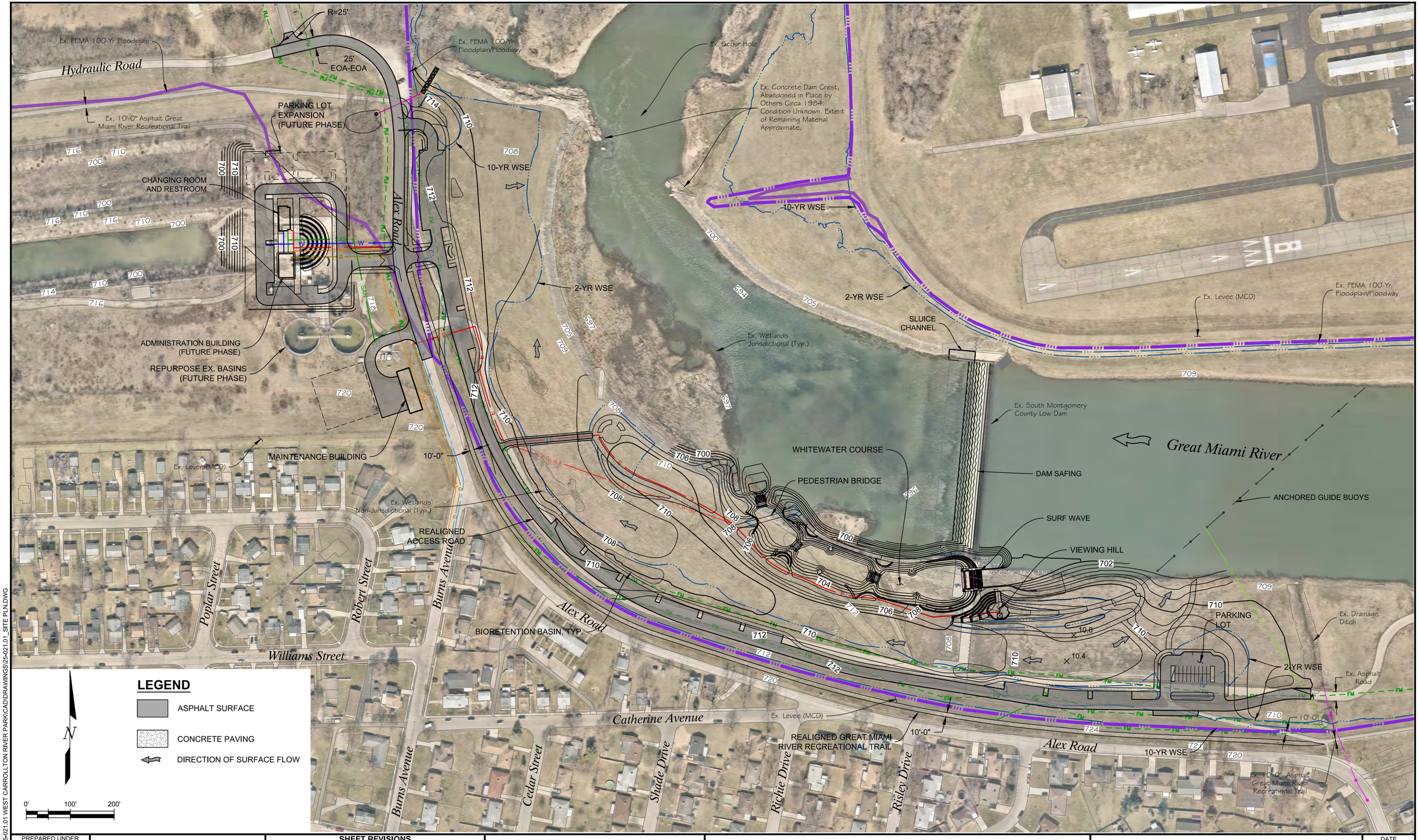

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MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

GENERAL

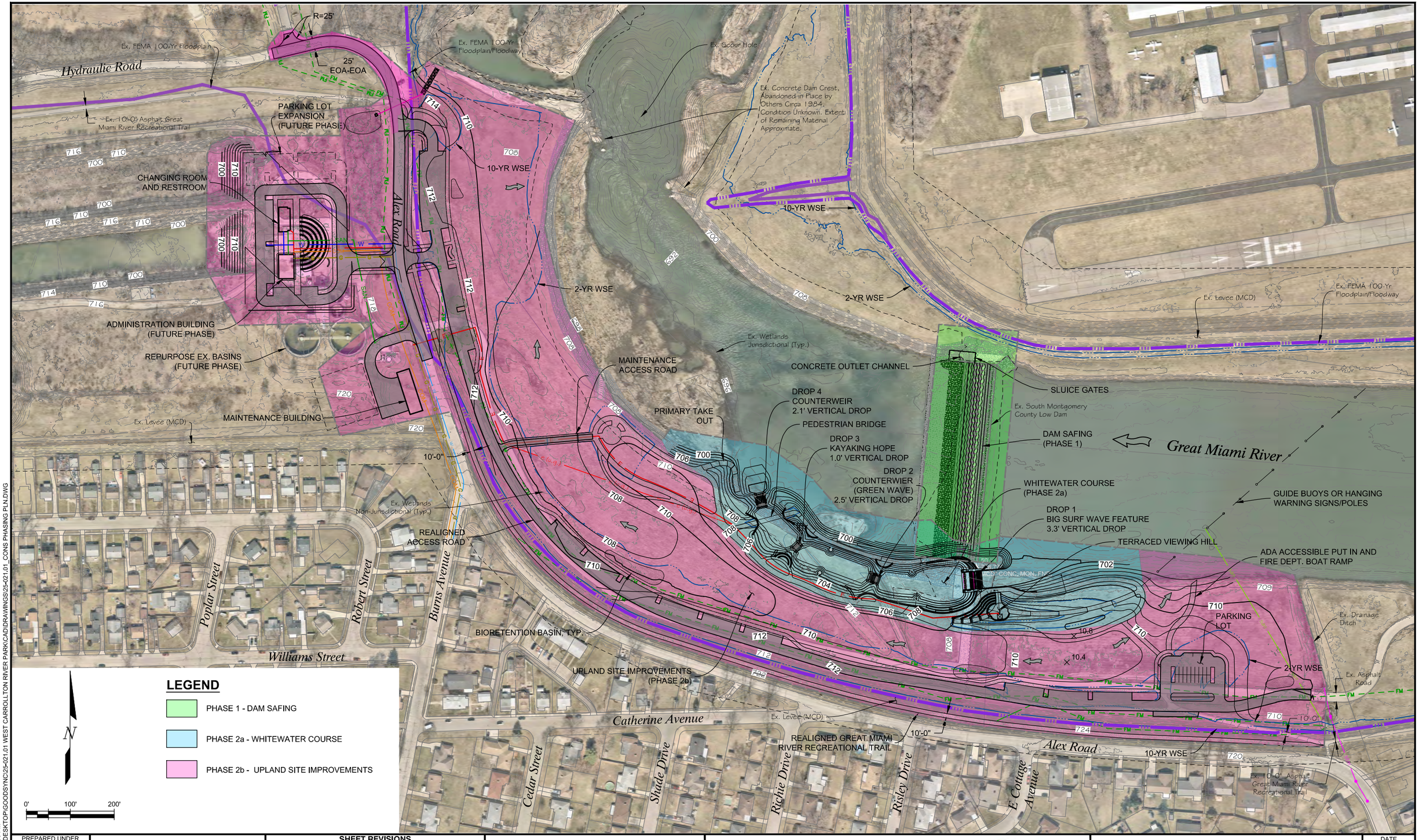
OVERALL SITE PLAN

DATE 11/14/2025

DRAWING NO. G-5

SHEET NO. 5 OF 52

PLOTTED: 11/10/2025 7:59:00 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_SITE PLN.DWG



PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

GENERAL

CONSTRUCTION PHASING PLAN

DATE 11/14/2025

DRAWING NO. G-6

SHEET NO. 6 OF 52

PLOTTED: 11/11/2025 12:42:03 PM
NAME: C:\USERS\KCZYZYK\DESKTOP\GOODSYNC\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_CONS PHASING PLN.DWG

NOT INCLUDED IN CMAR RFP

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

SURVEY

SURVEY PROJECT CONTROL DIAGRAM

DATE
11/14/2025

DRAWING NO.
S-1

SHEET NO.
7 OF 52

PLOTTED: 11/10/2025 8:36:23 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_GEO TST HOLE LOC PLN.DWG

NOT INCLUDED IN CMAR RFP

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

SURVEY

SUB-SURFACE UTILITY ENGINEERING (S.U.E)

DATE
11/14/2025

DRAWING NO.
S-2

SHEET NO.
8 OF 52

PLOTTED: 11/10/2025 8:36:23 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_GEO TST HOLE LOC PLN.DWG

NOTES:

1. UTILITY INFORMATION HAS NOT BEEN OBTAINED FOR ALL PROJECT AREAS, INCLUDING THE ABANDON TREATMENT PLANT.

N

0' 100' 200'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

ENGINEERING GEOLOGY

GEOTECHNICAL TEST HOLE LOCATIONS

DATE 11/14/2025

DRAWING NO. EG-1

SHEET NO. 9 OF 52

PLOTTED: 11/10/2025 8:36:21 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_GEO TST HOLE LOC PLN.DWG

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CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

ENGINEERING GEOLOGY

LEGEND AND NOTES

DATE
11/14/2025

DRAWING NO.
EG-2

SHEET NO.
10 OF 52

PLOTTED: 11/10/2025 8:36:23 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_GEO TST HOLE LOC PLN.DWG

NOT INCLUDED IN CMAR RFP

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CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

ENGINEERING GEOLOGY

BORING LOGS

DATE 11/14/2025

DRAWING NO. EG-3

SHEET NO. 11 OF 52

PLOTTED: 11/10/2025 8:36:24 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_GEO TST HOLE LOC PLN.DWG

Hydraulic Road

Alex Road

Miami Conservancy District K48 00918 0011

City of West Carrollton K48 00917 0004

Moraine Air Park Inc. J44104111 0053

Montgomery County Ohio County Commissioners J44104111 0054

Miami Conservancy District J44104111 0032

Great Miami River K48 00917W0000

Great Miami River

Great Miami River K48 00917W0000

Miami Conservancy District K48 00917 0017

Miami Conservancy District K48 00106 0050

Miami Conservancy District K48 00106 0050

Poplar Street

Robert Street

Burns Avenue

Williams Street

Alex Road

Catherine Avenue

Burns Avenue

Cedar Street

Shade Drive

Richie Drive

Risley Drive

E Cottage Avenue

Alex Road

N

0' 100' 200'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

EXISTING CONDITION

EXISTING CONDITION OVERALL SITE

DATE 11/14/2025

DRAWING NO. EX-1

SHEET NO. 12 OF 52

PLOTTED: 11/10/2025 8:55:11 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_EXIST COND INDX.DWG

MATCHLINE - SHT. 14

Ex. Headrace Structure
Ex. South Montgomery County Low Dam
Great Miami River
Great Miami River K48 00917W0000
Ex. RipRap
Ex. Stilling Basin
Ex. Sheet Pile
Ex. Sheet Pile
Ex. Canoe Portage Ramp
Ex. 24" Steel Waste Pipe (Continues, Alignment Unknown)
Ex. 24" Steel Waste Pipe
Ex. Boat Ramp & Dock
Miami Conservancy District K48 00111 0078
Ex. Concrete Parking
Ex. Wetlands (Typ.)
Ex. Parcel (Typ.)
709
710
Miami Conservancy District K48 00106 0050
Ex. Drainage Ditch
Ex. Parking Lot
703
Ex. 54" Force Main
709
Miami Conservancy District K48 00106 0050
Ex. 24" Force Main
Ex. 24" Force Main
Ex. Asphalt Road
715
711
710
Ex. Box Culvert
10'-0"
Ex. R.O.W. (Typ.)
720
724
Ex. Levee (MCD)
721
Alex Road
Ex. FEMA 100-Yr Floodplain/Floodway
720
Ex. 10'-0" Asphalt Great Miami River Recreational Trail
Risley Drive

KEYMAP
SCALE: 1"=1,600'

NOTES:

1. THE TOPOGRAPHIC DATA PRESENTED ON THESE PLANS WAS OBTAINED FROM LIDAR.
2. LIMITED UNDERGROUND UTILITY LOCATIONS WERE OBTAINED FROM GIS DATA PROVIDED BY MONTGOMERY COUNTY AND SHOULD BE CONSIDERED APPROXIMATE.
3. UTILITY DATA HAS NOT BEEN OBTAINED FOR ALL PROJECT AREAS, INCLUDING THE ABANDONED TREATMENT PLANT ALONG HYDRAULICS ROAD.
4. PROPERTY LINES WERE OBTAINED FROM GIS DATA PROVIDED BY MONTGOMERY COUNTY AND SHOULD BE CONSIDERED APPROXIMATE.
5. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983 (NAD 83) AND THE PROJECTION SYSTEM IS OHIO STATE PLAN SOUTH ZONE, NATIONAL SPATIAL REFERENCE SYSTEM 2011 (NSRS 2011).
6. VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
7. EFFECTIVE SPECIAL FLOOD HAZARD AREAS (SFHA) ARE FROM FEMA FLOOD INSURANCE RATE MAP (FIRM) PANELS 39113C0242E, REVISED 01/06/2005.

N

0' 50' 100'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

EXISTING CONDITION

EXISTING CONDITION PLAN

DATE 11/14/2025

DRAWING NO. EX-2

SHEET NO. 13 OF 52

PLOTTED: 11/10/2025 9:01:17 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_EXIST COND PLN.DWG

MATCHLINE - SHT. 15

MATCHLINE - SHT. 13

Ex. Concrete Ramp
Ex. Wetlands Jurisdictional (Typ.)
Great Miami River K48 00917W0000
Ex. Riprap
Ex. Parcel (Typ.)
Ex. Electrical Line
Ex. Wetlands Non-Jurisdictional (Typ.)
Ex. FEMA 100-Yr Floodplain/Floodway
Miami Conservancy District K48 00917 0017
Ex. 10'-0" Asphalt Great Miami River Recreational Trail
Ex. Asphalt Road
Ex. 54" Force Main
Ex. 24" Force Main
Ex. R.O.W. (Typ.)
Ex. Levee (MCD)
Ex. Waterline
Robert Street
Burns Avenue
Alex Road
Catherine Avenue
Cedar Street
Shade Drive
Richie Drive
COW
FM

KEYMAP
SCALE: 1"=1,600'

NOTES:

1. THE TOPOGRAPHIC DATA PRESENTED ON THESE PLANS WAS OBTAINED FROM LIDAR.
2. LIMITED UNDERGROUND UTILITY LOCATIONS WERE OBTAINED FROM GIS DATA PROVIDED BY MONTGOMERY COUNTY AND SHOULD BE CONSIDERED APPROXIMATE.
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6. VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
7. EFFECTIVE SPECIAL FLOOD HAZARD AREAS (SFHA) ARE FROM FEMA FLOOD INSURANCE RATE MAP (FIRM) PANELS 39113C0242E, REVISED 01/06/2005.

N

0' 50' 100'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

EXISTING CONDITION

EXISTING CONDITION PLAN

DATE 11/14/2025

DRAWING NO. EX-3

SHEET NO. 14 OF 52

PLOTTED: 11/10/2025 9:04:40 AM
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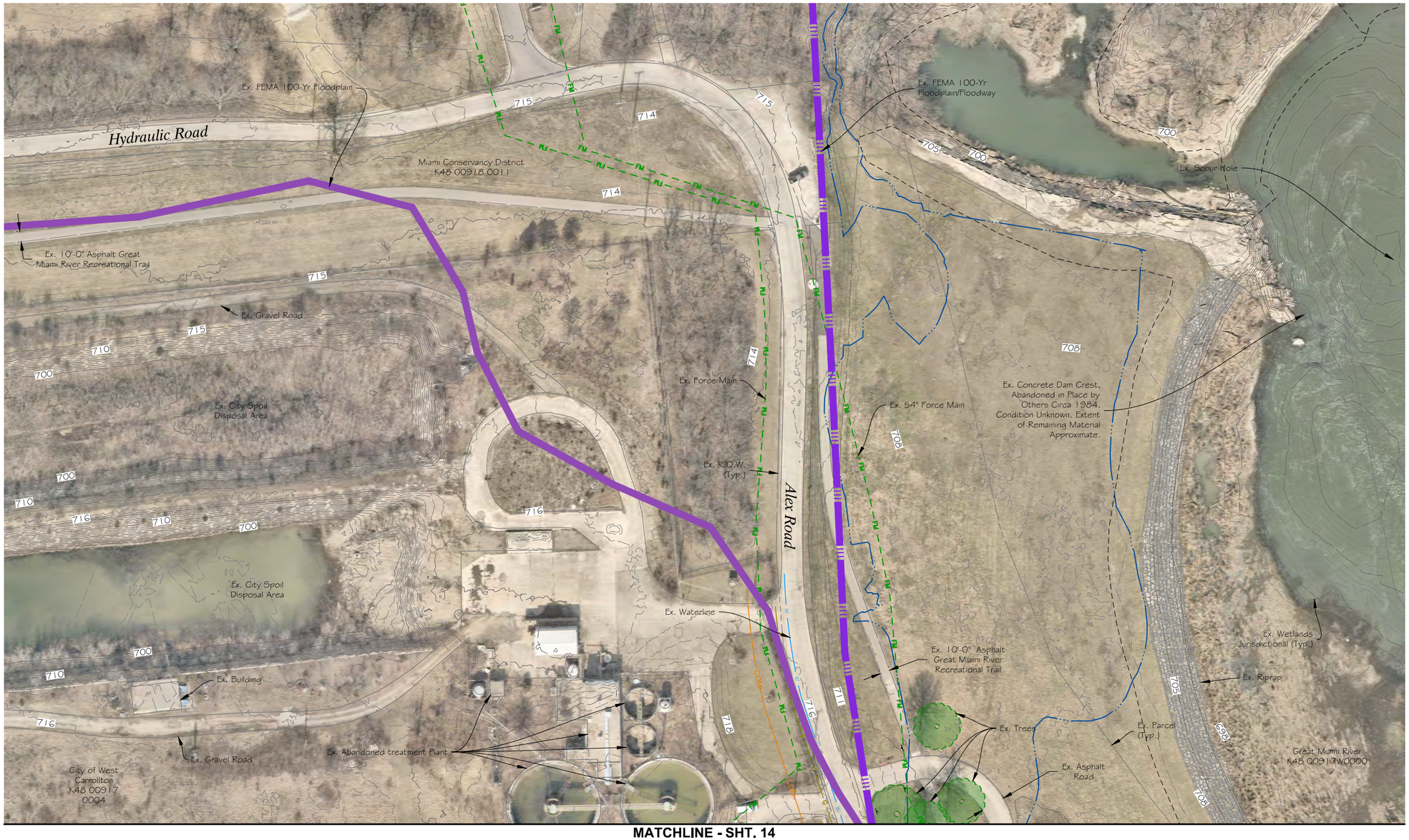

MATCHLINE - SHT. 14

KEYMAP
SCALE: 1"=1,600'

NOTES:

1. THE TOPOGRAPHIC DATA PRESENTED ON THESE PLANS WAS OBTAINED FROM LIDAR.
2. LIMITED UNDERGROUND UTILITY LOCATIONS WERE OBTAINED FROM GIS DATA PROVIDED BY MONTGOMERY COUNTY AND SHOULD BE CONSIDERED APPROXIMATE.
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6. VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
7. EFFECTIVE SPECIAL FLOOD HAZARD AREAS (SFHA) ARE FROM FEMA FLOOD INSURANCE RATE MAP (FIRM) PANELS 39113C0242E, REVISED 01/06/2005.

N

0' 50' 100'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

EXISTING CONDITION

EXISTING CONDITION PLAN

DATE 11/14/2025

DRAWING NO. EX-4

SHEET NO. 15 OF 52

PLOTTED: 11/10/2025 9:07:38 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_EXIST COND PLN.DWG

MATCHLINE - SHT. 17

REMOVE
Ex. Headrace Structure

Ex. South Montgomery County Low Dam

Great Miami River

Great Miami River
K48 00917W0000

REMOVE
Ex. RipRap

REMOVE
Ex. Stilling Basin

REMOVE
Ex. Sheet Pile

REMOVE
Ex. Sheet Pile

REMOVE
Ex. Canoe Portage Ramp

REMOVE
Ex. Concrete Parking

Ex. Wetlands (Typ.)

Ex. Parcel (Typ.)

Ex. 24" Steel Waste Pipe
(Continues, Alignment Unknown)

Ex. 24" Steel Waste Pipe

Ex. Boat Ramp & Dock

Miami Conservancy District
K48 00111 0078

Miami Conservancy District
K48 00106 0050

Ex. Drainage Ditch

Ex. Parking Lot

PROTECT
Ex. 54" Force Main

PROTECT
Ex. 24" Force Main

PROTECT
Ex. 24" Force Main

REMOVE 2292 SY OF ASPHALT PAVEMENT

Ex. Asphalt Road

Ex. Box Culvert

10'-0"

Ex. 10'-0" Asphalt Great Miami River Recreational Trail

Ex. R.O.W. (Typ.)

Ex. Levee (MCD)

Alex Road

Risley Drive

REMOVE 10836 SF OF ASPHALT TRAIL

Ex. FEMA 100-Yr Floodplain/Floodway

709 710 703 715 711 720 724 721

FM

KEYMAP
SCALE: 1"=1,600'

LEGEND

- CONCRETE REMOVAL
- FULL DEPTH ASPHALT PAVEMENT REMOVAL
- RIPRAP REMOVAL
- ASPHALT TRAIL REMOVAL
- EXCAVATION IN TREE PROTECTION ZONES SEE SHT. 5
- CONCRETE CURB AND GUTTER REMOVAL
- REMOVAL
- MODIFY
- PROTECT EX. TREE
- REMOVE EX. TREE
- TP — TREE PROTECTION
- CRZ — CRITICAL ROOT ZONE

NOTES:

1. UTILITY DATA HAS NOT BEEN OBTAINED FOR ALL PROJECT AREAS, INCLUDING THE ABANDONED TREATMENT PLANT.
2. DEMOLITION MAY INCLUDE UTILITIES AND OTHER ITEMS NOT SHOWN ON THIS EXHIBIT.

N

0' 50' 100'

PLOTTED: 11/10/2025 9:13:57 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_DEMO PLN.DWG

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

DEMOLITION

DEMOLITION PLAN

DATE 11/14/2025

DRAWING NO. D-1

SHEET NO. 16 OF 52

MATCHLINE - SHT. 18

MATCHLINE - SHT. 16

KEYMAP
SCALE: 1"=1,600'

LEGEND

- CONCRETE REMOVAL
- FULL DEPTH ASPHALT PAVEMENT REMOVAL
- RIPRAP REMOVAL
- ASPHALT TRAIL REMOVAL
- EXCAVATION IN TREE PROTECTION ZONES SEE SHT. 5
- CONCRETE CURB AND GUTTER REMOVAL
- REMOVAL
- MODIFY
- PROTECT EX. TREE
- REMOVE EX. TREE
- TP — TREE PROTECTION
- CRZ — CRITICAL ROOT ZONE

NOTES:

1. UTILITY DATA HAS NOT BEEN OBTAINED FOR ALL PROJECT AREAS, INCLUDING THE ABANDONED TREATMENT PLANT.
2. DEMOLITION MAY INCLUDE UTILITIES AND OTHER ITEMS NOT SHOWN ON THIS EXHIBIT.

N

0' 50' 100'

PLOTTED: 11/10/2025 9:17:23 AM
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PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

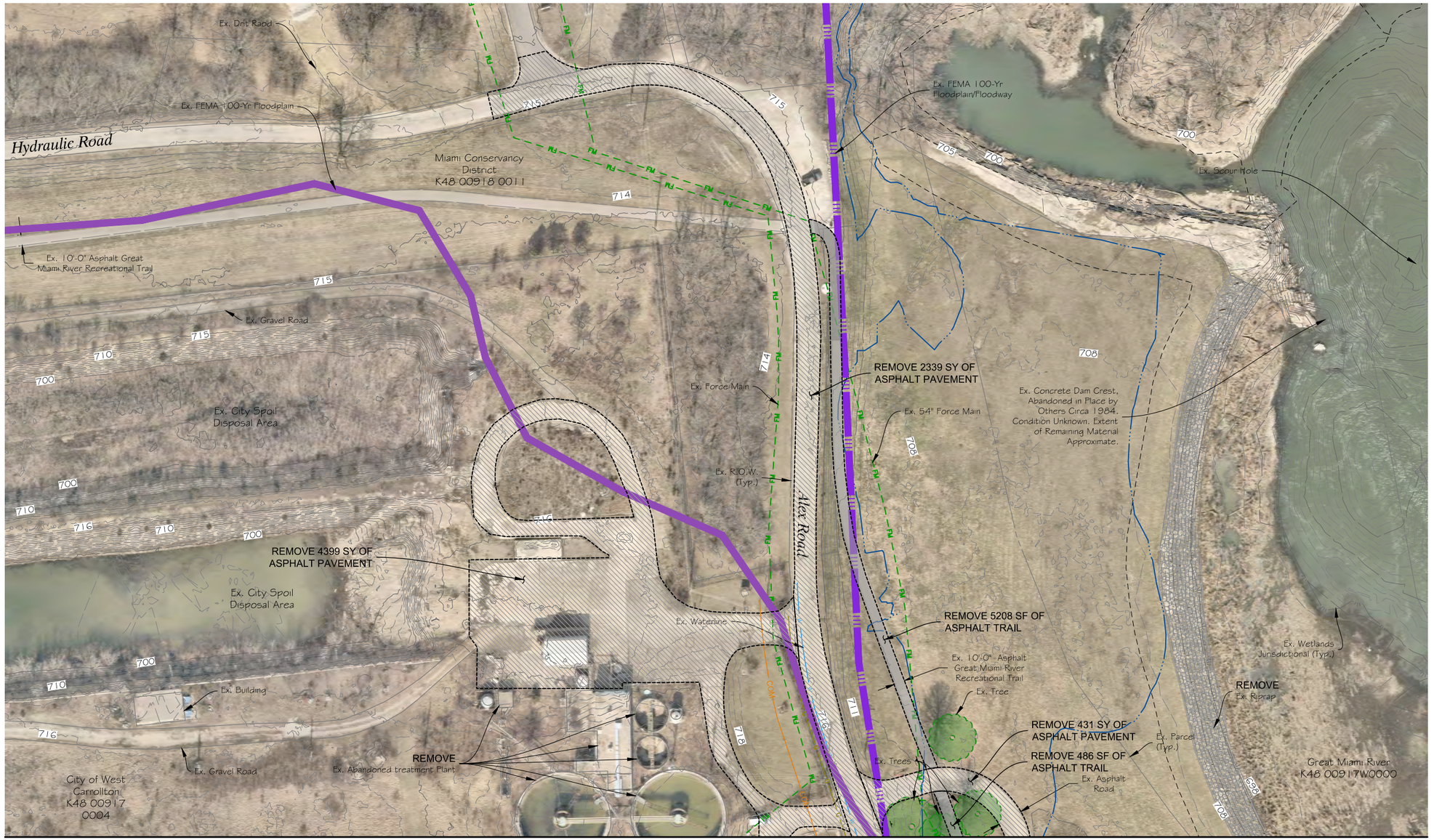
DEMOLITION

DEMOLITION PLAN

DATE 11/14/2025

DRAWING NO. D-2

SHEET NO. 17 OF 52



MATCHLINE - SHT. 17

KEYMAP
SCALE: 1"=1,600'

LEGEND

- CONCRETE REMOVAL
- FULL DEPTH ASPHALT PAVEMENT REMOVAL
- RIPRAP REMOVAL
- ASPHALT TRAIL REMOVAL
- EXCAVATION IN TREE PROTECTION ZONES SEE SHT. 5
- CONCRETE CURB AND GUTTER REMOVAL
- REMOVAL
- MODIFY
- PROTECT EX. TREE
- REMOVE EX. TREE
- TP — TREE PROTECTION
- CRZ — CRITICAL ROOT ZONE

NOTES:

1. UTILITY DATA HAS NOT BEEN OBTAINED FOR ALL PROJECT AREAS, INCLUDING THE ABANDONED TREATMENT PLANT.
2. DEMOLITION MAY INCLUDE UTILITIES AND OTHER ITEMS NOT SHOWN ON THIS EXHIBIT.

N

0' 50' 100'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

DEMOLITION

DEMOLITION PLAN

DATE 11/14/2025

DRAWING NO. D-3

SHEET NO. 18 OF 52

PLOTTED: 11/10/2025 9:20:23 AM
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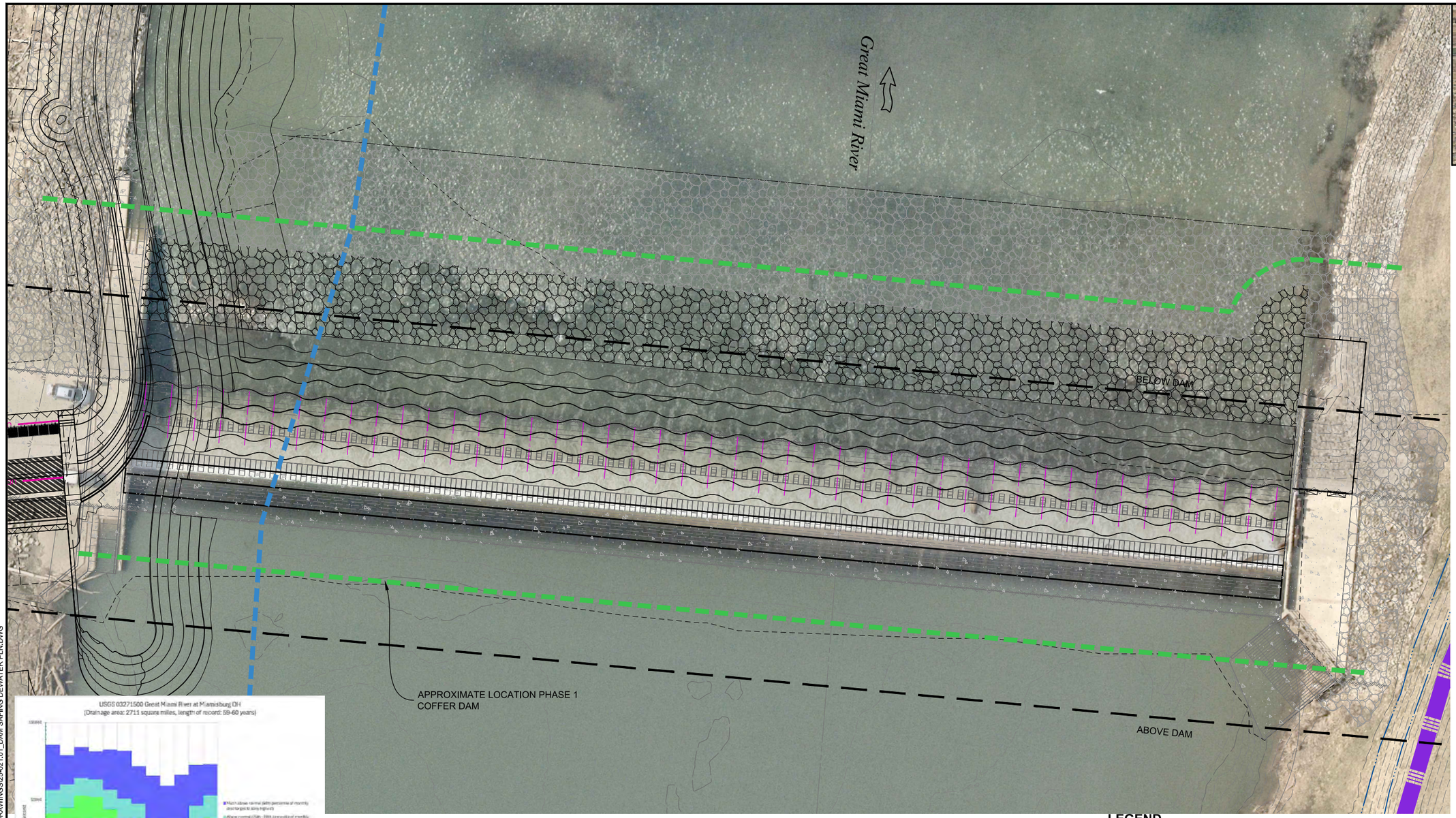
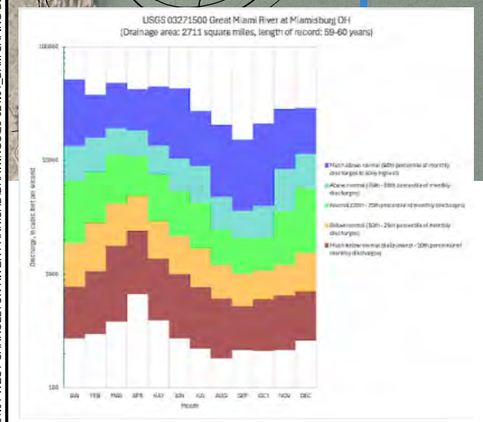


KEYMAP
SCALE: 1"=1,600'



Annual Chance of Being Equaled or Exceeeded	Discharge (cfs)	WSEL (ft NAVD 88)		
		Upstream of Dam	Below Dam	At Island Takeout
1 in 500	107,000	719.3	718.6	718.2
1 in 100	86,000	717.0	716.2	715.7
1 in 50	78,000	716.1	715.2	714.6
1 in 10	56,000	713.9	712.3	711.6
-	30,000	711.6	707.2	706.4
-	20,000	710.6	704.4	703.6
-	10,000	709.3	701.0	699.8

LEGEND

- PHASE 1 - CONCEPTUAL COFFER DAM ALIGNMENT
- PHASE 2 - CONCEPTUAL COFFER DAM ALIGNMENT
- LOCATION OF WSEL ESTIMATE

NOTES:

1. COFFER DAM LOCATION ARE SHOWN AS A VISUAL APPROXIMATIONS ONLY. CONTRACTOR IS RESPONSIBLE FOR DEVELOPING SITE DEWATERING PLAN.
2. WATER SURFACE ELEVATIONS ARE BASED ON PRELIMINARY HYDRAULIC MODELING AND ARE SUBJECT TO REVISION.

0' 20' 40'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

DAM HAZARD MITIGATION

DAM HAZARD MITIGATION DEWATERING & WATER CONTROL PLAN

DATE 11/14/2025

DRAWING NO. DS-1

SHEET NO. 19 OF 52

PLOTTED: 11/10/2025 9:26:38 AM
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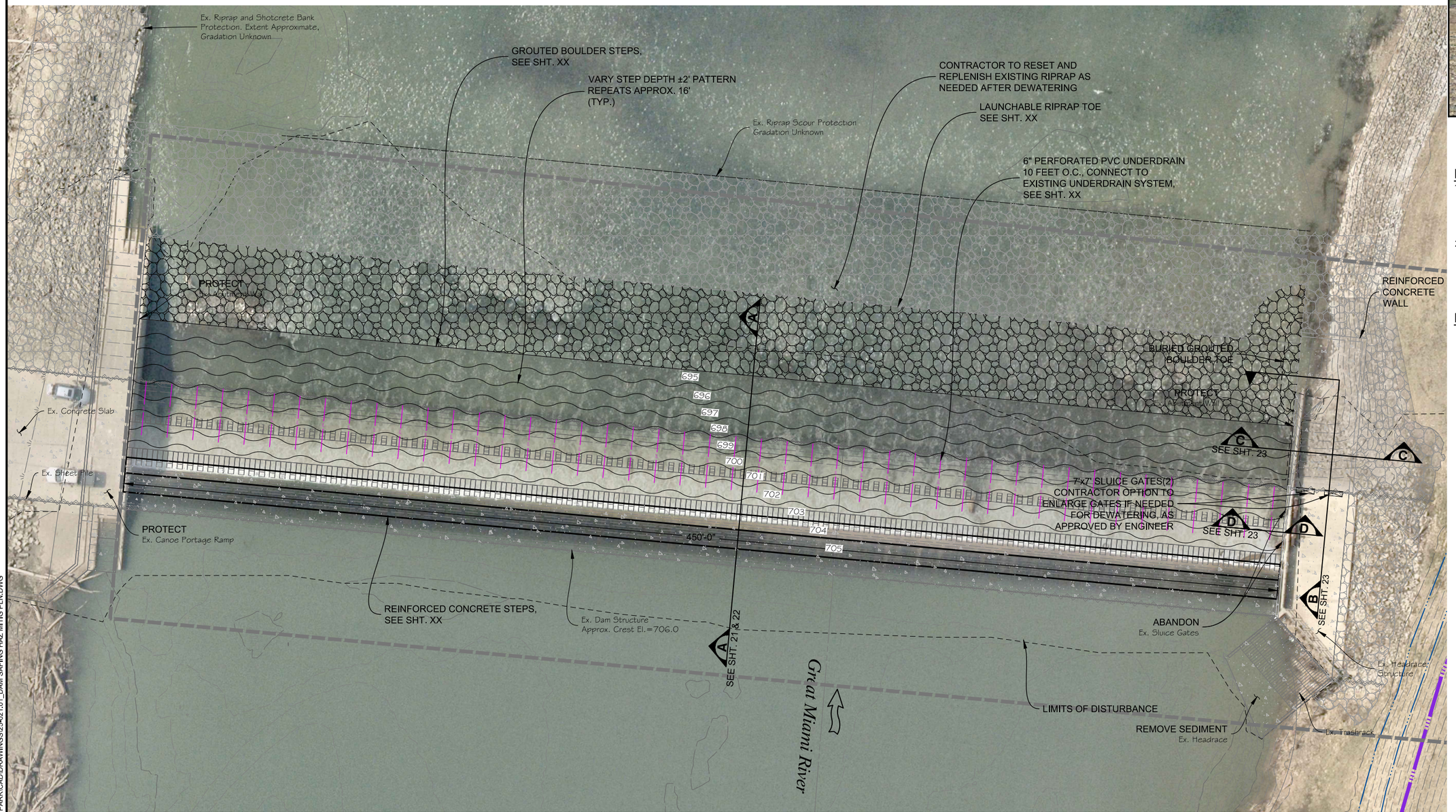

KEYMAP
SCALE: 1"=1,600'

NOTES:

1. COFFER DAM LOCATION ARE SHOWN AS A VISUAL APPROXIMATIONS ONLY. CONTRACTOR IS RESPONSIBLE FOR DEVELOPING SITE DEWATERING PLAN.
2. WATER SURFACE ELEVATIONS ARE BASED ON PRELIMINARY HYDRAULIC MODELING AND ARE SUBJECT TO REVISION.

LEGEND

RIPRAP

CONCRETE

N

0' 20' 40'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

DAM HAZARD MITIGATION

DAM HAZARD MITIGATION PLAN

DATE 11/14/2025

DRAWING NO. DS-2

SHEET NO. 20 OF 52

PLOTTED: 11/10/2025 9:30:43 AM
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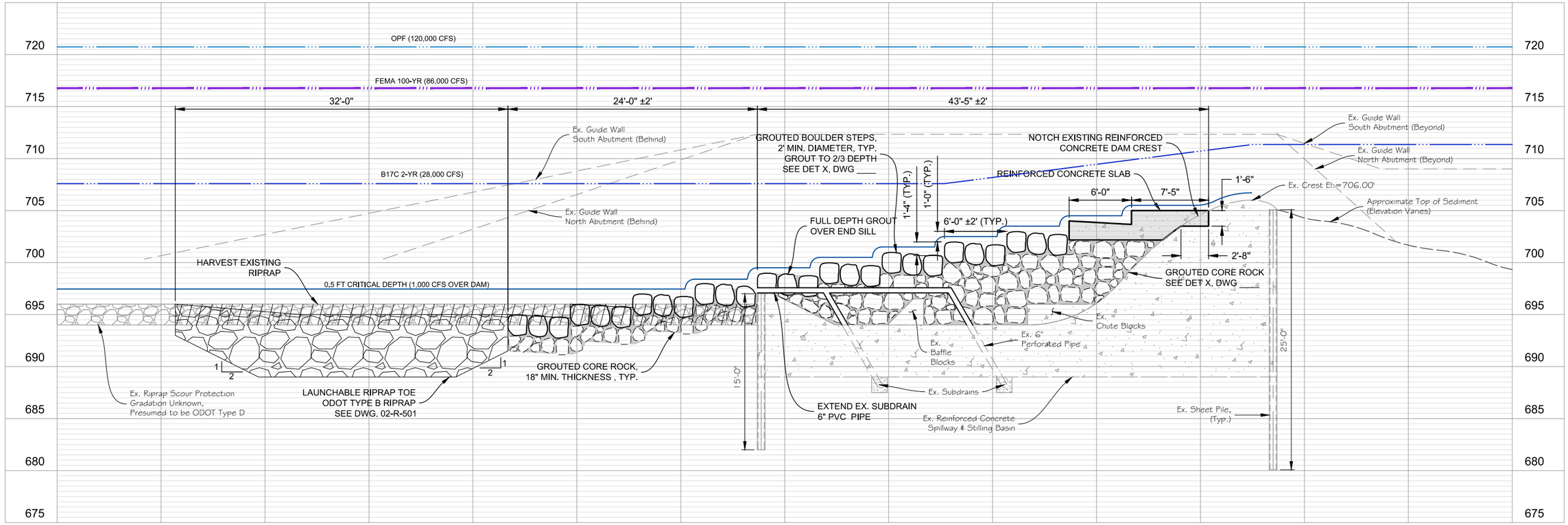

SOUTH MONTGOMERY LOW DAM - PROFILE A

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'
0' 5' 10'

NOTES:

1. ALL EXISTING DIMENSIONS FROM SOUTH MONTGOMERY COUNTY DAM CONSTRUCTION PLANS DATED FEBRUARY 1984.
2. ALL ELEVATIONS ARE RELATIVE TO DAM CREST. DAM CREST ELEVATION SHOWN ON 1984 CONSTRUCTION DRAWINGS IS NOT CONSISTENT WITH OBSERVED WATER SURFACE ELEVATIONS. DAM CREST TO BE SURVEYED PRIOR TO 60% DESIGN.
3. EXISTING REINFORCEMENT TYPICALLY 6" CLEAR.

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

DAM HAZARD MITIGATION

DAM HAZARD MITIGATION ELEVATION

DATE 11/14/2025

DRAWING NO. DS-3

SHEET NO. 21 OF 52

PLOTTED: 11/10/2025 9:31:23 AM
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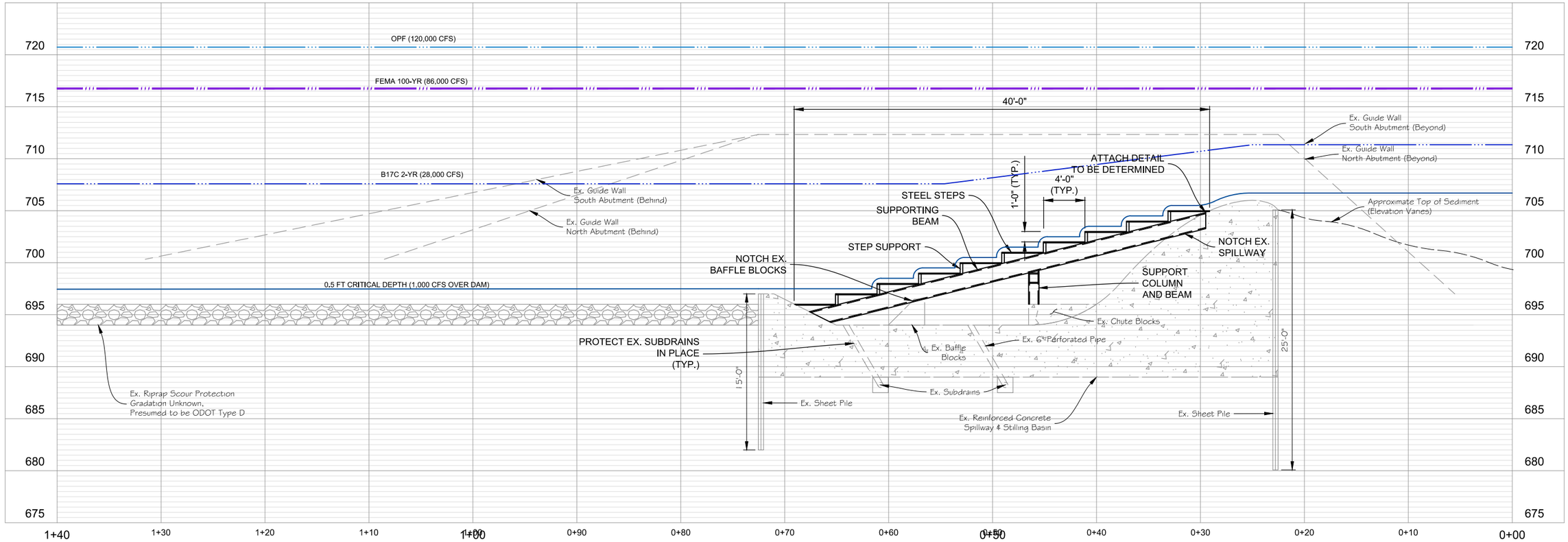


SOUTH MONTGOMERY LOW DAM - PROFILE A

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'
0' 5' 10'

NOTES:

1. DESIGN WILL LIKELY REQUIRE PHYSICAL HYDRAULIC MODELING TO VALIDATE THE EFFICACY OF EXISTING RIPRAP REVETMENT DOWNSTREAM OF END SILL.
2. ALL EXISTING DIMENSIONS FROM SOUTH MONTGOMERY COUNTY DAM CONSTRUCTION PLANS DATED FEBRUARY 1984.
3. ALL ELEVATIONS ARE RELATIVE TO DAM CREST. DAM CREST ELEVATION SHOWN ON 1984 CONSTRUCTION DRAWINGS IS NOT CONSISTENT WITH OBSERVED WATER SURFACE ELEVATIONS. DAM CREST TO BE SURVEYED PRIOR TO 60% DESIGN.
4. EXISTING REINFORCEMENT TYPICALLY 6" CLEAR.
5. VENTED STEEL STRUCTURE IS SHOWN TO ILLUSTRATE DESIGN CONCEPT ONLY. BEAM AND COLUMNS TO BE DESIGNED BY STRUCTURAL ENGINEER AT FUTURE PROJECT PHASE.
6. STRUCTURE TO BE DESIGNED TO SUPPORT 300 LB-FTS^2 LIVE LOAD.
7. BETWEEN SUPPORTING BEAMS, STEPS TO VENT TO ENCLOSED AREA BELOW STRUCTURE.

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON RIVER DISTRICT

WEST CARROLLTON RIVER PARK

DAM HAZARD MITIGATION

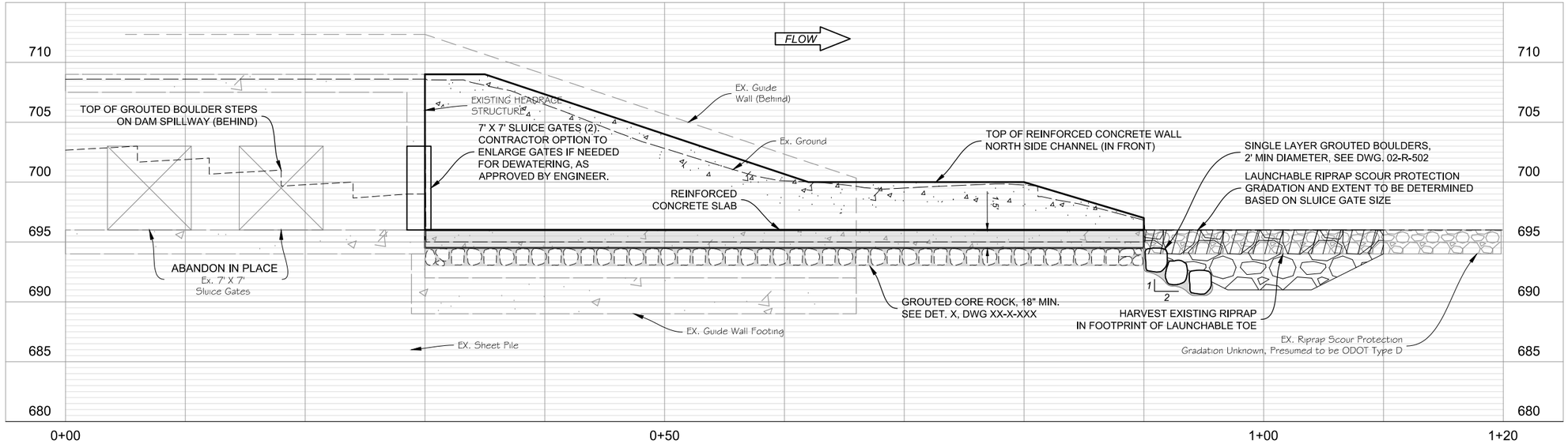
ALTERNATE DAM HAZARD MITIGATION APPROACH

DATE 11/14/2025

DRAWING NO. DS-4

SHEET NO. 22 OF 52

PLOTTED: 11/10/2025 9:31:26 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_DAM SAFING ELEV.DWG

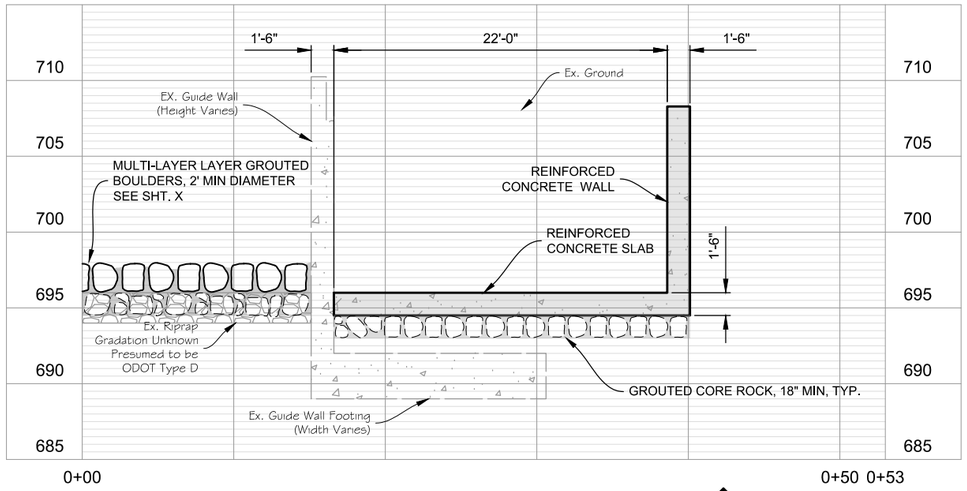


SLUICE CHANNEL - PROFILE (B)

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'
0' 5' 10'

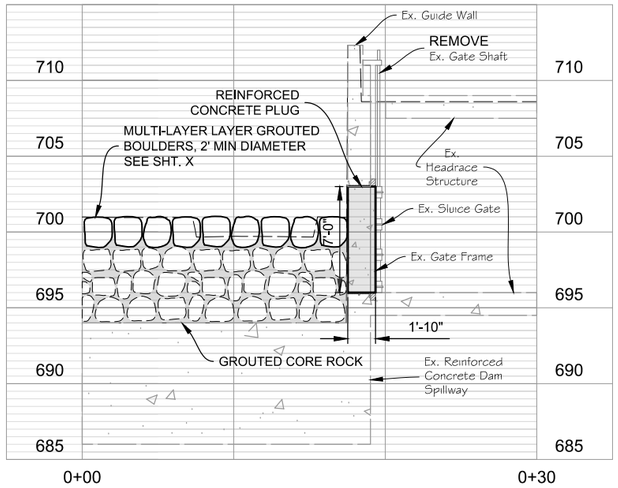
NOTES:

1. SECTION SHOWS GROUTED BOULDER STEPS FROM DAM HAZARD MITIGATION CONCEPT 1. TYPICAL SECTION ALSO APPLIES TO CONCEPT 2.



SLUICE CHANNEL - TYPICAL SECTION (C)

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'
0' 5' 10'



EXISTING SLUICE GATE CLOSURE - TYPICAL SECTION (D)

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'
0' 5' 10'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

DAM HAZARD MITIGATION

DAM HAZARD MITIGATION DETAILS

DATE 11/14/2025

DRAWING NO. DS-5

SHEET NO. 23 OF 52

PLOTTED: 11/10/2025 9:31:31 AM
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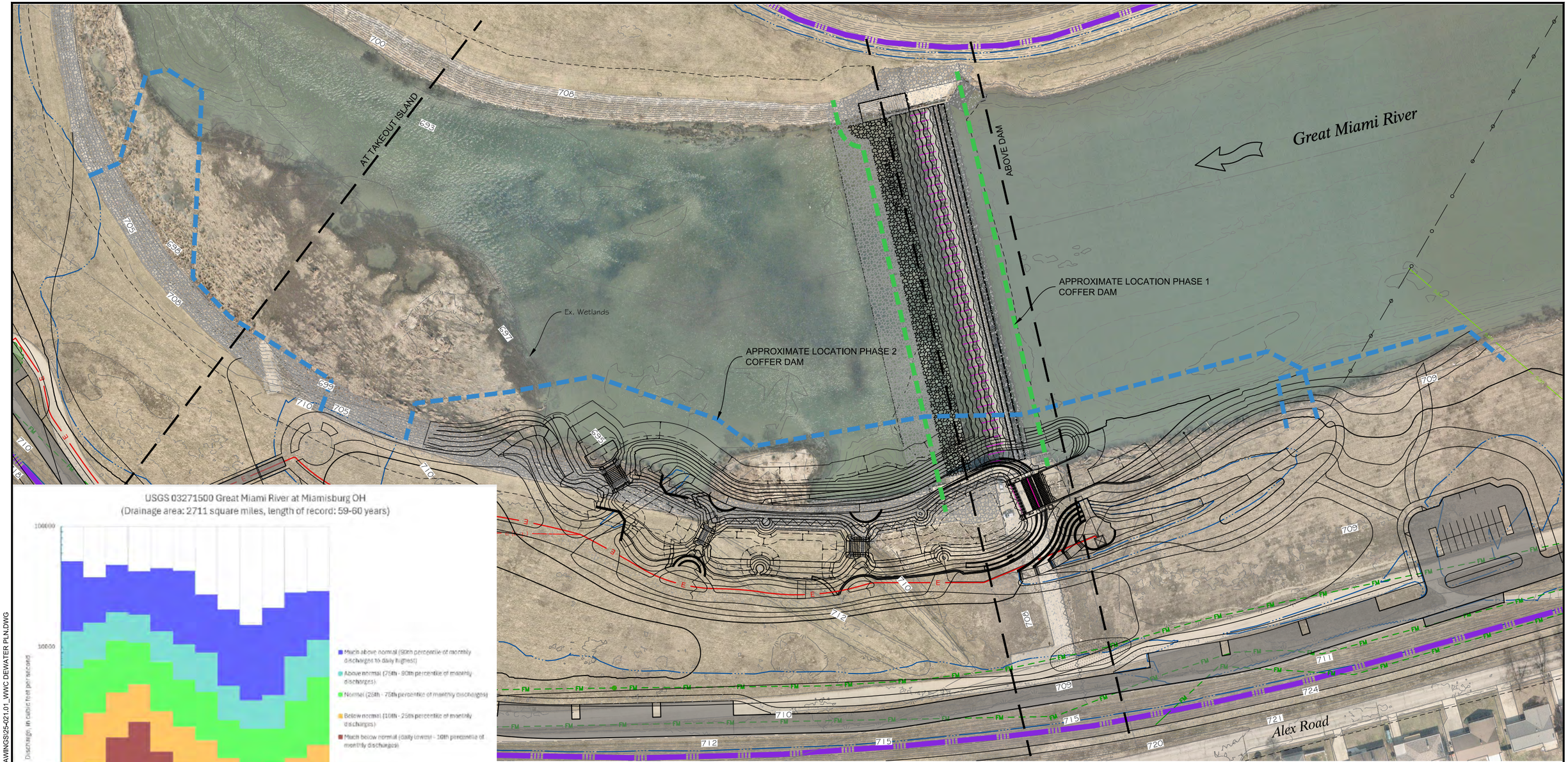

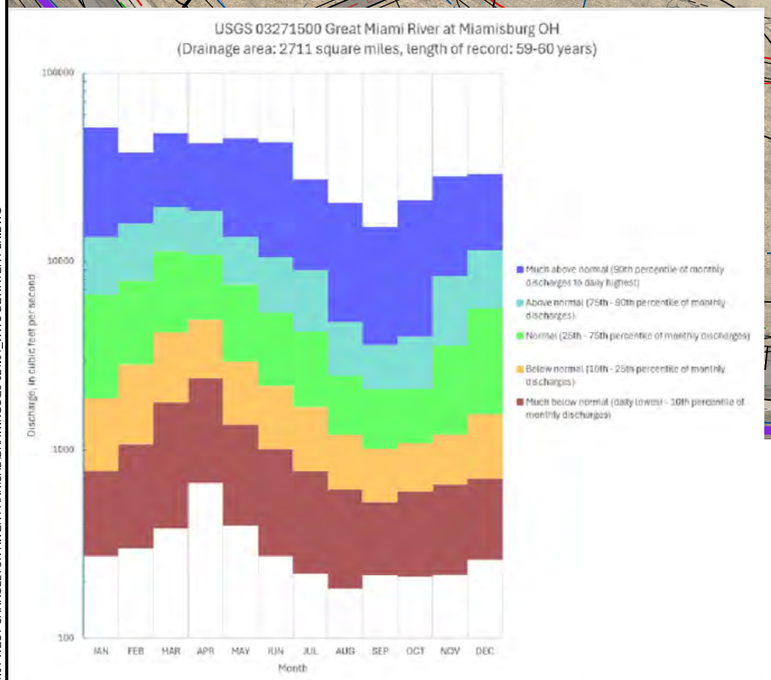

Annual Chance of Being Equaled or Exceeeded	Discharge (cfs)	WSEL (ft NAVD 88)		
		Upstream of Dam	Below Dam	At Island Takeout
1 in 500	107,000	719.3	718.6	718.2
1 in 100	86,000	717.0	716.2	715.7
1 in 50	78,000	716.1	715.2	714.6
1 in 10	56,000	713.9	712.3	711.6
-	30,000	711.6	707.2	706.4
-	20,000	710.6	704.4	703.6
-	10,000	709.3	701.0	699.8

LEGEND

- PHASE 1 - CONCEPTUAL COFFER DAM ALIGNMENT
- PHASE 2 - CONCEPTUAL COFFER DAM ALIGNMENT
- LOCATION OF WSEL ESTIMATE

NOTES:

1. COFFER DAM LOCATION ARE SHOWN AS A VISUAL APPROXIMATIONS ONLY. CONTRACTOR IS RESPONSIBLE FOR DEVELOPING SITE DEWATERING PLAN.
2. WATER SURFACE ELEVATIONS ARE BASED ON PRELIMINARY HYDRAULIC MODELING AND ARE SUBJECT TO REVISION.

N

0' 60' 120'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE DEWATERING & WATER CONTROL PLAN

DATE 11/14/2025

DRAWING NO. WW-1

SHEET NO. 24 OF 52

PLOTTED: 11/10/2025 9:43:10 AM
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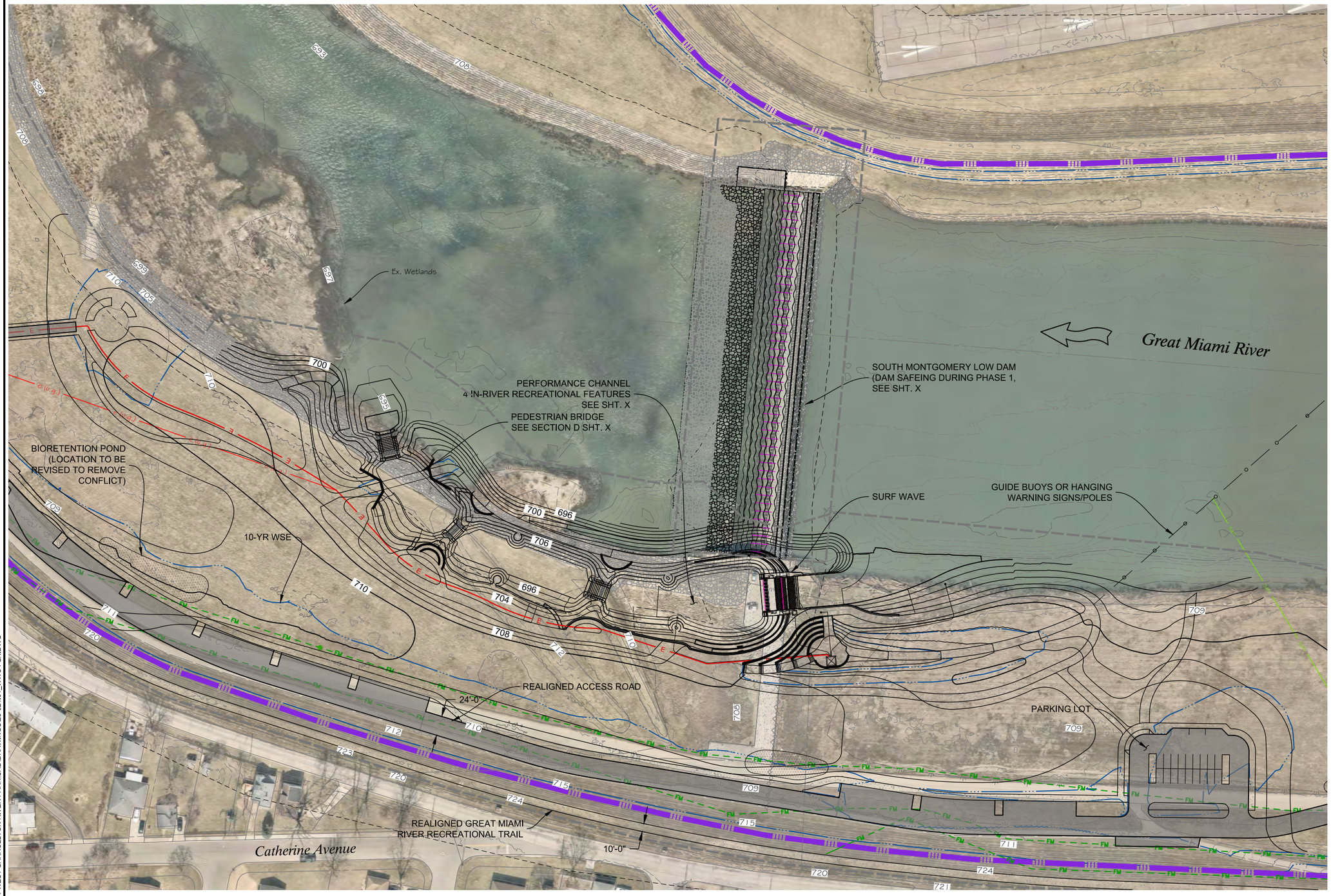


NOTES:

1. NOT ALL MATERIALS, INCLUDING RIPRAP, CORE ROCK, AND SHEET PILE SHOWN FOR CLARITY.

N

0' 60' 120'

PLOTTED: 11/10/2025 9:51:32 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_WWC PLN.DWG

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

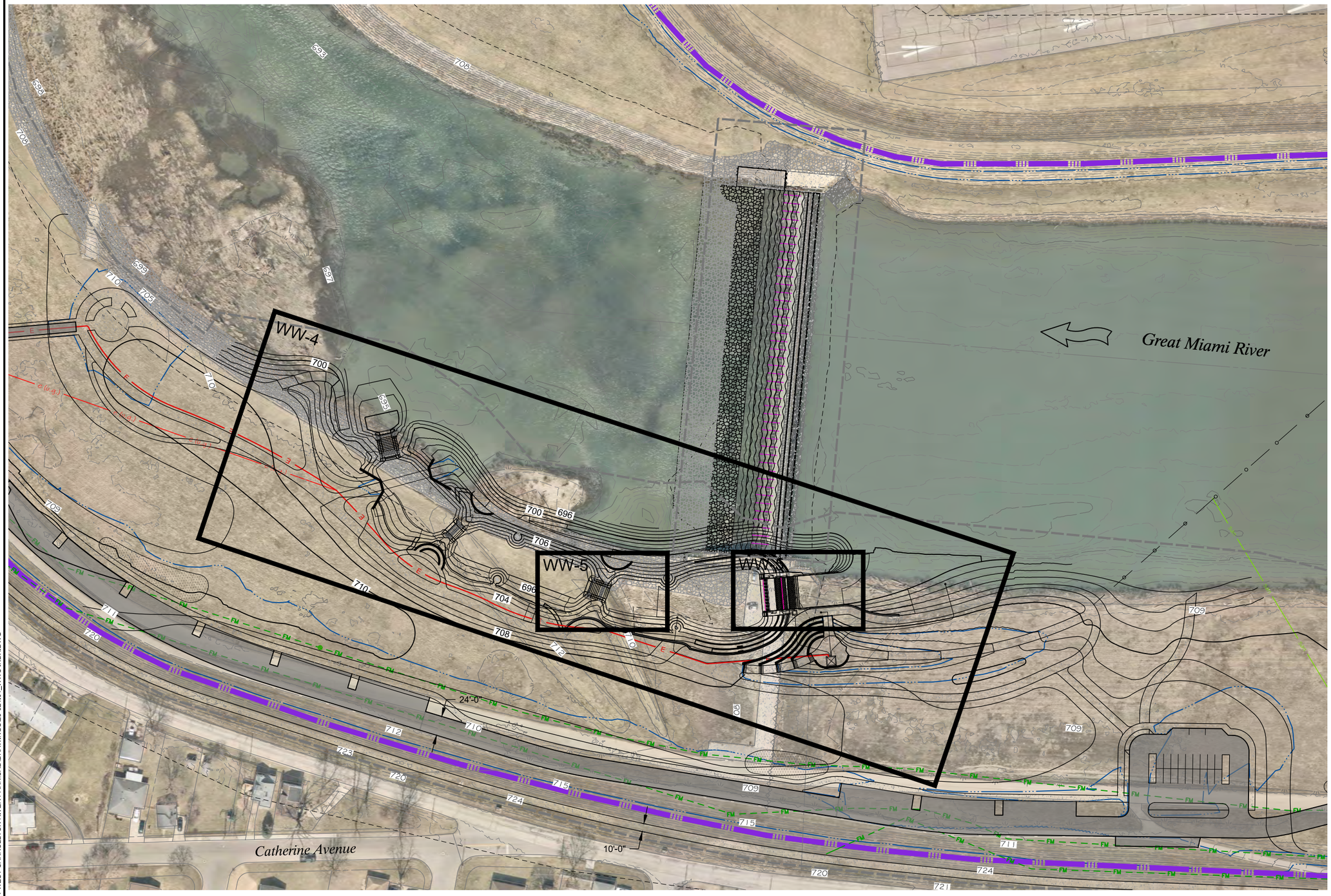
WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE PLAN

DATE 11/14/2025

DRAWING NO. WW-2

SHEET NO. 25 OF 52



NOTES:

1. NOT ALL MATERIALS, INCLUDING RIPRAP, CORE ROCK, AND SHEET PILE SHOWN FOR CLARITY.

PLOTTED: 11/10/2025 9:59:56 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_WWC INDX.DWG

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

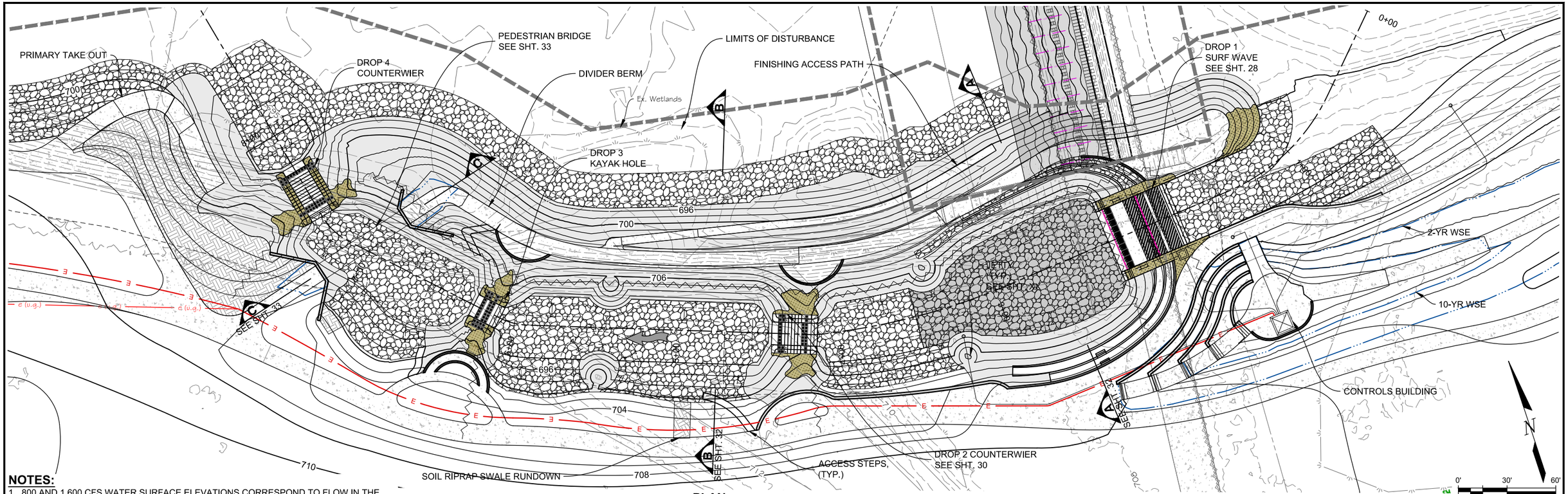
WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE ENLARGEMENTS KEY PLAN

DATE: 11/14/2025

DRAWING NO.: WW-3

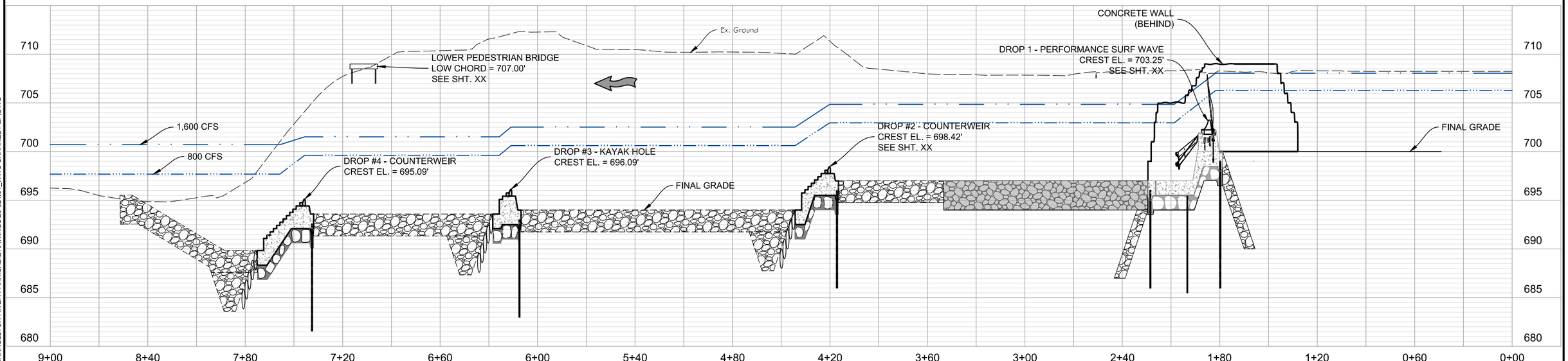
SHEET NO.: 26 OF 52



PLAN

NOTES:

1. 800 AND 1,600 CFS WATER SURFACE ELEVATIONS CORRESPOND TO FLOW IN THE PERFORMANCE CHANNEL 2-YR AND 10-YR WATER SURFACE ELEVATIONS CORRESPOND TO FLOW IN THE RIVER.



PROFILE

SCALE: HORIZ. 1"=30'
VERT. 1"=10'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE CHANNEL PLAN & PROFILE

DATE 11/14/2025

DRAWING NO. WW-4

SHEET NO. 27 OF 52

PLOTTED: 11/10/2025 10:01:33 AM
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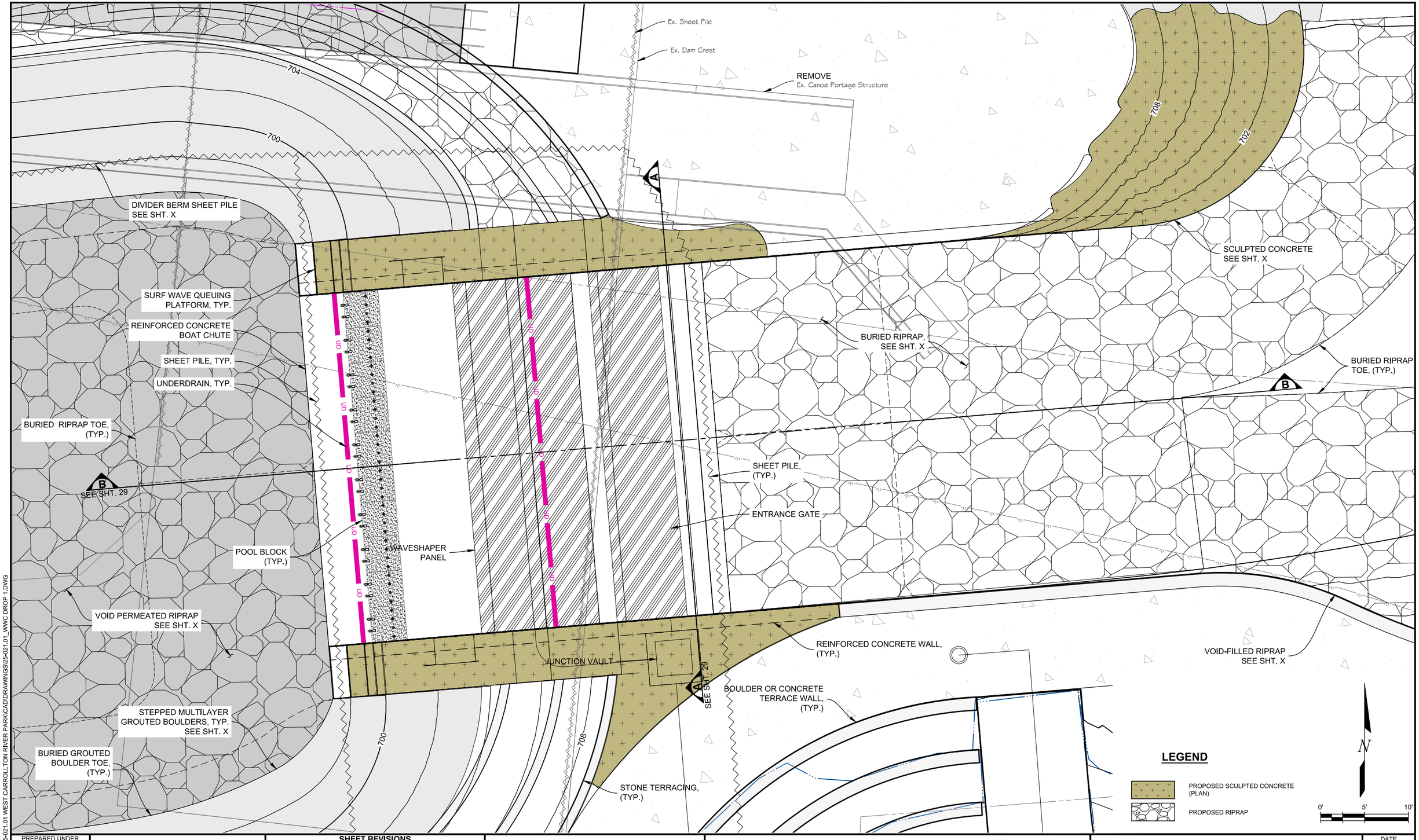

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE DROP 1 - SURF WAVE PLAN

DATE 11/14/2025

DRAWING NO. WW-5

SHEET NO. 28 OF 52

PLOTTED: 11/10/2025 10:02:29 AM
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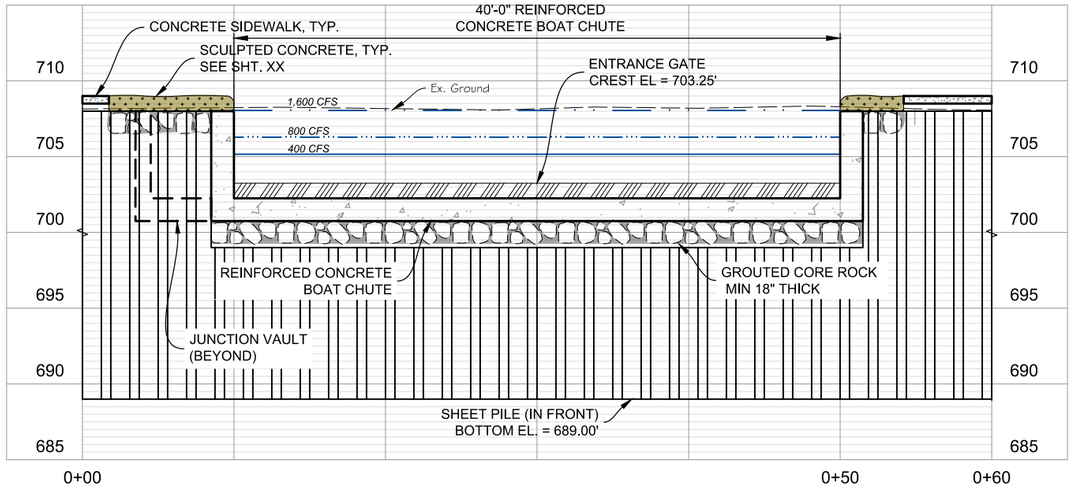
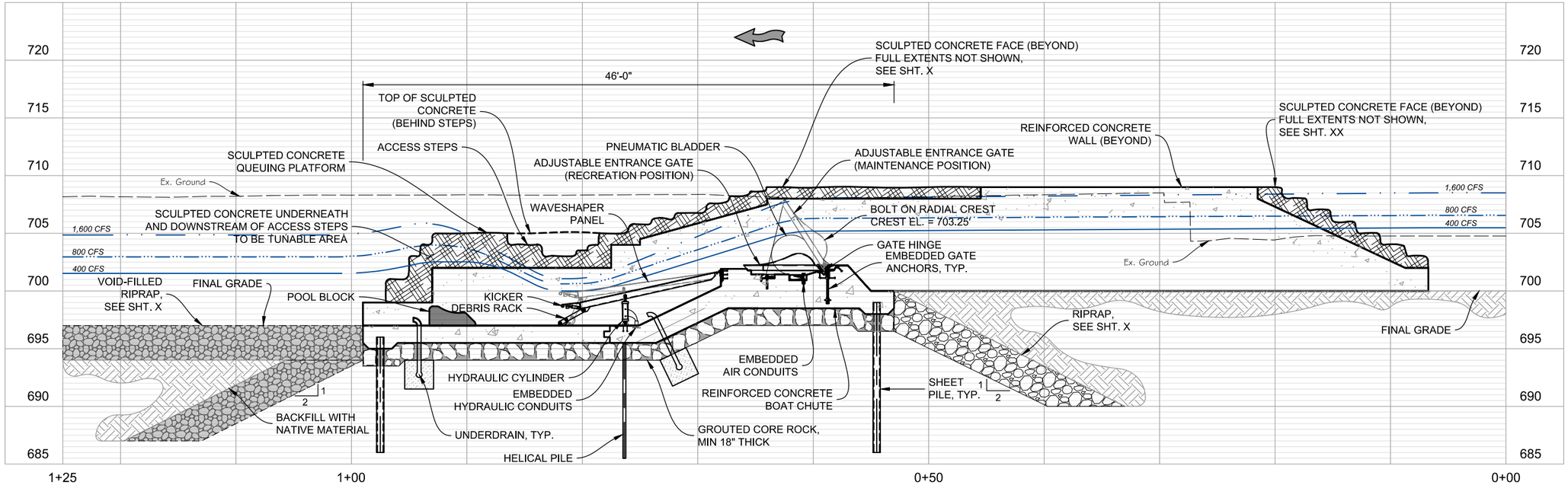


SURF WAVE CREST SECTION A

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'

0' 5' 10'



SURF WAVE PROFILE B

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'

0' 5' 10'

NOTES:

1. ALL FLOW ANNOTATIONS INDICATE FLOW IN PERFORMANCE CHANNEL.
2. SCHEMATIC LAYOUT ONLY. DESIGN SUBJECT TO MODIFICATION BASED ON FUTURE ANALYSIS AND MODELING.
3. BASE SLAB AND PIER DIMENSIONS ARE APPROXIMATE. TO BE DETERMINED BY STRUCTURAL ENGINEER AT FUTURE PROJECT PHASE.

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE DROP 1 - SURF WAVE SECTION & PROFILE

DATE 11/14/2025

DRAWING NO. WW-6

SHEET NO. 29 OF 52

PLOTTED: 11/10/2025 10:02:33 AM
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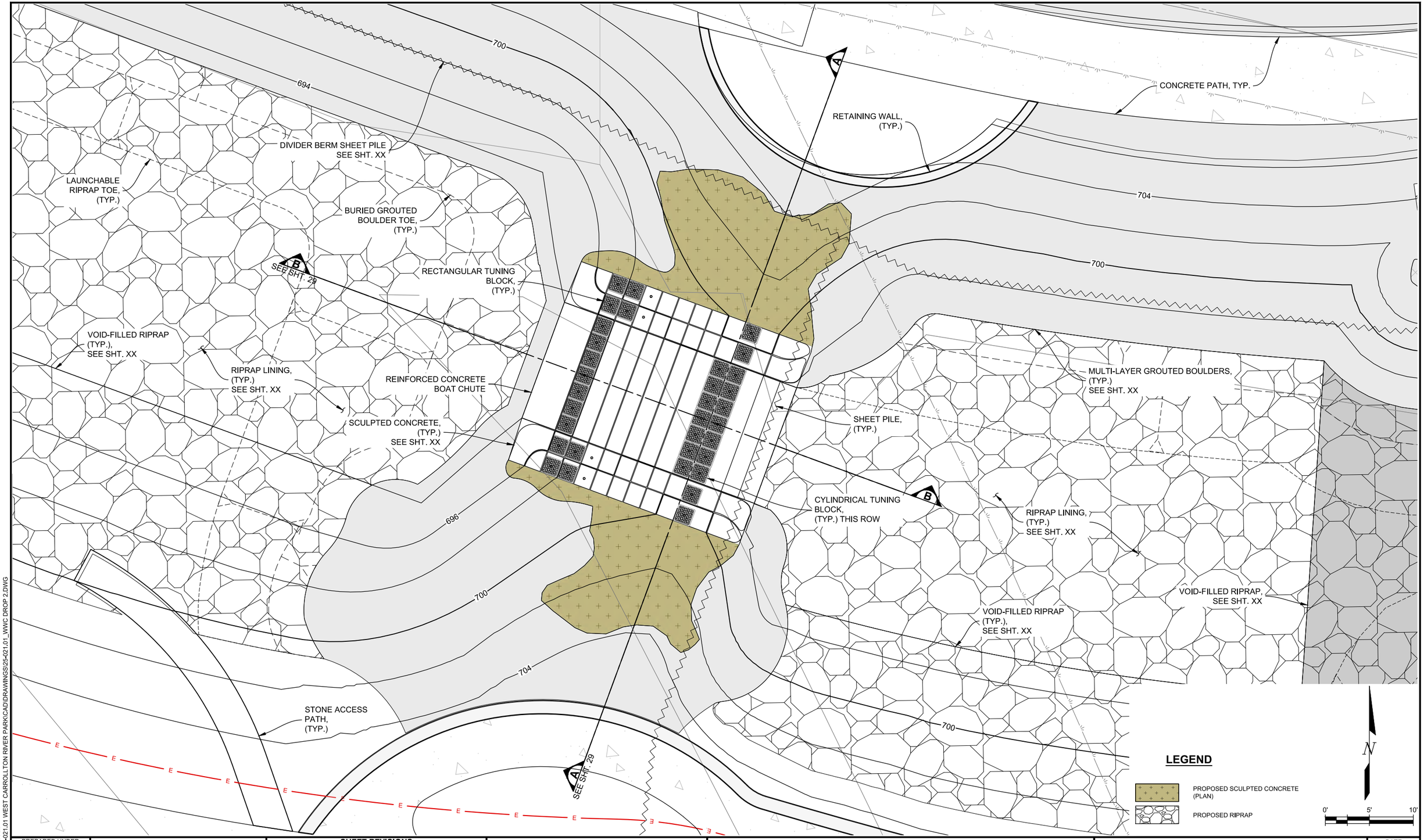

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PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

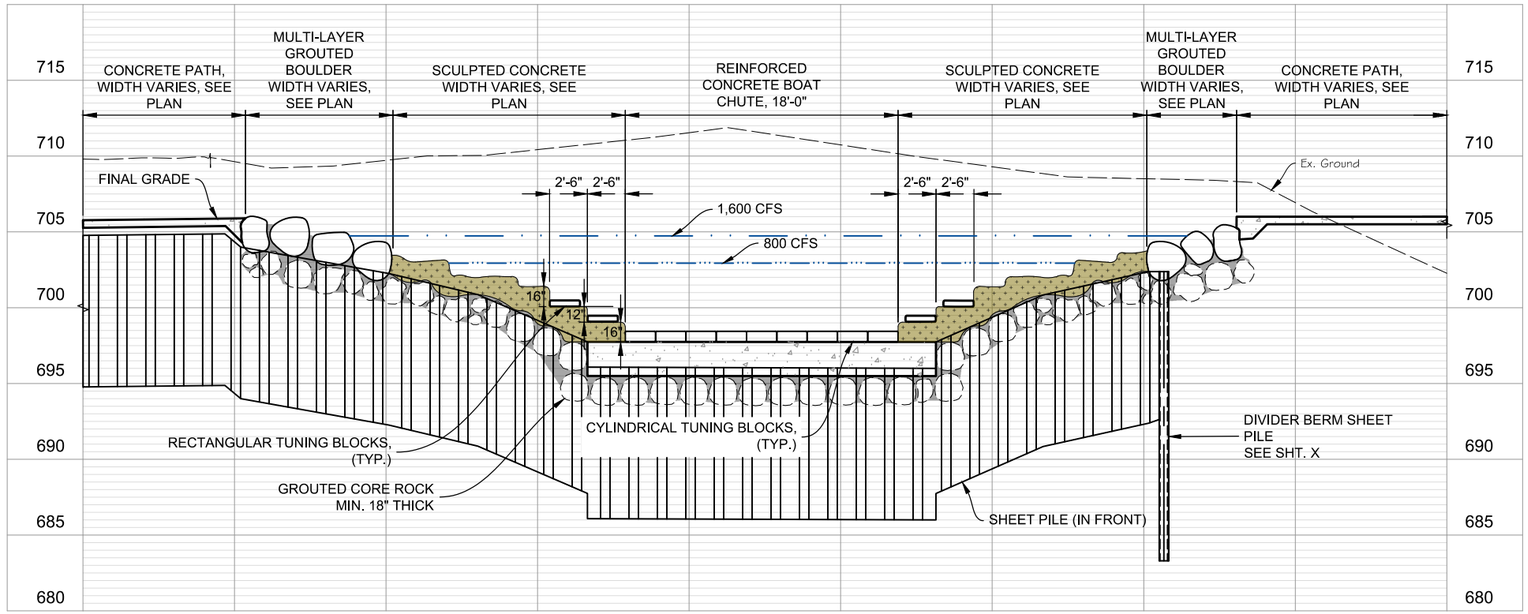
WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE DROP 2 - TYPICAL PLAN

DATE 11/14/2025

DRAWING NO. WW-7

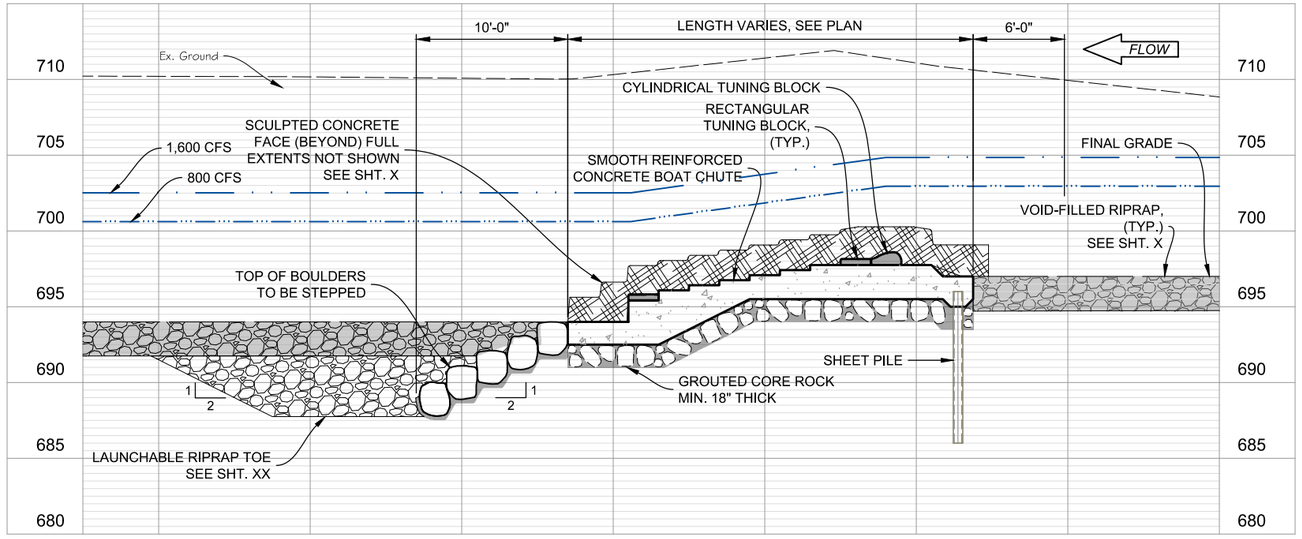
SHEET NO. 30 OF 52



TYPICAL CREST SECTION (DROPS 2-4) A

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'

0' 5' 10'



TYPICAL BOAT CHUTE PROFILE (DROPS 2-4) B

HORIZONTAL SCALE: 1"=5'
VERTICAL SCALE: 1"=5'

0' 5' 10'

NOTES:

1. ALL FLOW ANNOTATIONS INDICATE FLOW IN PERFORMANCE CHANNEL.
2. SCHEMATIC LAYOUT ONLY. DESIGN SUBJECT TO MODIFICATION BASED ON FUTURE ANALYSIS AND MODELING.
3. BASE SLAB AND PIER DIMENSIONS ARE APPROXIMATE. TO BE DETERMINED BY STRUCTURAL ENGINEER AT FUTURE PROJECT PHASE.

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE DROP 2-4 - TYPICAL SECTION & PROFILE

DATE 11/14/2025

DRAWING NO. WW-8

SHEET NO. 31 OF 52

PLOTTED: 11/10/2025 10:06:50 AM
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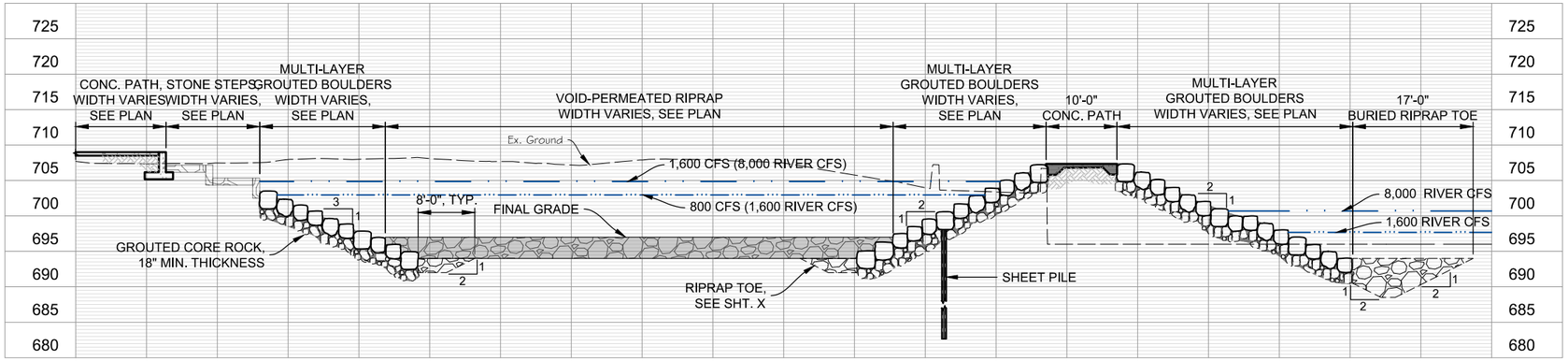
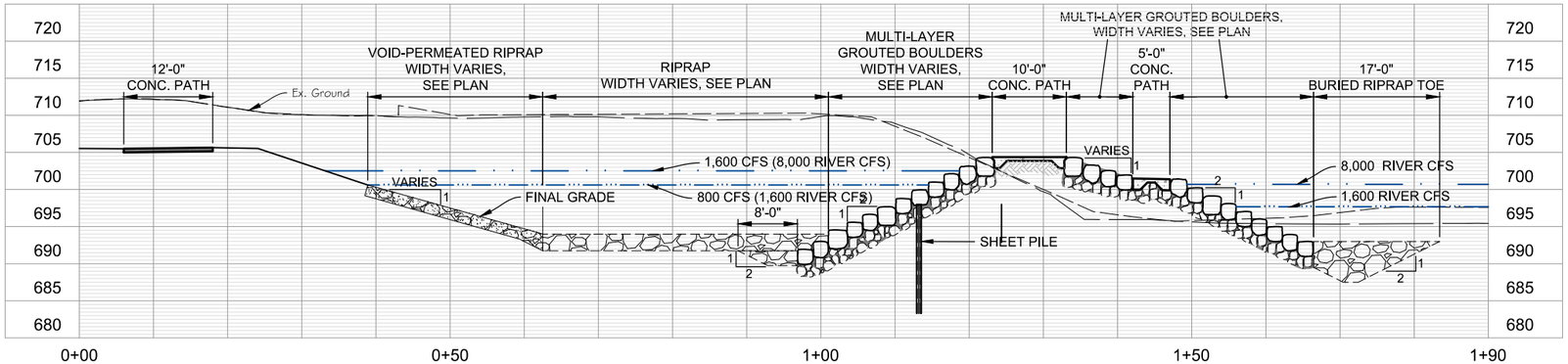


TYPICAL POOL SECTION - POOL #1 (A)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

0' 10' 20'



TYPICAL POOL SECTION - POOL #1 (B)

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

0' 5' 10'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE TYPICAL POOL & BEAM SETIONS

DATE 11/14/2025

DRAWING NO. WW-9

SHEET NO. 32 OF 52

PLOTTED: 11/10/2025 10:07:50 AM
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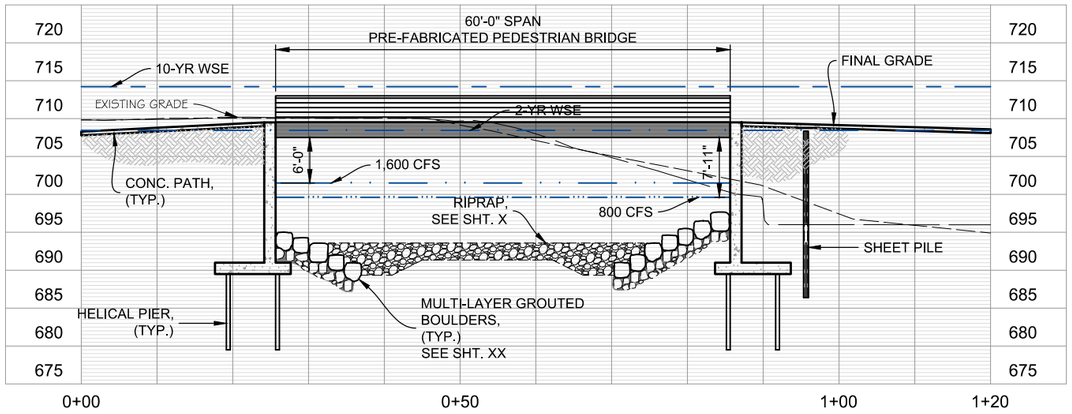

ADA ACCESSIBLE BRIDGE

C

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=10'

0' 10' 20'

NOTES:

1. BRIDGE FOOTING AND PIER DIMENSIONS ARE APPROXIMATE. TO BE DETERMINED BY STRUCTURAL ENGINEER AT FUTURE DESIGN PHASE.

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE TYPICAL BRIDGE SECTION

DATE 11/14/2025

DRAWING NO. WW-10

SHEET NO. 33 OF 52

PLOTTED: 11/10/2025 10:07:55 AM
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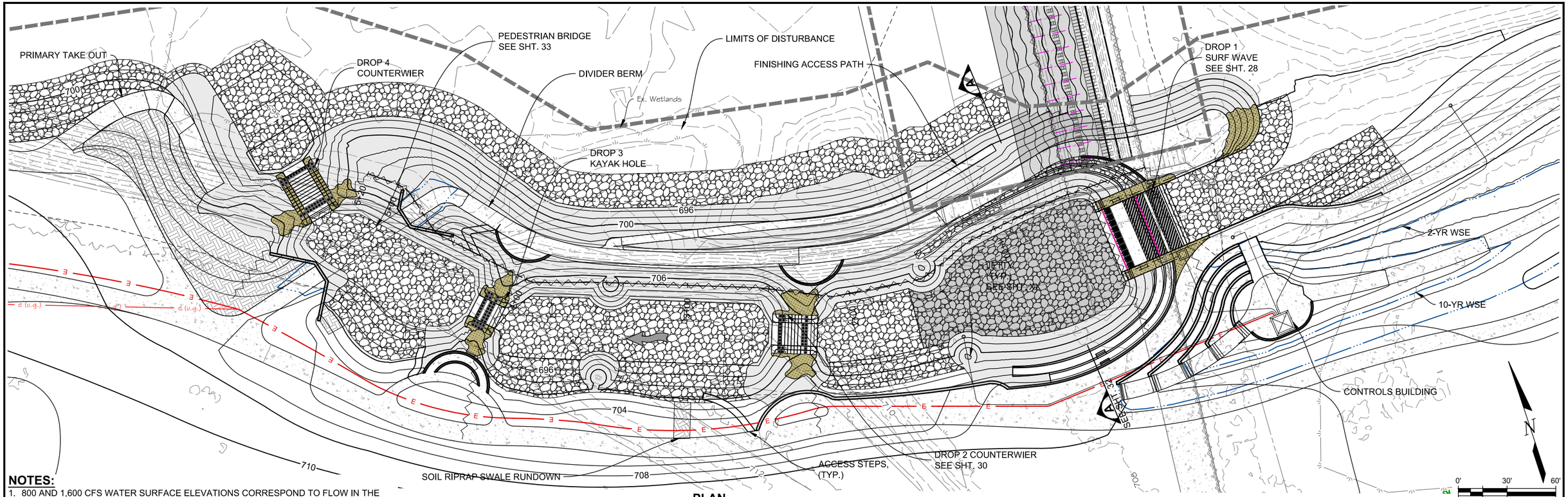
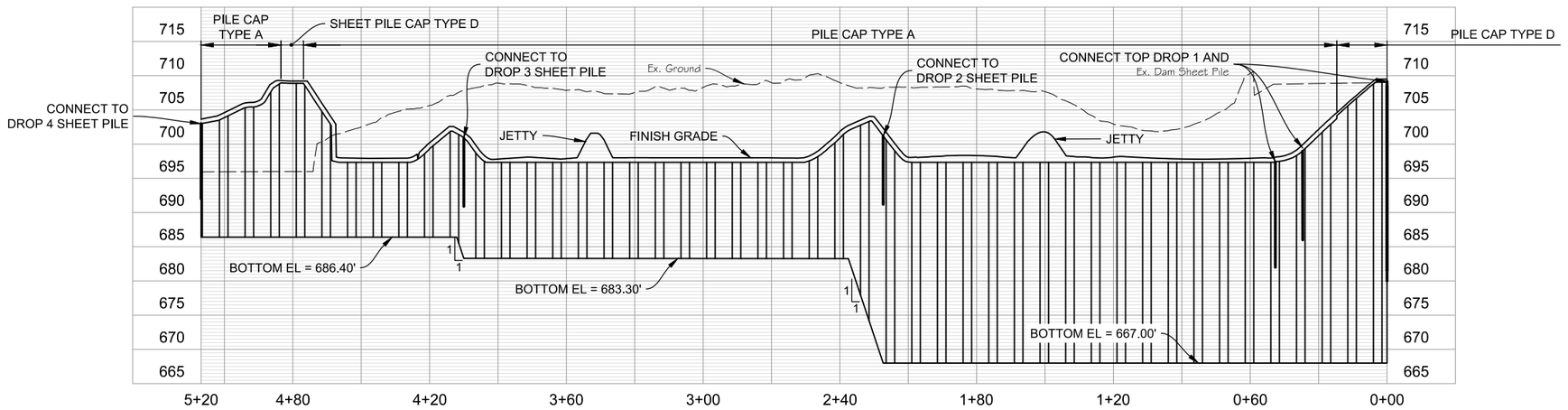


PLAN

NOTES:

1. 800 AND 1,600 CFS WATER SURFACE ELEVATIONS CORRESPOND TO FLOW IN THE PERFORMANCE CHANNEL 2-YR AND 10-YR WATER SURFACE ELEVATIONS CORRESPOND TO FLOW IN THE RIVER.



DIVIDER BERM SHEET PILE PROFILE

SCALE: HORIZ. 1"=30'
VERT. 1"=10'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

WHITEWATER COURSE SHEET PILE PLAN & PROFILE

DATE 11/14/2025

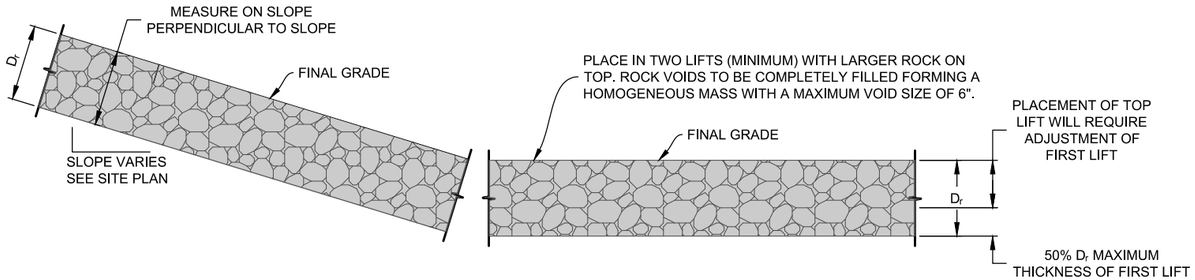
DRAWING NO. WW-11

SHEET NO. 34 OF 52

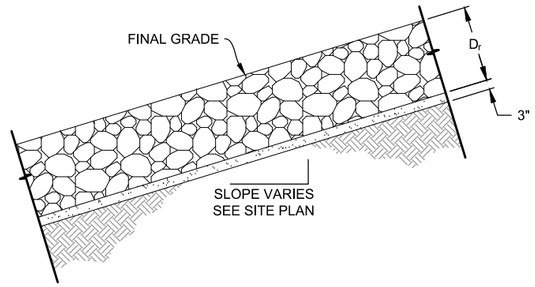
PLOTTED: 11/10/2025 10:09:36 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_WWC STR SHEET PILE P&P.DWG

KEYMAP
SCALE: 1"=1,600'

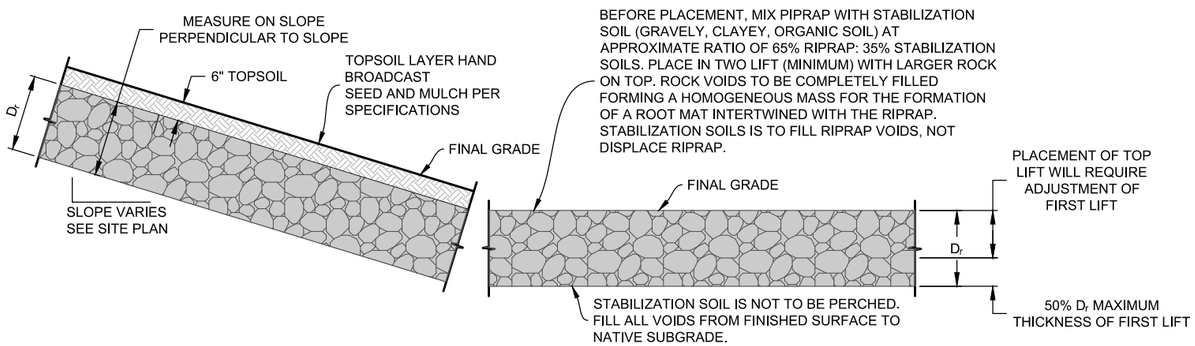
Ex. Sheet Pile
Ex. Sheet Pile
Great Miami River
Ex. Canoe Portage Ramp
WET WELL WITH
WATER LEVEL SENSOR
Ex. Wetlands
(Typ.)
Ex. Parcel
(Typ.)
WAVESHAPER PANEL
ENTRANCE GATE
JUNCTION VAULT
CAMERA
WET WELL WITH
WATER LEVEL SENSOR
Ex. Concrete Parking
DUCT BANK
(TYP.)
CONTROLS BUILDING
FFE=720.00
E
E
E



TYPICAL VOID-FILLED RIPRAP PLACEMENT
SCALE:NTS



TYPICAL RIPRAP PLACEMENT - EXPOSED INSTALLATIONS
SCALE:NTS



TYPICAL SOIL RIPRAP PLACEMENT
SCALE:NTS

RIPRAP TYPE	D_{50}	DEPTH OF RIPRAP LAYER (D_r)
B	18	36
C	12	27
D	6	18
ALL DIMENSIONS IN INCHES		

NOTES:
1. ALL RIPRAP DETAILS ARE APPLICABLE TO FLAT OR SLOPED AREAS. REFER TO SITE PLAN FOR ACTUAL LOCATION AND LIMITS OF EACH TYPE.
2. REFER TO SPECIFICATIONS FOR MATERIALS AND PLACEMENT REQUIREMENTS FOR RIPRAP.
3. GENERAL PLACEMENT TECHNIQUES SHOULD RESULT IN LARGER ROCK AT THE SURFACE WITH ROCK SECURELY INTERLOCKED AT THE DESIGN THICKNESS AND GRADE. TYPICAL FOR BOTH BURIED AND EXPOSED SOIL AND VOID-FILLED RIPRAP.
4. FINAL SOIL RIPRAP TO BE COMPACTED BY FULL LOADING OF BACK HOE BUCKET AS APPROVED. ANY SOFT, YIELDING OR POCKETS OF SMALL ROCK WILL BE REWORKED.
5. FOR BURIED SOIL RIPRAP, PLACE TOPSOIL 4 INCHES THICK OVER RIPRAP.

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

RIPRAP DETAILS

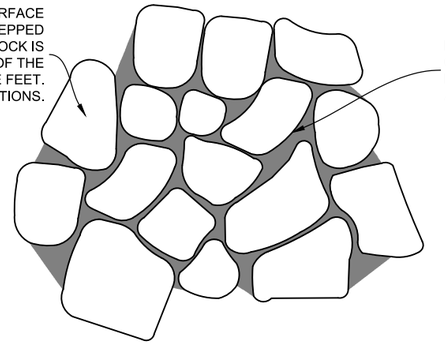
DATE 11/14/2025

DRAWING NO. WW-13

SHEET NO. 36 OF 52

PLOTTED: 11/10/2025 10:13:35 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_DETAILS.DWG

BOULDER SIZES AND EXPOSED SURFACE AREAS SHALL VARY EXCEPT WHERE STEPPED MULTI-LAYER GROUTED CORE ROCK IS SPECIFIED. THE MINIMUM SURFACE AREA OF THE EXPOSED FACE OF A BOULDER IS 4 SQUARE FEET. SEE SPECIFICATIONS.



BOULDERS SHALL BE INTERLOCKED AND SET IN CONTACT WITH EACH OTHER SO THAT THE VOIDS BETWEEN ADJACENT BOULDERS ARE AS SMALL AS THE CHARACTER OF ROCK WILL PERMIT.

GROUTED BOULDERS PLAN VIEW A

SCALE:NTS

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

GROUTED ROCK DETAIL

DATE 11/14/2025

DRAWING NO. WW-14

SHEET NO. 37 OF 52

PLOTTED: 11/10/2025 10:13:46 AM
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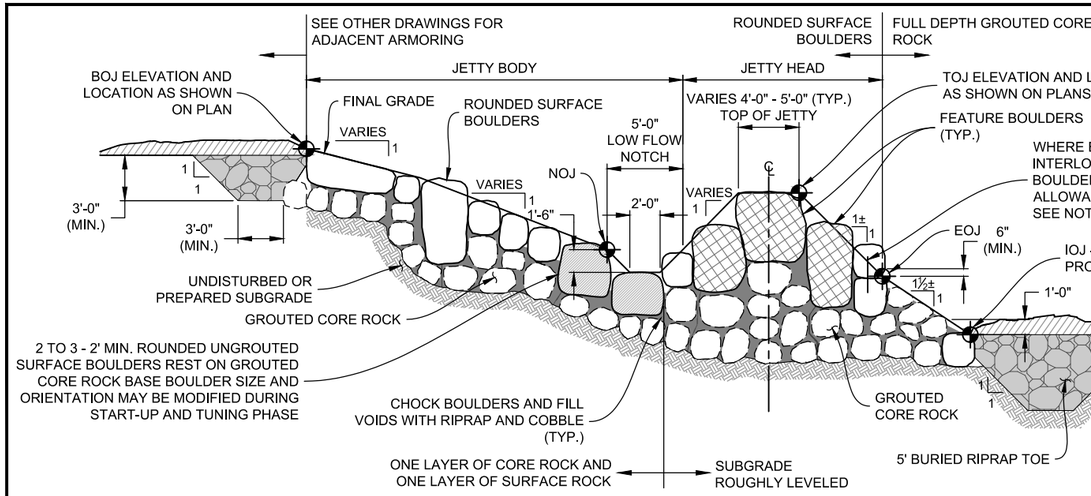
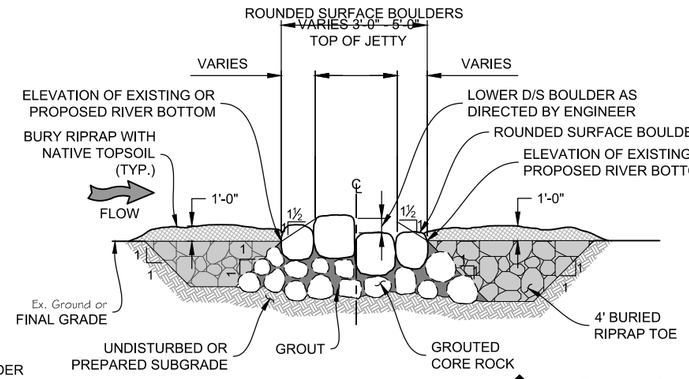


JETTY PERPENDICULAR TO FLOW (A)

SCALE:1"=5'

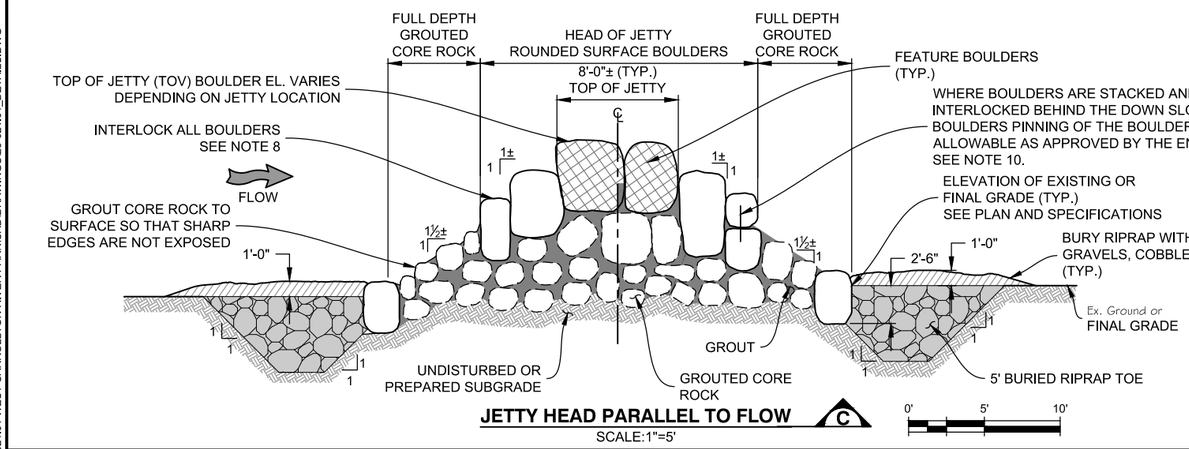


JETTY AT RIVER BANK (B)

SCALE:1"=5'

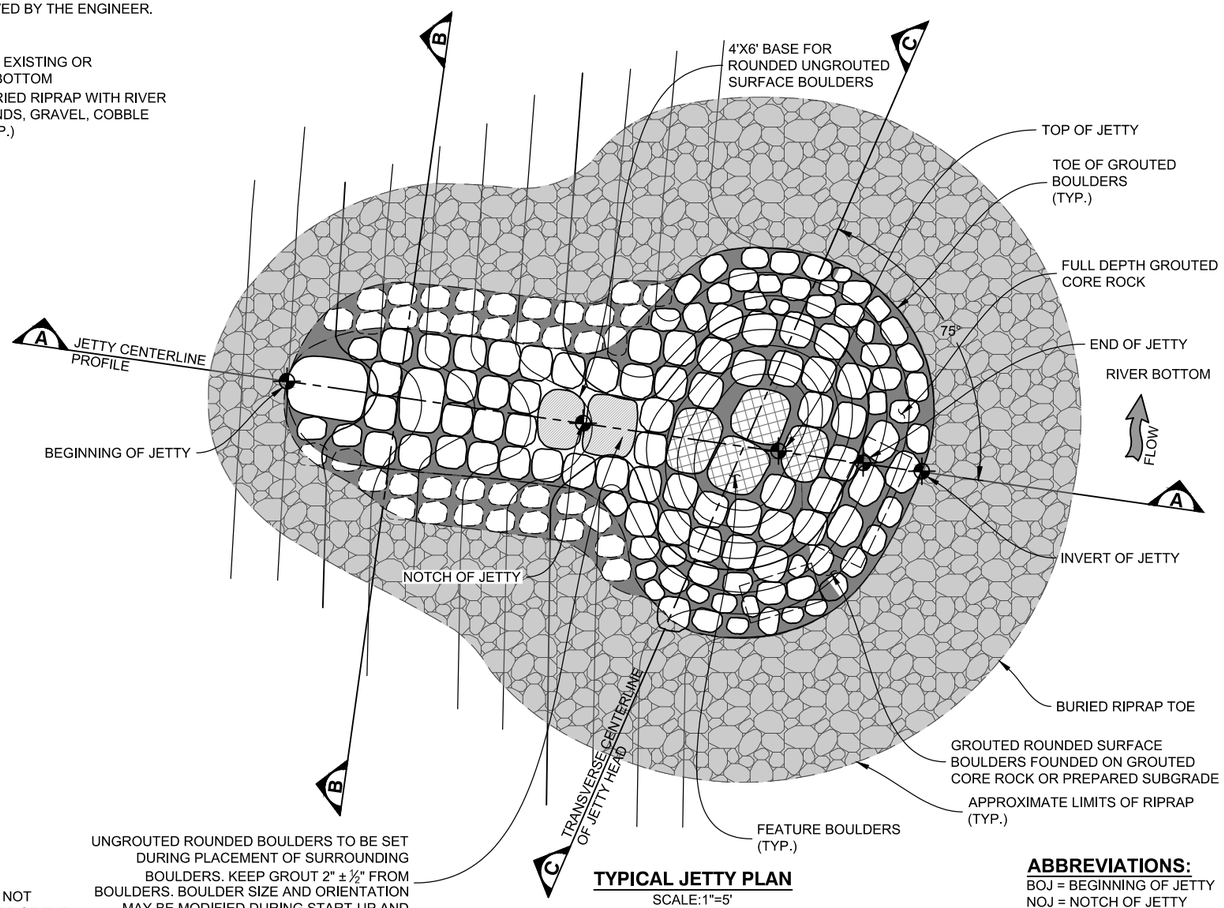
NOTE:

1. SEE MULTI-LAYER GROUTED BOULDER STEPPED PLACEMENT DETAIL ON SHT. XX FOR ALL SURFACE BOULDERS.



JETTY HEAD PARALLEL TO FLOW (C)

SCALE:1"=5'



TYPICAL JETTY PLAN

SCALE:1"=5'

ABBREVIATIONS:

BOJ = BEGINNING OF JETTY
NOJ = NOTCH OF JETTY
TOJ = TOP OF JETTY
EOJ = END OF JETTY
IOJ = INVERT OF JETTY

NOTES:

1. GROUT JETTIES MONOLITHICALLY AS MULTI-LAYERED GROUTED BOULDERS - SEE SPECIFICATIONS.
2. GROUT TO DEPTH AS DIRECTED BY ENGINEER. IN GENERAL THIS WILL BE APPROXIMATELY ½ WAY UP THE SIDE OF SURFACE BOULDERS.
3. THREE TO FIVE FEATURE BOULDERS PER JETTY - UNLESS OTHERWISE DIRECTED BY ENGINEER.
4. PLACE ALL FEATURE AND SURFACE BOULDERS AS DIRECTED BY THE ENGINEER.
5. GROUTED BOULDERS & CORE ROCK TO BE GROUTED BEFORE INSTALLATION OF ADJACENT RIPRAP.
6. JETTY HEAD CAN BE CONSTRUCTED OUT OF SCULPTED CONCRETE WHEN FEATURE BOULDERS ARE UNAVAILABLE AS DIRECTED BY THE ENGINEER.
7. BOULDER ARRANGEMENT SHOWN IS SCHEMATIC. NUMBER, SHAPE, AND LOCATION OF BOULDERS ARE APPROXIMATE AND VARY PER JETTY BASED ON FIELD CONDITIONS AND SIZE AND VARIABILITY OF AVAILABLE BOULDERS.
8. GROUTED BOULDER INTERLOCKING. EXCEPT AS NOTED BELOW, ALL GROUTED BOULDERS SHALL BE SUPPORTED ON ALL SIDES BY ADJACENT GROUTED BOULDERS BY A MINIMUM OF ⅓ THE HEIGHT OF EACH GROUTED BOULDER. LARGER BOULDERS MAY BE NEEDED IN STEEPER AREAS TO ACHIEVE THIS REQUIRED INTERLOCKING. PINNING OF BOULDERS MAY BE AN ACCEPTABLE ALTERNATIVE TO LARGER BOULDERS IF APPROVED BY THE ENGINEER. GROUTED BOULDERS AT THE TOE OF THE JETTY WHERE THE GROUTED BOULDERS END SHALL BE SUPPORTED THEIR ENTIRE HEIGHT BY THE SELF-LAUNCHING RIPRAP TOE.
9. THE FINISHED SURFACE OF GROUTED BOULDERS PLACED UPSTREAM AND DOWNSTREAM OF THE CRESTS OF ALL JETTIES SHALL BE BELOW THE CREST ELEVATIONS OF THESE STRUCTURES. THE JETTY CRESTS ARE IDENTIFIED IN PROFILE AND THE TABLE ON THIS SHEET.
10. SEE DWG 02-R-502 FOR PINNED BOULDER AND TOE CONNECTION DETAILS.

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

JETTY DETAILS

DATE 11/14/2025

DRAWING NO. WW-15

SHEET NO. 38 OF 52

PLOTTED: 11/10/2025 10:13:54 AM
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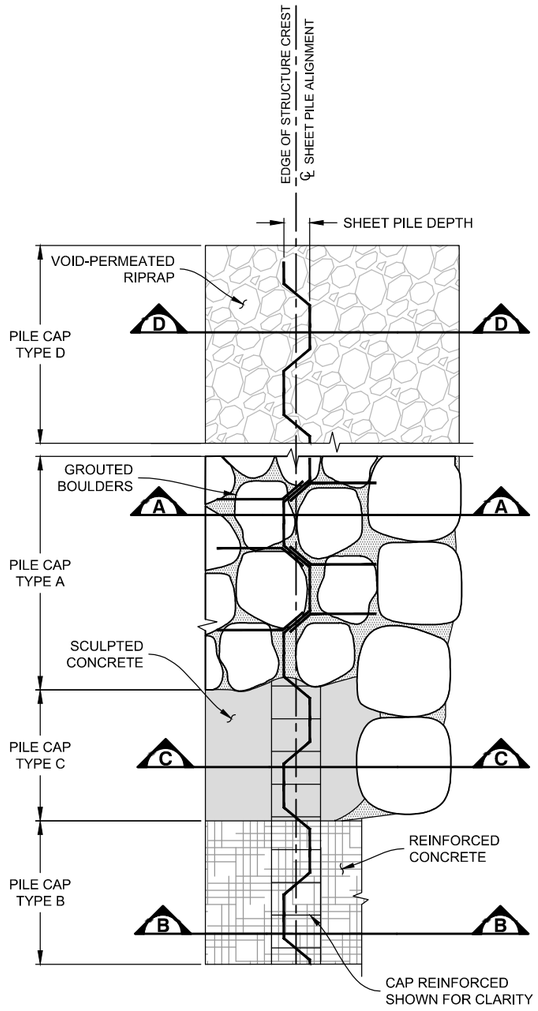
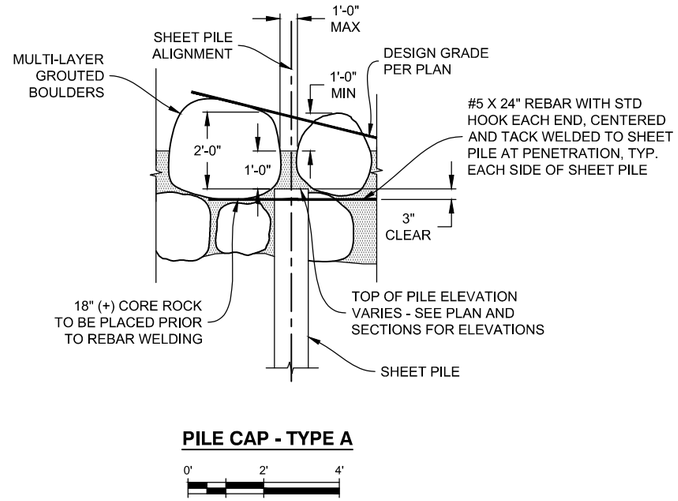


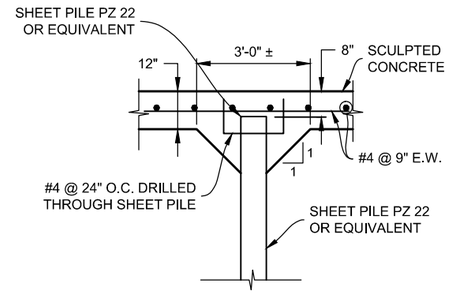
PARTIAL SHEET PILE PLAN

0' 2' 4'



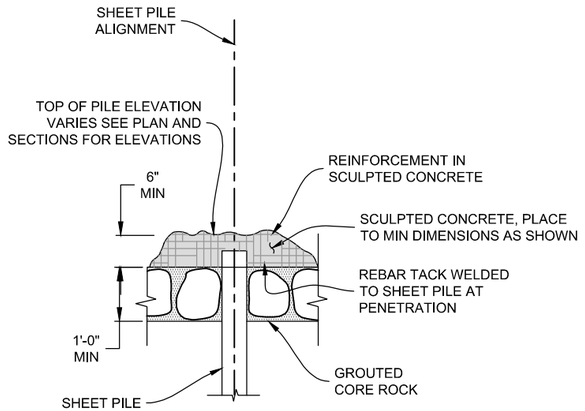
PILE CAP - TYPE A

0' 2' 4'



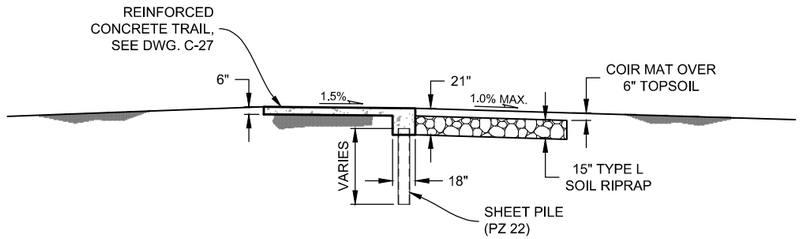
PILE CAP - TYPE B

0' 2' 4'



PILE CAP - TYPE C

0' 2' 4'



PILE CAP - TYPE D

0' 5' 10'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

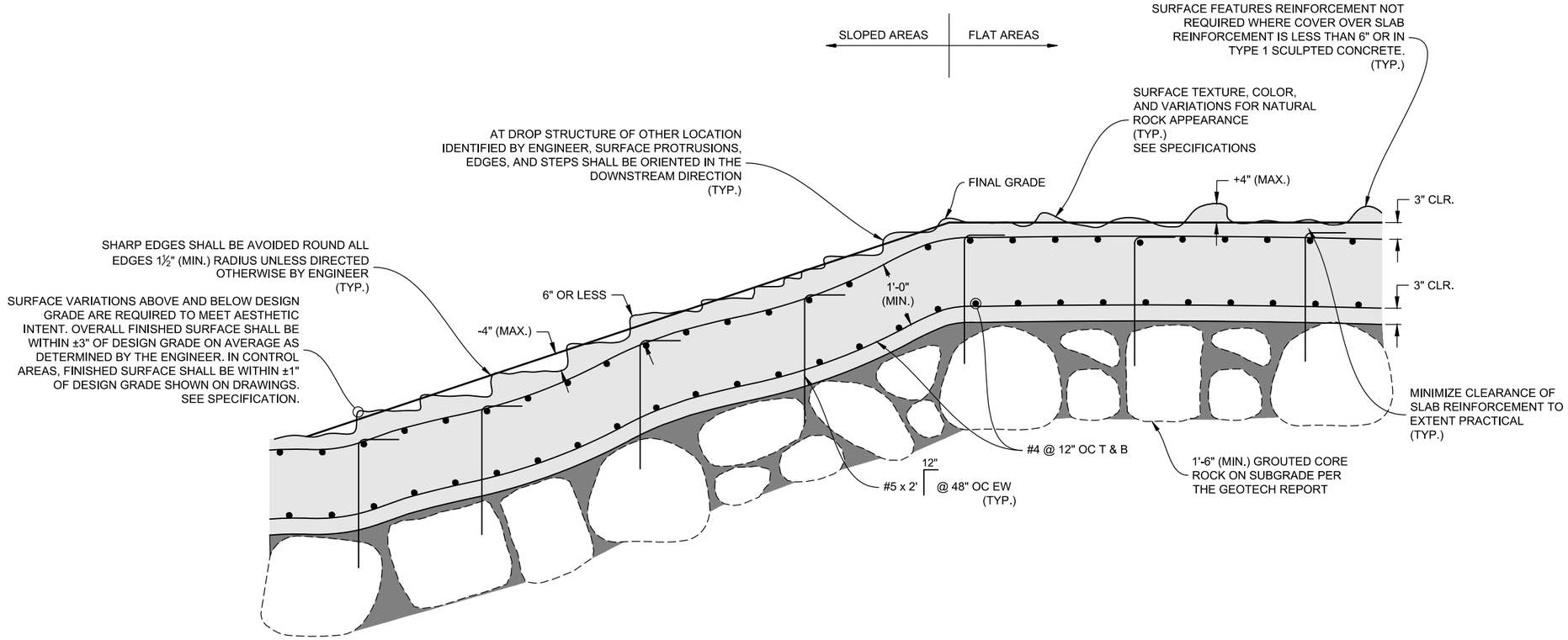
SHEET PILE CAP DETAILS

DATE 11/14/2025

DRAWING NO. WW-16

SHEET NO. 39 OF 52

PLOTTED: 11/10/2025 6:58:41 PM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_DETAILS.DWG



SCULPTED CONCRETE - TYPE I
SCALE:NTS

NOTES:

1. SCULPTED CONCRETE SHOWN WITH TUNING BLOCKS SHALL BE FINISHED LEVEL AND UNIFORM, SUFFICIENT TO ACCEPT TUNING BLOCKS. OUTER 6 INCHES OF STEPS SHALL BE FINISHED SMOOTH, NON-UNIFORM AND MEETING TYPE II SCULPTED CONCRETE REQUIREMENTS PER THIS SHEET.
2. PROVIDE CAST IN PLACE BLOCK ANCHORS WHERE TUNING BLOCKS ARE SHOWN IN PLAN VIEWS. TYPICAL ALL DROPS.
3. SCULPTED CONCRETE SHALL MIMIC NATURAL OCCURRING ROCK ON THE PROJECT SITE OR AS APPROVED BY ENGINEER. VARIATIONS IN SHAPE, FORM, TEXTURE, AND COLOR OF THE APPROVED AESTHETIC CONCEPT ARE REQUIRED THROUGHOUT THE PROJECT SUBJECT TO ENGINEER APPROVAL.
4. CONSTRUCTION OF A SAMPLE AREA AND APPROVAL BY ENGINEER REQUIRED PRIOR TO PERMANENT SCULPTED CONCRETE INSTALLATIONS.
5. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
6. ROCK ANCHORS/DOWELS EXTENDING FROM SCULPTED CONCRETE INTO UNDERLYING CORE ROCK LAYER CAN EITHER BE INSTALLED PRIOR TO GROUTING OF CORE ROCK OR DRILLED AND INSTALLED

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

WHITEWATER COURSE IMPROVEMENTS

SCULPTED CONCRETE DETAILS

DATE 11/14/2025

DRAWING NO. WW-17

SHEET NO. 40 OF 52

PLOTTED: 11/10/2025 10:14:12 AM
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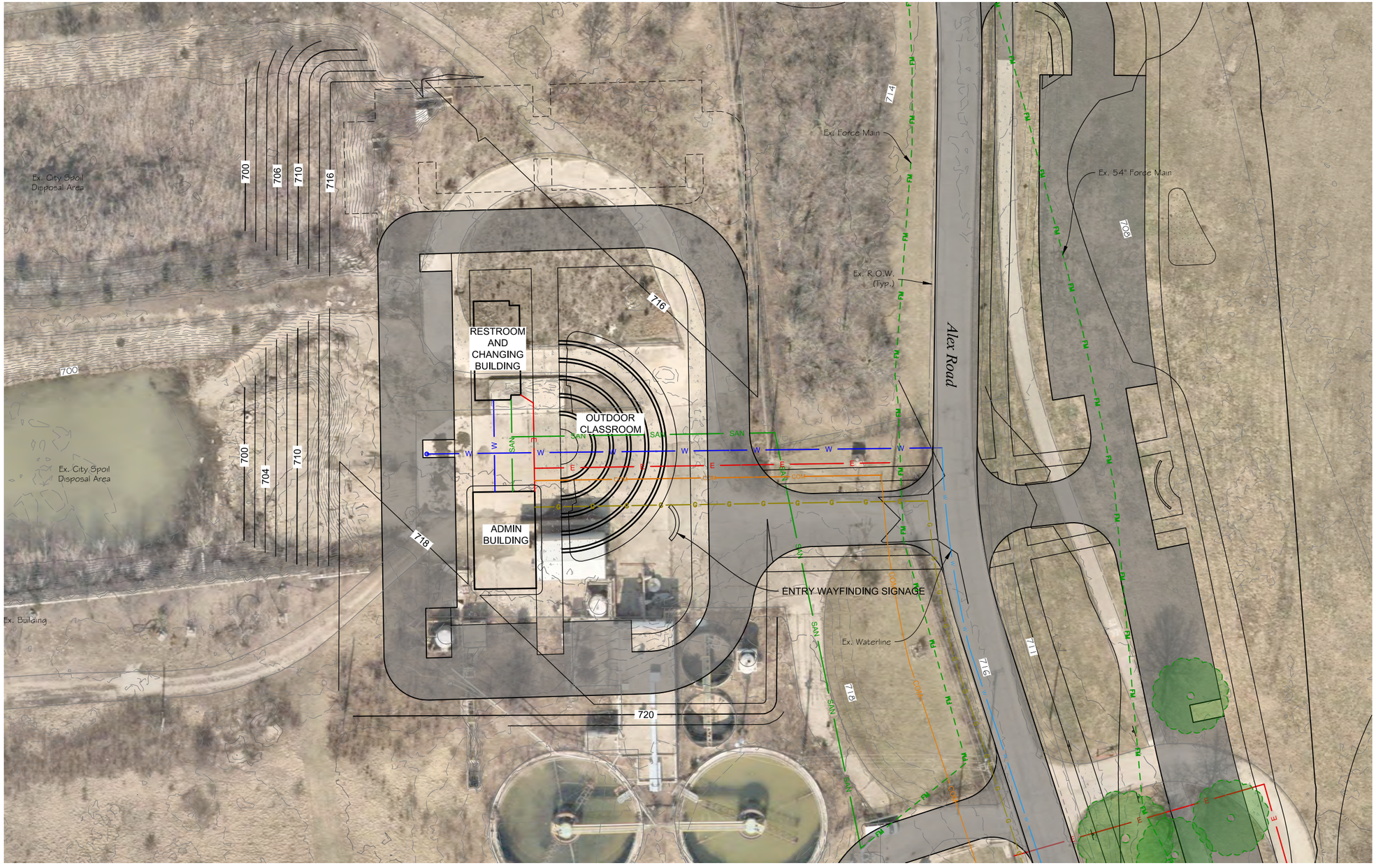


KEYMAP
SCALE: 1"=1,600'

NOTES:

1. THE TOPOGRAPHIC DATA PRESENTED ON THESE PLANS WAS OBTAINED FROM LIDAR.
2. LIMITED UNDERGROUND UTILITY LOCATIONS WERE OBTAINED FROM GIS DATA PROVIDED BY MONTGOMERY COUNTY AND SHOULD BE CONSIDERED APPROXIMATE.
3. UTILITY DATA HAS NOT BEEN OBTAINED FOR ALL PROJECT AREAS, INCLUDING THE ABANDONED TREATMENT PLANT ALONG HYDRAULICS ROAD.
4. PROPERTY LINES WERE OBTAINED FROM GIS DATA PROVIDED BY MONTGOMERY COUNTY AND SHOULD BE CONSIDERED APPROXIMATE.
5. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983 (NAD 83) AND THE PROJECTION SYSTEM IS OHIO STATE PLAN SOUTH ZONE, NATIONAL SPATIAL REFERENCE SYSTEM 2011 (NSRS 2011).
6. VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
7. EFFECTIVE SPECIAL FLOOD HAZARD AREAS (SFHA) ARE FROM FEMA FLOOD INSURANCE RATE MAP (FIRM) PANELS 39113C0242E, REVISED 01/06/2005.

N

0' 30' 60'

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

UPLAND SITE IMPROVEMENTS

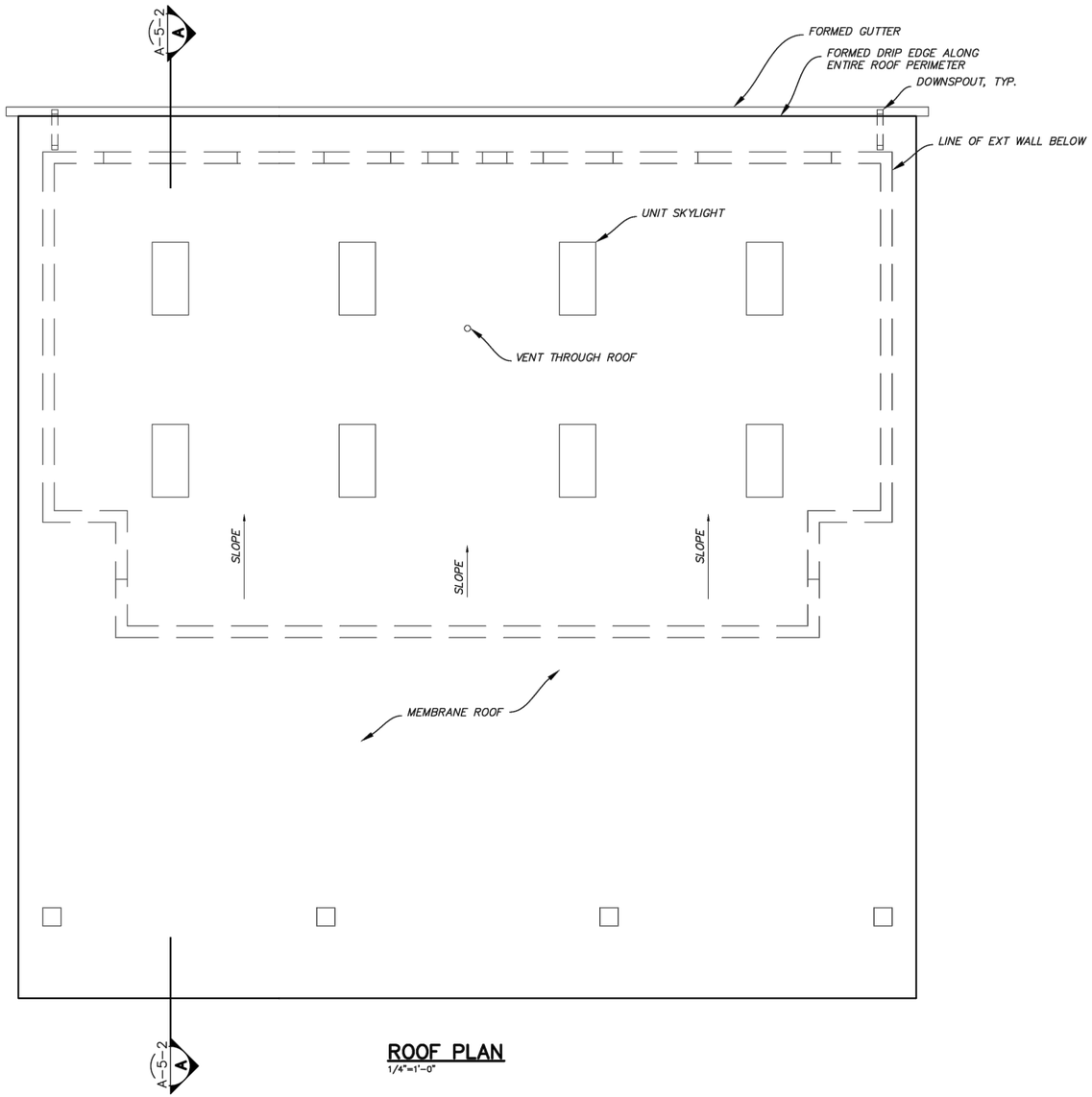
UPLAND SITE PLAN

DATE 11/14/2025

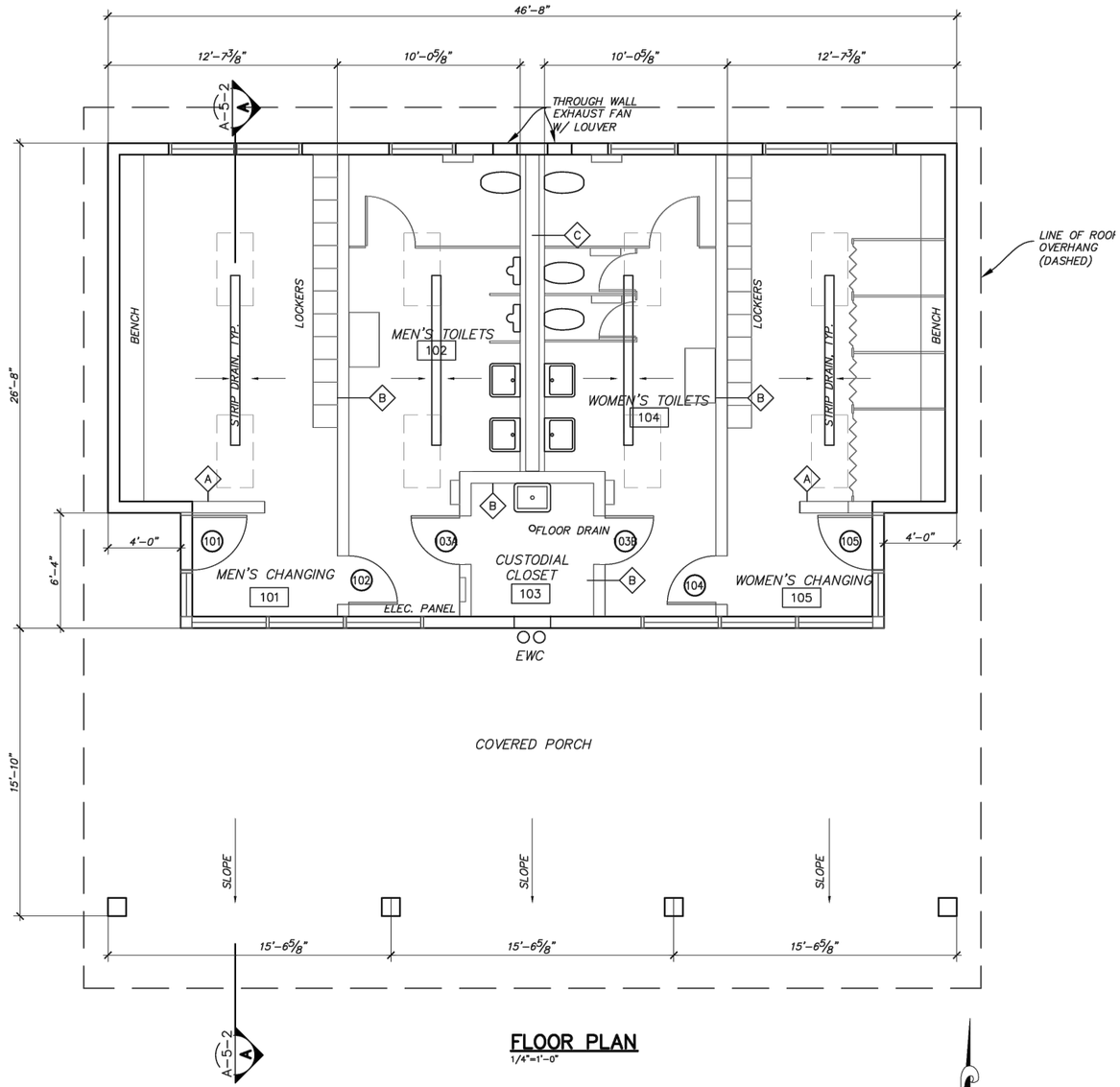
DRAWING NO. US-1

SHEET NO. 41 OF 52

PLOTTED: 11/10/2025 10:18:34 AM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_UPLAND SITE PLN.DWG



ROOF PLAN
1/4"=1'-0"



FLOOR PLAN
1/4"=1'-0"

KEY

- 034 DOOR NUMBER
- 103 ROOM NUMBER
- B PARTITION TYPE

NORTH
4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

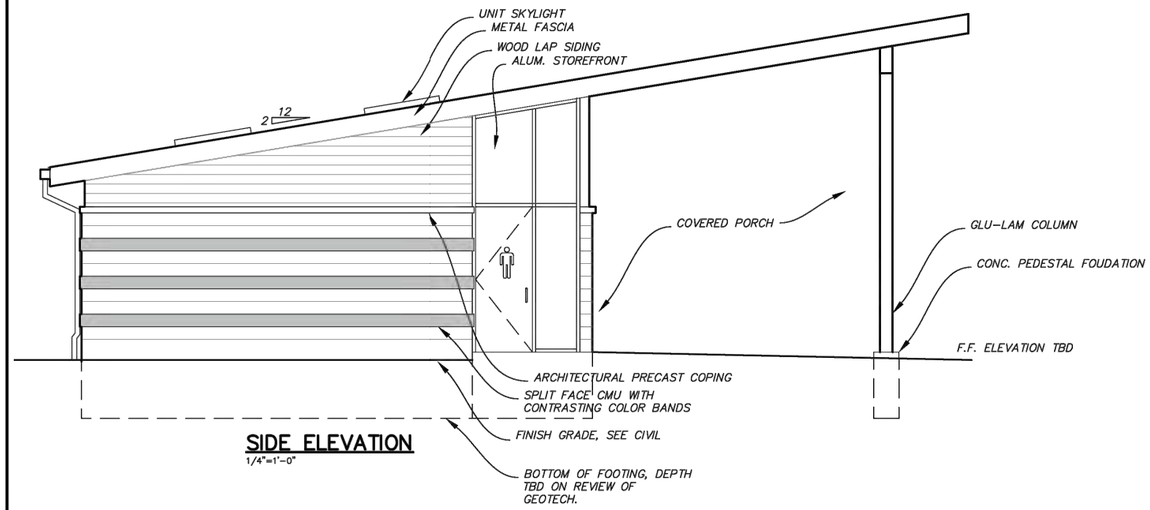
FLOOR PLAN
ROOF PLAN

DATE 11/14/2025

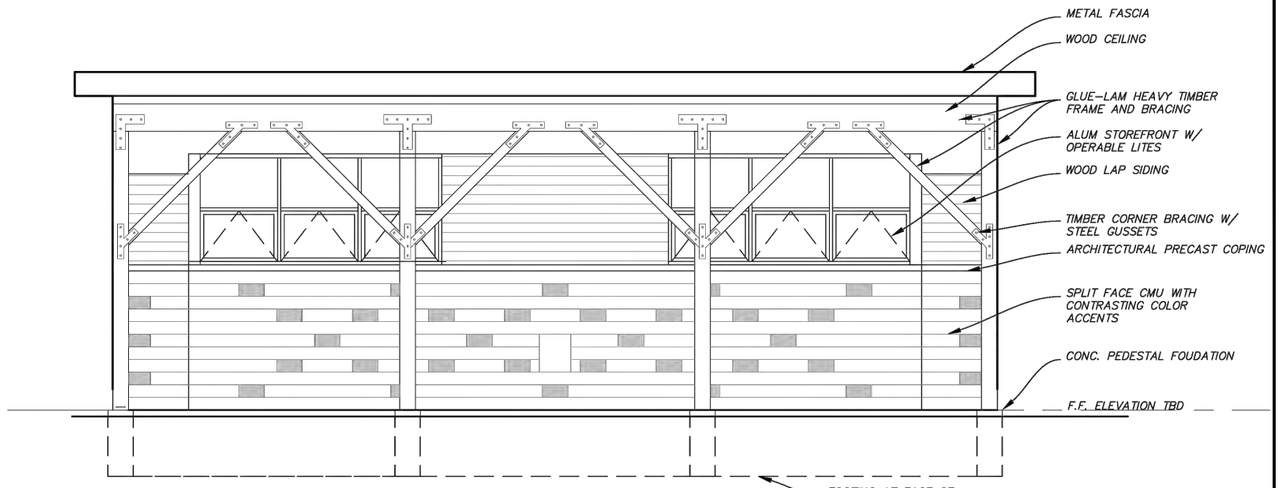
DRAWING NO. CR-1

SHEET NO. 42 OF 52

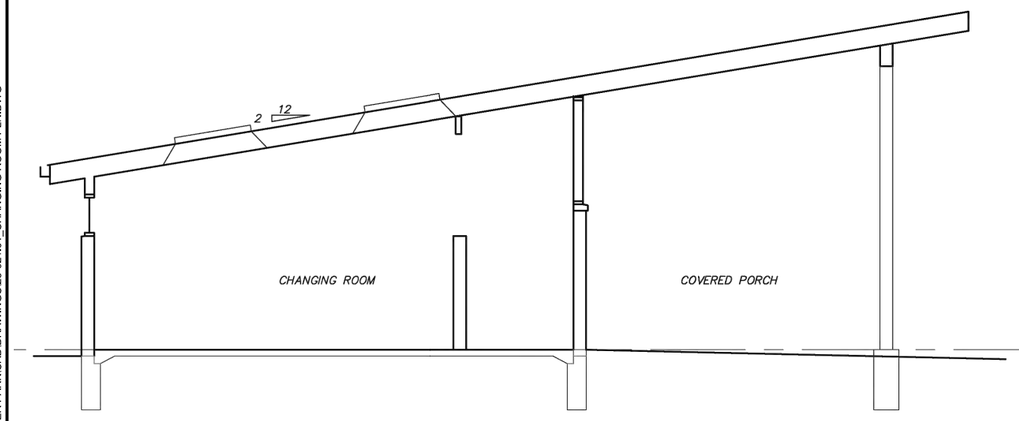
PLOTTED: 11/10/2025 3:18:06 PM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_CHANGING ROOM PLN.DWG



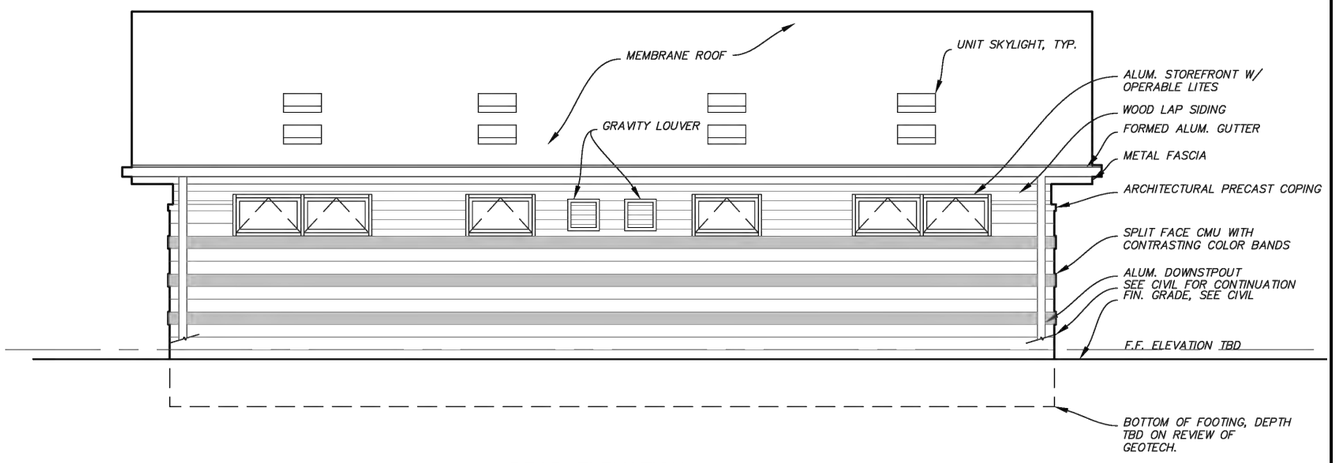
SIDE ELEVATION
1/4"=1'-0"



FRONT ELEVATION
1/4"=1'-0"



SECTION A-A
1/4"=1'-0"



REAR ELEVATION
1/4"=1'-0"

4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

ELEVATIONS BUILDING SECTION

DATE 11/14/2025

DRAWING NO. CR-2

SHEET NO. 43 OF 52

PLOTTED: 11/10/2025 3:16:30 PM
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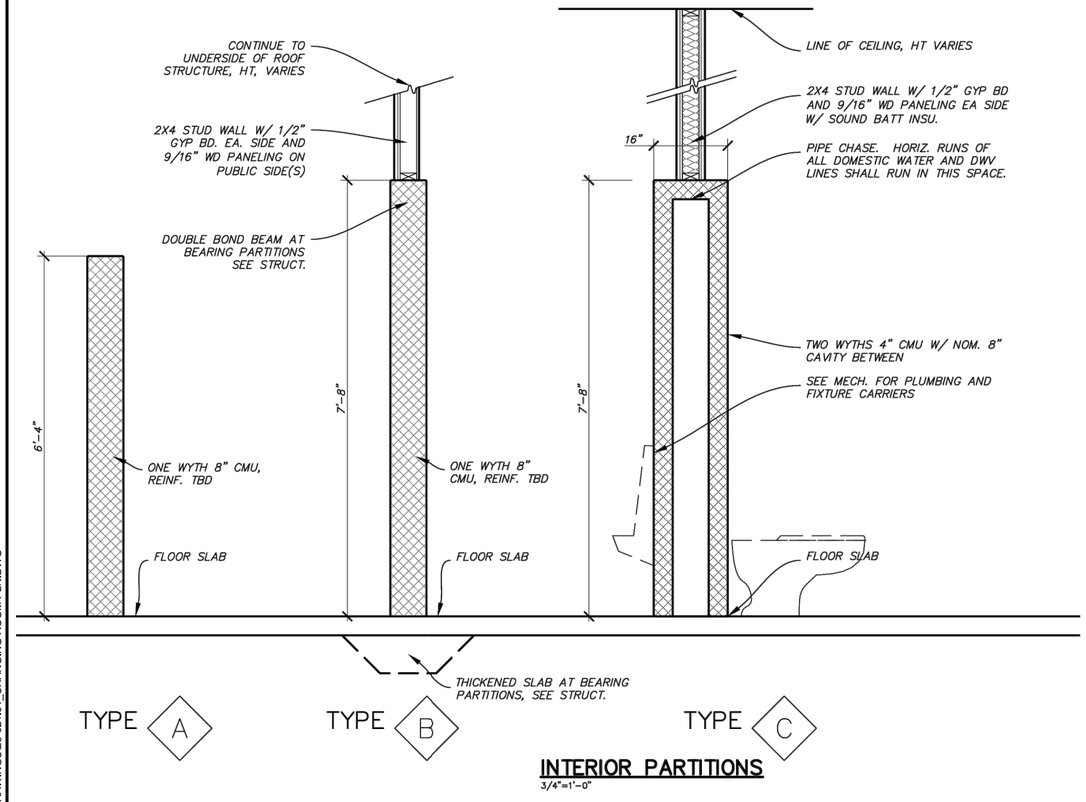


INTERIOR PARTITIONS
3/4"=1'-0"

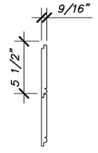
Door Schedule

			Door				Jamb			Hardware	Lock/Latch	Remarks
Mark	From	To	Type	Size	Mat'l.	Rating	Type	Mat'l.	Rating	Group	Function	
101	Exterior	Men's Changing 101	A	3-0x7-8x1-3/4"	Storefront	-		Alum	-		Restroom	Owner's time lock system
102	Men's Changing 101	Men's Toilets 102	C	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Restroom	
103a	Men's Toilet 102	Custodial Closet 103	B	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Store Rm.	
103b	Women's Toilet 105	Custodial Closet 103	B	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Store Rm.	
104	Women's Changing 105	Women's Toilet 104	C	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Restroom	
105	Exterior	Women's Changing 105	A	3-0x7-8x1-3/4"	Storefront	-		Alum	-		Restroom	Owner's time lock system

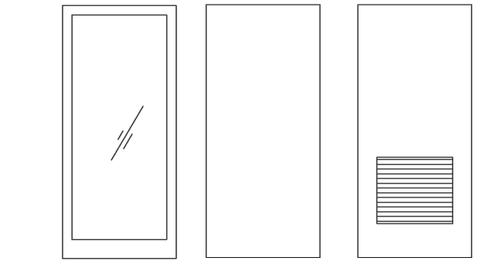
FINISH SCHEDULE

Room/ Area:	RM. No.	Walls				Floor	Ceiling		Base	Remarks:
		North	East	South	West		Ceiling Finish	Ceiling Height		
Men's Changing	101	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		
Men's Toilet	102	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		
Closet	103	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		
Women's Toilet	105	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		
Women's Changing	106	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		

SCHEDULES



WOOD PANELING DETAIL
3"=1'-0"



DOOR TYPES
NO SCALE

4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

DOOR, PARTITIONS SCHEDULES

DATE 11/14/2025

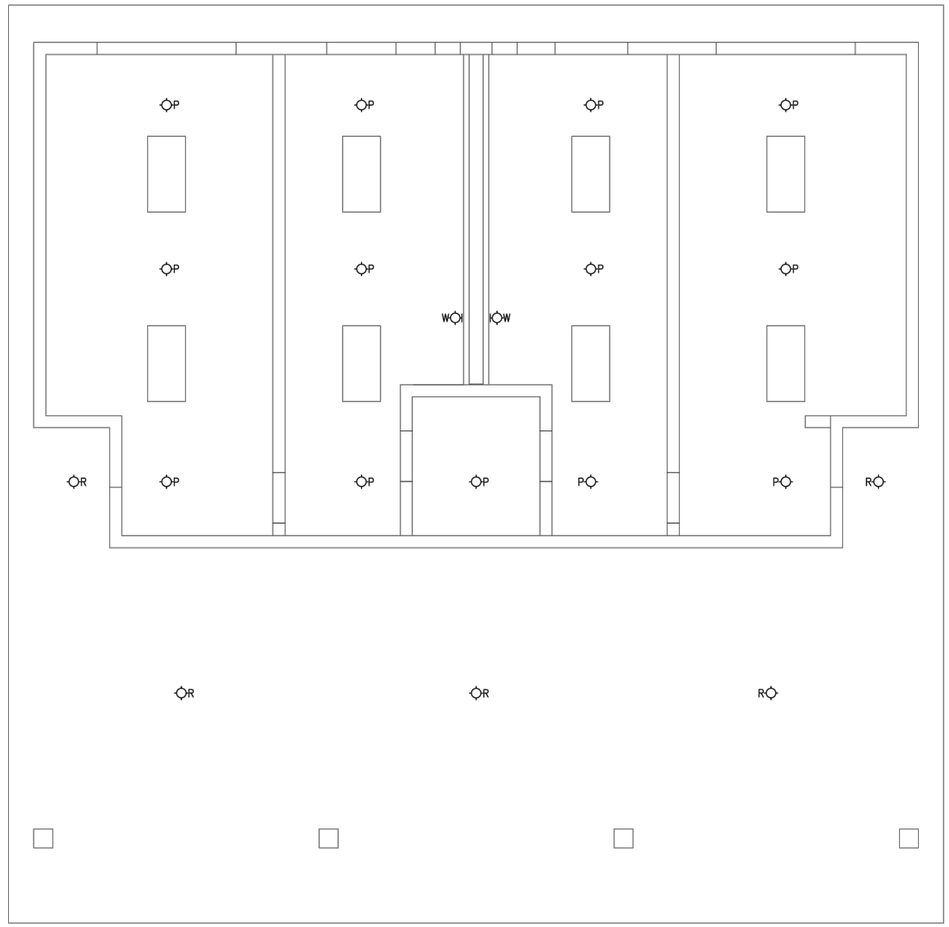
DRAWING NO. CR-3

SHEET NO. 44 OF 52

PLOTTED: 11/10/2025 3:13:44 PM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_CHANGING ROOM PLN.DWG

LIGHTING KEY

P PENDANT
W WALL
R RECESSED



FIRST FLOOR REFLECTED CEILING PLAN
1/4"=1'-0"

NORTH
4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

REFLECTED CEILING PLAN

DATE 11/14/2025

DRAWING NO. CR-4

SHEET NO. 45 OF 52

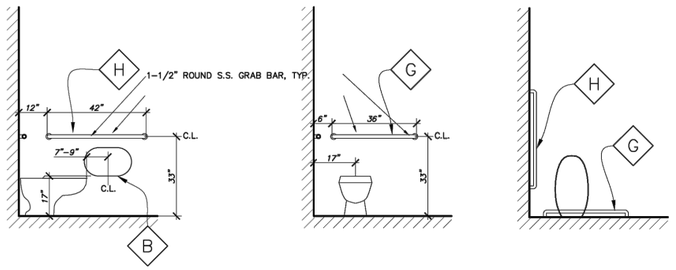
PLOTTED: 11/10/2025 3:12:26 PM
NAME: P:\2025 PROJECTS\25-021.01 WEST CARROLLTON RIVER PARK\CAD\DRAWINGS\25-021.01_CHANGING ROOM PLN.DWG

TOILET ACCESSORY SCHEDULE

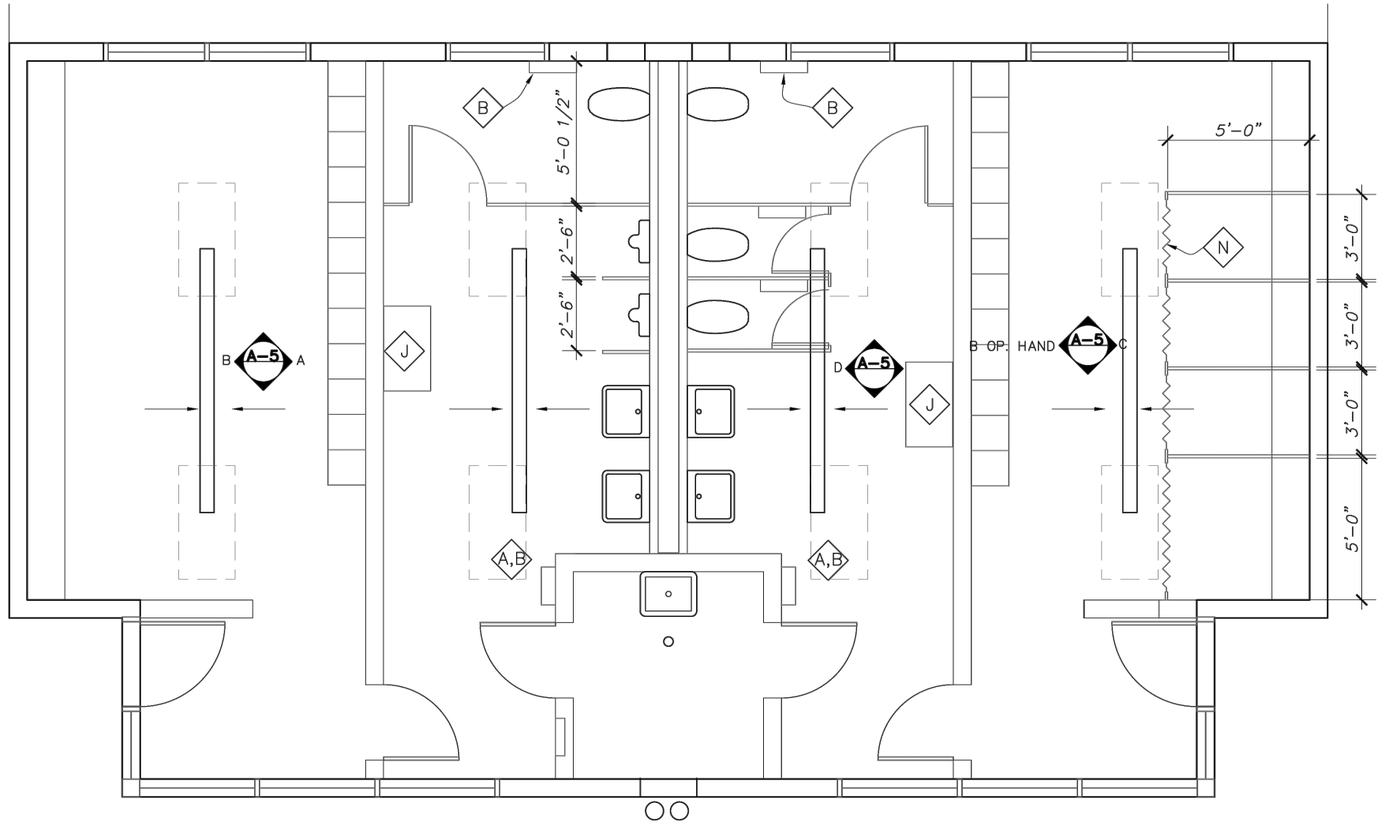
Mark	Item	Representative Manufacturer	Model No.	Mounting Height Above Floor*	Remarks
A	Waste Receptical-surface mount	Bobrick	B277	24" to 36"	to top of rim
B	Dual Toilet Paper Holder	Bradley	5425	20" to bot	Provide one per each toilet stall
C	Touchless Soap Dispenser (lavs)	Rubbermaid	Lumicel	36"	Mount between sinks, see dwgs
D	Fem. Napkin Disposal	Bradley	4781-11	36"	
E	Garment Hook	Bobrick	B 6827	40" ADA, 54" others	One per toilet compartment door
F	Channel-Framed Mirror	Bobrick	B165 2436	Per Drawings	
G	Grab Bar-36"	Bradley	812	Per Drawings	
H	Grab Bar-42"	Bradley	812	Per Drawings	
J	Baby Changing Station	Rubbermaid	FG 781888	Per Drawings	Horizontal deployment
K	Touchless Paper Towel Dispenser	Bradley	2494	Per Dawings	8" towel roll
L	Robe Hook	Bradley	9118	Per Drawings	
M	Bench support	Rakks	EH-1416	Per Drawings	48" o.c.
N	Shower Curtain	Bobrick	B-240-3		Length varies, hang on OH brace of changing compartment

KEY

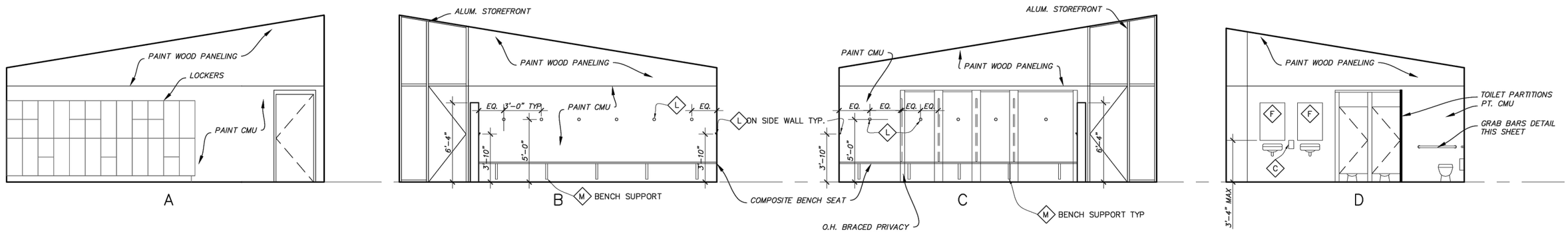
◇B TOILET ACCESSORY, SEE SCHEDULE



ACCESSIBLE TOILET STALL GRAB BARS
3/8"=1'-0"



ENLARGED PLAN
3/8"=1'-0"



INTERIOR ELEVATIONS
1/4"=1'-0"

4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

RESTROOM INTERIORS

DATE 11/14/2025

DRAWING NO. CR-5

SHEET NO. 46 OF 52

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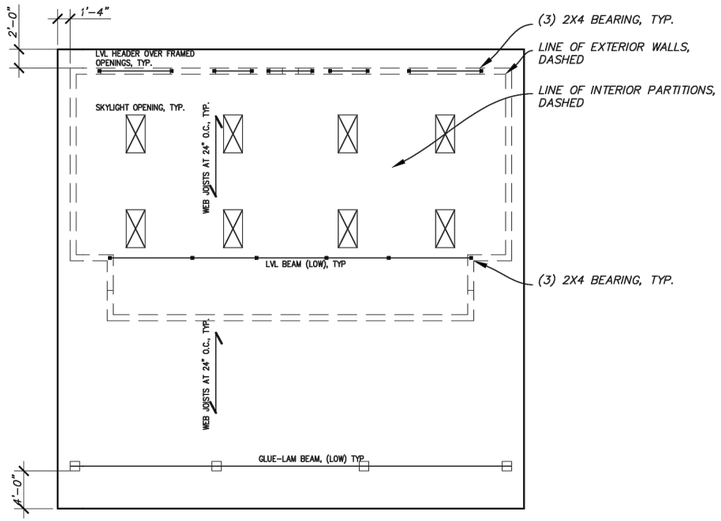
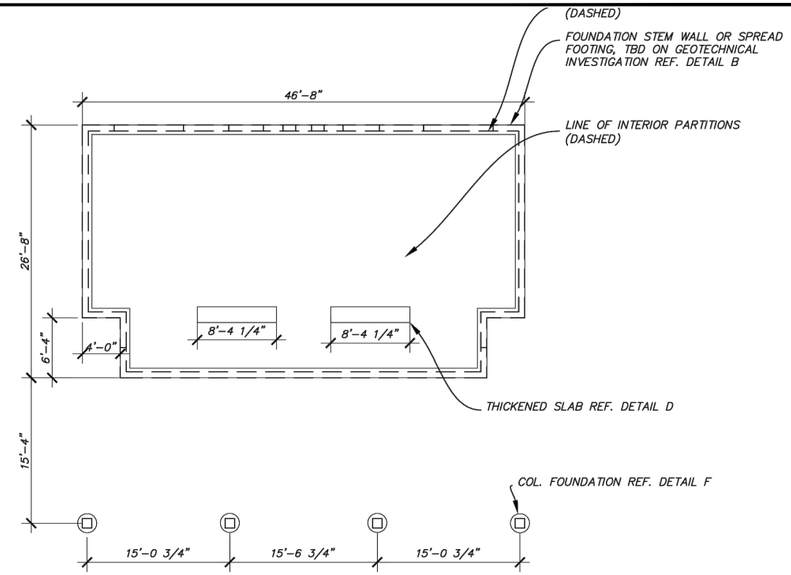
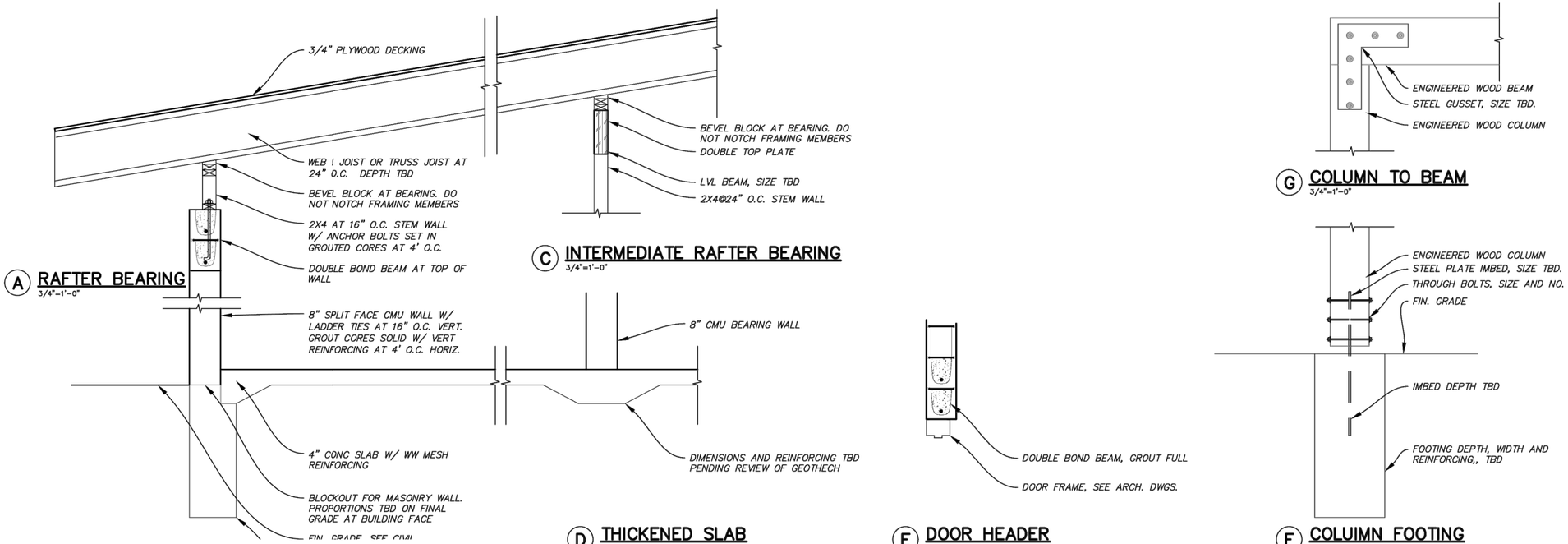


DIAGRAMATIC ROOF FRAMING PLAN
1/8"=1'-0"



DIAGRAMMATIC FOUNDATION PLAN
1/8"=1'-0"



A RAFTER BEARING
3/4"=1'-0"

B STEM WALL STRIP FOOTING
3/4"=1'-0"

C INTERMEDIATE RAFTER BEARING
3/4"=1'-0"

D THICKENED SLAB
3/4"=1'-0"

E DOOR HEADER
3/4"=1'-0"

F COLUIMN FOOTING
3/4"=1'-0"

G COLUMN TO BEAM
3/4"=1'-0"

NORTH
8 0 8 16
1/8 inch = 1 foot

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CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

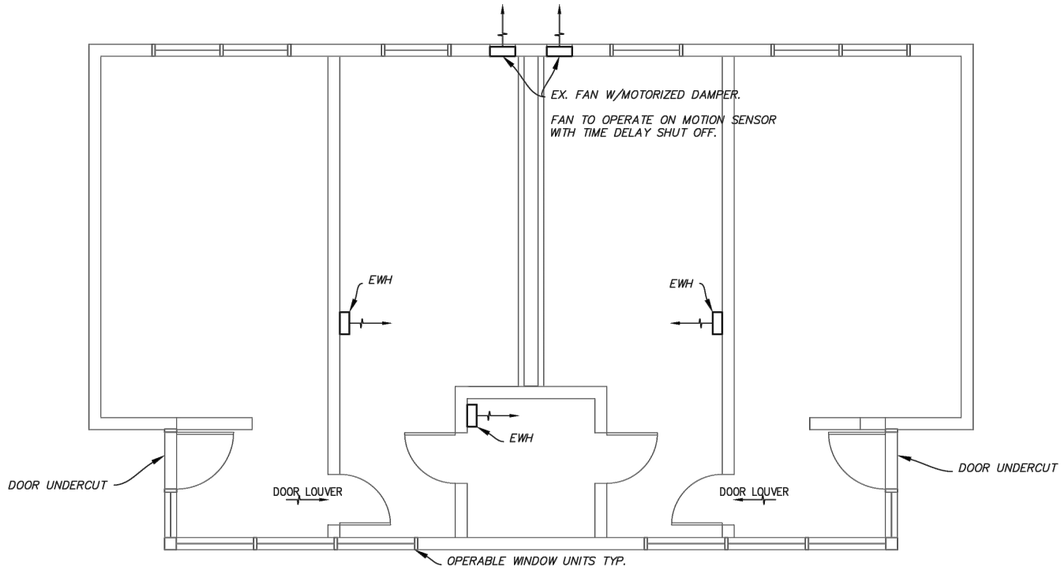
CHANGING ROOM AND RESTROOM BUILDING

FOUNDATION PLAN FRAMING SCHEMATIC DETAILS

DATE 11/14/2025

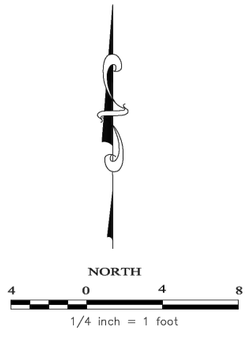
DRAWING NO. CR-6

SHEET NO. 47 OF 52



FIRST FLOOR MECHANICAL PLAN

1/4"=1'-0"



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SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

MECHANICAL PLAN

DATE 11/14/2025

DRAWING NO. CR-7

SHEET NO. 48 OF 52

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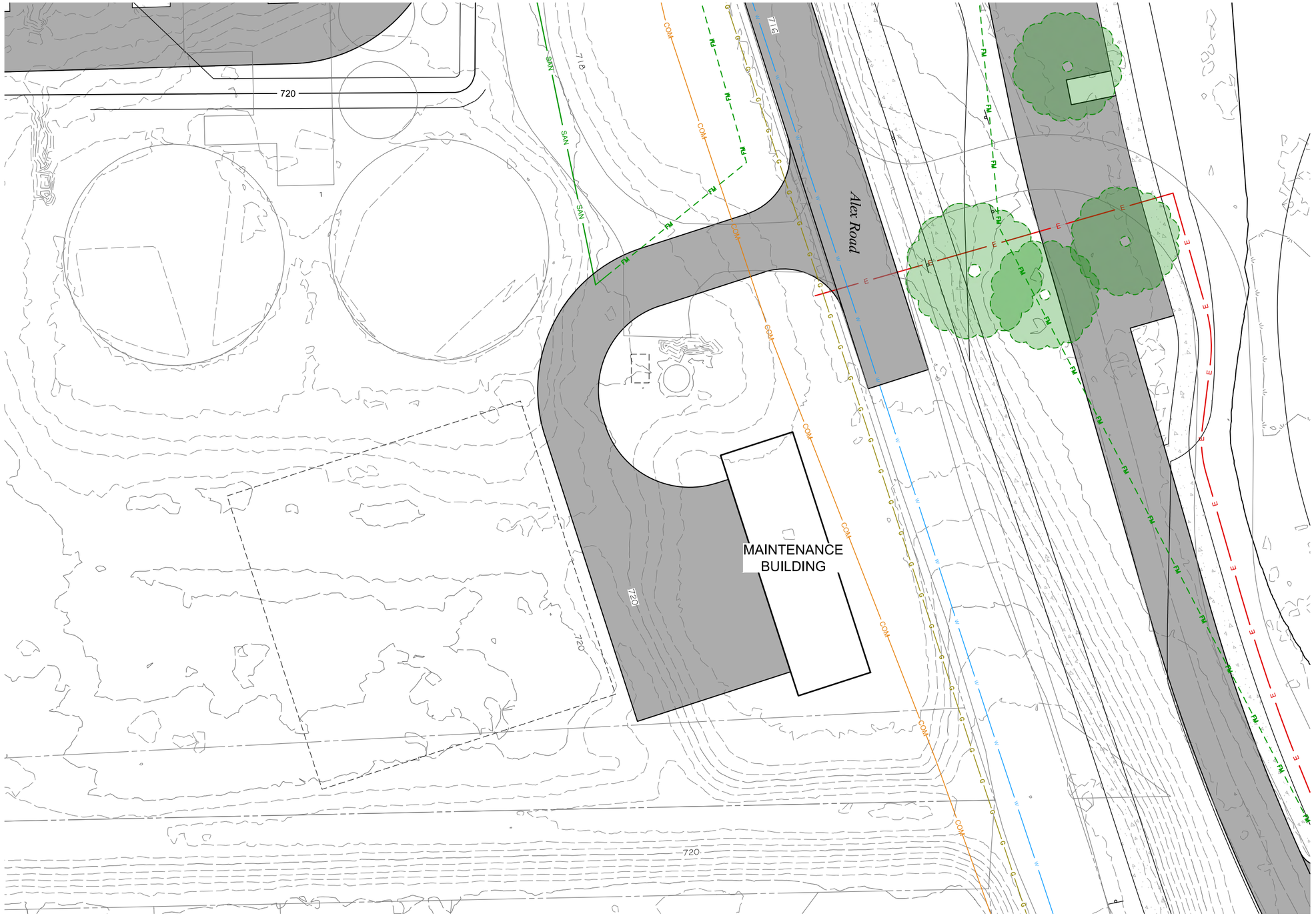

KEYMAP
SCALE: 1"=1,600'

NOTES:

1. THE TOPOGRAPHIC DATA PRESENTED ON THESE PLANS WAS OBTAINED FROM LIDAR.
2. LIMITED UNDERGROUND UTILITY LOCATIONS WERE OBTAINED FROM GIS DATA PROVIDED BY MONTGOMERY COUNTY AND SHOULD BE CONSIDERED APPROXIMATE.
3. UTILITY DATA HAS NOT BEEN OBTAINED FOR ALL PROJECT AREAS, INCLUDING THE ABANDONED TREATMENT PLANT ALONG HYDRAULICS ROAD.
4. PROPERTY LINES WERE OBTAINED FROM GIS DATA PROVIDED BY MONTGOMERY COUNTY AND SHOULD BE CONSIDERED APPROXIMATE.
5. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983 (NAD 83) AND THE PROJECTION SYSTEM IS OHIO STATE PLAN SOUTH ZONE, NATIONAL SPATIAL REFERENCE SYSTEM 2011 (NSRS 2011).
6. VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
7. EFFECTIVE SPECIAL FLOOD HAZARD AREAS (SFHA) ARE FROM FEMA FLOOD INSURANCE RATE MAP (FIRM) PANELS 39113C0242E, REVISED 01/06/2005.

N

0' 20' 40'

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SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

MAINTENANCE BUILDING

MAINTENANCE BUILDING SITE PLAN

DATE 11/14/2025

DRAWING NO. MB-1

SHEET NO. 49 OF 52

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NOT INCLUDED IN CMAR RFP

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CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

LANDSCAPE

LANDSCAPE PLAN

DATE 11/14/2025

DRAWING NO. L-1

SHEET NO. 50 OF 52

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PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

LANDSCAPE

LANDSCAPE PLAN

DATE
11/14/2025

DRAWING NO.
L-2

SHEET NO.
51 OF 52

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NOT INCLUDED IN CMAR RFP

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

LANDSCAPE

LANDSCAPE PLAN

DATE 11/14/2025

DRAWING NO. L-3

SHEET NO. 52 OF 52

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ATTACHMENT 4: AVAILABLE PROGRAM REQUIMENTS
Document 00 01 10 Table of Contents

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

Division 00 – Contents, Forms and Supplementary Conditions

00 01 10 ..... Table of Contents (this document)
00 73 00 ..... Supplementary Conditions
00 73 10 ..... Reference Documents

Division 01 – General Requirements

01 29 00 ..... Item Quantities and Unit Costs Descriptions

See Supplementary Conditions - 00 73 00 for the intent of the specifications included and listed below and other applicable referenced specifications.

FACILITY CONSTRUCTION AND SERVICES SUBGROUP

Division 02 – Not Included

Division 03 – Concrete

03 31 00 ..... Structural Concrete
03 31 01 ..... Sculpted Concrete
03 35 00 ..... Concrete Finishing
03 37 13 ..... Shotcrete

Division 04 – Not Included

Division 05 – Metals

05 50 00 ..... Miscellaneous Metals

Division 06 through 08 – Not Included

Division 09 – Finishes

09 90 00 ..... Painting

Division 10 through 30 – Not Included

SITE AND INFRASTRUCTURE SUBGROUP

Division 30 – Not Included

Division 31 – Earthwork

31 14 13 ..... Topsoil and Wetland Topsoil Stripping and Stockpiling
31 23 00 ..... Excavation and Fill
31 23 13 ..... Subgrade Preparation
31 23 19 ..... Dewatering
31 25 00 ..... Erosion and Sediment Controls
31 38 00 ..... Rock
31 62 16 ..... Steel Sheet Piles

Division 32 – Exterior Improvements

32 34 00 ..... Pedestrian and Light Vehicle Bridges

Division 33 through 34 – Not Included

Division 35 – Waterway and Marine

35 22 70 ..... Adjustable Wave Feature and Gates

35 23 00 ..... Startup and Tunning of Whitewater Facilities

Divisions 36 through 39 – Not Included

PROCESS EQUIPMENT SUBGROUP

Division 40 through 49 – Not Included

END OF DOCUMENT

ATTACHMENT 4: AVAILABLE PROGRAM REQUIMENTS
Document 00 73 00 Supplementary Conditions

PART 1 - GENERAL

1.01 DESCRIPTION

A. These Supplemental Conditions modify, clarify, or supplement the General Conditions of the Contract. Where the Supplemental Conditions differ from or are inconsistent with the General Conditions, the provisions of the Supplemental Conditions shall take precedence. All other terms of the General Conditions remain in full force and effect.

1.02 INTENT OF THESE PROVIDED SPECIFICATIONS

A. These Specifications are in draft form and only a few of the Specifications that will be included in the final Contract Documents are included herein. These are listed in Section 00 10-00 – Table of Contents. The Specifications included are considered more specific than those included in typical river-related capital improvement projects.

1.03 DRAFT LIST OF SPECIFICATIONS TO BE INCLUDED IN FINAL CONTRACT DOCUMENTS

A. This is a draft list of anticipated specifications to be included in the final contract documents:
   1. Division 00 - Procurements Contracting
      a. General Conditions
   2. Division 01 - General Requirements
      a. Site Conditions
      b. Summary of Work
      c. Coordination and Meetings
      d. Definition of Bid Items
      e. Special Conditions
      f. Submittal Procedures
      g. Quality Control
      h. Inspection and Materials Testing
      i. Temporary Facilities
      j. Tree Protection
      k. Temporary Environmental Controls
      l. Project Sign
      m. Emergency Action Plan
      n. Closeout
      o. Construction Progress Documentation
   3. Division 02 – Existing Conditions

   a. Selective Site Demolition
4. Division 03 – Concrete
   a. Concrete Forming
   b. Construction Joints
   c. Waterstops
   d. Reinforcing Steel
   e. Structural Concrete
   f. Sculpted Concrete
   g. Concrete Finishing
   h. Shotcrete
   i. Concrete Curing
   j. Precast Concrete Vaults
   k. Grouting
5. Division 04 – Masonry
   a. Concrete Unit Masonry
   b. Masonry Veneer
6. Division 05 – Metals
   a. Structural Steel Framing
   b. Steel Decking
   c. Miscellaneous Metals
7. Division 06 – Wood, Plastics, and Composites
   a. Rough Carpentry
   b. Miscellaneous Rough Carpentry
   c. Plastic-Laminate-Clad Architectural Cabinets
8. Division 07 – Thermal and Moisture Protection
   a. Concrete Water Repellent
   b. Manhole Preformed Joint Seals
   c. Sealants
   d. Bituminous Dampproofing
   e. Thermal Insulation
   f. Standing Seam Metal Roof Panels
   g. Sheet Metal Flashing and Trim
   h. Roof Accessories
9. Division 08 – Openings
   a. Hollow Metal Doors and Frames
   b. Aluminum Windows
   c. Door Hardware
   d. Glazing

10. Division 09 – Finishes
    a. Painting
    b. Gypsum Board
    c. Ceramic Tiling
    d. Acoustical Tile Ceilings
    e. Resilient Base and Accessories
    f. High Performance Painting and Coatings
    g. Fluid-Applied Epoxy Flooring
11. Division 10 – Specialties
    a. Buoy System
    b. Signs for Caution and Hazards
    c. Plastic Toilet Compartments
    d. Toilet, Bath, and Laundry Accessories
    e. Fire Protection Cabinets
    f. Fire Extinguishers
12. Division 11- Equipment
    a. General Equipment
    b. Residential Appliances
13. Division 12 – Furnishings
    a. Site Furnishings
14. Division 13 – Special Construction
    a. Site Shelters
    b. Cathodic Protection and Bonding for Buried Pipelines
15. Division 22 – Plumbing
    a. Common Motor Requirements for Plumbing and HVAC Equipment
    b. Sleeves and Sleeve Seals for Plumbing Piping
    c. Escutcheons for Plumbing Piping
    d. Meters and Gages for Plumbing Piping
    e. Ball Valves for Plumbing Piping
    f. Check Valves for Plumbing Piping
    g. Hangers and Supports for Plumbing Piping and Equipment
    h. Vibration Controls for Plumbing Piping and Equipment
    i. Identification for Plumbing and HVAC Piping and Equipment
    j. Plumbing Piping Insulation
    k. Domestic Water Piping
    l. Domestic Water Piping Specialties
    m. Inline, Domestic-Water Pumps
    n. Sanitary Waste and Vent Piping

o. Sanitary Waste Piping Specialties
p. Facility Storm Drainage Piping
q. Storm Draining Piping Specialties
r. Electric, Domestic Water Heaters
s. Fuel-Fired, Domestic Water Heaters

16. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)
    a. Testing, Adjusting and Balancing for HVAC
    b. Duct Insulation
    c. Direct Digital Control (DDC) System for HVAC
    d. Sequence of Operations for HVAC DDC
    e. Facility Natural-Gas Piping
    f. Refrigerant Piping
    g. Metal Ducts
    h. Air Duct Accessories
    i. Flexible Ducts
    j. Centrifugal HVAC Fans
    k. HVAC Power Ventilators
    l. Air Diffusers
    m. Registers and Grilles
    n. Low-Intensity, Gas Fired, Radiant Heaters
    o. Split-System Air-Conditioners
    p. Wall and Ceiling Unit Heaters
17. Division 26 – Electrical
    a. Electrical General Conditions
    b. Excavating, Trenching and Backfilling
    c. Electrical Service
    d. Motors
    e. Power and Instrumentation Cable – Less than 600V
    f. Grounding and Bonding for Electrical Systems
    g. Hangers and Supports for Electrical Systems
    h. Conduit
    i. Cable Tray for Electrical Systems
    j. Boxes
    k. Underground Duct and Raceways for Electrical Systems
    l. Precast Concrete Electrical Manholes and Handholes
    m. Identification for Electrical Systems
    n. Electrical Power Monitoring

o. General Purpose Dry-Type Distribution Transformer (1500 KVA and Below)
p. Switchboards
q. Panelboards
r. Motor Control Centers
s. Transition Cabinet
t. Wiring Devices
u. Fuses
v. Enclosed Switches
w. Enclosed Controllers
x. Variable Frequency Motor Controllers
y. Static Uninterruptible Power Supply System (UPS)
z. Surge Protective Devices
aa. Luminaires

18. Division 31 – Earthwork
    a. Clearing and Grubbing
    b. Topsoil Stripping and Stockpiling
    c. Excavation and Fill
    d. Subgrade Preparation
    e. Dewatering
    f. Flowable Fill
    g. Trenching and Backfilling
    h. Erosion and Sediment Controls
    i. Geotextile
    j. Watering
    k. Rock
    l. H Pile
    m. Steel Sheet Piles
19. Division 32 – Exterior Improvements
    a. Aggregate Base Course
    b. Asphalt Paving
    c. Crusher Fines Surfacing
    d. Stabilized Crusher Fines Surfacing
    e. Sidewalks Curb and Gutter
    f. Pavement Markings
    g. Fences
    h. Chain Link Fencing
    i. Pedestrian and Light Vehicle Bridges

j. Site Stone
k. Irrigation
l. Soil Preparation
m. Topsoil
n. Sodding
o. Seeding
p. Landscape Planting
q. Soil Bioengineering or Shoreline Stabilization

20. Division 33 – Utilities
    a. Subdrainage
    b. Manholes
    c. Identification of Buried Piping
    d. Reinforced Concrete Pipe
    e. High Density Polyethylene Pipe (HDPE)
    f. Spiral Ribbed Aluminized Steel Pipe (ASP)
    g. Polyvinyl Chloride PVC Pipe
21. Division 35 – Waterway and Marine Construction
    a. Adjustable Wave Feature and Gates
    b. Startup and Tuning of Whitewater Facilities
    c. Levee Construction

1.04 REFERENCED SPECIFICATIONS

A. Other specifications that can be referenced to provide a more complete understanding of the Project include:
B. Appendices III, IV, and V from the MCD LAND USE POLICY - MIAMI CONSERVANCY DISTRICT - Approved April 29, 2013, by Motion M 03-581, as included in REFERENCED DOCUMENTS -00 73 10
C. Technical Specifications in Divisions 2 and higher from the Mile High Flood District (MHFD) https://www.mhfd.org/specifications

1.05 DESIGN BUILD SERVICES TO BE PERFORMED BY THE CMAR

A. Design services to be included within the CMAR Contractors' scope of work include various utilities, services, and ancillary project improvements. The Engineer will provide specific requirements, specifications and locations for these utilities, services, and ancillary project improvements during the preconstruction phase of the project. These utilities, services, and ancillary project improvements include, but not necessarily limited to:
B. Water and Sewer Services and connections for the buildings.
C. Electric services for the buildings, vaults, lighting and equipment.
D. Site Lighting

END OF SECTION

ATTACHMENT 4: AVAILABLE PROGRAM REQUIMENTS
Document 00 73 10 Reference Documents

Incorporation of Reference Documents. All exhibits, schedules, appendices, and other attachments referenced in or attached to these Contract Documents (collectively, the "Reference Documents") are hereby incorporated into and made part of these Contract Documents as if fully set forth herein. In the event of any conflict between the terms specified elsewhere within the Contract Documents including these Specifications or Design Drawings, the terms of these shall govern unless expressly stated otherwise in such Reference Document.

The following documents are made part of these Contract Documents. These documents are included in Document 00 73 10.

Index of Referenced Documents 00 73 10

- Miami Conservancy District (MCD) Appendix III
- Miami Conservancy District (MCD) Appendix V
- Miami Conservancy District (MCD) Appendix VI
- Report of Geotechnical Engineering Exploration, Planning Area 1. June 10, 2024.
- Report of Geotechnical Engineering Exploration, Planning Area 3. June 10, 2024.
- Water Resources Delineation Report. April 11, 2024.
- Endangered, Threatened, and Rare Species and Habitat Assessment. April 11, 2024.
- Mussel Survey Report. October 20, 2024.
- Architectural Design Report. August 2024.
- Architectural Preliminary Design Drawings. October 2025.

APPENDIX III

GENERAL DESIGN AND CONSTRUCTION REQUIREMENTS

Improvements and developments on MCD land must be designed to minimize their effect on MCD and subdistrict infrastructure.

a. All surveys to locate the proposed improvement, development, or use, include property and right-of-way surveys, shall be the responsibility of the applicant.
b. No permanent cuts through dams, levees, floodwalls or other flood protection structures will be permitted.
c. Dam and levee embankment penetrations requiring boring and jacking will not permitted.
d. Boring in the foundation beneath the levee and/or river channel is subject to MCD approval.
e. Levee Excavation
    - Levee excavations that require open cutting are subject to MCD approval.
    - The design and construction must be sequenced to minimize the time required for the levee cut.
    - The grantee or its contractor provide MCD a contingency plan for filling the opening and armoring it against high water within 24 hours after notification from MCD.
    - Complete levee cuts may not be open for more than five consecutive days. All levee cuts must be restored to a minimum elevation equal to the FEMA base flood for that levee section during weekends and any time the contractor is not on site for two or more consecutive days.
f. Earthen Areas
    - All disturbed earthen areas shall be restored to the lines and grades of the approved project plans or to original lines and grades as appropriate.
    - All areas shall be graded to avoid pockets that do not drain.
    - Areas graded to encourage concentrated flow shall be adequately armored against erosion.
g. Fill Material
    - All fill materials for embankment construction and restoration must be approved by MCD.
    - Fill and embankment soil material is specified in Appendix V of the Land Use Policy.
    - Fill shall be clean earthen material free of loam, roots, organic matter, boulders, concrete, asphalt, wood, metal, building rubble, and other unsuitable material.
    - MCD reserves the right to reject any fill material.
    - MCD requires a Standard Proctor test to be performed on the proposed material prior to use to determine the optimal water content at which the soil can reach its maximum dry density. Copies of all test reports shall be provide to MCD for approval.
    - Grantee shall provide contact information of all sources of materials.
    - MCD may require environmental testing of material.
    - MCD may require a physical sample of the proposed material for approval.
    - Fill may not be placed on frozen, wet subgrade, or in standing water.
    - Fill for restoring levee slopes shall be placed in loose lifts not to exceed six-inch in depth and compacted to 95% Standard Proctor as determined by a certified testing company. Testing will be performed every two (2) compacted lifts of height at one-hundred (100) foot intervals beginning fifty (50) feet from the ends

of the project or as directed by MCD. Copies of all compaction and laboratory test reports shall be provided to MCD.

- Moisture control limits are to be within -1% to +3% of optimum.
- Lifts may not contain any veins of gravel material.
- Fill material shall be no larger than three (3) inches in diameter.
- Fill material shall have no more than 15% gravel.
- MCD may require gradation testing of material to ensure the material conforms to the Fill and Embankment Soil Specifications per Appendix V.
- The fill shall be graded to the lines and grades of the adjoining areas.
- The surface of the levee shall be stripped of organics and topsoil to a depth of six (6) inches prior to benching the levee slope.
- The existing levee embankment shall be over-excavated in all directions by benching one (1) foot vertical and a minimum of one (1) foot horizontal into stiff undisturbed soil. A level bottom surface day-lighting toward the levee toe shall be provided from which the upward benching on the sides shall initiate. Benching may have to be performed by hand methods or using small-scale excavation equipment.
- The levee soil on which the backfill is to be placed should not be excavated until immediately before backfilling, and shall not be allowed to become overly wet or dry while exposed.
- The surface area of the benches shall be scarified as necessary to ensure a good bond between the existing soil and the backfill material.

h. Top Soil
    - After the final lines, grades, and elevations have been established, six (6) inches of topsoil placed in loose lifts that construct a four (4) inch compacted depth shall be spread on all disturbed areas.
    - The topsoil shall be tracked in with a dozer or approved equipment to compact and provide a good contact between the topsoil and the surface of the fill material.
    - Topsoil shall be scarified prior to seeding.

i. Seeding
    - Within ten days following any construction or land disturbing activity, all disturbed earth areas shall be seeded, fertilized and mulched. Seed, fertilizer and mulch specification and application rates are specified in Appendix V of the Land Use Policy.
    - MCD will do a preliminary inspection after 4 weeks to ensure that grass is being established after final seeding.
    - MCD will inspect all seeded areas no earlier than 6 months and no later than 12 months after final seeding. For any area identified without uniform density of at least 90 percent grass cover, the grantee will be required to seed, fertilize and mulch any areas where sufficient turf has not been established.
    - If seeding of an area is not successful, MCD may require sodding of disturbed areas.
    - All property is to be properly monitored and maintained until sufficient turf has been established.

j. Structural components (concrete, asphalt, masonry, crushed aggregate, rock slope protection, metal, etc.) shall conform to the ODOT 2013 Construction and Material Specifications.
    - Because of the various types of structures on MCD property, structural restoration requirements shall be addressed on a case by case basis.

k. Revetment
    - Any damage to revetment shall be restored to match the adjacent lines and grades.
    - Any damaged sections of revetment shall be restored using materials that meet the MCD material specification from the Land Use Policy APPENDIX V.
    - Damaged sections of revetment shall be saw-cut at the nearest construction joint and removed.
    - Sub-base shall be compacted to 95% Standard Proctor.
    - 6” of ODOT ITEM 304 aggregate base shall be placed and compacted to 95% Standard Proctor.
    - Place 4x4x4/4 85 pound welded steel fabric in a way to maintain proper mesh clearance of 2” from top of the slab during placement of concrete per ODOT ITEM 709.10.
    - 18” #4 epoxy coated dowels shall be epoxied 6” in depth into the toe wall with 12” in the new revetment concrete. Dowels shall be 12” on center per ODOT ITEM 709.13.
    - 12” #4 epoxy coated dowels shall be epoxied 6” in depth into the adjacent revetment panel with 6” in the new revetment concrete. Dowels shall be 12” on center per ODOT ITEM 709.13.
    - Concrete to have a “soft” broom finish with all edges having a ¼” radius.
    - MCD may require expansion joint material where needed.
    - ODOT ITEMS are referenced to the 2013 ODOT Construction and Material Specifications.
    - A typical revetment section drawing is located at the end of this appendix.

l. Pavement
    - Depending of the severity of damage to the recreation trail, MCD shall require either, pavement planing (milling) and a surface course of asphalt be applied or full depth replacement with intermediate and surface courses of asphalt per MCD’s typical recreation trail section drawings.
    - Full depth replacement will require sub-base to be compacted to 95% Standard Proctor.
    - Base shall consist of 8” of ODOT ITEM 304 aggregate base material compacted to 95% Standard Proctor.
    - See typical recreation trail section drawings located at the end of this appendix for asphalt concrete details.
    - For asphalt roads, parking lots, and all other asphalt surfaces, MCD will determine the design on a per project basis.
    - Concrete roads, trails and parking lots disturbed by construction shall be restored to their original lines and grades. Remove all damaged areas by saw-cutting to provide a clean square joint. The concrete for the pavement shall be Class QC1 per ODOT ITEM 499. All replacement concrete pavement shall be dowelled into existing pavement per ODOT ITEMS 509 and 510. The size and spacing of dowels shall be determined by MCD on a per project basis.
    - ODOT ITEMS are referenced to the 2013 ODOT Construction and Material Specifications.
m. Plans for lighting, signage, wayfinding information, striping, painting, landscaping and all other supporting facilities must be submitted for review.
n. MCD access

- No improvement, development, or use will be approved that obstructs or alters existing access to the river channel for routine maintenance, inspection, or emergency repairs.
- No new structures or obstructions, including trees and landscaping, will be permitted within 15 feet of the land side levee toe.
- MCD will retain right of access and inspection of all improvements, developments, and uses on MCD owned or controlled property.

o. MCD maintenance
   - MCD will not approve improvements, developments, or uses that permanently alter or diminish MCD's ability to maintain the flood protection system or existing river corridor amenities.
   - Concrete stairways and other structures on levee slopes affect mowing and require additional maintenance effort. The need for additional stairways must be shown before MCD will consider more stairways. Positive consideration may be given to a proposed access ramp if the project includes removal of a stairway in the same area.
   - MCD may not approve a proposed improvement, development, or use if it creates an "orphan" maintenance area (i.e. a small grass area not connected to other maintained grass areas that is difficult to access or maintain.)
   - MCD will consider other amenities owned and maintained by the requesting agency. If existing amenities are not properly maintained, additional amenities will not be permitted.

p. Levee embankments and structures
   - MCD will not allow removing, lowering, notching, or otherwise altering a levee top elevation (including floodwall and crest wall top elevations) that would result in reducing existing freeboard or lowering the level of flood protection.
   - MCD will not allow ramps or other improvements, developments, or uses to be constructed that would result in narrowing the levee top width.
   - Cutting into levees for ramps or other improvements, developments, or uses can weaken the levee. Concrete walls may be used to replace earthen levee sections, but they must be designed to withstand the hydraulic loading during the OPF.
   - Dam and levee slopes may not be made steeper than they currently exist. New slopes should be designed at 3:1 (horizontal:vertical) to accommodate slope maintenance. If 3:1 slopes are shown to negatively affect channel hydraulics or result in irregular levee slopes within an area, MCD may consider slopes as steep as 2 ½ :1.

q. Temporary Activities
   - Temporary activities that are necessary for construction shall be designed to minimize erosion or damage to MCD property and infrastructure. Such activities include but are not limited to stripping turf, excavation, building and removing cofferdams and causeways, material stockpiling, and temporary embankments.
   - Erosion or other damages to MCD property or infrastructure caused by construction activities must be repaired and restored to MCD's satisfaction.
   - MCD may allow gravel placement for temporary access road. All construction materials placed for access roads must be removed from MCD property.

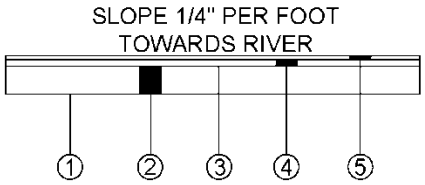
r. Underground tanks and fuel tanks
   - The installation or construction of any underground fuel tank is prohibited.
   - The installation of new gravity flow fuel tanks is prohibited.

s. Signs

- MCD will not allow signs for the purpose of commercial public advertising.
- MCD will not allow signs that generate a profit for the Grantee or other party.
- Signs identifying a municipality or other political subdivision (i.e. Welcome to City) may include name s or logos of local organizations and businesses. The Grantee may charge an installation or maintenance fee but may not sell advertising space for revenue generation.
- Signs identifying a neighboring business or organization may be permitted. The sign may have the organization's name and/or logo.
- Signs, lettering, and logos may not be affixed to or painted on floodwalls or revetment.

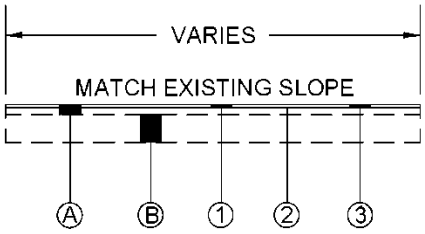
t. Naming and designations
    - The applicant must submit any proposed naming plans and intended designations.
    - MCD reserves the right to deny names and third-party designations for any requested improvement, development, or use of MCD property.

u. A Professional Engineer registered in Ohio must sign plans for any structure.



① ITEM 203 - SUBGRADE COMPACTION
② ITEM 304 - AGGREGATE BASE ~ 8" COURSE
③ ITEM 407 - TACK COAT @ 0.075 GAL/SY
④ ITEM 448 - ASPHALT CONCRETE ~ 2" INTERMEDIATE COURSE, TYPE 2, PG 64-22 PER ITEM 441.02
⑤ ITEM 448 - ASPHALT CONCRETE ~ 1" SURFACE COURSE, TYPE 1, PG 64-22 PER ITEM 441.02

TYPICAL SECTION
(FULL DEPTH REPLACEMENT)

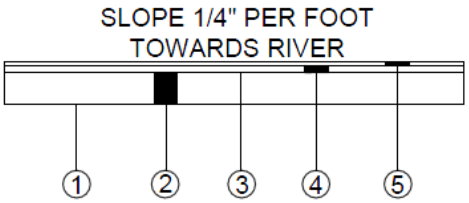


Ⓐ EXISTING ASPHALT CONCRETE (THICKNESS MAY VARY)
Ⓑ EXISTING AGGREGATE BASE ~ 6" COURSE
① ITEM 254 - 1" PAVEMENT PLANING, ASPHALT CONCRETE
② ITEM 407 - TACK COAT @ 0.075 GAL/SY
③ ITEM 448 - ASPHALT CONCRETE ~ 1" SURFACE COURSE, TYPE 1, PG 64-22 PER ITEM 441.02

TYPICAL SECTION
(PLANING AND RESURFACING)

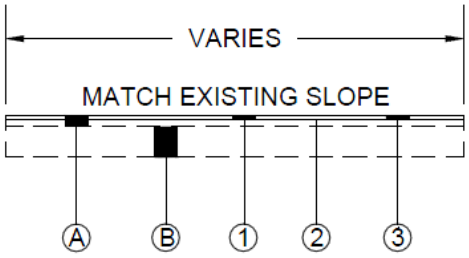
NOTE: ALL PAVEMENT SHALL MATCH EXISTING SLOPES OR IF NECESSARY SLOPE TOWARDS THE RIVER. AT NO TIME SHOULD THE TRAIL BE SLOPED AWAY FROM THE RIVER.

NOTE: ITEMS REFER TO ODOT 2013 CONSTRUCTION AND MATERIAL SPECIFICATIONS



① ITEM 203 - SUBGRADE COMPACTION
② ITEM 304 - AGGREGATE BASE ~ 8" COURSE
③ ITEM 407 - TACK COAT @ 0.075 GAL/SY
④ ITEM 448 - ASPHALT CONCRETE ~ 2" INTERMEDIATE COURSE, TYPE 2, PG 64-22
⑤ ITEM 448 - ASPHALT CONCRETE ~ 1" SURFACE COURSE, TYPE 1, PG 64-22

TYPICAL SECTION
(FULL DEPTH REPLACEMENT)

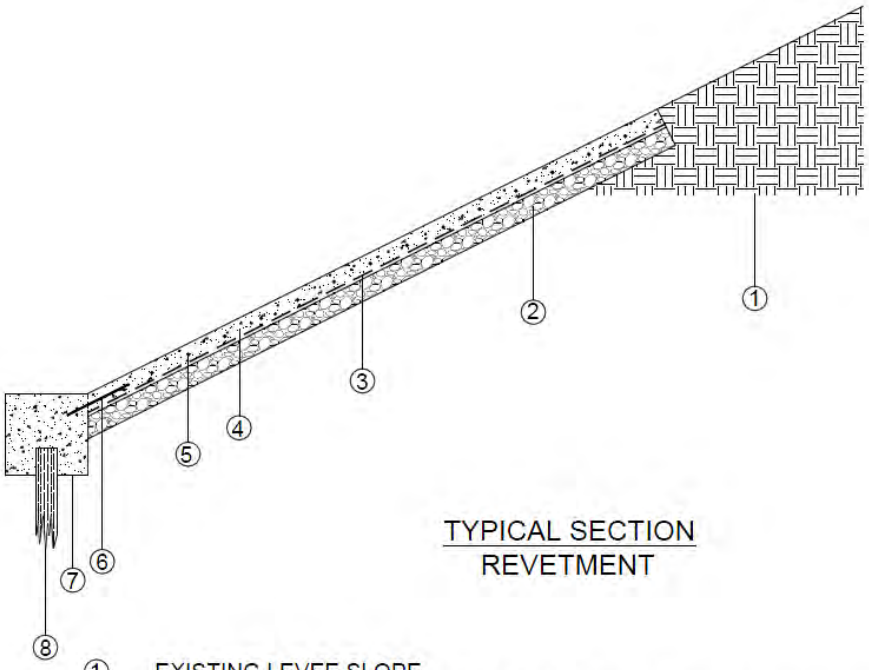


Ⓐ EXISTING ASPHALT CONCRETE (THICKNESS MAY VARY)
Ⓑ EXISTING AGGREGATE BASE ~ 6" COURSE
① ITEM 254 - 1" PAVEMENT PLANING, ASPHALT CONCRETE
② ITEM 407 - TACK COAT @ 0.075 GAL/SY
③ ITEM 448 - ASPHALT CONCRETE ~ 1" SURFACE COURSE, TYPE 1, PG 64-22

TYPICAL SECTION
(PLANING AND RESURFACING)

NOTE: ALL PAVEMENT SHALL MATCH EXISTING SLOPES OR IF NECESSARY SLOPE TOWARDS THE RIVER. AT NO TIME SHOULD THE TRAIL BE SLOPED AWAY FROM THE RIVER.

NOTE: ITEMS REFER TO ODOT 2013 CONSTRUCTION AND MATERIAL SPECIFICATIONS



TYPICAL SECTION
REVETMENT

① EXISTING LEVEE SLOPE
② ITEM 304 AGGREGATE BASE - 6" DEPTH
③ ITEM 709.10 4X4X4/4 85 POUND WELDED STEEL FABRIC (MAINTAIN 2" CONCRETE COVER)
④ ITEM 511 USING 6" QC1 CONCRETE (4000 PSI)
⑤ ITEM 709.13 12"- #4 EPOXY COATED DOWEL, 12" ON CENTER (EPOXY 6" INTO ADJACENT PANEL)
⑥ ITEM 709.13 18"- #4 EPOXY COATED DOWEL, 12" ON CENTER (EPOXY 6" INTO TOE WALL)
⑦ TOE WALL (SIZE VARIES)
⑧ TIMBER PILING

NOTE: NOT ALL TOE WALLS SIT ON TIMBER PILING.
WALLS THAT DON'T ARE TYPICALLY LARGER IN DIMENSIONS.

NOTE: ITEMS REFER TO ODOT 2013 CONSTRUCTION AND MATERIAL SPECIFICATIONS

APPENDIX V

MATERIAL SPECIFICATIONS (Updated 4/17/2018)

1. Fill and embankment soil
    a. Dam embankment – MCD dams were constructed using hydraulic fill methods to place different gradations of soil materials in specific zones. Any fill material placed in a dam embankment must be specified to match the existing materials in the zone where it is to be placed. Soil boring or test pits may be required to define the characteristics of the existing material. Soil must be clean natural material free from masses of organic matter, sticks, branches, roots, broken concrete, asphalt, metal, building rubble, and other debris, including hazardous and regulated solid wastes. Under no circumstances shall frozen earth, snow, or ice in the material be considered acceptable.
    b. Levee embankment – material placed in levee embankments should be naturally occurring or contractor blended clayey material. Addition of lime, cement, or other soil amendments for any reason is not permitted. Soil that is classified in accordance with ASTM D2487 and the Unified Soil Classification System as CH and CL is suitable. Soil classified as ML shall be considered unsuitable; however, minor amounts of ML may be suitably blended with CH or CL to formulate a material that classifies as a CL as per ASTM D2487. Soil must be free from masses of organic matter, sticks, branches, roots, broken concrete, asphalt, metal, building rubble, and other debris, including hazardous and regulated solid wastes. Soil from a contractor-supplied earthen clay material source may not contain excessive amounts of wood. Not more than 1% (by volume) of objectionable material shall be contained in clay material. Pockets and/or zones of wood shall not be acceptable. Material consisting of greater than 35% sands (by dry weight) or materials with a Plasticity Index (PI) of less than 10 will not be accepted as well as material having an organic content exceeding 9% by weight. Under no circumstances shall frozen earth, snow, or ice in the material be considered acceptable.
    c. Berm or blanket – material placed in a berm or blanket designed to reinforce a dam or levee embankment must meet the design specifications for the berm or blanket. Soil must be clean natural material free from masses of organic matter, sticks, branches, roots, broken concrete, asphalt, metal, building rubble, and other debris, including hazardous and regulated solid wastes. Under no circumstances shall frozen earth, snow, or ice in the material be considered acceptable.
    d. Random fill – areas designed by MCD as not integral to dam and levee embankments may be filled with random fill material. Soil must be clean natural material free from masses of organic matter, sticks, branches, roots, broken concrete, asphalt, metal, building rubble, and other debris, including hazardous and regulated solid wastes. Under no circumstances shall frozen earth, snow, or ice in the material be considered acceptable.

2. Vegetation Restoration of Levee Slopes shall consist of one of the following methods:

    Hydroseeding
    a. Between the Seeding Period of **March 15th through October 30th** all disturbed levee slopes shall be hydroseeded.

b. Seed types shall consist of an 80/20 Turf Type Tall Fescue Mix with perennial rye with an application rate of 8 pounds per 1000 square feet.
c. Fertilizer shall be 18-24-12 25% Polyplus Fertilizer.
d. Mulch shall consist of Cellulose (Paper) Fiber Mulch, or Wood Fiber Mulch. Application Rate for mulch shall be 2000 pounds per acre.
e. Tackifier shall be added to the solution and applied at an application rate of 2 gallons per acre. The tackifier shall not contain any priority pollutants listed under the U.S. Clean Water Act Section 307(2)(1) Priority Pollutant List (40 CFR 401.15).
f. Application of the slurry should proceed until a uniform cover is achieved.
g. Prior to application, the topsoil on the levee slope shall be scarified by tracking it in using a steel cleated piece of equipment.
h. Hydraulic matrices require 24 hours to dry before rainfall occurs to be effective.
i. Hydroseeded slopes should be inspected periodically for damage due to wind, water, or human disturbance.
j. Repair all damaged areas immediately using hydroseeding at the original specifications.
k. Supplemental watering may be required.

Note: Smaller projects during the Seeding Period of **March 15th through October 30th** may use erosion control blankets as described below with approval from MCD.

Erosion Control Blankets

a. Between the Seeding Period of **October 31st through March 14th** all disturbed levee slopes shall be protected with biodegradable straw erosion control blankets.
b. The erosion control blankets shall consist of a rapid-breakdown polypropylene netting design, using the finest straw fibers available, be environmentally sensitive and shall be certified that they are weed seed free.
c. Performance capabilities shall have a shear stress rating of 84 Pa (1.75 lb/ft^2) for slopes that are 2:1 and flatter.
d. Seed types shall consist of an 80/20 Turf Type Tall Fescue Mix with perennial rye with an application rate of 8 pounds per 1000 square feet.
e. Fertilizer shall be 18-24-12 25% Polyplus Fertilizer.

3. All other areas
   a. All disturbed earth areas shall be seeded. Seed types shall meet specifications of an 80/20 Turf Type Tall Fescue Mix with perennial rye.
   b. MCD must approve seed mix prior to seeding.
   c. Application rate of 8 pounds per 1000 square feet.
   d. Hydroseeding is acceptable, approved tackifier shall be applied at 2 gallons per acre.
   e. Fertilizer shall be 18-24-12 25% Polyplus Fertilizer.
   f. Mulch shall consist of straw, hay or wood fiber and be free of weed.
   g. Evenly place straw mulch over all seeded areas at the following rates:

Seeding Period	Rate
From March 15 to October 30	2 Tons per acre
From October 31 to March 14	3 Tons per acre

h. Evenly place wood fiber mulch from March 1 to October 30 at the following rate:

Surface	Rate
Slopes 3:1 or flatter	46 Pounds per 1000 square feet

i. Apply a non-toxic and environmentally safe tackifier, at manufacturer's recommendations, to straw, hay or wood fiber mulch.

4. Plantings

All plantings subject to periodic flooding must be able to withstand inundation and be able to regenerate after being under water. In MCD maintained areas Turf Type Tall Fescue shall be used unless alternate planting materials are approved. Alternate planting materials shall be natural materials compatible with their surroundings (i.e. wetlands, mowed areas, prairies, woodlands). Species considered to be invasive to the area will not be allowed.

The following guidelines identify requirements for alternate planting materials within various defined areas of MCD-maintained channels and structures:

a. Dam embankments
   - Species may be considered on a site-specific case-by-case basis
   - No woody vegetation will be permitted
   - All plantings are subject to periodic mowing (minimum once per year)

b. Edge of water along maintained areas
   - Woody vegetation and twiggy plants that tend to catch floating debris will not be permitted
   - Roots structures should provide erosion control year around
   - Plants shall withstand high velocity flows and should be able to bend under the force of the water
   - Aesthetics of the plants in their surroundings and the view of the river from trails will be considered
   - Plants should regenerate after mowing

c. Flat beach area between edge of water and toe of levee
   - Woody vegetation and twiggy plants that tend to catch floating debris will not be permitted
   - Roots structures should provide erosion control year around
   - Plants shall withstand high velocity flows and should be able to bend under the force of the water
   - Aesthetics of the plants in their surroundings will be considered
   - Plants should be able to regenerate after periodic mowing
   - Plants shall withstand occasional vehicular traffic
   - MCD may require a hydraulic analysis to demonstrate that the plants do not affect flow patterns or channel capacity

d. River side of levee slope
   - Woody vegetation will not be permitted
   - Roots structures shall provide erosion control year around
   - Plants shall completely cover the planted area – no bare earth areas will be permitted
   - Plants shall withstand high velocity flows and should be able to bend under the force of the water
   - Plants shall not block vehicular access

- Plants shall not affect MCD's ability to maintain and inspect the levee
- Aesthetics of the plants in their surroundings will be considered
- Plants should be able to regenerate after periodic mowing
- MCD may require a hydraulic analysis to demonstrate that the plants do not affect flow patterns or channel capacity
- Low growing plants that require infrequent mowing should be considered for steep slopes

e. Top of levee
- Plants shall not block vehicular access
- Trees and woody vegetation may be considered in a case-by-case basis using the following criteria:
  - The top width of the levee is more than 50 feet or the roots are physically contained by a root barrier
  - The trees or vegetation shall not affect MCD's ability to maintain and inspect the levee
  - Roots shall not surface on the levee slope
  - Roots shall not affect recreation trails

f. Land side of levee slope
- Woody vegetation will not be permitted
- Plants shall not block vehicular access
- Plants shall not affect MCD's ability to maintain and inspect the levee
- Aesthetics of the plants in their surroundings will be considered
- Plants should regenerate after mowing
- Low growing plants that require infrequent mowing should be considered for steep slopes

g. Adjacent to land side levee toe
- Plants shall not block vehicular access
- Plants, including canopies, shall not affect MCD's ability to maintain and inspect the levee
- Plants shall not block access to or otherwise affect piezometers or wells
- Plants shall be able to regenerate after periodic mowing

h. Under bridges
- Plants must withstand deep shading and dry conditions
- The requirements for beach areas and river side levee slopes apply for the appropriate location

i. Adjacent to concrete or stone walls, revetment or other structures
- Plants shall not affect MCD's ability to maintain and inspect the structure
- Roots shall not affect the structure
- Vines and other climbing plants will not be permitted

5. Environmental Considerations
   a. No natural material including plants, rocks, or soil shall be removed or destroyed without prior written approval.
   b. The top ten (10) inches of topsoil is to be removed and stockpiled for restoration purposes prior to starting any excavation.
   c. No tree four (4) inches in diameter or great may be removed without prior written approval. The planting of two (2) trees will be required for the removal of every tree larger than four (4) inches in diameter. Type and location of trees to be planted will be as directed.

d. Except for authorized activities, no bird nest or animal habitation shall be moved or destroyed.
e. Concerning the removal of trees located along MCD owned or controlled property lines
    - If MCD determines any portion of the tree presents a hazard, the tree will be trimmed or removed by MCD, subject to an agreement with adjacent property owner to have the tree trimmed or removed at no liability to MCD.
    - If MCD determines the tree is of no danger to the adjacent property no further action will be taken.
    - If written authorization is granted by MCD allowing the adjacent property owner or its agent to trim or remove any portion of the tree, MCD, subject to pre-approval, agrees to pay fifty (50%) percent of the cost of trimming or removal.

6. Asphalt for recreation trails
    a. ODOT ITEM 304 - Aggregate base – 8” course
    b. ODOT ITEM 407 – Tack coat @ 0.075 GAL/SY
    c. ODOT ITEM 448 - Asphalt Concrete – 2” Intermediate Course - Type 2, PG 64-22, per ODOT ITEM 441.02
    d. ODOT ITEM 448 – Asphalt Concrete – 1” Surface Course, Type 1, PG 64-22, per ODOT ITEM 441.02
    e. ODOT ITEMS are referenced to the 2013 ODOT Construction and Material. Specifications.

7. Concrete for structures
    a. Concrete for structures on MCD property shall conform to ODOT ITEM 511.
    b. Concrete shall be Class QC1 per ODOT ITEM 499.
    c. Dowels and reinforcing steel shall be epoxy coated and conform to ODOT ITEM 709.
    d. Anchoring grout shall be a non-shrink, non-metallic material that conforms to ODOT ITEM 705.20.
    e. ODOT ITEMS are referenced to the 2013 ODOT Construction and Material Specifications.

8. Other Materials – all other materials not specified herein shall be approved by MCD prior to use on MCD property.

APPENDIX VI

STRUCTURE REMOVAL AND ABANDONMENT

Upon termination of a Land Use Permit and prior to releasing the Grantee of its obligations under the terms of the permit, all structures, improvements, and physical installations shall be removed or abandoned. MCD must approve all plans for removal or abandonment, including the time schedule. At no time shall the removal or abandonment, including all site restoration, require more than six months to complete.

1. All above-ground structures, improvements, and physical installations must be completely removed from MCD property.

2. Underground structures
    a. Underground structures include, but are not limited to foundations, footers, bases, anchors, piling, gate chambers, manholes, meter pits, and vaults.
    b. MCD will determine whether underground structures must be removed or may be abandoned in place.
    c. Underground structures designated for removal shall be excavated and completely removed. The area shall be backfilled with clean fill material and restored to MCD's satisfaction. See Appendix III for restoration specifications.
    d. Underground structures designated for abandonment must be addressed as follows:
        - All gates, valves, meters, and other equipment must be removed from the structure.
        - All connections such as water, gas, or electric must be disconnected and removed.
        - All pipes and conduits must be disconnected from the structure and removed or abandoned per item c. below.
        - The structure must be cut off and removed to a minimum of three feet below the ground surface.
        - The top cone or top section of any pre-cast structure shall be removed.
        - The remainder of the structure and the excavation shall be backfilled with clean fill material or flowable cement grout.
        - The area shall be restored to MCD's satisfaction.

3. Pipe lines and conduits
    a. MCD will determine whether the pipe line or conduit must be removed or abandoned in place.
    b. Pipe lines designated for removal shall be excavated and completely removed. The area shall be backfilled with clean fill material and restored to MCD's satisfaction. See Appendix III for restoration specifications.
    c. Pipe lines designated for abandonment must be addressed as follows:
        - The pipe or conduit must be completely removed within six feet of any levee slope and within ten feet of any river bank
        - The remainder of the pipe or conduit must be mechanically capped or plugged with concrete (minimum 12 inches thickness)

- Pipes and conduits shall be capped or plugged with concrete (minimum 12 inches thickness) at all manholes or access points, and all terminus points where they have been disconnected from wells, tanks, meters or other pipelines

d. Vents should be removed to a minimum depth of three feet and mechanically capped or plugged with concrete (minimum 12 inches thickness).
e. The area shall be backfilled with clean fill material and restored to MCD's satisfaction. See Appendix III for restoration specifications.

4. Aerial lines and buried conduits
    a. All aerial lines, poles, guy wires, anchors, and buried cables must be removed.
    b. Ducts and conduits shall be addressed per item c. above.
    c. Towers, vaults, transformer pads, and other associated structures shall be addressed per items a. and b. above.

5. Wells
    a. MCD will determine whether the well must be abandoned, or may remain in place.
    b. All wells designated for abandonment shall be properly abandoned and sealed per the requirements of Ohio Revised Code Chapter 1521 and Ohio Administrative Code Chapters 3701 and 3745; as well as all regulations of the Ohio Department of Natural Resources, Ohio Department of Health, Ohio Environmental Protection Agency, and all other state and local entities with jurisdiction over wells.
    c. All required well abandonment reports and forms shall be submitted to the appropriate agency, with copies provided to MCD.
    d. Following well abandonment, the site shall be restored to MCD's satisfaction. See Appendix III for restoration specifications.
    e. MCD or an MCD subdistrict may elect to assume ownership and maintenance of a well, including but not limited to casing, screens, pumps, piping, and other structures or facilities. The terms of the ownership transfer shall be agreed to in writing by both parties before the obligations of the Grantee are released.

6. Fuel tanks and underground storage tanks
    a. All fuel tanks and underground storage tanks shall be properly removed per the requirements of Ohio Administrative Code Chapter 1301 as wells as the regulations of the Bureau of Underground Storage Tank Regulations, the State of Ohio Fire Marshal’s office and all other state and local entities with jurisdiction over fuel tanks and underground storage tanks.
    b. All required tank removal reports and forms shall be submitted to the appropriate agency, with copies provided to MCD.
    c. Upon removal of all fuel tanks and underground storage tanks, the Grantee shall take soil samples for analysis by a competent laboratory to determine if the soil has been contaminated.
    d. All contaminated soil shall be removed from MCD property and properly disposed.
    e. Following removal and any required remediation, the site shall be restored to MCD's satisfaction. See Appendix III for restoration specifications.

7. Roads, driveways, sidewalks, and trails
    a. MCD will determine whether a road, driveway, sidewalk, or trail must be removed or may remain in place.
    b. All roads, driveways, sidewalks, and trails designated for removal shall be addressed as follows:
        - All materials including but not limited to asphalt, concrete, brick and other pavement material shall be removed from MCD property and legally disposed.
        - Site shall be restored to match adjacent lines and grades.
        - Any damaged sections of recreational trail or revetment shall be restored using materials and construction requirements that meet the MCD Land Use Policy APPENDIX III and V.
        - Gravel, mulch, and earthen trails shall be disked.
        - All areas shall be restored to MCD's satisfaction.
    c. MCD or an MCD subdistrict may elect to assume ownership and maintenance of a road, driveway, sidewalk, or trail. The terms of the ownership transfer shall be agreed to in writing by both parties before the obligations of the Grantee are released.

8. General site restoration
    a. For levee and dam embankment restorations, refer to Appendix III for specifications.
    b. Backfill shall meet the appropriate requirements for material per Appendix V "Fill and embankment soil".
    c. Fill material shall be no larger than three (3) inches in diameter.
    d. Fill material shall have no more than 15% gravel.
    e. Soil shall be placed in six-inch lifts and compacted.
    f. Fill may not be placed on frozen or wet subgrade, or in standing water.
    g. The fill shall be graded to the lines and grades of the adjoining areas.
    h. After the final lines, grades, and elevations have been established, six (6) inches of topsoil placed in loose lifts that construct a four (4) inch compacted depth shall be spread on all disturbed areas.
    i. The topsoil shall be tracked in with a dozer or approved equipment to compact and provide a good contact between the topsoil and the surface of the fill material.
    j. Topsoil shall be scarified prior to seeding.
    k. Within ten days following any construction or land disturbing activity, all disturbed areas shall be seeded with a turf-type tall fescue grass mixture, and covered with straw or other acceptable mulch. See Appendix V for seeding specifications.

REPORT OF
GEOTECHNICAL ENGINEERING EXPLORATION

WEST CARROLLTON RIVER PARK
PLANNING AREA 1
WEST CARROLLTON, OHIO

PREPARED FOR:

MERRICK & COMPANY
5970 GREENWOOD PLAZA BOULEVARD
GREENWOOD VILLAGE, COLORADO 80111

Patriot Engineering and Environmental, Inc.
2568 Kohnle Drive
Miamisburg, Ohio 45342

June 10, 2024

PATRIOT
ENGINEERING AND ENVIRONMENTAL, INC.

June 10, 2024

Ms. Christi Wisleder, PE
Merrick & Company
5970 Greenwood Plaza Boulevard
Greenwood Village, Colorado 80111

Re: Report of Preliminary Geotechnical Engineering Exploration
West Carrollton River Park – Planning Area 1
Alex Road/Hydraulic Road
West Carrollton, Ohio
Patriot Project No.: 24-0274-07G

Dear Christi:

Attached is the report of our preliminary geotechnical engineering exploration for the above referenced project. This exploration was completed in general accordance with our proposal dated February 14th, 2024.

This report includes detailed and graphic logs of eighteen (18) soil borings drilled at the proposed project site. Also included in the report are the results of laboratory tests performed on samples obtained from the site, and preliminary geotechnical recommendations pertinent to the site development, foundation design, and construction.

We appreciate the opportunity to perform this preliminary geotechnical engineering exploration and are looking forward to working with you during the construction phase of the project. If you have questions regarding this report or if we may be of additional assistance regarding geotechnical aspect of the project, please do not hesitate to contact our office.

Respectfully submitted,
Patriot Engineering and Environmental, Inc.

Logan Young, P.E.
Project Engineer

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APPENDICES

Appendix A:	Site Vicinity Map (Figure No. 1) Boring Location Map (Figure No. 2) Boring Location Map – Original Preliminary Plan (Figure No. 3) Whitewater Course Plan (Figure No. 4) Bypass Channel River Enlargements Key Plan (Figure No. 5) Boring Logs Boring Log Key Unified Soil Classification System (USCS)
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REPORT OF PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION

West Carrollton River Park – Planning Area 1
Alex Road/Hydraulic Road
West Carrollton, Ohio
Patriot Project No.: 24-0274-07G

1.0 INTRODUCTION

1.1 General

The City of West Carrollton, in conjunction with Merrick & Company, are planning the design and construction of a river park that will be located along Alex Road/Hydraulic Road in West Carrollton, Ohio. The results of our preliminary geotechnical engineering exploration for the project are presented in this report.

1.2 Purpose and Scope

The purpose of this preliminary exploration is to determine the general near surface and subsurface conditions within the project area and to develop the geotechnical engineering recommendations necessary for the design and construction of the proposed river park. This was achieved by drilling soil borings, and by conducting laboratory tests on samples taken from the borings. This report contains the results of our findings, an engineering interpretation of these results with respect to the available project information, and recommendations to aid in the design and construction of the proposed river park.

2.0 PROJECT INFORMATION

The proposed West Carrollton River Park Project is a part of the West Carrollton River District Project that is set to transform the city's riverfront into a hub of entertainment, recreation, and community activity. There are three (3) areas planned for the West Carrollton River Park Project. "Planning Area 1" consists of the whitewater park, "Planning Area 2" consists of the motorized boat launch and tie-up, and "Planning Area 3" consists of the uplands structures. This Geotechnical Engineering Report focuses on "Planning Area 1" .

Planning Area 1 will include the whitewater park that will stem from the Great Miami River into Miami Bend Park on the south side of the river and downstream of the dam. The river park will have two (2) channels. One (1) channel will include a big wave feature that will

allow for casual and competitive surfing, canoeing, and kayaking. The other channel will be for easy tubing and recreational use. The channels will generally have side slopes ranging from 2H:1V (horizontal: vertical) to 4H:1V.

Each of the channels will have weirs along the proposed alignments to alter the velocity of the water for the surfing big wave feature, performance kayaking, tubing, and causal kayaking. The weirs will be reinforced concrete and underlain by grouted core rock and will include sheet piling on the upstream side of the weir. The water vertical drops will range from 0.8 to 3.2 feet.

A pedestrian trail will cross both channel alignments and continue along the crest of a grouted boulder berm to a viewing platform near the South Montgomery Low Dam. The trail will have two (2) pedestrian bridges across both channels. One (1) bridge will be 50 feet long and 15 feet wide and the other bridge will be 75 feet long and 12 feet in width. The bridges will be vehicle rated for emergency access. The grouted boulder berm is assumed to be constructed with suitable onsite soils and cased with grouted boulder/rip rap at a slope of 2H:1V (horizontal: vertical).

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The project site stretches from the upstream side of the South Montgomery Low Dam to downstream of the dam at Miami Bend Park. The surrounding area is generally an area of residential development and industrial use. The topography in the area proposed for construction is generally relatively flat with ground surface elevations at the boring locations ranging from 707.4 to 710.4 feet. The elevation data was gathered utilizing the *Tremble DA2* with an accuracy of approximately 6 inches.

3.2 General Subsurface Conditions

Our interpretation of the subsurface conditions is based upon eighteen (18) soil borings drilled at the approximate locations shown on the Boring Location Map (Figure No. 2) in Appendix “A”. All depths discussed below refer to depths below the existing ground or pavement surface. Based on the results of the soil borings completed at the site, the following subsurface profile is presented. A description of each general soil unit has been identified and is described below:

Table No. 1: Summary of Boring Locations

Boring Numbers	Location of Borings	Approximate Depth of Borings (Feet)
B-1 through B-18	Planning Area 1	30 to 60
B-19 through B-30	Planning Area 3	10 to 40

Topsoil, a surficial layer of material that is a blend of silts, sands, and clays, with varying amounts of organic matter, was encountered at the ground surface at seventeen (17) of the eighteen (18) boring locations. The topsoil layer was about 6 to 8 inches thick in the borings. Boring B-3 encountered a mixture of river rock and gravel at the existing ground surface and was approximately 12 inches thick.

The surficial layers are generally underlain by soil varying from sand, silty sand or sandy or silty clay that have trace amounts of organic matter.

The **SILTY or SANDY CLAY (CL)** layers vary from very soft to hard and typically extend to depths of 6 to 13 ½ feet below the existing ground surface. The natural moisture content of this material ranges from 8 to 50 percent (%). The silty or sandy clay layers have unconfined compressive strengths, as determined by a hand penetrometer, of 0.4 to 3.8 tons per square foot (tsf). Standard Penetration Test N-values (blow counts) in this material varied from the weight of the hammer (WOH) to 48 blows per foot (bpf). **A layer of highly plastic, CLAY (CH) was encountered in Boring B-16 from approximately 6 to 8 ½ feet below existing grade.**

The **SAND (SP-SM)** or **SILTY SAND (SM)** layers vary from very loose to medium dense and are generally encountered within and below the silty or sandy clay layers. Standard Penetration Test N-values in these sands varied from 2 to 32 bpf.

Boring B-4 encountered woody material (decomposing into peat) at varying depths from 6 to 23 ½ feet below existing grade.

The above soil layers were subjected to loss on ignition (LOI), Standard Proctor, and Atterberg Limits testing. The results are shown in the tables below. LOI tests will show the percentage of organic content that are present within the soils.

Table No. 2: Summary of LOI Tests

Boring Number	Sample Number	LOI (%)
B-1	BULK	2.8
B-2	BULK	2.6
B-3	S-1	2.6
B-4	BULK	3.1
B-5	BULK	2.4
	S-3	2.8
B-8	BULK	1.0
B-9	S-4	4.0
B-10	BULK	2.6
B-11	BULK	3.8
B-12	S-3	3.6
B-15	BULK	1.9
	S-3	3.6
B-16	S-3	5.9
	BULK	1.1
B-18	BULK	1.6

Table No. 3: Summary of Standard Proctor Tests

Boring Number	Soil Classification	Maximum Dry Density (%)	Optimum Moisture (%)
B-1	Silty Clay (CL)	112.9	14.9
B-2	Silty Clay (CL)	107.1	16.2
B-4	Silty Clay (CL)	126.2	13.2
B-5	Silty Clay (CL)	110.9	15.1
B-8	Silty Clay (CL)	128.1	10.8
B-10	Sand (SP-SM)	111.7	14.5
B-11	Silty Clay (CL)	109.6	14.4
B-15	Silty Clay (CL)	116.0	14.3
B-16	Silty Clay (CL)	128.8	10.6
B-18	Sandy Clay (CL)	140.0	9.0

Table No. 4: Summary of Atterberg Limits Tests

Boring Number	Liquid Limit	Plastic Limit	Plasticity Index
B-1, BULK	41	22	19
B-2, BULK	41	22	19
B-3, S-1	39	18	21
B-4, BULK	33	22	11
B-5, BULK	37	20	17
B-5, S-3	49	27	22
B-8, BULK	26	16	10
B-9, S-4	47	21	26
B-11, BULK	40	21	19
B-12, S-3	45	21	24
B-15, BULK	33	19	14
B-15, S-3	42	24	18
B-16, S-3	54	27	27
B-16, BULK	23	15	8
B-18, BULK	31	19	12

Below the poor to marginal sands and clays and organic material, medium dense to very dense, **SAND (SP-SM)** was generally encountered to predetermined boring termination depths of 30 to 60 feet below existing grade. Standard Penetration Test N-values in this silty sand varied from 13 to more than 50 bpf.

Within the medium dense to very dense sands, stiff to hard, **SILTY or SANDY CLAY (CL)** was generally encountered from 8 ½ to 18 ½ feet below existing grade. The natural moisture content of this material varied from 9 to 22 percent (%). The silty or sandy clay layer has unconfined compressive strengths, as determined by a hand penetrometer, of 1.8 to greater than 6 tsf. Standard Penetration Test N-values (blow counts) in this material varied from 16 to more than 50 bpf.

The soil conditions described above are general, and some variations in the descriptions should be expected; for more specific information, please refer to the boring logs presented in Appendix “A”. It should be noted that the dashed stratification lines shown on the soil

boring logs indicate approximate transitions between soil types. In-situ stratification changes could occur gradually or at different depths.

As previously mentioned, unsuitable very soft to soft clays, very loose sands, and organic material were encountered in seven (7) of the eighteen (18) borings, to depths ranging from 3 ½ to 23 ½ feet below the existing ground surface. The following table presents the extent of the unsuitable soils encountered in the borings:

Table No. 5: Summary of Unsuitable Soils Encountered in Borings

Boring Number	Soil Classification	Approximate Depth of Unsuitable Soils (feet)(1)
B-1	Soft Silty Clay (CL)	3 ½ to 6
B-3	Very Loose Silty Sand (SM)	3 to 4
	Very Soft Silty Clay (CL)	4 to 6
B-4	Woody Material (Organic)	6 to 8 ½
		13 ½ to 16
		18 ½ to 23 ½
B-8	Soft Silty Clay (CL)	3 ½ to 6
B-12	Very Soft to Soft Silty Clay (CL)	6 to 9
B-14	Soft Silty Clay (CL)	0 to 3 ½
B-15	Medium Stiff Silty Clay (CL)	6 to 9
B-16	Soft, Highly Plastic Clay (CH)	6 to 8 ½

(1) Represents depth below existing ground surface.

3.3 Groundwater Conditions

The term groundwater pertains to any water that percolates through the soil found on site. This includes any overland flow that permeates through a given depth of soil, perched water that occurs below the “water table”, a zone that remains saturated and water-bearing year-round.

Groundwater was observed during drilling in the eighteen (18) soil borings performed at the site at depths between 11 and 18 ½ feet below the existing ground surface. Immediately after the borings were completed and the augers were removed from the boreholes, groundwater was observed at depths between 6 and 19 feet below the existing ground

surface in the eighteen (18) soil borings. The remaining borings were dry at the cave-in depths shown on the boring logs.

Table No. 6: Groundwater Summary Table

Boring Number	Groundwater Level During Drilling (feet)(1)	Groundwater Level After Drilling (feet)(1)
B-1	13	19
B-2	11	9
B-3	11	9
B-4	11	8
B-5	11	9
B-6	11	17
B-7	11	12
B-8	11	8
B-9	11	7
B-10	11	9
B-11	11	7
B-12	12	14
B-13	11	6
B-14	12	13
B-15	11	9
B-16	11	8
B-17	18 ½	10
B-18	18 ½	11

(1) Represents depth below existing ground surface.

It should be recognized that fluctuations in the groundwater level should be expected over time due to variations in rainfall, Great Miami River elevation, and other environmental or physical factors. The true static groundwater level can only be determined through observations made in cased holes over a long period of time, the installation of which was beyond the scope of this exploration.

4.0 PRELIMINARY DESIGN RECOMMENDATIONS

4.1 Basis

Our recommendations are based on data presented in this report, which include soil borings, laboratory testing, and our experience with similar projects. Subsurface variations that may not be indicated by a dispersive exploratory boring program can exist on any site. If such variations or unexpected conditions are encountered during construction, or if the project information is incorrect or changed, we should be informed immediately since the validity of our recommendations may be affected.

4.2 Performance Channel

Borings B-1, B-3, B-4, B-6, and B-9 were drilled along the proposed path of performance channel. The approximately 850 feet long performance channel will begin on the upstream side of the South Montgomery Low Dam and end downstream of the low head dam. The channel will have four (4) weir drops. Sheet piling is anticipated to be utilized for stability of the drops. The channel bottom elevation changes are depicted in the table below:

Table No. 7: Channel Bottom Elevation Changes

Drop	Approximate Station	Upstream Elevation (feet)	Downstream Elevation (feet)
1	2+00	700	697
2	4+25	697	694
3	6+20	694	693.75
4	7+50	693.75	690

Concrete Structures

The weir drops will be a reinforced concrete structure underlain by grouted core rock. As previously mentioned, very soft to soft clays, very loose sands, and organic material was encountered in eight (8) of the eighteen (18) borings to depths ranging from 3 ½ to 23 ½ feet below the existing ground surface. ***If very soft to soft clays, very loose sands, organic matter, or other unsuitable materials are encountered at the footing level or below, they must be undercut and replaced with well-compacted structural fill prior to construction of foundations, or the footings can be extended to suitable natural soils.***

The proposed structures can be supported bearing on the medium dense to very dense sands encountered or on new well-compacted structural fill overlying the same. These foundations should be proportioned using a net allowable soil bearing pressure not exceeding 2,000 to 4,000 pounds per square foot (psf). For proper performance at the recommended design bearing pressure, foundations must be constructed in compliance with the recommendations for footing excavation inspection that are discussed in Section 5.0 *"Construction Considerations"*.

In using the above net allowable soil bearing pressures, the weight of the foundation and backfill over the foundation need not be considered. Hence, only loads applied at or above the minimum finished grade adjacent to the footing need to be used for dimensioning the foundations. Each new foundation should be positioned so it does not induce significant pressure on adjacent foundations; otherwise, the stress overlap must be considered in the design.

All exterior foundations should be located at a depth of at least 30 inches below final exterior grade for frost protection. We estimate that the total foundation settlement should not exceed approximately 1 inch and that differential settlement should not exceed about ¾ inch. Careful field control during construction is necessary to minimize the actual settlement that will occur.

Channel Side Slopes

The proposed channel will be excavated to elevations ranging from 690 to 697 feet, which will result in side slopes that range from 2H:1V to 4H:1V. The north side of the channel will be a grouted boulder berm and the south side of the channel will be excavated into existing soils. The side slopes will range in height from 8 to 11 feet. Due to the preliminary nature of the project, slope stability analysis was not conducted on the side slopes of the channel.

4.3 Bypass Channel

Borings B-1, B-2, B-5, B-7, B-8, and B-10 through B-18 were drilled along the proposed path of the bypass channel. The approximately 2300 feet long bypass channel will begin on the upstream side of the South Montgomery Low Dam and end downstream of the low head dam. The channel will have nine (9) weir drops. Sheet piling is anticipated to be utilized for stability of the drops. The channel bottom elevation changes are depicted in the table below:

Table No. 8: Channel Bottom Elevation Changes

Drop	Approximate Station	Upstream Elevation (feet)	Downstream Elevation (feet)
1	3+00	703	702
2	6+65	702	700
3	8+10	700	698.5
4	9+50	698.5	697.2
5	11+60	697.2	696.2
6	14+30	696.2	695.5
7	14+80	695.5	694.5
8	15+40	694.5	693.5
9	15+85	693.5	691.5

Concrete Structures

The weir drops will be a reinforced concrete structure underlain by grouted core rock. As previously mentioned, very soft to soft clays, very loose sands, and organic material was encountered in eight (8) of the eighteen (18) borings to depths ranging from 3 ½ to 23 ½ feet below the existing ground surface. ***If very soft to soft clays, very loose sands, organic matter, or other unsuitable materials are encountered at the footing level or below, they must be undercut and replaced with well-compacted structural fill prior to construction of foundations, or the footings can be extended to suitable natural soils.***

The proposed structures can be supported bearing on the medium dense to very dense sands (N-value of 18 or greater) encountered or on new well-compacted structural fill overlying the same. These foundations should be proportioned using a net allowable soil bearing pressure not exceeding 2,000 to 4,000 pounds per square foot (psf). For proper performance at the recommended design bearing pressure, foundations must be constructed in compliance with the recommendations for footing excavation inspection that are discussed in Section 5.0 *"Construction Considerations"*.

In using the above net allowable soil bearing pressures, the weight of the foundation and backfill over the foundation need not be considered. Hence, only loads applied at or above the minimum finished grade adjacent to the footing need to be used for dimensioning the foundations. Each new foundation should be positioned so it does not induce significant

pressure on adjacent foundations; otherwise, the stress overlap must be considered in the design.

All exterior foundations should be located at a depth of at least 30 inches below final exterior grade for frost protection. We estimate that the total foundation settlement should not exceed approximately 1 inch and that differential settlement should not exceed about ¾ inch. Careful field control during construction is necessary to minimize the actual settlement that will occur.

Channel Side Slopes

The proposed channel will be excavated to elevations ranging from 691.5 to 703 feet, which will result in side slopes that range from 2H:1V to 4H:1V. The north side of the channel will be a grouted boulder berm and the south side of the channel will be excavated into existing soils. The side slopes will range in height from 7 to 17 feet. Due to the preliminary nature of the project, slope stability analysis was not conducted on the side slopes of the channel.

4.4 General Channel Slope Recommendations

The table below indicates the approximate slopes the channel should be stable at based on the soils encountered at the project site.

Table No. 9: Estimated Stable Slopes Based on Soil Conditions

Soil Condition	Approximate Stable Slope
Stiff to Hard Clays, Very Dense Sands	2H: 1V
Medium Dense to Dense Sands, Medium Stiff Clays	3H: 1V
Unsuitable Soils, Loose Sands	4H: 1V

The channel side slope should be properly prepared to control erosion. The channel side slopes should not have exposed soil as the side slopes should be lined with a combination of a geotextile and rip-rap or concrete lined.

The following erosion control should include, but not limited to, the following for use of geotextile and rip rap:

- Remove all debris and organic material along the side slopes, if any.
- Line the slope with geotextile fabric. The geotextile fabric should be placed so that there is enough excess fabric to wrap the stone.
- Backfill with rip-rap

- The rip-rap should be graded at a minimum of 2H: 1V (horizontal: vertical) slope

If the channel side slopes will be lined with concrete, the exposed soils should be properly prepared and sloped at a minimum of 2H: 1V based on the soil conditions.

4.5 Pedestrian Bridges

Two (2) pedestrian bridges will be constructed over both the performance and bypass channels. Borings B-12, B-13, and B-14 were drilled in the area of the proposed pedestrian bridge (Figure No. 3 in Appendix "A") based on the plans and information available at the time of the field activities. However, based on the plans dated May, 2024 (Figure No. 4 in Appendix "A"), the number of pedestrian bridges increased from one (1) to two (2) bridges and moved approximately 250 to 300 feet to the southeast. With the new locations of the pedestrian bridges, the closest boring information are Borings B-8 through B-10. Prior to construction of the pedestrian bridges, **it is recommended that additional borings be drilled at each abutment of the pedestrian bridges.**

Shallow Foundations

It is recommended that the bridge foundations be constructed on stiff to very stiff clays or medium dense to dense sands encountered at approximately 6 to 8 ½ feet below existing grade or on well-compacted and tested structural fill overlying the same. ***The subgrade of the pedestrian bridges should be verified that no very soft to soft clays, very loose sands, organic material, or any other unsuitable soils are present below the foundations. If these unsuitable soils are encountered at the foundation bearing elevation or below, they must be undercut and replaced with properly compacted and tested structural fill overlying suitable soils.***

These foundations should be proportioned using a net allowable soil bearing pressure not exceeding 1,500 to 3,000 psf. For proper performance at the recommended design bearing pressure, foundations must be constructed in compliance with the recommendations for footing excavation inspection that are discussed in Section 5.0 *"Construction Considerations"*.

We estimate that the total foundation settlement should not exceed approximately 1 inch and that differential settlement should not exceed about ¾ inch. Careful field control during construction is necessary to minimize the actual settlement that will occur.

Intermediate Foundations

Intermediate foundations, such as Geopier Rammed Aggregate Piers or Helical Piers, can be utilized to avoid extending the foundations to 6 to 8 ½ feet.

Geopier Rammed Aggregate Piers

Based on the existing soil conditions at this site, properly installed Geopier Rammed Aggregate Piers™ (open hole with compacted crushed stone layers) system is highly recommended to avoid deep undercuts and replacement with structural fill. The Geopier Foundation System not only allows for the use of a shallow spread footing foundation using conventional construction methods, but also allows for some improvement of the soils within the project area due to the construction methods involved in placing the Geopiers.

Rammed Aggregate Piers are constructed by drilling 24 to 30-inch diameter holes within the shallow foundation footprint, and then backfilling the holes with compacted crushed stone to form a dense aggregate pier. The footings are then constructed directly on the Geopier reinforced subgrade using conventional construction methods. The Geopier Foundation Company retains the responsibility for the final pier designs. Geopier can provide estimated foundation settlements along with warranting the performance of the footings supported by Geopier elements.

Patriot recommends that the Geopiers should be installed and extended adequately into native medium dense to very dense sands at about 15 to 20 feet below the existing ground surface. Additionally, we recommend that Patriot be retained to observe the installation process. Although the Geopier Foundation Company warrants the performance of their work, it is their standard practice to have quality assurance during installation of the Geopiers.

Based on our past experience with similar projects, it is estimated that by reinforcing the weaker soil and fill layers with Geopier foundation elements, an allowable soil bearing pressure on the order of 4,000 to 6,000 pounds per square foot (psf) could be utilized for the design of the spread footing foundations. ***However, the actual allowable bearing capacity and estimated settlements can only be determined by the Geopier Foundation Company. Our estimates should only be considered as a guide for preliminary design.***

Helical Piers

Helical piers are another option for foundations support of the pedestrian bridges. We recommend that the helical pier contractor review the soil conditions presented in this report and assure the project team and the owner that the selected system can be installed to required depths and capacities. In addition, we recommend a pile load testing program be implemented for helical piers as well.

Typical ultimate compression capacities of the commonly used helical piers (such as AB Chance® SS-5, SS-175, and SS-200 and/or other 1 ½" to 3 ½" O.D. schedule 80 pipe helical) range from 40 to 150 kips. However, due to the variation in the selected system and the final tip elevation of the pier, the capacity of the selected helical pier will depend on the specific system and the depth of the piers. We recommend that the tip elevation for the helical piers will be located into the medium dense to very dense sands at approximately 15 to 20 feet and should not terminate at shallower depths. The helical piers may encounter construction difficulties such as refusal on cobbles, dense gravels, hard clays or on buried debris and the contractor should be prepared for this condition.

Selected helical piers must be designed, installed, and warranted by an experienced specialty foundation contractor. Therefore, we recommend that the owner retain a specialty foundation contractor to design, install and warrant the most appropriate and economical system. We also recommend the design be prepared under the supervision of an Ohio licensed Professional Engineer. A list of some experienced specialty foundation contractors can be provided upon request.

We recommend that Patriot be retained to review the helical pier design plans and monitor the installation of helical piers. The capacity of the selected helical pier system must be verified by performing filed load tests. The helical piers should be designed with corrosion protection.

<u>Deep Foundations</u>

If the Client is interested in utilizing deep foundations, such as Auger Cast Piles or Driven Piles, we can provide additional information upon request. These recommendations will require additional 60 feet borings at the bridge abutment locations.

Retaining Walls

We anticipate that the pedestrian bridge abutments will include a retaining wall structure, however, it is unknown at the time of this report what type of retaining wall will be utilized for design and construction. The retaining walls should be constructed based on the shallow foundation recommendations above and can also utilize intermediate foundations if necessary. Additional recommendations can be provided once the final design of the pedestrian bridges is available.

4.6 Lateral Earth Pressures (Retaining Walls)

For the design of retaining walls, the magnitude of the lateral earth pressure on the walls is dependent on the method of backfill placement behind the walls, the type of backfill soil, drainage provisions and whether or not the wall is permitted to yield during and/or after placement of the backfill. When a retaining wall is held rigidly against horizontal movement, the lateral pressure against the wall is greater than the "active" earth pressure that is typically used in the design of free-standing retaining walls. Therefore, rigid walls should be designed for higher "at-rest" pressures (using an at-rest lateral earth pressure coefficient, K_o), while yielding walls can be designed for active pressures (using an active lateral earth pressure coefficient, K_a).

The retaining walls proposed for the project are expected to be rigid walls. ***It should be noted that the on-site clayey soils are <u>not</u> suitable for use as backfill immediately against the loading dock walls.*** Therefore, provided ***a clean well-graded granular material is used for backfill***, a total soil unit weight (γ_t) of 125 pounds per cubic foot (pcf), an at-rest lateral earth pressure coefficient (K_o) of 0.45, an active lateral earth pressure coefficient (K_a) of 0.30, and a passive lateral earth pressure coefficient (K_p) of 3.4 can be used for calculating the lateral earth pressures. An equivalent fluid active pressure of 38 psf per foot of wall height is recommended for design purposes in conditions where the top of the wall is allowed to yield during backfilling. However, if the top of the wall will be fixed, an equivalent fluid at-rest pressure of 57 psf per foot of wall height is recommended for design purposes. This equivalent fluid pressure would increase linearly from zero (0) psf at the ground surface, to a maximum at the base of the wall.

When calculating passive earth pressure, the upper 3 feet of soil should be neglected due to the potential for frost disturbance or otherwise insufficiently compacted soil to appropriately generate the specified passive pressure. Additionally for design purposes,

it should be recognized that in order for passive earth pressures to be fully developed, the wall must move laterally about 0.04H (where "H" equals the wall height). ***In most cases, passive earth pressures behind walls should not be considered in design.***

If hydrostatic pressure due to water build-up against the retaining walls is anticipated, the equivalent fluid pressure method will be changed for the soil. Rather, the lateral earth pressure should be computed using a total soil unit weight of 125 pcf above the highest anticipated water level, and a buoyant soil unit weight of 63 pcf below the highest anticipated water level. The earth pressure coefficient indicated above should be used above and below the water level to compute the lateral earth pressure. The hydrostatic pressure should be computed using the highest anticipated water level. The lateral earth pressure and hydrostatic pressure should be added to obtain the total lateral pressure on the wall.

Furthermore, in conjunction with and as a direct result of the lateral earth pressures defined above, the shear resistance against base sliding can be computed by multiplying the minimum normal force on the base of the footing times a coefficient of friction (μ) of 0.3. We recommend that for evaluation of sliding stability that a minimum factor of safety (F_S) of 1.5 is utilized for design purposes. Additionally for design, the toe pressure for the retaining wall footings should not exceed the maximum allowable bearing pressure provided in Section 4.2 *"Foundations"*.

Table No. 10: Summary of Lateral Earth Design Pressures for Retaining Walls

Soil Unit Weight (γ_t)	At-Rest Coefficient (K_o)	Active Coefficient (K_a)	Passive Coefficient (K_p)	Coefficient of Friction (μ)	Minimum Factor of Safety (FS)
125 pcf	0.45	0.30	3.4	0.3	1.5

4.7 Seismic Considerations

For structural design purposes, we recommend using a ***Site Classification of "D"*** as defined by the current Ohio Building Code (modified International Building Code (IBC)). Furthermore, along with using a Site Classification of "D", we recommend the use of the maximum considered spectral response acceleration and design spectral response acceleration coefficients provided in Table No. 11 below. Refer to Appendix "B" for *"Seismic Site Class Evaluation"* report summary. **There is a possibility that a Site Classification**

of "C" could be obtained for the site using Multi-Channel Analysis of Surface Waves (MASW) testing. This is not guaranteed to provide a Site Classification of "C", but if the *Client* would like the possibility, we can provide a cost estimate for the additional work.

Table No. 11: Seismic Design Spectral Response Acceleration Coefficients

Period (seconds)	Maximum Considered Spectral Response Acceleration Coefficient	Soil Factor	Design Spectral Response Acceleration Coefficient
0.2	S_S = 0.149 g	1.6	S_{DS} = 0.159 g
1.0	S_1 = 0.072 g	2.4	S_{D1} = 0.116 g

These values were obtained from the *"ATC Hazards by Location"* program for seismic design, developed by the Applied Technology Council (ATC), utilizing latitude 39.67954° (degrees) north and longitude 84.24850° (degrees) west as the designation for identifying the location of the parcel. Other earthquake resistant design parameters should be applied consistent with the minimum requirements of the current Ohio Building Code.

4.8 Grouted Boulder Berm

A grouted boulder berm will be located on the north side of the performance channel between the Great Miami River and the channel. The berm is anticipated to be constructed of a soil core, which should be constructed of suitable natural soils or properly compacted and tested structural fill. The berm should have a layer of geotextile between the rip-rap and soil and then the rip-rap can be grouted in-place.

4.9 Pedestrian Trail

A pedestrian trail will cross both channels via pedestrian bridges and will extend across the area between the bypass channel and performance channel as well as across the grouted boulder berm. Borings B-1, B-4, B-8, and B-9 were completed in the general area of the pedestrian bridge.

As previously mentioned, very soft to soft clays, very loose sands, and organic material were encountered in three (3) of the borings near the proposed pedestrian trail and a total of

seven (7) of the eighteen (18) borings across the site to depths ranging from 3 ½ to 23 ½ feet below the existing ground surface. ***If very soft to soft clays, very loose sands, organic matter, or other unsuitable materials are encountered at the pavement level or below, they must be undercut and replaced with well-compacted structural fill prior to construction of pavements.***

Alternatively, if the *Client* is willing to accept the risk of future vertical movement and increased maintenance of the pedestrian trail, the unsuitable soils can be over excavated 2 feet below the pavement section and replaced with well-compacted and tested structural fill. Additionally, geogrid can be placed along the surface of the natural soil to lower the risk.

The base soil for the pavement section will need to be firm and dry. The subgrade should be sloped properly in order to provide good base drainage. Based upon the near surface soils encountered in the borings, we recommend using a California Bearing Ratio (CBR) value of 3 for the design of flexible (hot mix asphalt (HMA)) pavement sections. It should be recognized though, that the recommended CBR value provided is based on empirical relationships only, and laboratory tests may determine higher allowable values.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Site Preparation

All areas that will support foundations, pavements, or newly placed structural fill must be properly prepared. All loose surficial soil or “topsoil” and other unsuitable materials must be removed. Unsuitable materials include frozen soil, relatively soft material, relatively wet soils, deleterious material, or soils that exhibit a high organic content. ***Additionally, all existing trees, underbrush and associated root-mass must also be completely removed within the proposed building and pavement areas prior to construction.***

Approximately 6 to 8 inches of loose surficial topsoil was encountered in the borings. The topsoil was measured at discrete locations as shown on the Boring Location Map (Figure No. 2) in Appendix “A”. The topsoil thickness measured at the boring locations may or may not be representative of the overall average topsoil thickness at the site. Therefore, it is possible that the actual stripping depth could significantly vary from this data. The data presented should be viewed only as a guide to the minimum stripping depth that will be required to remove organic material at the surface. Additional field exploration by *Patriot*

would be required to provide an accurate estimate of the stripping depth. This limited data indicates that a minimum stripping depth will be required to remove the organic material at the surface, followed by the potential for additional stripping and/or scarification and recompaction as may be required to achieve suitable subgrade support. ***Additionally, if saturated conditions exist with the surface soils, light tracked equipment could be required to avoid pushing organics deeper into the suitable subgrade soils.*** A *Patriot* representative should verify the stripping depth at the time grading operations occur.

Prior to construction of pavements or the placement of new structural fill, the exposed subgrade must be evaluated by a Patriot representative, which will include proofrolling of the subgrade. Proofrolling should consist of repeated passes of a loaded, pneumatic-tired vehicle such as a tandem-axle dump-truck or scraper. The proofrolling operations should be observed by a *Patriot* representative, and the proofrolling vehicle should be loaded as directed by *Patriot*. Any area found to rut, pump, or deflect excessively should be compacted in-place or, if necessary, undercut and replaced with structural fill, compacted as specified in Section 5.3 *"Structural Fill and Fill Placement Control"*.

Care must be exercised during grading and fill placement operations. ***The combination of heavy construction equipment traffic and excess surface moisture can cause pumping and deterioration of the near surface soils. The severity of this potential problem depends to a great extent on the weather conditions prevailing during construction.*** The contractor must exercise discretion when selecting equipment sizes and also make a concerted effort to control construction traffic and surface water while the subgrade soils are exposed. We recommend that heavy construction equipment (i.e. dump trucks, scrapers, etc.) be rerouted away from the building and pavement areas. If such problems do arise, the operations in the affected area should be halted and the *Patriot* representative contacted to evaluate the condition.

5.2 Foundation Excavation

Excavation will be performed on sandy soils that can be easily disturbed. If the subgrade soil is disturbed, it should be re-compacted, or a crushed stone layer should be placed at the subgrade level.

Upon completion of the foundation excavations and prior to the placement of reinforcing steel, a *Patriot* representative should check the exposed subgrade to confirm that a bearing surface of adequate strength has been reached. Any localized soft soil zones

encountered at the bearing elevations should be further excavated until adequate support soils are encountered. The cavity should be backfilled with structural fill as defined below, or the footing can be poured at the excavated depth. Structural fill used as backfill beneath footings should be limited to lean concrete, well-graded sand and gravel, or crushed stone placed and compacted in accordance with Section 5.3 *"Structural Fill and Fill Placement Control"*.

If it is necessary to support spread footings on structural fill, the fill pad must extend laterally a minimum distance beyond the edge of the footing. The minimum structural pad width would correspond with a point at which an imaginary line extending downward from the outside edge of the footing at a 1H:2V (horizontal: vertical) slope intersects the surface of the natural soils. For example, if the depth to the bottom of excavation is 4 feet below the bottom of the foundation, the excavation would need to extend laterally beyond the edge of the footing at least 2 feet, as shown in Illustration "A" found at the conclusion of this report.

Excavation slopes should be maintained within all requirements set-forth by the Occupational Safety and Health Standards (OSHA), but specifically Section 1926 Subpart "P" – *"Excavations"*. We recommend that any surcharge fill or heavy equipment be kept at least 5 feet away from the edge of the excavation.

In addition, excavations that occur near existing in-use foundations should be carefully performed making a conscious effort not to undermine the support of the in-use foundations. If it is necessary to excavate soil adjacent to and below the bearing elevation of any in-use foundations, *Patriot* should be contacted to make further recommendations regarding these excavations. Please refer to Illustration "B" at the end of this report for further details.

Construction traffic on the exposed surface of the bearing soil will potentially cause some disturbance of the subgrade and consequently loss of bearing capacity. However, the degree of disturbance can be minimized by proper protection of the exposed surface.

5.3 Structural Fill and Fill Placement Control

Structural fill, defined as any fill which will support structural loads, should be clean and free of organic material, debris, deleterious materials, and frozen soils. Samples of the proposed fill materials should be tested prior to initiating the earthwork and backfilling operations to determine the classification, the natural and optimum moisture contents and maximum dry density and overall suitability as a structural fill. ***Structural fill should have a liquid limit***

less than 40, a plasticity index less than 20, and organic content less than 5 percent. Refer to Section 3.2 for test results pertaining to onsite material possible being utilized as structural fill.

All structural fill beneath slabs, adjacent to foundations and over foundations, should be compacted to at least 95 percent (%) of its maximum Standard Proctor dry density (ASTM D-698). This minimum compaction requirement should be increased to 100 percent (%) of the maximum Standard Proctor dry density for fill supporting footings, provided these are designed as outlined Section 4.0 *"Design Recommendations"*.

Structural fill supporting, around and over utilities should be compacted to at least 95 percent (%) of its maximum Standard Proctor dry density (ASTM D-698) for utilities underlying structural areas (i.e., buildings, pavements, sidewalks, etc.). However, the minimum compaction requirement can be reduced for backfill around and over the utilities to 90 percent (%) of the maximum Standard Proctor dry density where utilities underlie greenbelt areas (i.e., grassy lawns, landscaping, etc.). It is recommended that a clean well-grade granular material be utilized as the bedding material, as well as the backfill material around and over the utility lines.

In cut areas, where pavement sections are planned, the upper 10 inches of subgrade should be scarified and compacted to a dry density of at least 100 percent (%) of the Standard Proctor maximum dry density (ASTM D-698). Any grade-raise fill placed within 1 foot of the base of the pavement section should also be compacted to at least 100 percent (%) of the Standard Proctor maximum dry density. This can be reduced to 95 percent (%) for structural fill placed more than 1 foot below the base of the pavement section.

To achieve the recommended compaction of the structural fill, we suggest that the fill be placed and compacted in layers not exceeding 8 inches in loose thickness (the loose lift thickness should be reduced to 6 inches when utilizing small hand compactors) and within the range of 2 percentage (%) points below or above the optimum moisture content value. All fill placements should be monitored by a *Patriot* representative. ***Each lift should be tested for proper compaction at a frequency of at least one (1) test every 2,500 square feet (ft^2) per lift for the building areas, at least one (1) test every 10,000 square feet***

***(ft^2) per lift for the parking and roadway areas, and at a frequency of at least one (1) test for every 50 lineal feet of utility installation*.**

5.4 Groundwater and Dewatering Considerations

Groundwater was observed during our field activities at depths between about 6 and 19 feet below the existing ground surface (Refer to the *"Groundwater Summary Table*" in Section 3.3 *"Groundwater Conditions"*). Due to the proximity to the Great Miami River, it is expected that the groundwater elevations to be directly correlated with the elevation of the river water elevation. The excavations of the channels will require significant water control and dewatering. ***Additionally, sand layers and seams could be encountered which are expected to be free-flowing and will tend to readily cave and/or slough into excavations; therefore, over-excavation, benching and/or shoring should be expected in order to maintain the side slopes of the excavations.*** Furthermore, it should also be noted that there may be the potential for encountering heaving of sand layers near the groundwater elevations during construction.

Cofferdams are expected to be utilized to control water infiltration and stability for the channel excavations along the river. The *Client* should obtain the proper permits for the use of temporary cofferdams and continually inspect and maintain the cofferdams during construction.

Groundwater inflow into shallow excavations **above** the groundwater table is expected to be adequately controlled by conventional methods such as gravity drainage and/or pumping from sumps. More significant inflow can be expected in deeper excavations **below** the groundwater table requiring more aggressive dewatering techniques, such as well or wellpoint systems. For groundwater to have minimal effects on the construction, foundation excavations should be constructed and poured in the same day, if possible.

6.0 EXPLORATIONAL PROCEDURES

6.1 Field Work

A total of eighteen (18) soil borings were drilled, sampled, and tested at the project site between March 19th and 27th, 2024, at the approximate locations shown on the Boring Location Map (Figure No. 2) in Appendix "A". The depths that the soil borings were advanced to are shown on the Boring Logs in Appendix "A".

The borings were advanced using 3¼ inch inside diameter hollow-stem augers. Samples were recovered in the undisturbed material below the bottom of the augers using the standard drive sample technique in accordance with ASTM D 1586-74. A 2 inch outside diameter by 1 3/8 inch inside diameter split-spoon sampler was driven a total of 18 inches with the number of blows of a 140-pound hammer falling 30 inches recorded for each 6 inches of penetration. The sum of blows for the final 12 inches of penetration is the Standard Penetration Test result commonly referred to as the N-value (or blow-count). Split-spoon samples were recovered at 2.5 feet intervals, beginning at a depth of 1 foot below the existing surface grade, extending to a depth of 10 feet, and at 5 feet intervals thereafter to the termination of the boring.

Water levels were monitored at each borehole location during drilling and upon completion of the boring. The boreholes were backfilled with auger cuttings prior to demobilization.

Upon completion of the boring program, samples retrieved during drilling were returned to *Patriot*'s soil testing laboratory where they were visually examined and classified. A laboratory-generated log of each boring was prepared based upon the driller's field log, laboratory test results, and our visual examination. Test boring logs and a description of the classification system are included in Appendix "A" in this report. Indicated on each log are the primary strata encountered, the depth of each stratum change, the depth of each sample, the Standard Penetration Test results, groundwater conditions, and selected laboratory test data. The laboratory logs were prepared for each boring giving the appropriate sample data and the textural description and classification.

6.2 Laboratory Testing

Representative samples recovered in the borings were selected for testing in the laboratory to evaluate their physical properties and engineering characteristics. Laboratory analysis included:

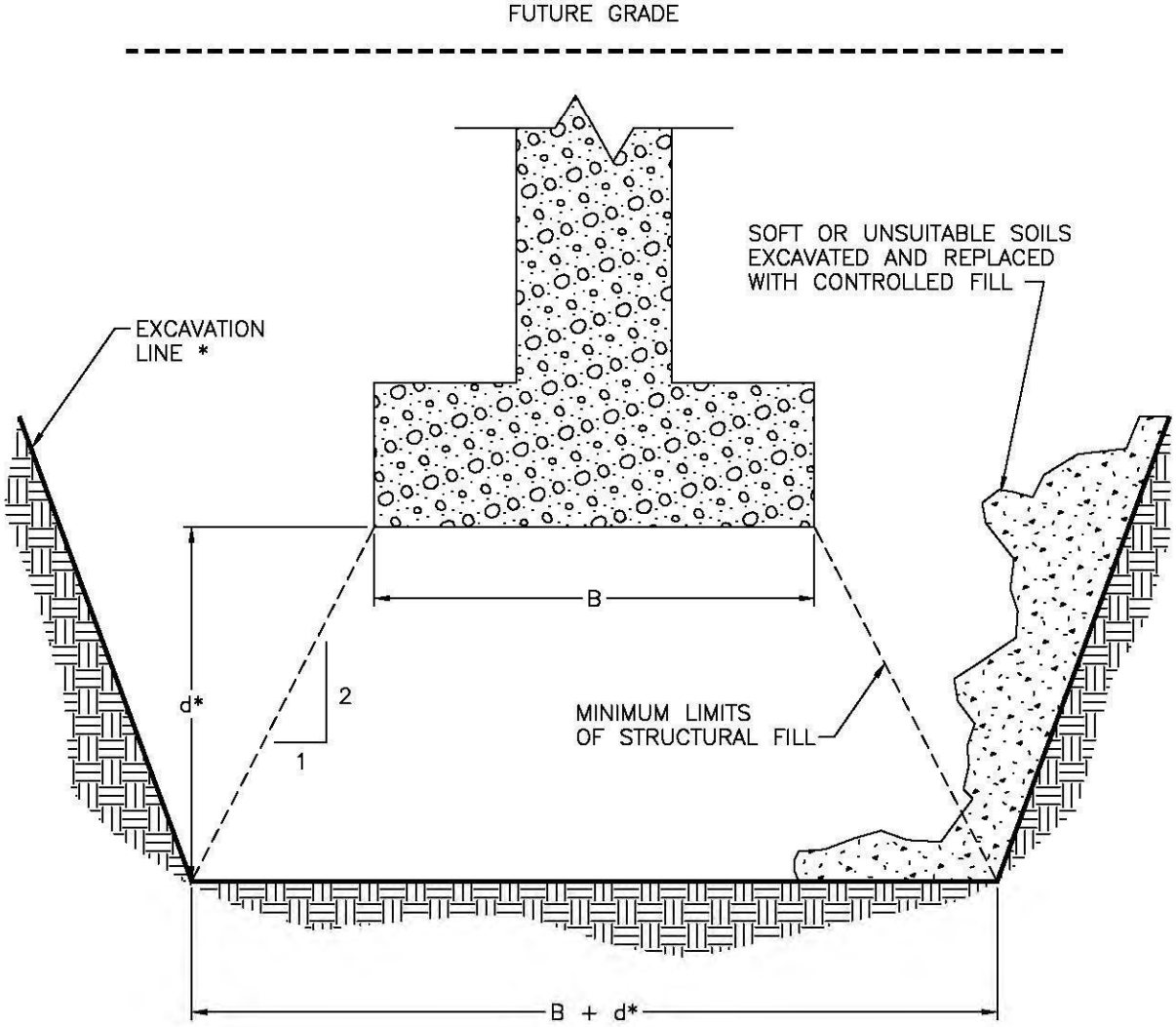
- Natural Moisture Content Analysis (ASTM D 2216)
- Atterberg Limits Analysis (ASTM D 4318)
- Loss on Ignition (ASTM D 2974)
- Standard Proctor (ASTM D 698)

Additionally, an estimate of the cohesive soil strength was determined utilizing a hand penetrometer (q_p). The results of laboratory tests are summarized in Section 3.2 *"General*

Subsurface Conditions", as well as in Appendix "B". Soil descriptions on the boring logs are in accordance with the Unified Soil Classification System (USCS).

7.0 ILLUSTRATIONS

See Illustrations "A" and "B" on the following pages. These illustrations are presented to further visually clarify several of the construction considerations presented in Section 5.2 *"Foundation Excavations"*.



*d IS DEPTH TO SUITABLE SOILS

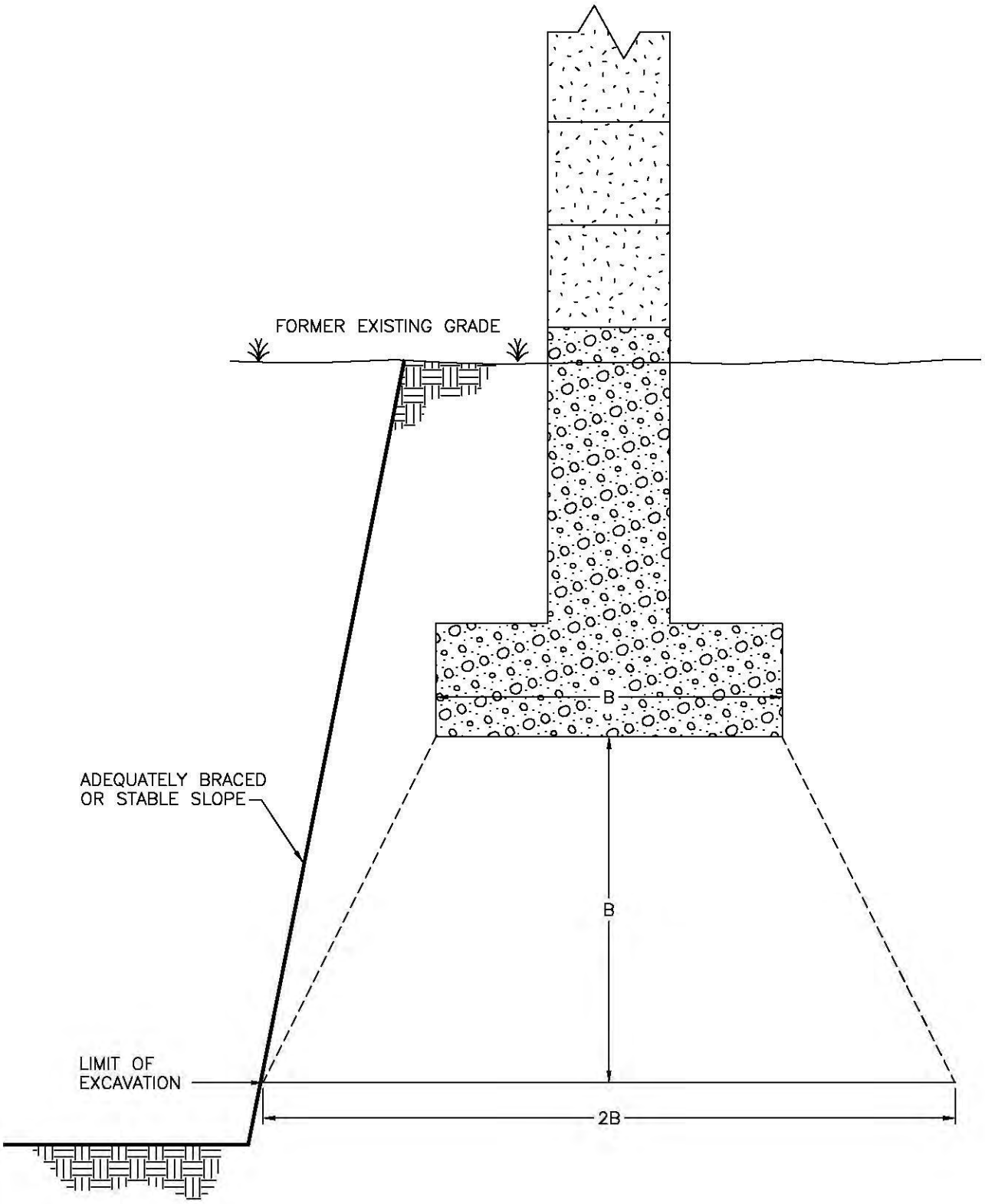
* IN COMPLIANCE WITH OSHA STANDARDS

PATRIOT ENGINEERING
and Environmental, Inc.
Engineering Value for Project Success
Consulting Environmental, Geotechnical
and Materials Engineers

Excavation for Footings In an Area of Fill
ILLUSTRATION A

job. no.:

figure:



PATRIOT ENGINEERING and Environmental, Inc.
Engineering Value for Project Success
Consulting Environmental, Geotechnical and Materials Engineers

Excavation Near Existing In Use Foundations
ILLUSTRATION B

job. no.:

figure:

APPENDIX A

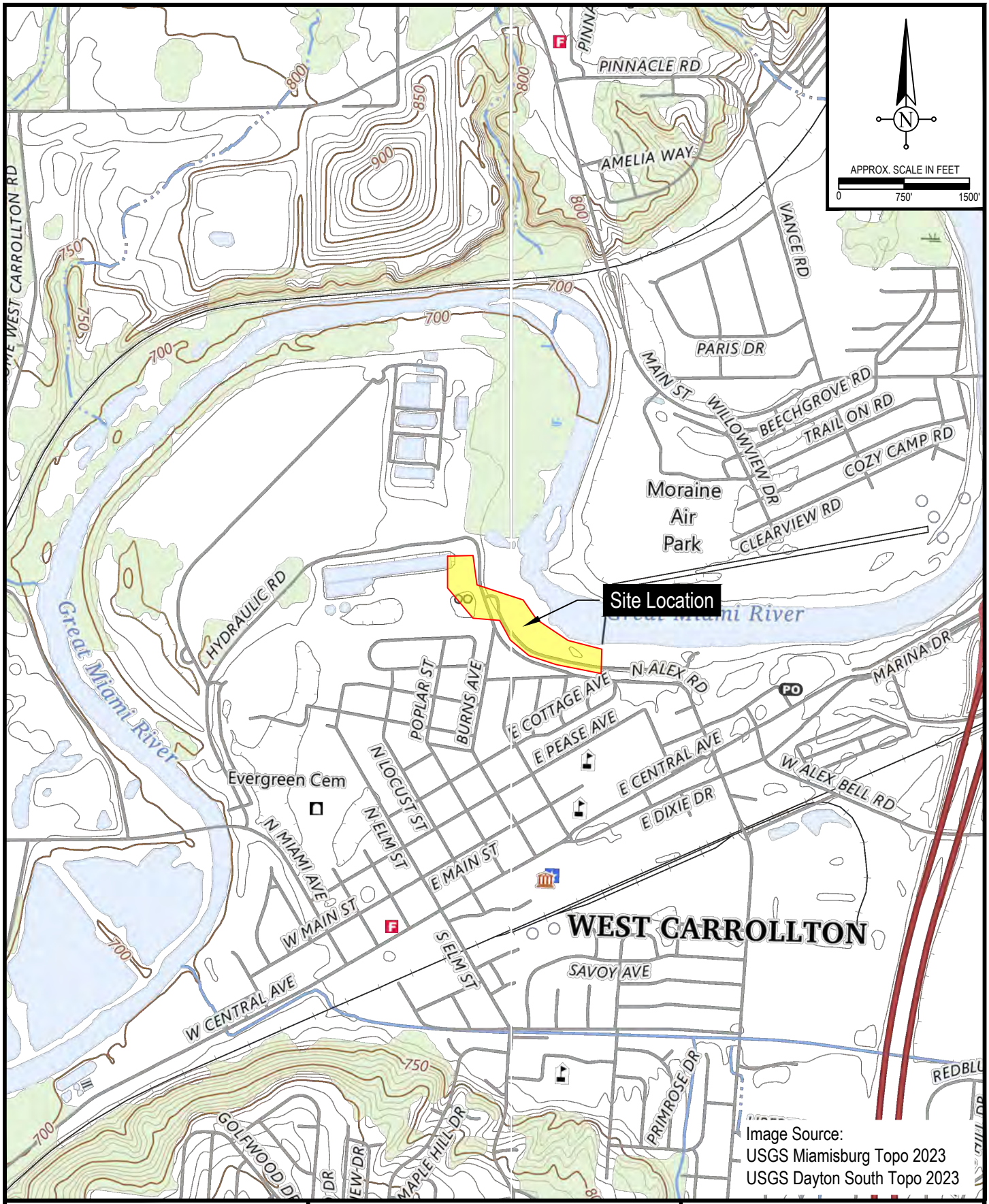
SITE VICINITY MAP (FIGURE NO. 1)

BORING LOCATION MAP (FIGURE NO. 2)

BORING LOGS

BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)



Patriot Engineering & Environmental, Inc.

Project: West Carrollton River Park GEO
Alex Road & Hydraulic Road
West Carrollton, Ohio

	Drawn By: J. DuMond
Project Number:24-0274-07	Approved: L. Young
Date: May 20, 2024	DWG: 24-0274-07_geo

Figure 1

Site Vicinity Map

Patriot Engineering & Environmental, Inc.

LEGEND
- PATRIOT Soil Boring
- B-1 Soil Boring ID

NOTES:
1. Boring locations were staked by PATRIOT. All locations are shown as approximate.
2. All locations were determined in the field with references to existing landmarks.
3. Image Source: Bing Maps
4. Scale as shown.

Project: West Carrollton River Park GEO
Alex Road & Hydraulic Road
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Date: May 20, 2024	DWG: 24-0274-07_geo

Figure 2

Soil Boring Location Map
Aerial

AND COMPANY SHALL BE AT THE SOLE RISK FOR THE UNAUTHORIZED USER WITHOUT LIABILITY OR LOSS EXPOSURE TO T

C:\Users\Documents_Projects\West Carrollton OH\Drawings\Alt 1 E-3A Big wave with beginner channel and curves.dwg Plot Date:10/21/2022 5:59 PM Last Saved By: JAARCH

DISCHARGE TO RIVER AND TAKEOUT

B-18

MILD GRADIENT CHANNEL

B-17

WHITEWATER TUBING DROPS, 30' LONG, 1.3' HEIGHT, 3 EQUAL VERTICAL AND HORIZONTAL STEPS.
GRADING: UPSTREAM CREST EL. 1.5' ABOVE THE POOL INVERT, DITTO DOWNSTREAM CREST

B-16

PEDESTRIAN BRIDGE, 60' L. 10' WIDE

B-15

B-13

B-14

B-12

MCD #83A
FLAP GATE

B-11

B-10

B-9

Great Miami River

BANK FISHING AREA

EXTEND MAINTENANCE GATE DISCHARGE DOWNSTREAM.

POSSIBLE HYDRO DEVELOPMENT WITHIN MAINTENANCE GATE BAYS

ADDITIONAL TOE OF DAM ARMORING, EXTENT T.B.D.

ADDITIONAL RIP RAP APRON SCOUR PROTECTION. EXTENT T.B.D.

EXISTING RIP RAP

DAM HAZARD MITIGATION STEPS. LOWER WEIR CREST AS NEEDED TO MITIGATE FLOOD IMPACTS

SUSPEND
PASSAGE AN

LINE OF WARNING BUOYS

SURVEYED WS. 697.5 1000 CFS

RIP RAP SCOUR PROTECTION

STEPPED COUNTER WEIR (4 EQUAL STEPS)

DIVIDER ISLAND

IMPROVED AND ARMORED BANK WITH FISHING AREAS AND SEATING

BIG WAVE FEATURE

BANK FISHING AREA

BOX CULVERT w/ BUTTERFLY GATE

SCREENED WATER INTAKE

LOW WATER MAINT. ROAD

OBERMEYER MAINTENANCE GATE

B-6

B-8

B-3

B-4

B-7

B-5

B-1

B-2

PUT IN

SC1317

716.5
711.64

717
712.14

(126', SAN, 4)

SC1318

SC1319

SAN

CO-ALIGN EXISTING BIKE PATH AND ACCESS ROAD

TO R5TO RIVER

Hydraulic Drive

APPROX. SCALE IN FEET
0 50 100

50'

SITE PLAN

CALL BEFORE YOU DIG | CLIENT NAME | PE STAMP | TITLE:

Patriot Engineering & Environmental, Inc.

LEGEND
PATRIOT Soil Boring
B-1 Soil Boring ID

NOTES:
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2. All locations were determined in the field with references to existing landmarks.
3. Image Source: Merrick
4. Scale as shown.

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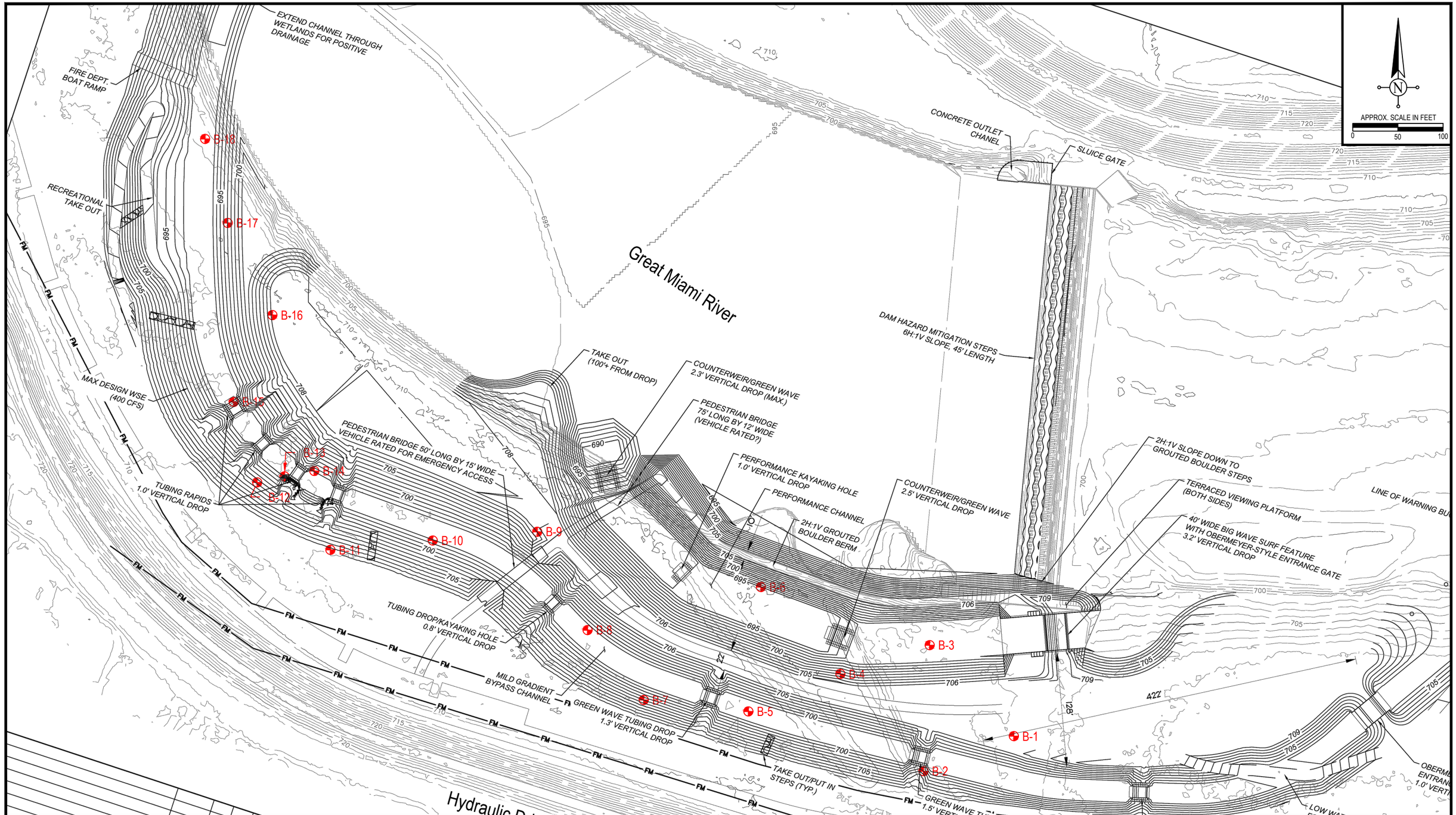
West Carrollton, Ohio

	Drawn By: J. DuMond
Project Number: 24-0274-07	Approved: L. Young
Date: May 20, 2024	DWG: 24-0274-07_geo

Figure 3

Boring Location Plan
Original Preliminary Plan



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LEGEND
- PATRIOT Soil Boring
- B-1 Soil Boring ID

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4. Scale as shown.

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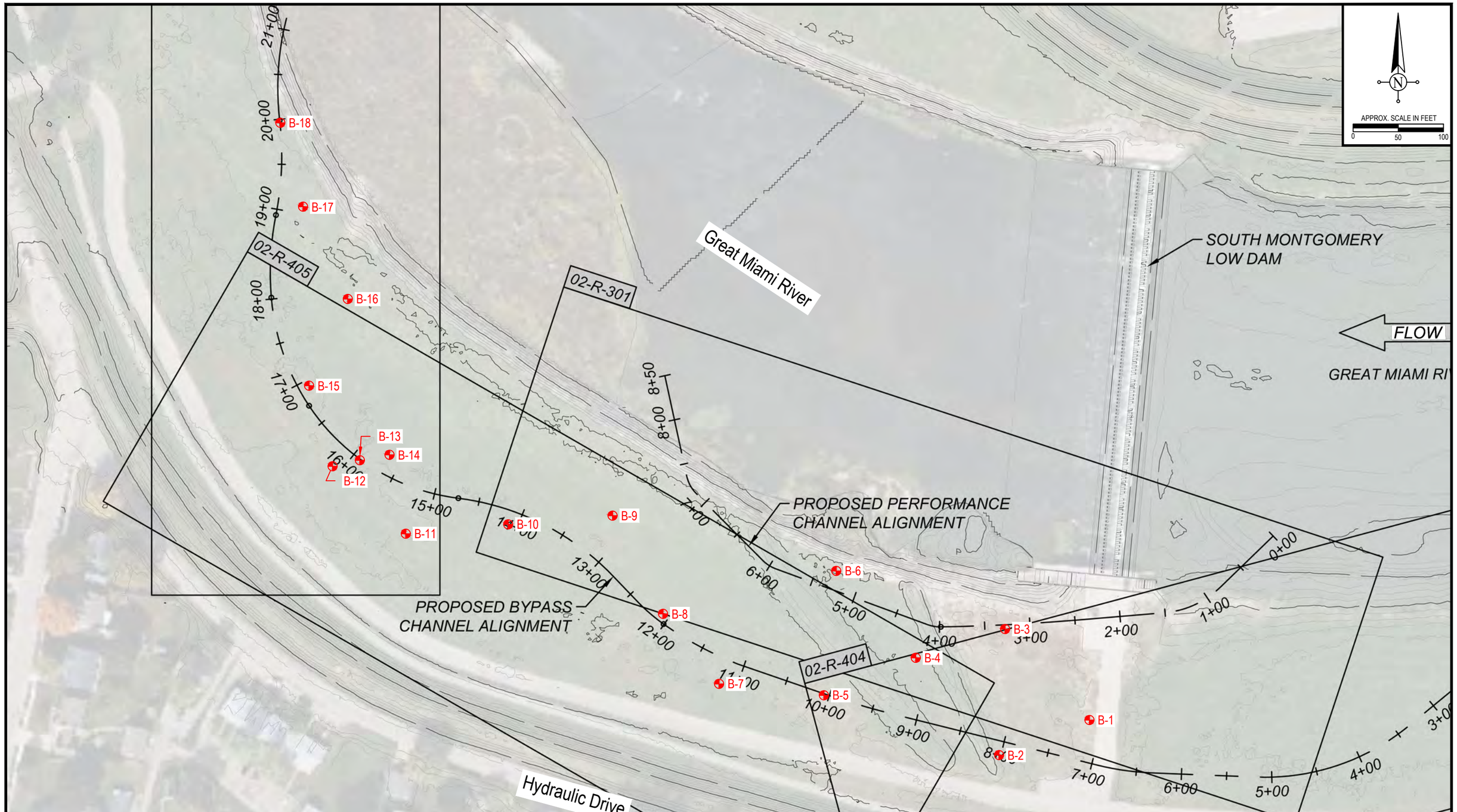
West Carrollton, Ohio

	Drawn By: J. DuMond
Project Number: 24-0274-07	Approved: L. Young
Date: May 20, 2024	DWG: 24-0274-07_geo

Figure 4

Whitewater Course Plan



Patriot Engineering & Environmental, Inc.

LEGEND

PATRIOT Soil Boring

B-1 Soil Boring ID

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3. Image Source: Merrick
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Alex Road & Hydraulic Road
West Carrollton, Ohio

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Project Number: 24-0274-07	Approved: L. Young
Date: May 20, 2024	DWG: 24-0274-07_geo

Figure 5

Bypass Channel River Enlargments Key Plan

PATRIOT ENGINEERING and Environmental Inc.
Indianapolis, Terre Haute, Evansville, Fort Wayne, Lafayette, Bloomington Louisville, KY Dayton, Cincinnati, OH

LOG OF BORING B-1

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 707.7 feet
Start Date	: 03/22/2024	Latitude	: 39°40'44.86"N
Drilling Method	: HSA	Longitude	: 84°14'47.72"W

Water Levels
- During Drilling - 13 feet
- After Completion - 19 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 707.7	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
	705	CL	Brown and gray, very moist, stiff to very stiff, SILTY CLAY with trace sand and trace organic matter	1	100	4/7/6	2.1	29	Bulk sample collected from 0.0 to 5.0 feet. As received moisture content-31%.
5		CL	Gray and brown, very moist, soft, SILTY CLAY with trace sand, interbedded sand seams, and trace organic matter	2	89	2/2/2		29	Sample No. Bulk: Atterberg Limits Test LL = 41, PL = 22, PI = 19
	700	CL	Gray and brown, very moist, stiff, SILTY CLAY with trace sand and interbedded sand seams	3	78	5/7/7	1.9	29	Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 2.8%
10		CL	Gray and brown, moist, stiff to very stiff, SILTY CLAY with trace sand	4	67	7/9/7	1.8	22	
	695	SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and some gravel	5	89	9/12/14			
15			Brown, saturated, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	6	56	13/15/17			
	690			7	56	11/16/14			
20				8	67	12/10/8			
	685	SP-SM							Boring caved to 22 feet upon auger removal.
25				9	78	7/7/8			
	680								
30				10	50	10/11/11			
	675		Boring terminated at 30 feet.						
35									

05-31-2024 C:\Users\lyoung\Patriot Engineering\GEO - Documents\Mtech\2024 Mtech\0274-07G\b1.bor

PATRIOT ENGINEERING and Environmental Inc.
Indianapolis, Terre Haute, Evansville, Fort Wayne, Lafayette, Bloomington Louisville, KY Dayton, Cincinnati, OH

LOG OF BORING B-2

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 708.4 feet
Start Date	: 03/22/2024	Latitude	: 39°40'44.45"N
Drilling Method	: HSA	Longitude	: 84°14'48.99"W

Water Levels
- During Drilling - 11 feet
- After Completion - 9 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 708.4	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
		CL	Gray, moist, medium stiff, SILTY CLAY with trace sand and some root material	1	56	5/4/4		21	
	705								
5		CL	Brown, moist, medium stiff to stiff, SILTY CLAY with trace sand	2	100	6/3/5	2.4	17	Bulk sample collected from 5.0 to 10.0 feet. As received moisture content-28%.
		CL	Gray, very moist, very stiff, SILTY CLAY with trace sand and trace organic matter	3	22	7/9/9		31	
	700	SP-SM	Gray, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt and trace organic matter	4	28	9/7/11			Sample No. Bulk: Atterberg Limits Test LL = 41, PL = 22, PI = 19
10		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt	5	67	10/9/12			Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 2.6%
	695								
15		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace to little gravel	6	56	11/13/14			
				7	89	10/13/15			Boring caved to 17 feet upon auger removal.
	690			8	67	13/14/15			
20									
	685								
25		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt	9	89	9/12/16			
	680								
30		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and little to some gravel	10	100	14/17/15			
	675		Boring terminated at 30 feet.						
35									

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LOG OF BORING B-3

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 707.4 feet
Start Date	: 03/22/2024	Latitude	: 39°40'45.83"N
Drilling Method	: HSA	Longitude	: 84°14'48.94"W

Water Levels
- During Drilling - 11 feet
- After Completion - 9 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 707.4	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					ROCK and GRAVEL (12")						
	705		CL		Gray and brown, very moist, soft, SILTY CLAY with trace sand and trace organic matter	1	100	4/1/2		39	Sample No. 1: Atterberg Limits Test LL = 39, PL = 18, PI = 21
			SM		Brown, slightly moist, very loose, SILTY SAND	2	100	1/1/1		24	Sample No. 1: Loss on Ignition (LOI) Organic Content = 2.6%
5			CL		Gray, moist, very soft, SILTY CLAY with trace sand, trace organic matter, and interbedded sand seams	3	78	7/12/17			
	700		SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt						
		▽	CL		Gray, moist, very stiff, SILTY CLAY with little sand	4	67	9/11/15		16	
10			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	5	28	4/7/12			
	695	▼	SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt	6	78	10/10/19			Boring caved to 14 feet upon auger removal.
15			SP-SM		Brown, saturated, dense, fine to medium grained, SAND with trace silt and some gravel	7	89	14/17/16			
	690		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt	8	78	12/14/15			
20											
	685										
			SP-SM		Brown, saturated, dense to very dense, fine to medium grained, SAND with trace silt and some to little gravel	9	78	21/23/20			
25											
	680										
			SP-SM			10	67	18/21/24			
30											
	675										
						11	78	15/17/22			
35											

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LOG OF BORING B-3

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 707.4 feet
Start Date	: 03/22/2024	Latitude	: 39°40'45.83"N
Drilling Method	: HSA	Longitude	: 84°14'48.94"W

Water Levels
- During Drilling - 11 feet
- After Completion - 9 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 707.4	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35											
	670		SP-SM		Brown, saturated, dense to very dense, fine to medium grained, SAND with trace silt and some to little gravel	12	89	21/29/24			
40					Boring terminated at 40 feet.						
	665										
45											
	660										
50											
	655										
55											
	650										
60											
	645										
65											
	640										
70											

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LOG OF BORING B-4

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.8 feet
Start Date	: 03/20/2024	Latitude	: 39°40'45.50"N
Drilling Method	: HSA	Longitude	: 84°14'50.20"W

Water Levels
- During Drilling - 11 feet
- After Completion - 8 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.8	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
		CL	Brown, moist, stiff to very stiff, SILTY CLAY with trace sand, trace root material, and trace slag	1	33	3/4/5	3.2	16	
5	705	CL	Gray and brown, moist, very stiff, SILTY CLAY with trace sand, trace gravel, and little woody material	2	78	4/7/12	2.0	19	
			WOODY MATERIAL (ORGANIC)	3	78	7/12/15			
10	700	SP-SM	Brown, slightly moist, dense, fine to medium grained, SAND and gravel with trace silt and trace organic matter	4	89	7/15/17			Bulk sample collected from 10.0 to 15.0 feet. As received moisture content-30%.
		CL	Brown, moist, very stiff to hard, SILTY CLAY with trace sand, trace gravel, and trace organic matter	5	78	15/16/19	1.9	24	
15	695		WOODY MATERIAL (ORGANIC) with trace clay	6	56	13/17/15		52	Sample No. Bulk: Atterberg Limits Test LL = 33, PL = 22, PI = 11
		SP-SM	Brown, saturated, dense, fine to medium grained, SAND and gravel with trace silt	7	100	12/16/20			Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 3.1%
20	690		WOODY MATERIAL (ORGANIC) with trace sand and trace gravel	8	56	18/21/25			Boring caved to 14 feet upon auger removal.
25	685	SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt	9	100	12/14/15			
30	680	SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt, little to some gravel, trace wood, and interbedded clay seams	10	67	7/12/9			
35	675		Boring terminated at 30 feet.						

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LOG OF BORING B-5

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.2 feet
Start Date	: 03/25/2024	Latitude	: 39°40'45.07"N
Drilling Method	: HSA	Longitude	: 84°14'51.49"W

Water Levels
- During Drilling - 11 feet
- After Completion - 9 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.2	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (7")						
		CL	Brown and gray, very moist to moist, medium stiff to stiff, SILTY CLAY with trace to little sand, trace gravel, and trace organic matter	1	67	3/4/4	3.0	27	Bulk sample collected from 0.0 to 5.0 feet. As received moisture content-28%.
	705			2	56	4/4/4	1.9	19	Sample No. Bulk: Atterberg Limits Test LL = 37, PL = 20, PI = 17
5		CL	Gray, dark gray, and brown, very moist, stiff, SILTY CLAY with trace sand and trace organic matter	3	67	7/9/7		40	Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 2.4%
	700	SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	4	67	10/14/16			Sample No. 3: Atterberg Limits Test LL = 49, PL = 27, PI = 22
10		CL	Gray and dark gray, moist, hard, SANDY CLAY and gravel	5	78	7/13/21		19	Sample No. 3: Loss on Ignition (LOI) Organic Content = 2.8%
	695	SP-SM	Brown, saturated, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	6	89	12/9/15			
15				7	28	14/15/17			
	690	SP-SM	Brown, slightly moist, medium dense to dense, fine to medium grained, SAND with trace silt and trace to little gravel	8	89	11/12/12			Boring caved to 19 feet upon auger removal.
20									
	685			9	44	14/17/15			
25									
	680			10	39	12/10/12			
30			Boring terminated at 30 feet.						
	675								
35									

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LOG OF BORING B-6

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 710.4 feet
Start Date	: 03/20/2024	Latitude	: 39°40'46.43"N
Drilling Method	: HSA	Longitude	: 84°14'51.34"W

Water Levels
- During Drilling - 11 feet
- After Completion - 17 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 710.4	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	710		TOPSOIL (8")						
		CL	Gray and brown, moist, stiff, SILTY CLAY with trace sand	1	67	4/5/5	3.8	18	
		CL	Brown, very moist, stiff, SILTY CLAY with trace sand and interbedded sand seams	2	78	3/5/6	1.8	27	
5	705	SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	3	100	9/13/14			
		CL	Brown, moist, hard, SILTY CLAY with trace sand	4	33	19/50-2"	1.8	16	
		SP-SM	Brown, slightly moist, very dense, fine to medium grained, SAND and gravel with trace silt	5	67	17/9/11			
10	700		Brown, saturated, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	6	78	19/15/17			
				7	67	16/17/19			
15	695			8	67	17/9/10			
		SP-SM							Boring caved to 22 feet upon auger removal.
20	690								
			Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and little to some gravel	9	78	11/14/15			
25	685								
		SP-SM		10	67	7/13/10			
30	680								
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	11	89	9/7/10			
35									

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LOG OF BORING B-6

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 710.4 feet
Start Date	: 03/20/2024	Latitude	: 39°40'46.43"N
Drilling Method	: HSA	Longitude	: 84°14'51.34"W

Water Levels
- During Drilling - 11 feet
- After Completion - 17 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 710.4	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35	675		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel						
40	670		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and some gravel	12	89	12/14/13			
45	665				Boring terminated at 40 feet.						
50	660										
55	655										
60	650										
65	645										
70											

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LOG OF BORING B-7

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.5 feet
Start Date	: 03/25/2024	Latitude	: 39°40'44.96"N
Drilling Method	: HSA	Longitude	: 84°14'53.04"W

Water Levels
- During Drilling - 11 feet
- After Completion - 12 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.5	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (7")						
		CL	Gray and brown, moist, medium stiff to stiff, SILTY CLAY with little sand	1	56	4/2/3	2.0	16	
				2	67	6/5/4		22	
5	705	CL	Gray, dark gray, and brown, very moist, stiff to very stiff, SILTY CLAY with trace sand and trace organic matter	3	78	5/7/8		31	
		SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	4	28	7/10/11		29	
10	700								
		SP-SM	Brown, saturated, dense to medium dense, fine to medium grained, SAND and gravel with trace silt	5	17	14/15/18			
				6	22	16/21/19			
15	695			7	89	14/12/15			
				8	67	12/13/16			Boring caved to 21 feet upon auger removal.
20	690								
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	9	78	9/12/11			
25	685								
				10	89	13/10/14			
30	680		Boring terminated at 30 feet.						
35	675								

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LOG OF BORING B-8

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 710.5 feet
Start Date	: 03/25/2024	Latitude	: 39°40'45.93"N
Drilling Method	: HSA	Longitude	: 84°14'53.78"W

Water Levels
- During Drilling - 11 feet
- After Completion - 8 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 710.5	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	710		TOPSOIL (8")						
		CL	Brown, very moist, stiff to very stiff, SILTY CLAY with trace sand	1	89	3/5/4	2.2	26	
		CL	Gray and brown, moist, soft, SILTY CLAY with trace sand	2	67	2/2/2		22	
5	705	CL	Gray and brown, very moist, medium stiff to stiff, SILTY CLAY with trace sand and trace organic matter	3	89	2/3/5	1.2	38	Bulk sample collected from 5.0 to 10.0 feet. As received moisture content-17%.
		CL	Gray and brown, very moist, stiff to very stiff, SILTY CLAY with trace sand	4	100	7/13/17	1.0	36	Sample No. Bulk: Atterberg Limits Test LL = 26, PL = 16, PI = 10
10	700	SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	5	89	9/14/19			Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 1.0%
			Brown, saturated, dense to medium dense, fine to medium grained, SAND and gravel with trace silt	6	11	9/9/12			
15	695	SP-SM		7	78	11/12/13			
				8	89	14/16/19			
20	690								Boring caved to 21 feet upon auger removal.
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace to little gravel	9	78	16/13/15			
25	685								
30	680			10	89	11/15/18			
35			Boring terminated at 30 feet.						

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LOG OF BORING B-9

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.9 feet
Start Date	: 03/25/2024	Latitude	: 39°40'46.99"N
Drilling Method	: HSA	Longitude	: 84°14'54.52"W

Water Levels
- During Drilling - 11 feet
- After Completion - 7 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.9	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
		CL	Brown, very moist, medium stiff, SILTY CLAY with trace sand	1	67	2/4/4	1.3	27	
5	705	CL	Gray and brown, very moist, medium stiff, SILTY CLAY with trace sand and interbedded sand seams	2	56	3/2/3	1.4	27	
		CL	Gray and brown, very moist, stiff to very stiff, SILTY CLAY with trace sand and trace organic matter	3	78	4/7/6	1.5	34	
10	700			4	67	9/11/13	0.9	35	Sample No. 4: Atterberg Limits Test LL = 47, PL = 21, PI = 26
				5	72	13/11/15	1.1	36	Sample No. 4: Loss on Ignition (LOI) Organic Content = 4.0%
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt						
15	695	SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt, little gravel, and interbedded clay seams	6	28	14/10/12			
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and little to some gravel	7	67	10/12/13			
20	690			8	78	11/13/17			Boring caved to 19 feet upon auger removal.
25	685	SP-SM	Brown, saturated, dense, fine to medium grained, SAND and gravel with trace silt	9	67	12/15/19			
		SP-SM	Brown, saturated, dense, fine to medium grained, SAND with trace silt and trace gravel	10	78	13/13/20			
30	680		Boring terminated at 30 feet.						
35	675								

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LOG OF BORING B-10

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.4 feet
Start Date	: 03/25/2024	Latitude	: 39°40'46.87"N
Drilling Method	: HSA	Longitude	: 84°14'56.00"W

Water Levels
- During Drilling - 11 feet
- After Completion - 9 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.4	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
		CL	Brown, moist, stiff, SILTY CLAY with trace sand and interbedded sand seams	1	67	4/6/7		18	
		CL	Gray and brown, very moist, medium stiff to stiff, SILTY CLAY with trace sand	2	56	2/2/3	1.0	27	
5	705	SM	Brown, slightly moist, loose, SILTY SAND						
		CL	Brown and gray, very moist, very stiff, SILTY CLAY with trace sand	3	67	4/7/10	2.1	29	
		SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt and trace organic matter	4	56	5/8/8			
10	700	SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt and trace organic matter	5	67	10/12/11			Bulk sample collected from 10.0 to 15.0 feet. As received moisture content-26%.
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and little gravel	6	56	14/11/15			Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 2.6%
15	695								
		SP-SM	Brown, saturated, dense, fine to medium grained, SAND and gravel with trace silt	7	100	20/16/16			
20	690			8	89	19/18/15			Boring caved to 19 feet upon auger removal.
		SP-SM		9	78	17/22/23			
25	685								
		SP-SM	Brown, saturated, dense, fine to medium grained, SAND with trace silt and trace gravel	10	89	14/17/15			
30	680		Boring terminated at 30 feet.						
35	675								

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LOG OF BORING B-11

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.1 feet
Start Date	: 03/25/2024	Latitude	: 39°40'46.75"N
Drilling Method	: HSA	Longitude	: 84°14'57.45"W

Water Levels
- During Drilling - 11 feet
- After Completion - 7 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.1	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
		CL	Brown, moist, stiff, SILTY CLAY with trace sand, interbedded sand seams, and trace organic matter	1	67	3/5/5	1.4	19	Bulk sample collected from 0.0 to 5.0 feet. As received moisture content- 25%.
	705								
5		CL	Brown and gray, very moist, stiff to very stiff, SILTY CLAY with little to trace sand and trace organic matter	2	78	4/6/5	0.9	27	Sample No. Bulk: Atterberg Limits Test LL = 40, PL = 21, PI = 19
				3	89	5/8/9	1.5	35	Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 3.8%
	700		Brown, slightly moist, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	4	78	7/6/7			
10				5	50	8/12/11			
	695			6	67	17/14/15			
15		SP-SM		7	78	18/21/23			Boring caved to 17 feet upon auger removal.
	690			8	89	21/17/20			
20									
	685		Brown, saturated, dense, fine to medium grained, SAND with trace silt and little to some gravel	9	78	19/20/24			
25		SP-SM							
	680			10	67	17/21/18			
30			Boring terminated at 30 feet.						
	675								
35									

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LOG OF BORING B-12

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 708.5 feet
Start Date	: 03/19/2024	Latitude	: 39°40'47.47"N
Drilling Method	: HSA	Longitude	: 84°14'58.50"W

Water Levels
- During Drilling - 12 feet
- After Completion - 14 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 708.5	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (7")						
		CL	Brown, moist, stiff to very stiff, SILTY CLAY with trace sand	1	100	5/5/5	2.7	22	
	705	CL	Gray, dark gray, and brown, very moist, medium stiff, SILTY CLAY with little sand, trace organic matter, and interbedded sand seams	2	100	5/4/3	0.5	39	
5		CL	Gray and brown, very moist, very soft, SILTY CLAY with little sand and trace organic matter	3	100	W/O/H		41	WOH - Weight of Hammer Sample No. 3: Atterberg Limits Test LL = 45, PL = 21, PI = 24
	700	CL	Gray and brown, very moist, soft, SILTY CLAY with little sand and trace organic matter	4	100	0/0/4		31	
10		SP-SM	Brown, slightly moist, very loose, fine to medium grained, SAND and gravel with trace silt	5	89	14/22/26	1.0	40	Sample No. 3: Loss on Ignition (LOI) Organic Content = 3.6%
		CL	Gray, dark gray, and brown, very moist, hard, SILTY CLAY with trace sand and trace organics	6	78	11/18/19			
	695	SP-SM	Brown, saturated, dense, fine to medium grained, SAND with trace silt and some gravel	7	67	15/29/40			
15		SP-SM	Brown, saturated, very dense, fine to medium grained, SAND with trace silt and trace gravel	8	89	12/8/11			Boring caved to 18 feet upon auger removal.
	690								
20				9	78	14/16/14			
	685								
25		SP-SM	Brown, saturated, medium dense to dense, fine to medium grained, SAND with trace silt and trace to little gravel	10	78	12/13/14			
	680								
30				11	67	13/16/15			
	675								
35									

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LOG OF BORING B-12

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 708.5 feet
Start Date	: 03/19/2024	Latitude	: 39°40'47.47"N
Drilling Method	: HSA	Longitude	: 84°14'58.50"W

Water Levels
- During Drilling - 12 feet
- After Completion - 14 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 708.5	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35											
	670				Brown, saturated, medium dense to dense, fine to medium grained, SAND with trace silt and trace to little gravel	12	89	11/10/13			
40											
	665					13	89	12/8/14			
45			SP-SM								
	660					14	67	13/14/16			
50											
	655					15	78	10/14/13			
55											
	650					16	100	7/10/8			
60					Boring terminated at 60 feet.						
	645										
65											
	640										
70											

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LOG OF BORING B-13

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.8 feet
Start Date	: 03/19/2024	Latitude	: 39°40'47.54"N
Drilling Method	: HSA	Longitude	: 84°14'58.12"W

Water Levels
▼ During Drilling - 11 feet
▽ After Completion - 6 feet
◆ After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.8	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					TOPSOIL (6")						
			CL		Brown and gray, moist to very moist, stiff, SILTY CLAY with little to trace sand and interbedded sand seams	1	100	4/5/7	1.1	24	
						2	100	6/4/5	1.1	28	
5	705	▽									
			CL		Brown and gray, very moist, stiff to medium stiff, SILTY CLAY with little to trace sand and trace organic matter	3	100	5/7/7			
			SP-SM		Gray, slightly moist, loose, fine to medium grained, SAND and gravel with trace silt	4	67	1/1/5		32	
10	700	▼									
			SP-SM		Brown, saturated, very dense to dense, fine to medium grained, SAND and gravel with trace silt	5	50	11/37/24			
						6	78	12/22/24			
15	695										
			SP-SM		Brown, saturated, medium dense to dense, fine to medium grained, SAND with trace silt and trace gravel	7	50	8/9/12			Boring caved to 18 feet upon auger removal.
						8	89	9/11/15			
20	690										
						9	100	13/15/17			
25	685										
			SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	10	78	11/13/12			
30	680										
						11	67	12/14/14			
35	675										

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LOG OF BORING B-13

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.8 feet
Start Date	: 03/19/2024	Latitude	: 39°40'47.54"N
Drilling Method	: HSA	Longitude	: 84°14'58.12"W

Water Levels
- During Drilling - 11 feet
- After Completion - 6 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.8	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35											
40	670				Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	12	78	11/10/13			
45	665		SP-SM			13	89	9/13/15			
50	660					14	100	11/14/15			
55	655					15	67	9/9/12			
60	650		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt	16	78	8/7/9			
65	645				Boring terminated at 60 feet.						
70	640										

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LOG OF BORING B-14

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 710.2 feet
Start Date	: 03/202024	Latitude	: 39°40'47.61"N
Drilling Method	: HSA	Longitude	: 84°14'57.70"W

Water Levels
- During Drilling - 12 feet
- After Completion - 13 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 710.2	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	710				TOPSOIL (8")						
			CL		Brown, very moist, soft, SILTY CLAY with trace sand	1	100	2/2/2		30	
5	705		CL		Gray, dark gray, and brown, very moist, medium stiff, SILTY CLAY with trace sand and trace organic matter	2	100	4/3/3	0.6	39	
			CL		Gray, dark gray, and brown, very moist, soft to medium stiff, SILTY CLAY with little sand, trace organic matter, and interbedded sand seams	3	100	6/4/2	0.4	36	
10	700		CL		Gray, dark gray, and brown, very moist, medium stiff, SILTY CLAY with little sand and trace organic matter	4	100	0/1/5	0.8	36	
		▼ ▽	CL		Gray, dark gray, and brown, very moist, hard, SILTY CLAY with little sand and trace organic matter	5	67	14/19/24		30	
15	695		SP-SM		Brown, saturated, dense, fine to medium grained, SAND with trace silt, trace to little gravel, and interbedded clay seams	6	78	14/15/21			
			SP-SM		Brown, saturated, medium dense to dense, fine to medium grained, SAND with trace silt and trace gravel	7	56	7/11/9			
20	690					8	89	13/10/12			Boring caved to 19 feet upon auger removal.
						9	78	12/15/18			
25	685										
30	680		SP-SM		Brown, saturated, dense, fine to medium grained, SAND with trace silt, trace gravel, and interbedded clay seams	10	67	13/16/15			
			SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace to little gravel	11	56	9/12/11			
35											

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LOG OF BORING B-14

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 710.2 feet
Start Date	: 03/202024	Latitude	: 39°40'47.61"N
Drilling Method	: HSA	Longitude	: 84°14'57.70"W

Water Levels
- During Drilling - 12 feet
- After Completion - 13 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 710.2	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35	675		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace to little gravel	12	78	13/10/12			
40	670					13	67	14/11/13			
45	665					14	78	10/14/15			
50	660					15	67	11/12/14			
55	655					16	72	6/9/11			
60	650				Boring terminated at 60 feet.						
65	645										
70											

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LOG OF BORING B-15

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 708.6 feet
Start Date	: 03/27/2024	Latitude	: 39°40'48.34"N
Drilling Method	: HSA	Longitude	: 84°14'58.86"W

Water Levels
- During Drilling - 11 feet
- After Completion - 9 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 708.6	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
		CL	Brown, very moist, stiff to very stiff, SILTY CLAY with trace sand and trace root material	1	67	5/4/5	2.9	27	
5	705	CL	Gray and brown, very moist, stiff, SILTY CLAY with trace sand and interbedded sand seams	2	78	7/5/5		29	Bulk sample collected from 5.0 to 10.0 feet. As received moisture content-23%.
		CL	Gray, dark gray, and brown, very moist, medium stiff, SILTY CLAY with trace sand and trace organic matter	3	67	3/3/2	0.6	50	Sample No. Bulk: Atterberg Limits Test LL = 33, PL = 19, PI = 14
10	700	SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt and trace organic matter	4	78	12/13/15	0.5	38	Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 1.9%
		CL	Gray, dark gray, and brown, very moist, very stiff, SILTY CLAY with trace sand and trace organic matter	5	89	14/11/10	0.6	40	Sample No. 3: Atterberg Limits Test LL = 42, PL = 24, PI = 18
15	695	SP-SM	Brown, saturated, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	6	67	16/19/23			Sample No. 3: Loss on Ignition (LOI) Organic Content = 3.6%
			Brown, saturated, dense to medium dense, fine to medium grained, SAND with trace silt and trace gravel	7	67	14/21/18			
20	690			8	78	12/14/11			
25	685	SP-SM		9	67	17/18/24			Boring caved to 22 feet upon auger removal.
30	680	SP-SM	Brown, saturated, dense, fine to medium grained, SAND with trace silt and trace gravel	10	100	19/23/22			
35	675		Boring terminated at 30 feet.						

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LOG OF BORING B-16

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.3 feet
Start Date	: 03/22/2024	Latitude	: 39°40'49.30"N
Drilling Method	: HSA	Longitude	: 84°14'58.33"W

Water Levels
- During Drilling - 11 feet
- After Completion - 8 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.3	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (6")						
		CL	Brown and gray, very moist, medium stiff, SILTY CLAY with trace sand	1	78	3/3/4	2.5	26	
5	705	CL	Gray and brown, moist, stiff, SILTY CLAY with little sand and interbedded sand seams	2	100	5/3/6	1.2	22	
		CH	Dark gray and gray, very moist, soft, CLAY with trace sand and trace organic matter	3	89	1/2/1		47	Sample No. 3: Atterberg Limits Test LL = 54, PL = 27, PI = 27
10	700	CL	Gray, dark gray, and brown, very moist, medium stiff to stiff, SILTY CLAY with some sand and trace organic matter	4	67	4/5/6	0.5	28	Sample No. 3: Loss on Ignition (LOI) Organic Content = 5.9%
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt	5	89	10/14/11			Bulk sample collected from 10.0 to 15.0 feet. As received moisture content-15%.
15	695	SP-SM	Brown, saturated, dense, fine to medium grained, SAND and gravel with trace silt and interbedded clay seams	6	78	15/17/19			Sample No. Bulk: Atterberg Limits Test LL = 23, PL = 15, PI = 8
		SP-SM	Brown, saturated, dense, fine to medium grained, SAND and gravel with trace silt	7	11	17/16/25			Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 1.1%
20	690	SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and some gravel	8	78	10/15/13			Boring caved to 20 feet upon auger removal.
25	685	SP-SM	Brown, saturated, dense, fine to medium grained, SAND with trace silt and trace to little gravel	9	89	14/21/17			
30	680		Boring terminated at 30 feet.	10	78	17/22/20			
35	675								

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LOG OF BORING B-17

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 709.8 feet
Start Date	: 03/22/2024	Latitude	: 39°40'50.30"N
Drilling Method	: HSA	Longitude	: 84°14'58.99"W

Water Levels
- During Drilling - 18.5 feet
- After Completion - 10 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 709.8	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
		CL	Brown and gray, slightly moist, stiff, SANDY CLAY with trace gravel	1	67	4/6/5	3.0	8	
5	705	CL	Gray and brown, moist, very stiff, SILTY CLAY with trace sand and interbedded sand seams	2	89	7/7/9	2.3	20	
		SP-SM	Brown, slightly moist, loose, fine to medium grained, SAND with trace silt	3	78	8/6/3		17	
10	700	SP-SM	Brown, slightly moist, very dense, fine to medium grained, SAND and gravel with trace silt	4	89	11/22/31			
				5	6	50-1"			
15	695	CL	Gray, slightly moist, very stiff to hard, SANDY CLAY with trace gravel	6	89	12/17/13	>6.0	9	
				7	67	10/14/17	>6.0	11	Boring caved to 17 feet upon auger removal.
20	690	SP-SM	Brown, saturated, dense to very dense, fine to medium grained, SAND with trace silt and trace gravel	8	100	15/19/21			
25	685			9	89	19/12/25			
30	680			10	67	20/23/28			
35	675		Boring terminated at 30 feet.						

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LOG OF BORING B-18

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 708.7 feet
Start Date	: 03/27/2024	Latitude	: 39°40'51.21"N
Drilling Method	: HSA	Longitude	: 84°14'59.33"W

Water Levels
- During Drilling - 18.5 feet
- After Completion - 11 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 708.7	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (8")						
		CL	Brown and gray, slightly moist, stiff to very stiff, SANDY CLAY with trace gravel and trace organic matter	1	89	6/9/5	2.8	14	Bulk sample collected from 0.0 to 5.0 feet. As received moisture content- 8%.
	705								
5		CL	Gray and brown, moist, very stiff, SILTY CLAY with little sand and interbedded sand seams	2	78	5/9/7	2.5	18	Sample No. Bulk: Atterberg Limits Test LL = 31, PL = 19, PI = 12
				3	67	6/7/7		24	Sample No. Bulk: Loss on Ignition (LOI) Organic Content = 1.6%
		SM	Brown, slightly moist, medium dense, SILTY SAND						
	700								
10		SP-SM	Brown, slightly moist, dense, fine to medium grained, SAND and gravel with trace silt	4	78	7/13/28			
			COBBLES	5	89	12/14/19			
	695								
15		CL	Gray, slightly moist, very stiff to hard, SANDY CLAY with trace gravel	6	78	9/11/14	5.9	11	
				7	100	13/18/15	4.8	10	
	690								
20			Gray, saturated, dense to very dense, fine to medium grained, SAND with trace silt and trace gravel	8	89	21/20/22			Boring caved to 20 feet upon auger removal.
	685	SP-SM		9	78	22/26/23			
25									
	680			10	100	22/27/29			
30			Boring terminated at 30 feet.						
	675								
35									

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BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM
FIELD CLASSIFICATION SYSTEM
FOR SOIL EXPLORATION

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	-4 blows/ft. or less
Loose	-5 to 10 blows/ft.
Medium Dense	-11 to 30 blows/ft.
Dense	-31 to 50 blows/ft.
Very Dense	-51 blows/ft. or more

Grain Size Terminology

Soil Fraction	Particle Size	US Standard Sieve Size
Boulders	Larger than 12”	Larger than 12”
Cobbles	3” to12”	3” to 12”
Gravel: Coarse	¾” to 3”	¾” to 3”
Small	4.76mm to ¾”	#4 to ¾”
Sand: Coarse	2.00mm to 4.76mm	#10 to #4
Medium	0.42mm to 2.00mm	#40 to #10
Fine	0.074mm to 0.42mm	#200 to #40
Silt	0.005mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005mm	Smaller than #200

RELATIVE PROPORTIONS FOR SOILS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Unconfined Compressive Strength (tons/sq. ft.)	Field Identification (Approx.) SPT Blows/ft.
Very Soft	Less than 0.25	0 - 2
Soft	0.25 – < 0.5	3 - 4
Medium Stiff	0.5 - < 1.0	5 - 8
Stiff	1.0 - < 2.0	9 -15
Very Stiff	2.0 - < 4.0	16 - 30
Hard	Over 4.0	> 30

Classification on logs are made by visual inspection.

Standard Penetration Test - Driving a 2.0” O.D., $1^{3/8}$” I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for **Patriot** to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6.0 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.).

Strata Changes - In the column “Soil Descriptions” on the drill log the horizontal lines represent strata changes. A solid line (————) represents an actually observed change, a dashed line (- - - - - -) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

Groundwater symbols: ▼-observed groundwater elevation, encountered during drilling; ∇-observed groundwater elevation upon completion of boring.

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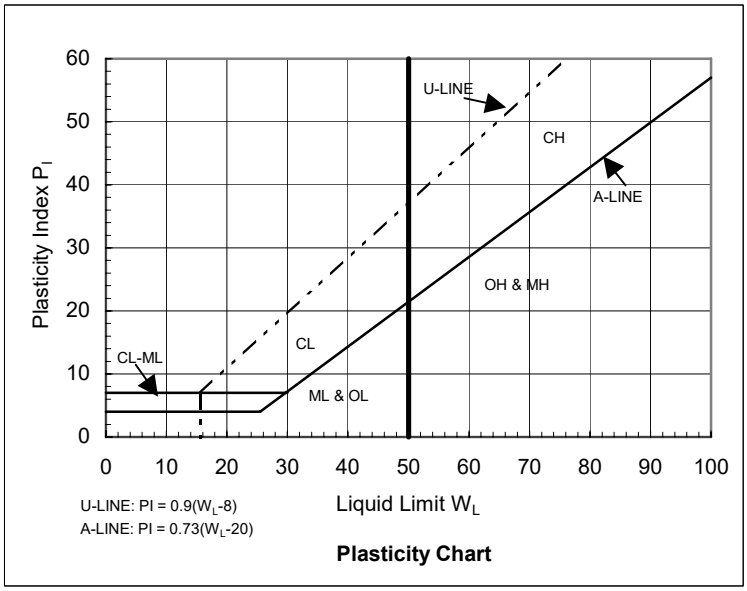
Unified Soil Classification System

Major Divisions			Group Symbol		Typical Names	Classification Criteria for Coarse-Grained Soils		
Coarse-grained soils (more than half of material is larger than No. 200)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	$C_U \geq 4$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{D^2_{30}}{D_{10} D_{60}}$
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW ($C_U < 4$ or $1 > C_C > 3$)		
		Gravels with fines (appreciable amount of fines)	GM	d u l	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A line or $P_I < 4$	Above A line with $4 < P_I < 7$ are borderline cases requiring use of dual symbols	
			GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above A line or $P_I > 7$		
	Sands (more than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_U \geq 6$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{(D_{30})^2}{D_{10} D_{60}}$
			SP		Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW ($C_U < 6$ or $1 > C_c > 3$)		
		Sands with fines (appreciable amount of fines)	SM	d u l	Silty sands, sand-silt mixtures	Atterberg limits below A line or $P_I < 4$	Limits plotting in hatched zone with $4 \leq P_I \leq 7$ are borderline cases requiring use of dual symbols	
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above A line with $P_I > 7$		
Fine-grained soils (more than half of material is smaller than No. 200)	Silt and clays (liquid limit <50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Determine percentages of sand and gravel from grain size curve. 2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5% - GW, GP, SW, SP More than 12% - GM, GC, SM, SC 5-12% - Borderline cases requiring dual symbols		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (liquid limit >50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays or high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		PT		Peat and other highly organic soils			



Plasticity Chart

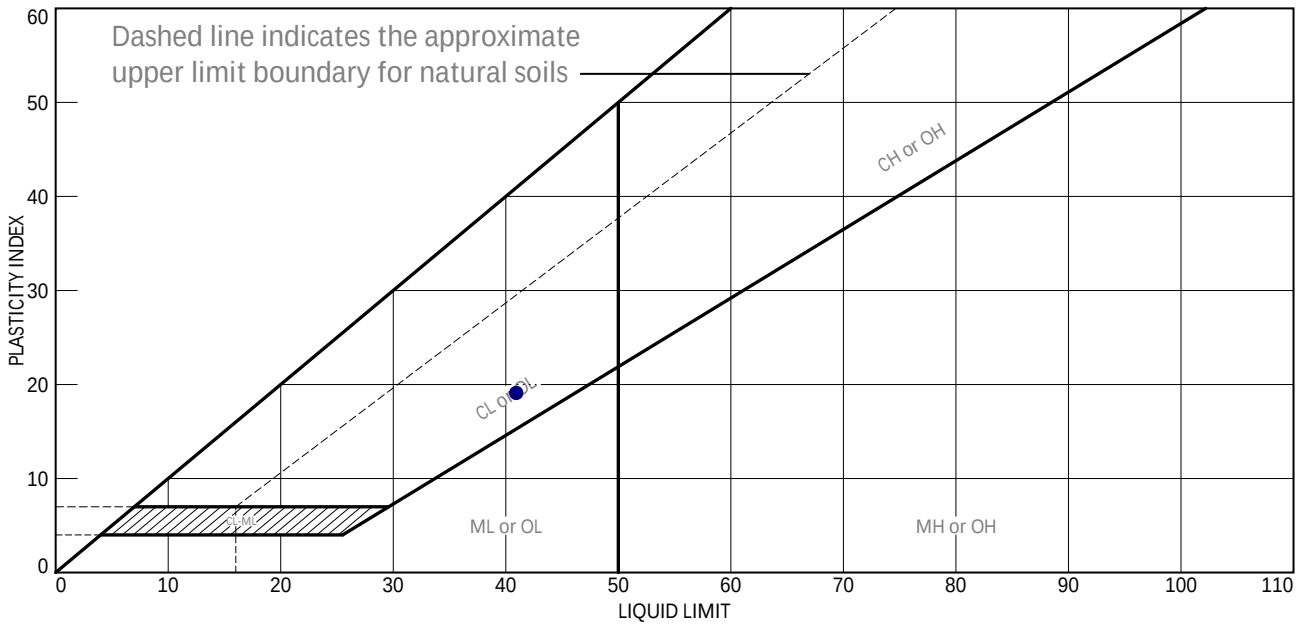
APPENDIX B

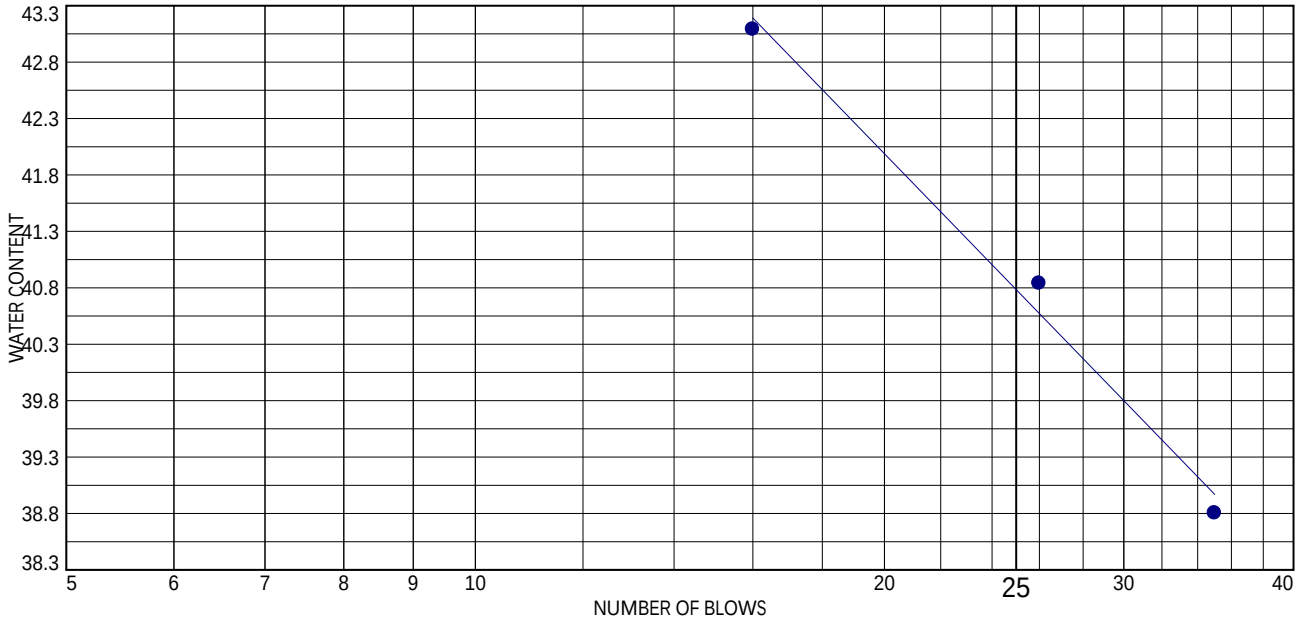
Atterberg Limits

Standard Proctor

Loss on Ignition (LOI)

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown and gray SILTY CLAY with trace sand and trace organic matter	41	22	19			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-1 Depth: 0.0-5.0 feet
Sample Number: Bulk

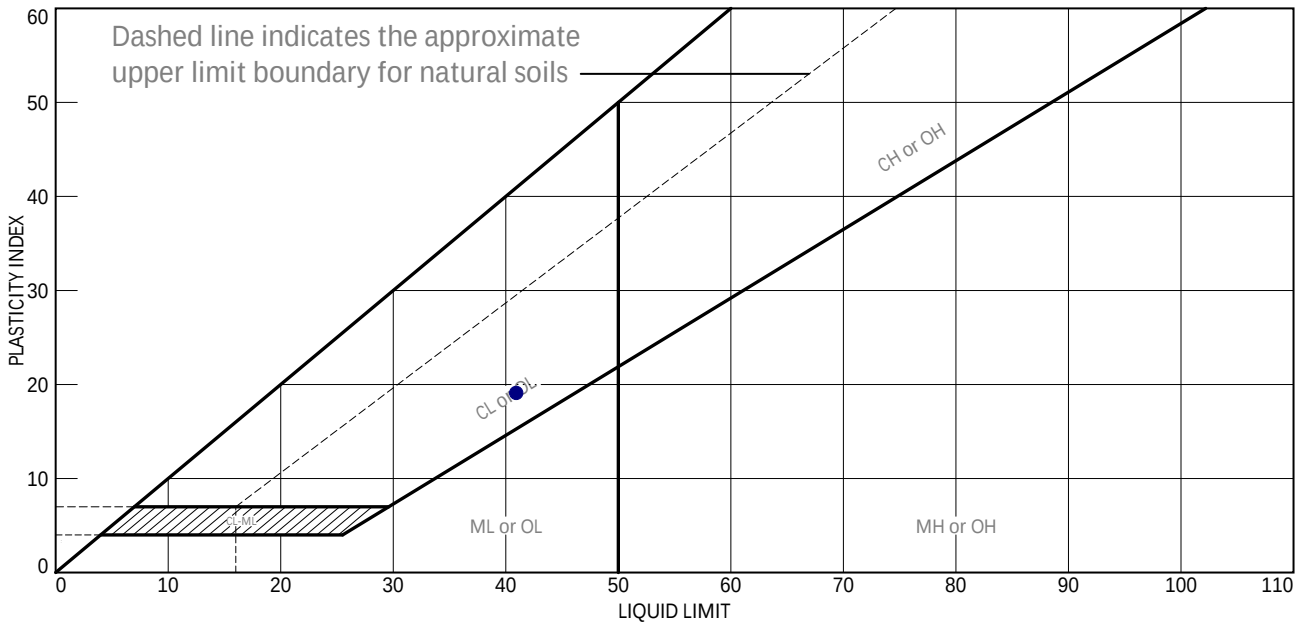
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

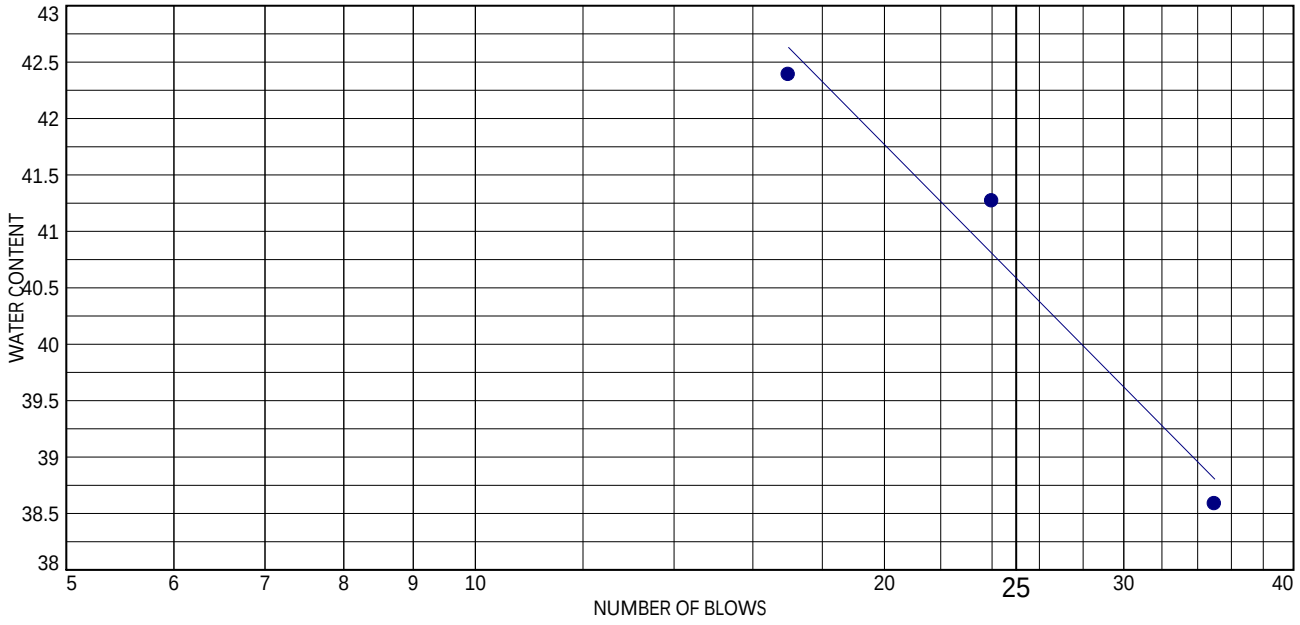
Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown and gray SILTY CLAY with trace sand and trace organic matter	41	22	19			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-2 Depth: 5.0-10.0 feet
Sample Number: Bulk

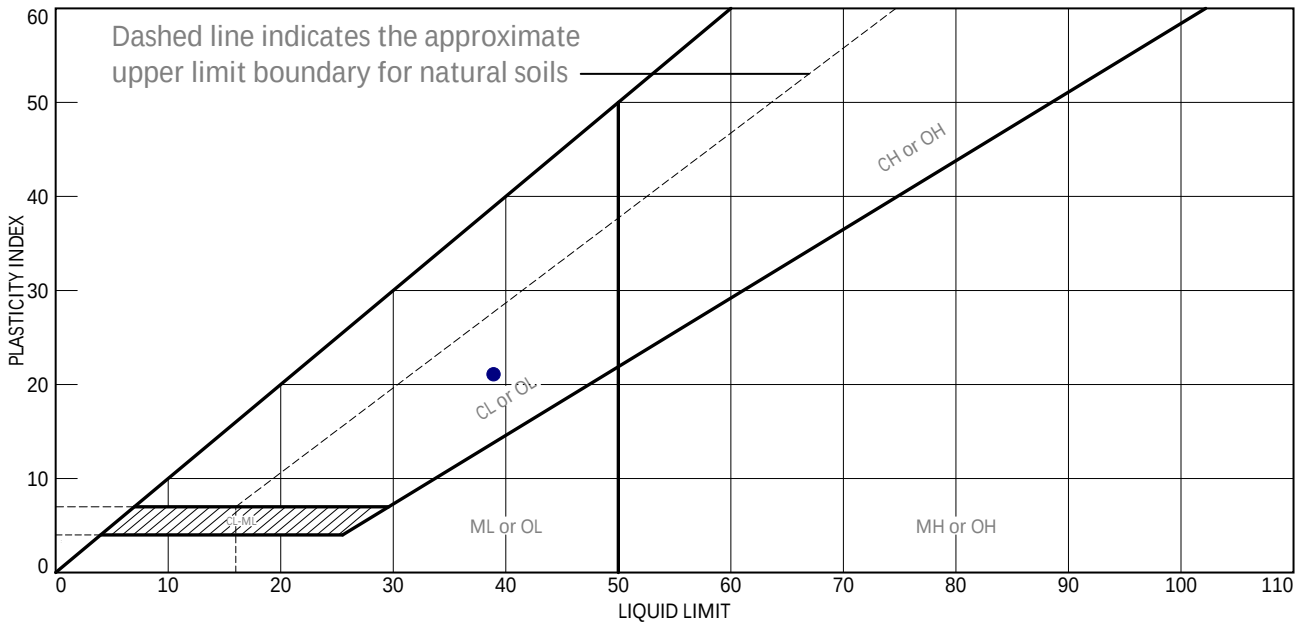
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

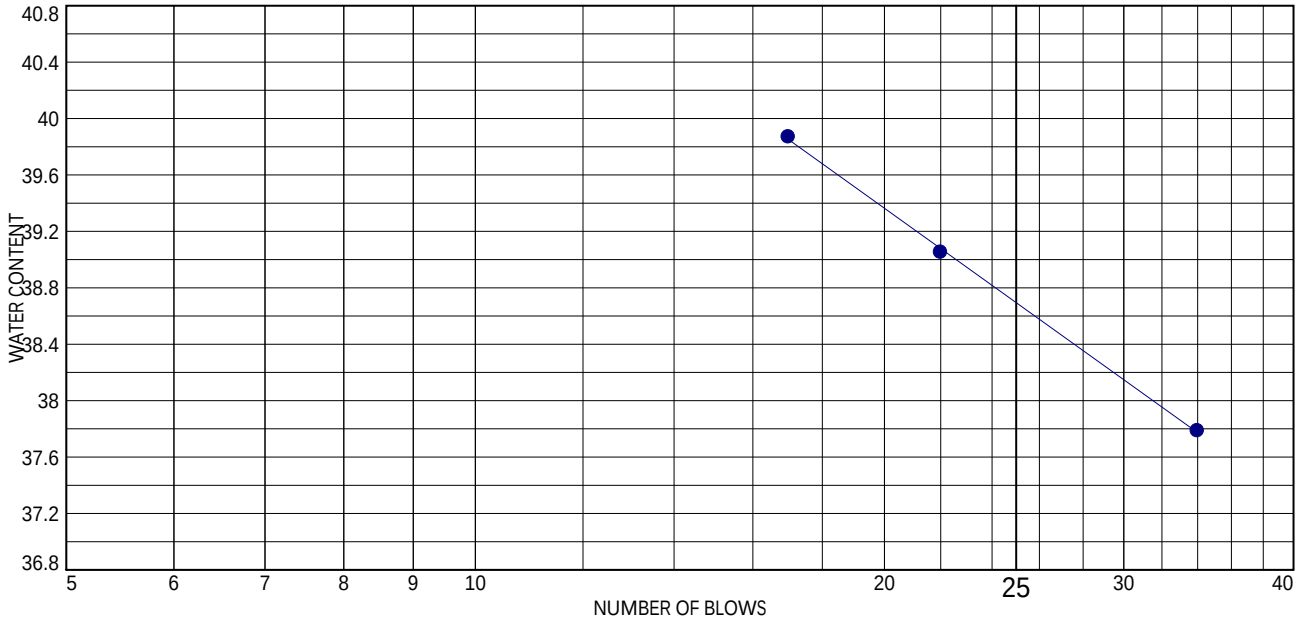
Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray and brown SILTY CLAY with trace sand and trace organic matter	39	18	21			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-3 Depth: 1.0-2.5 feet
Sample Number: SS-1

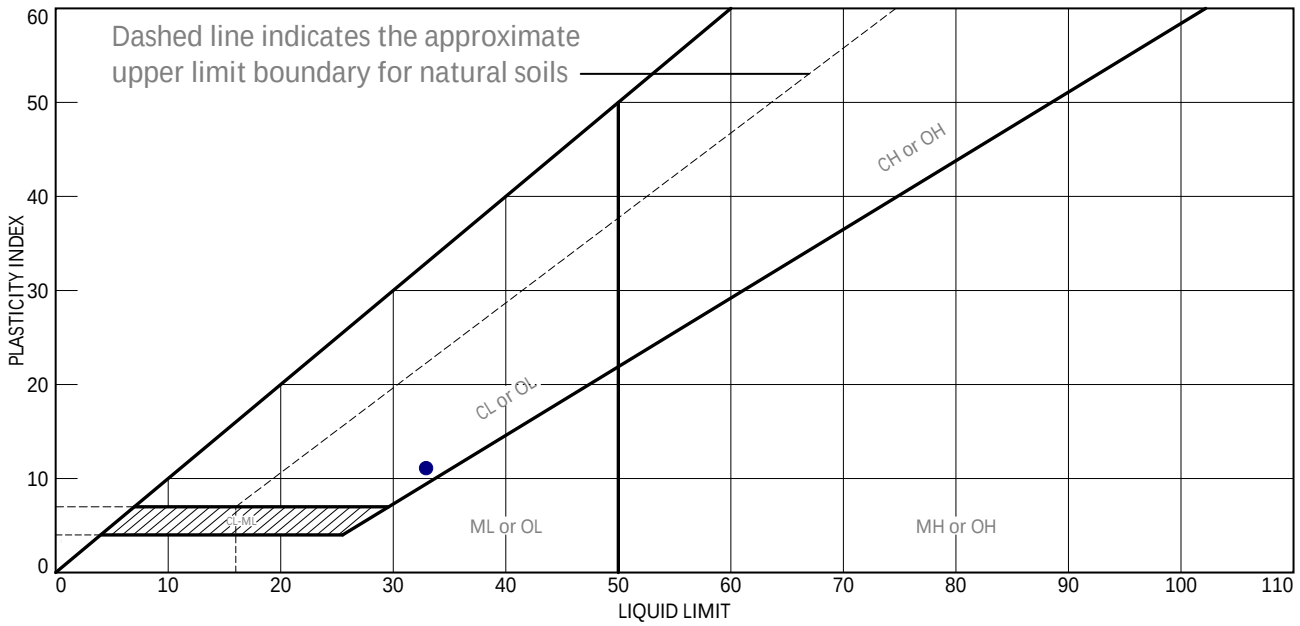
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

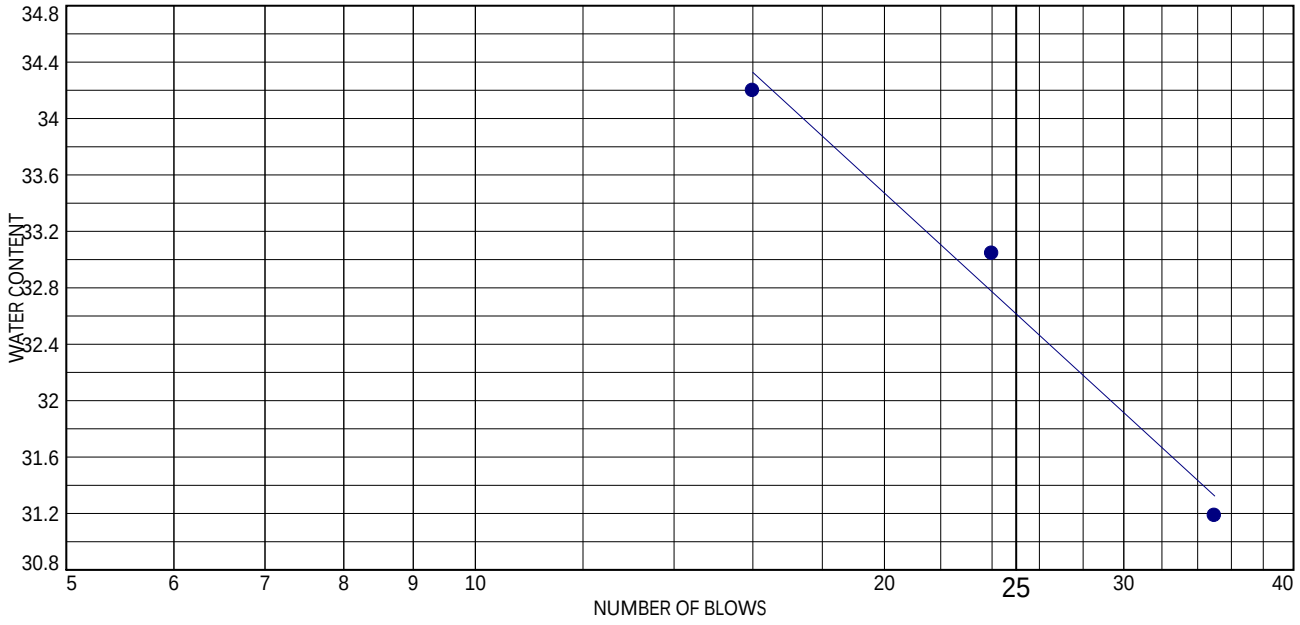
Indianapolis, Indiana

Remarks:

Tested By: J. Rogers Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown SILTY CLAY with trace sand, trace gravel, and trace organic matter	33	22	11			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-4 Depth: 10.0-15.0 feet

Sample Number: Bulk

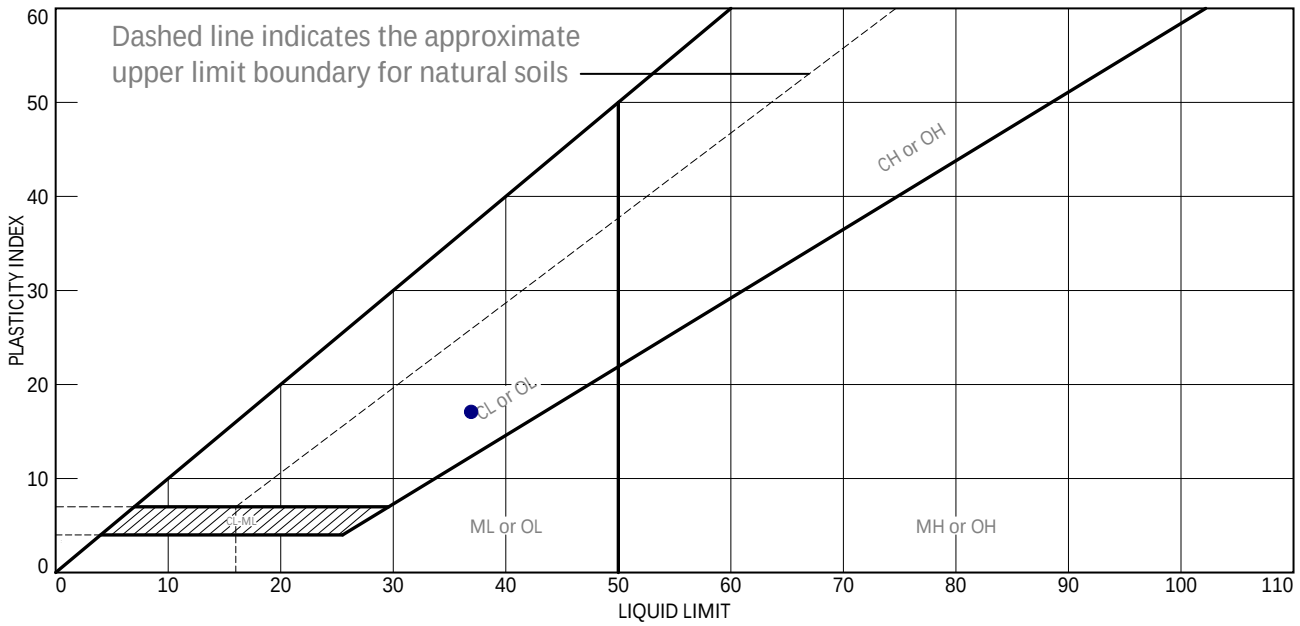
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

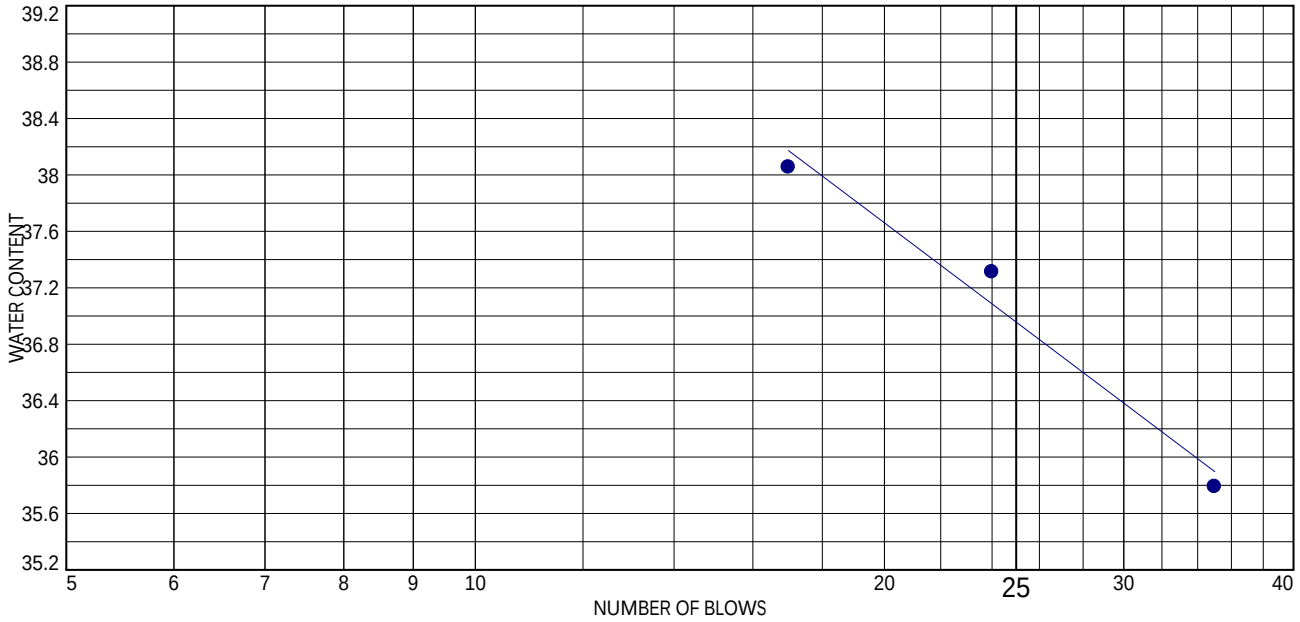
Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown and gray SILTY CLAY with trace to little sand, trace gravel, and trace organic matter	37	20	17			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-5 Depth: 0.0-5.0 feet

Sample Number: Bulk

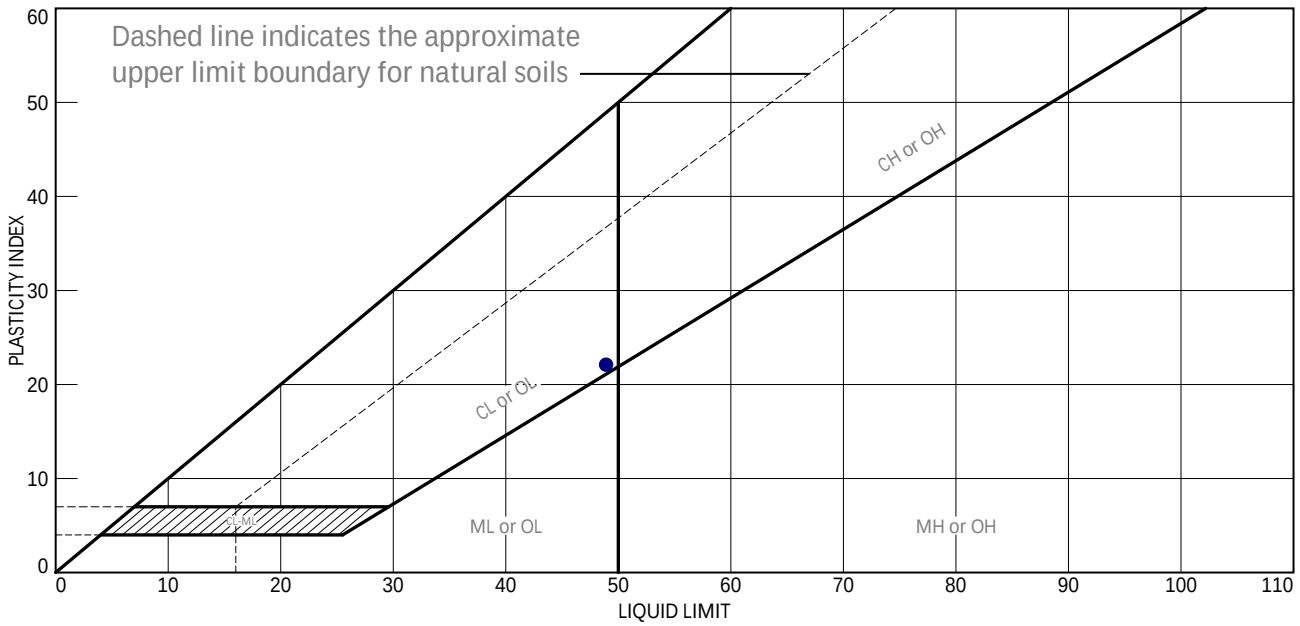
Remarks:

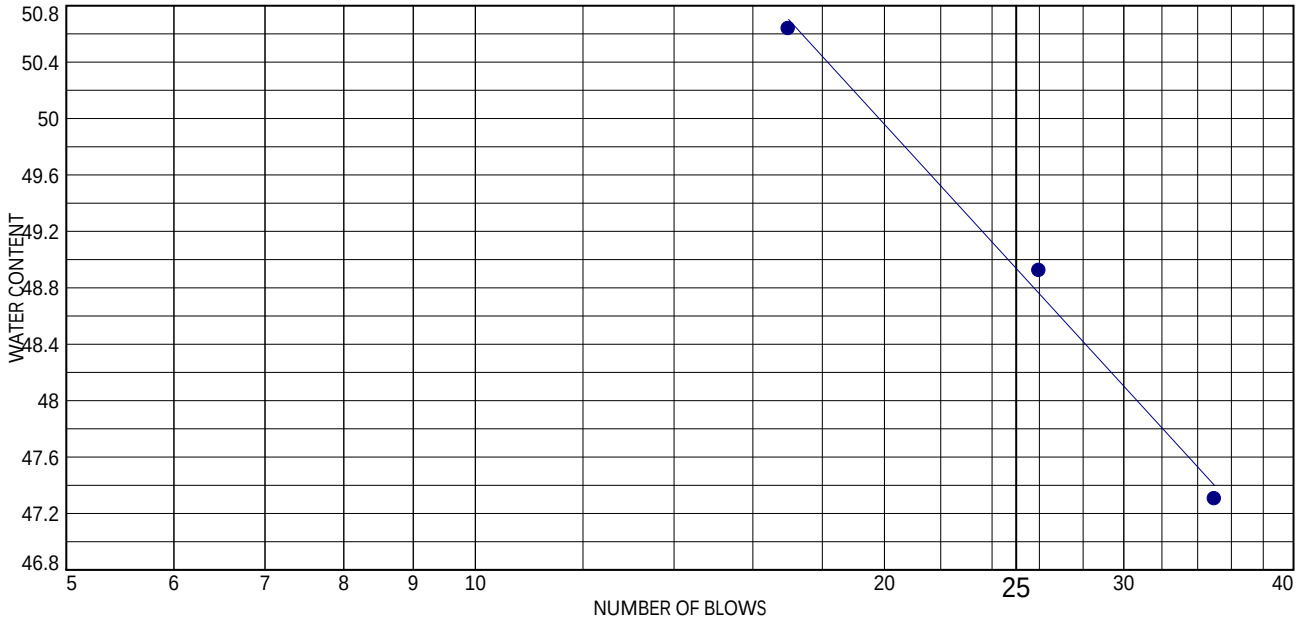
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

Indianapolis, Indiana

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, dark gray, and brown SILTY CLAY with trace sand and trace organic matter	49	27	22			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-5 Depth: 6.0-7.5 feet
Sample Number: SS-3

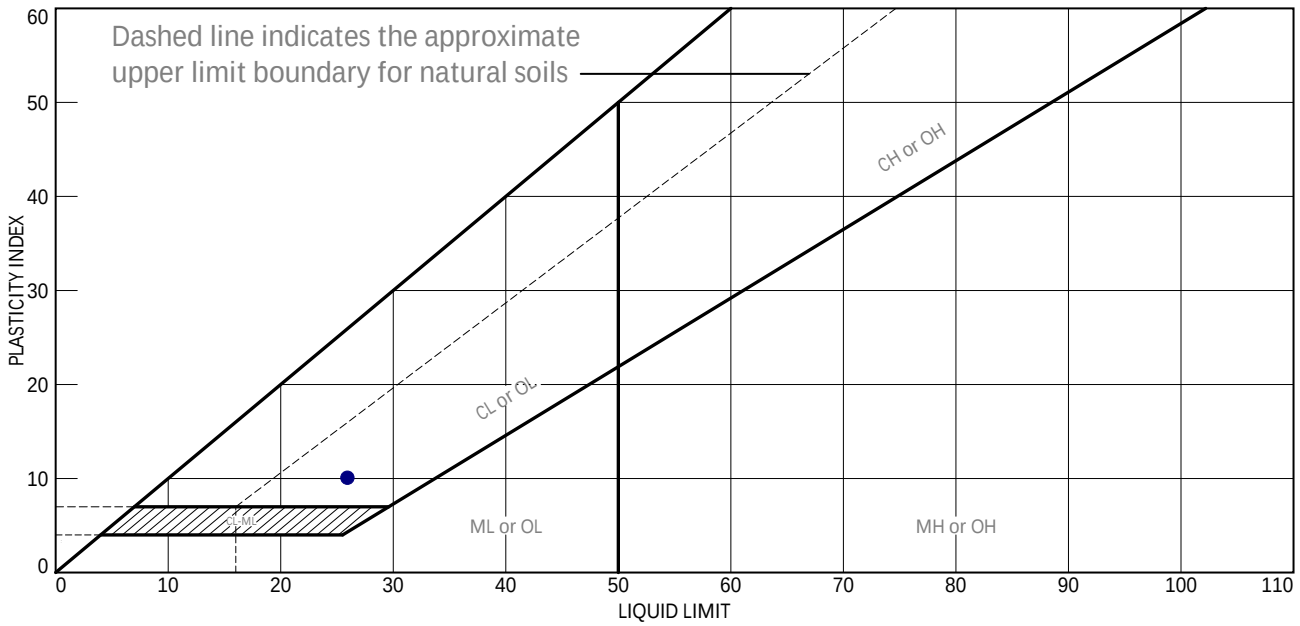
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

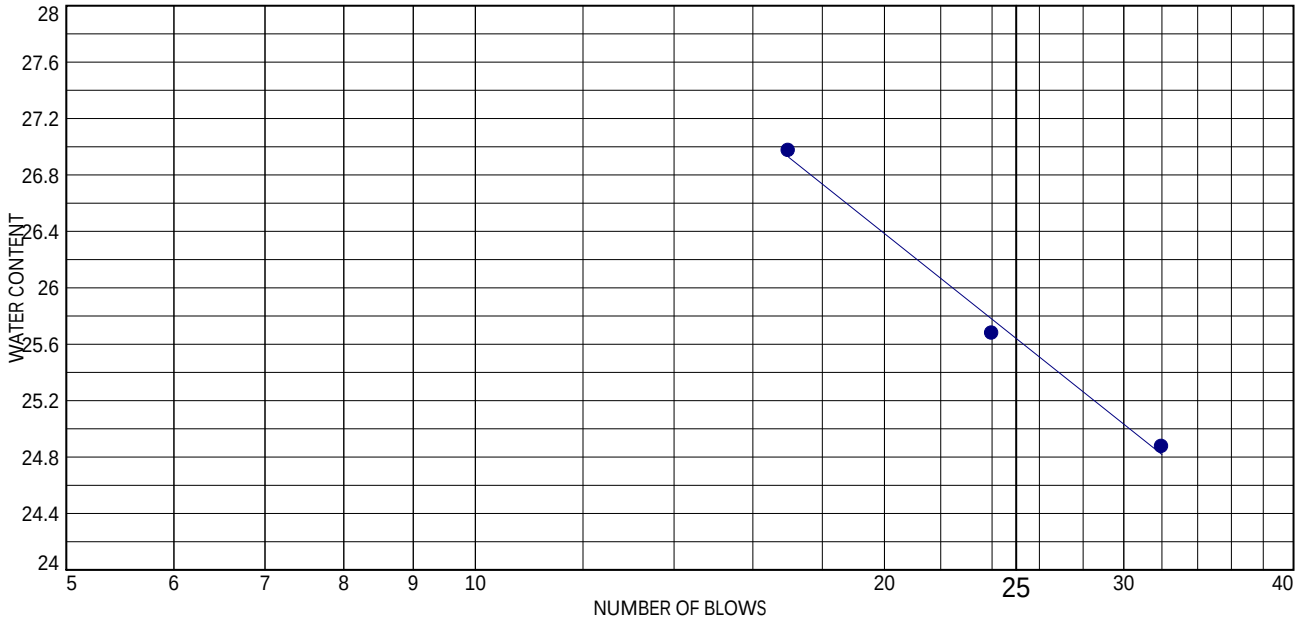
Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray and brown SILTY CLAY with trace sand and trace organic matter	26	16	10			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-8 Depth: 5.0-10.0 feet

Sample Number: Bulk

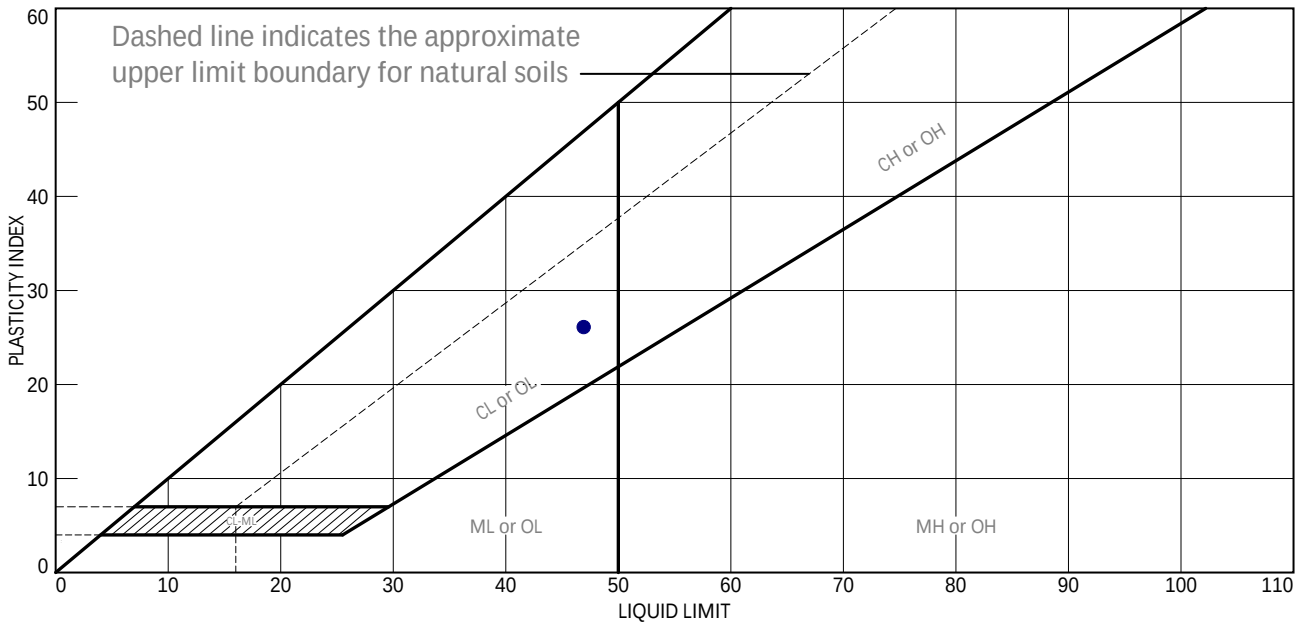
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

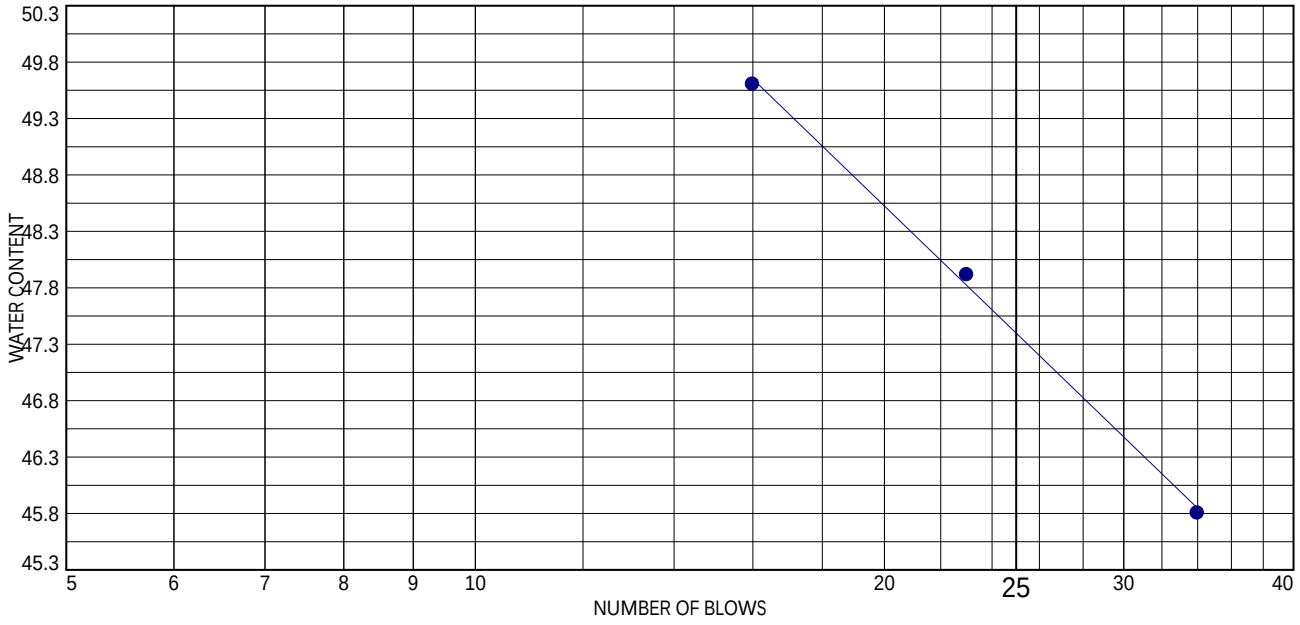
Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray and brown SILTY CLAY with trace sand and trace organic matter	47	21	26			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-9 Depth: 8.5-10.0 feet
Sample Number: SS-4

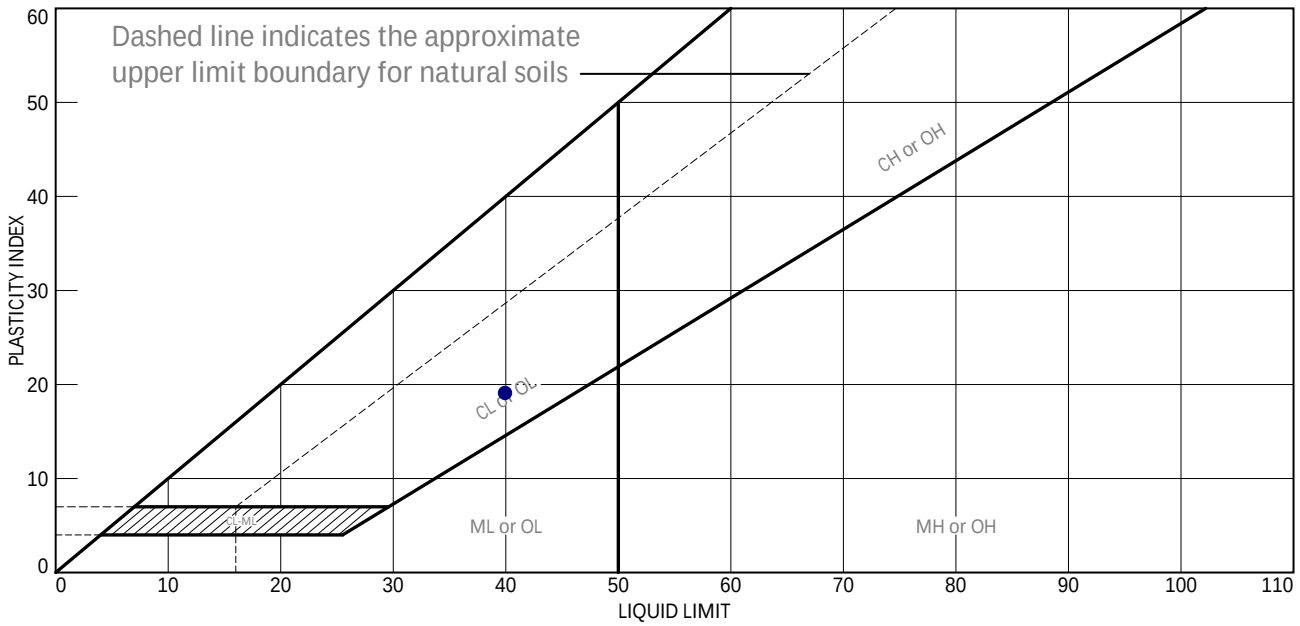
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

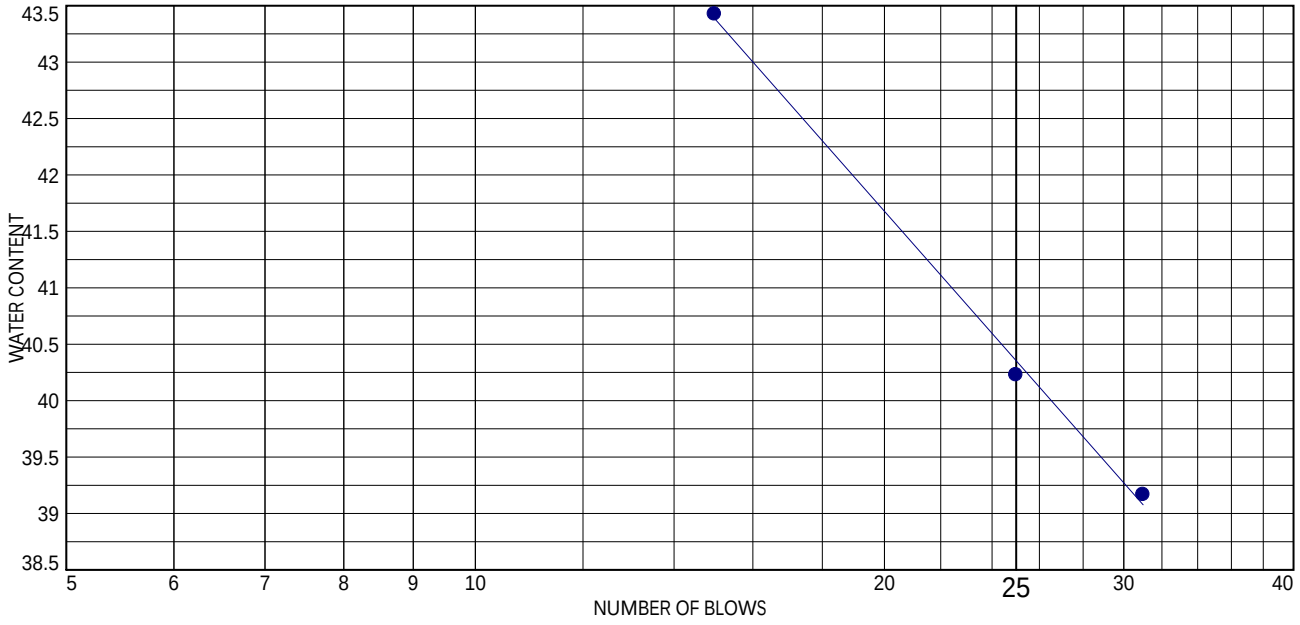
Indianapolis, Indiana

Remarks:

Tested By: J. Rogers Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown SILTY CLAY with trace sand and trace organic matter	40	21	19			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-11 Depth: 0.0-5.0 feet

Sample Number: Bulk

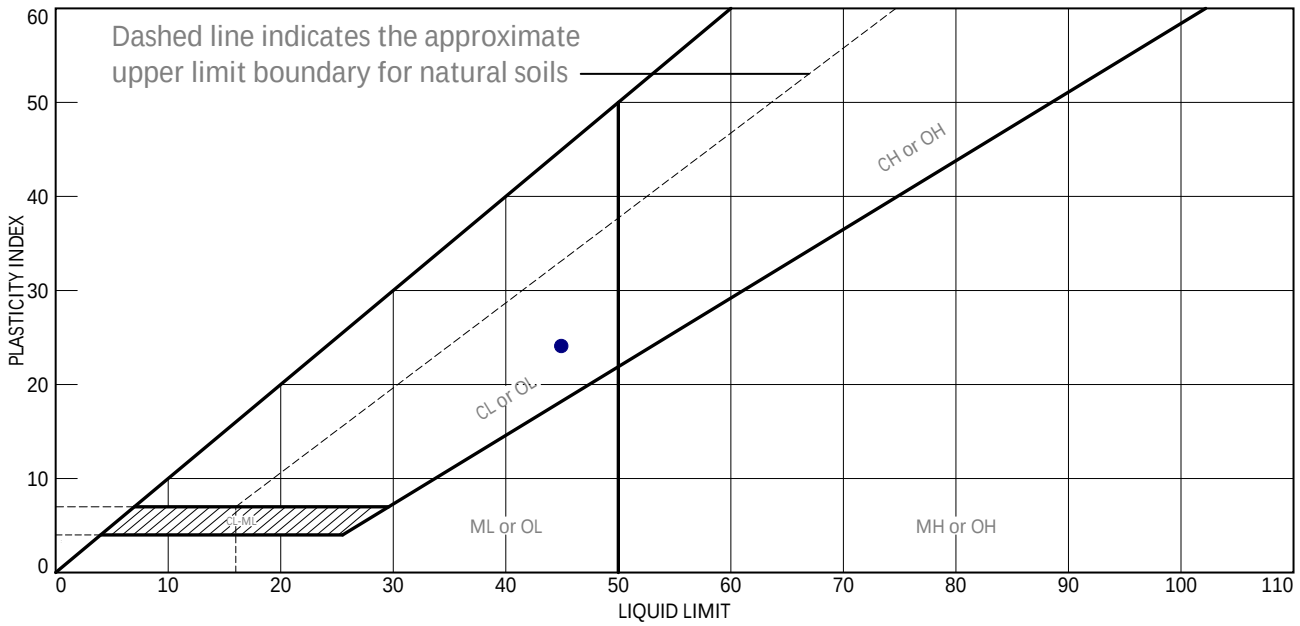
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

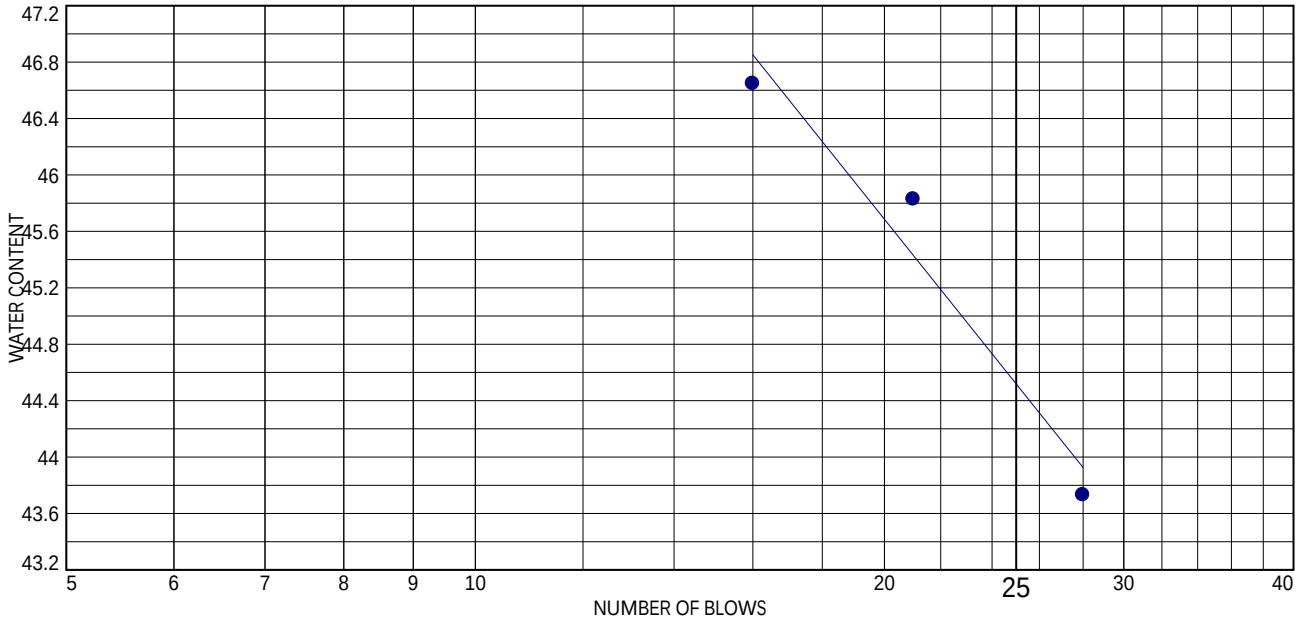
Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray and brown, SILTY CLAY with little sand and trace organic matter	45	21	24			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-12 Depth: 6.0-7.5 feet
Sample Number: SS-3

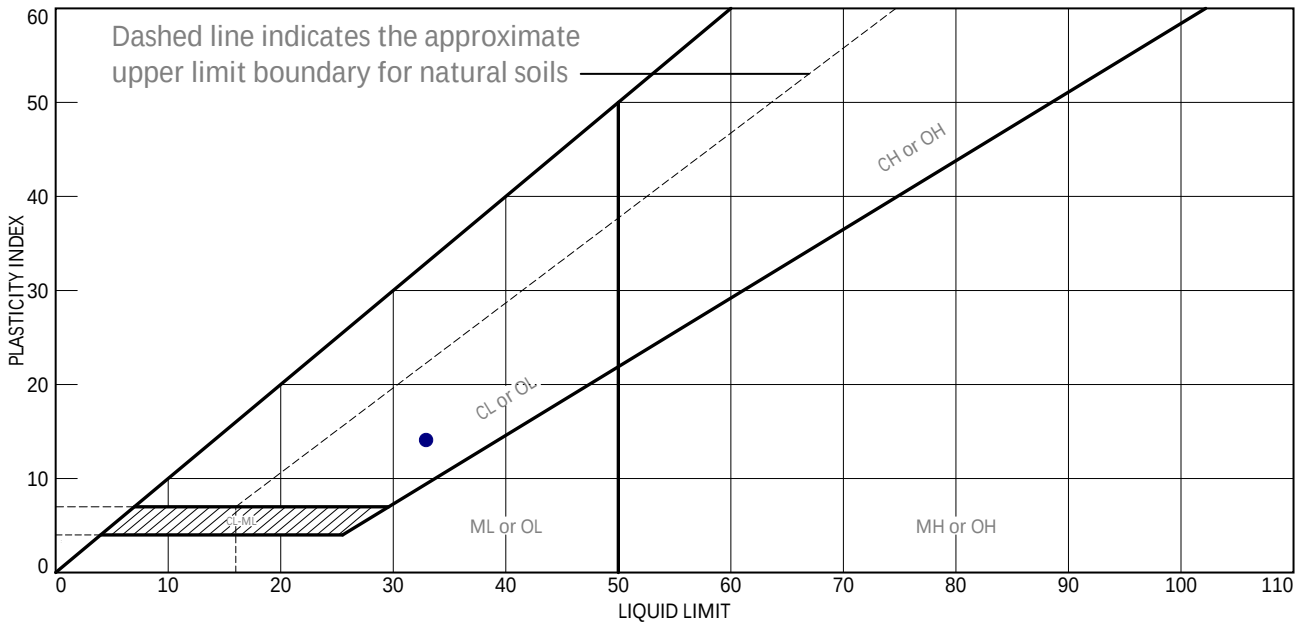
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

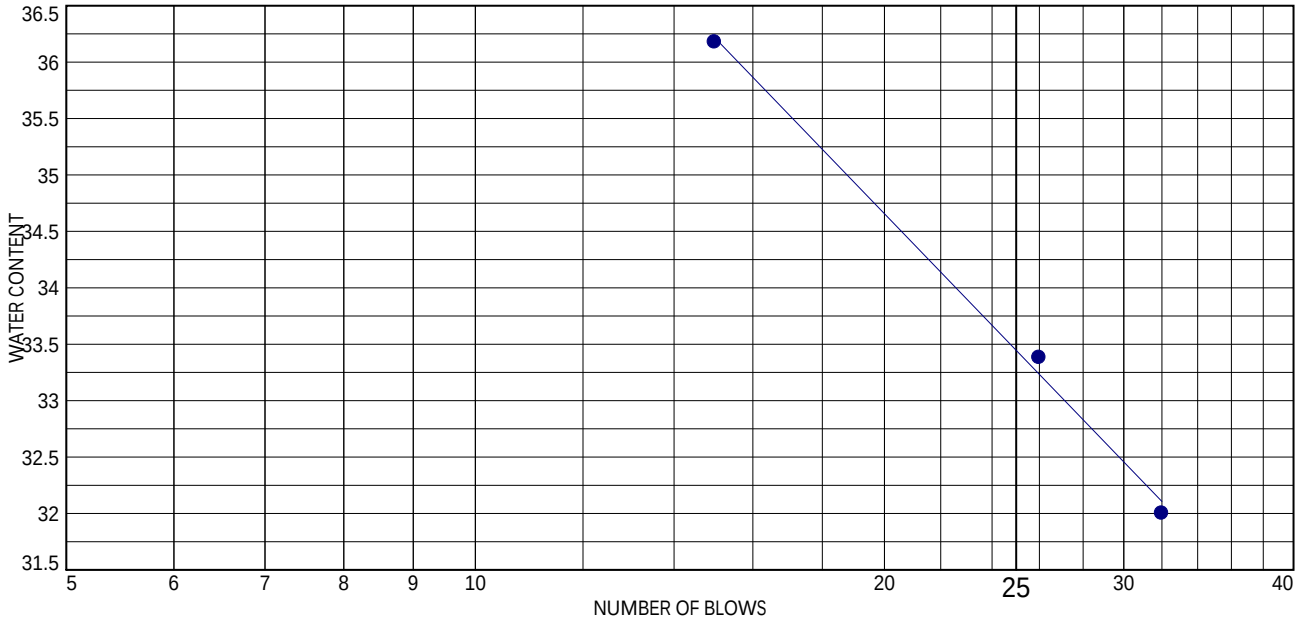
Indianapolis, Indiana

Remarks:

Tested By: J. Rogers Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray and brown SILTY CLAY with trace sand, trace organic matter, and interbedded sand seams	33	19	14			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-15 Depth: 5.0-10.0 feet

Sample Number: Bulk

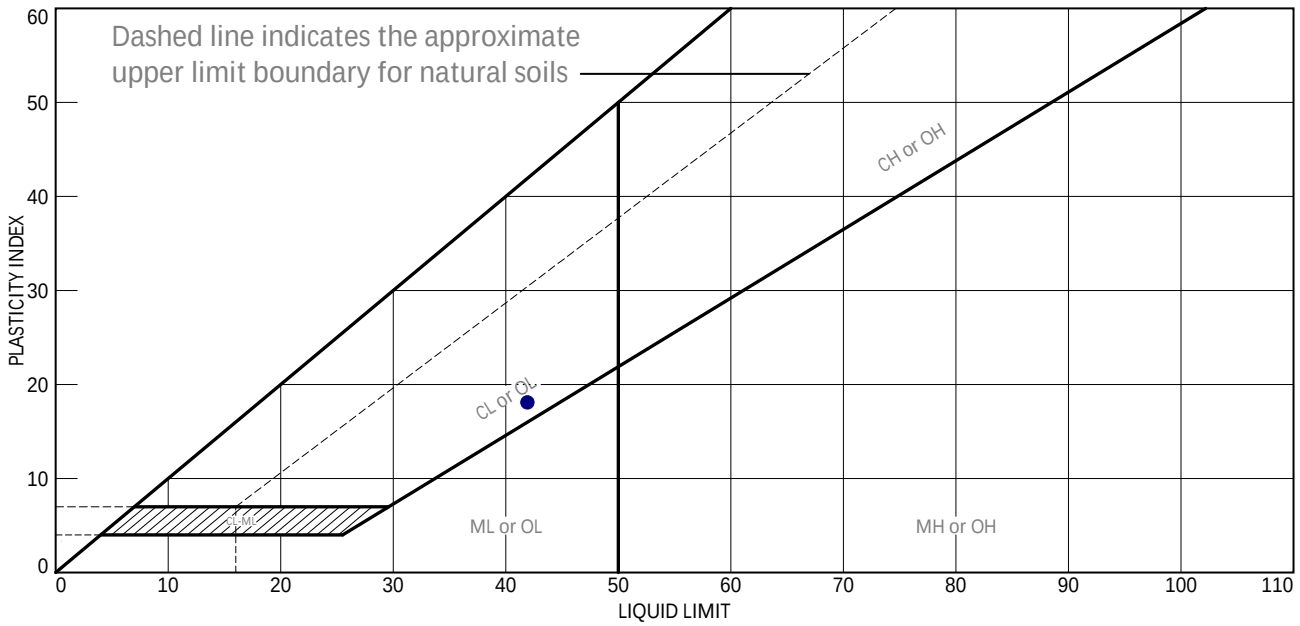
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

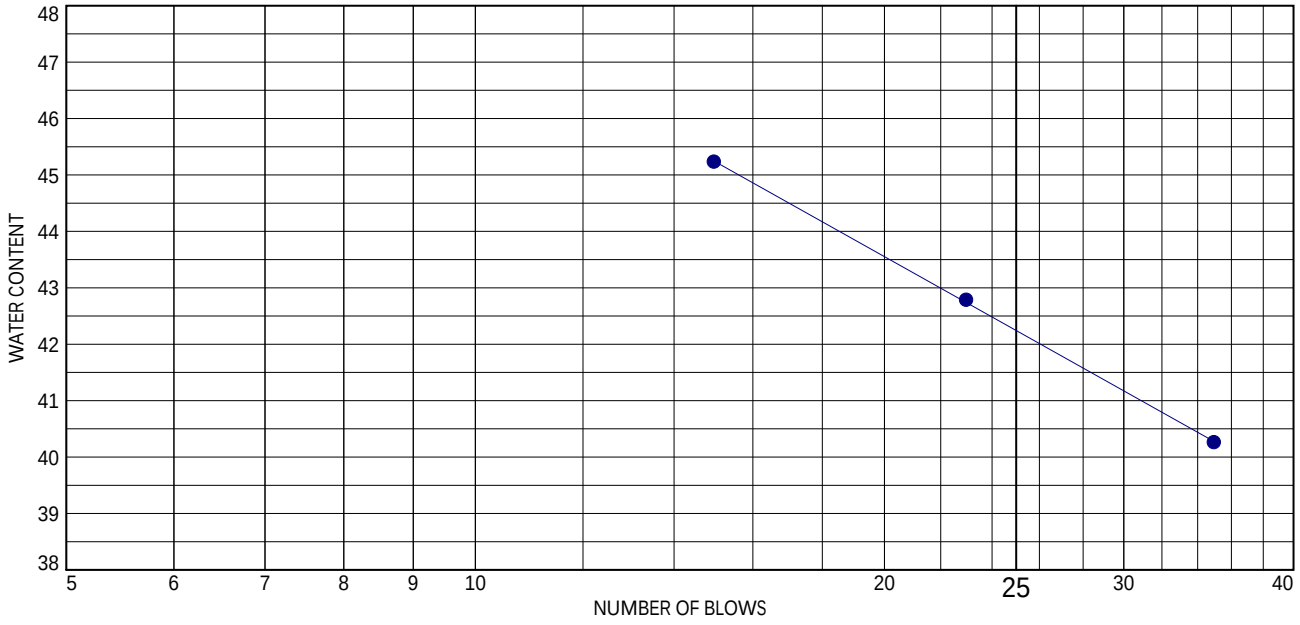
Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, dark gray, and brown, SILTY CLAY with trace sand and trace organic matter	42	24	18			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-15 Depth: 6.0-7.5 feet
Sample Number: SS-3

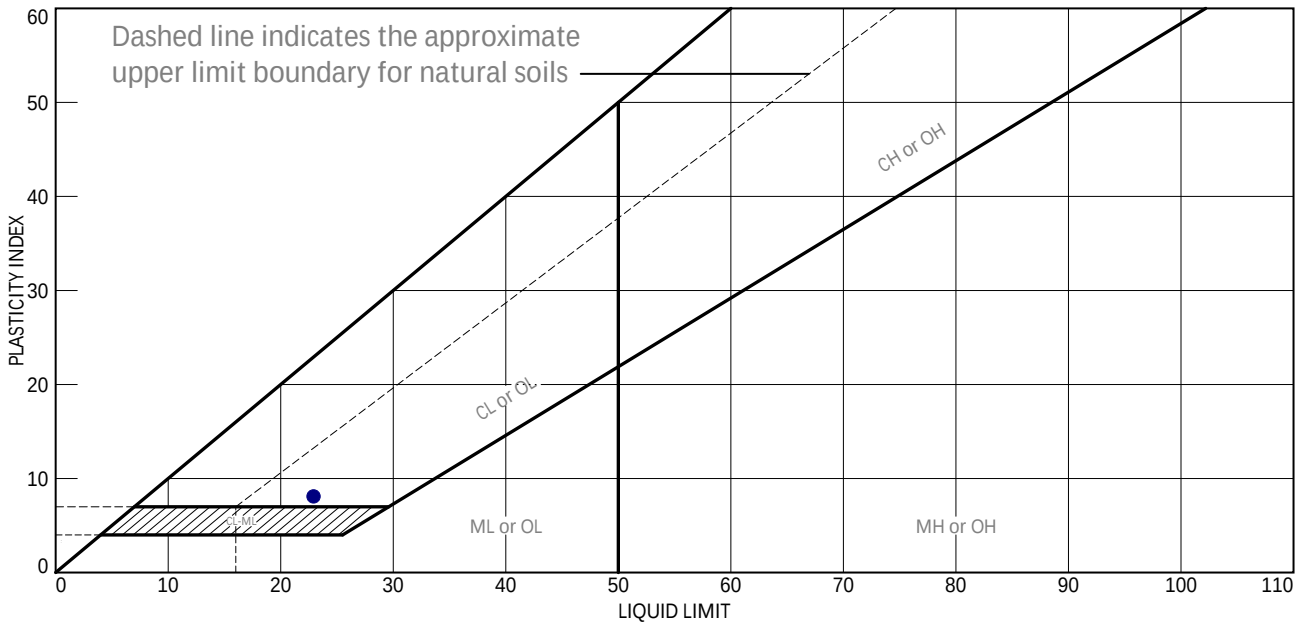
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, dark gray, and brown SILTY CLAY with some sand and trace organic matter	23	15	8			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-16 Depth: 10.0-15.0 feet

Sample Number: Bulk

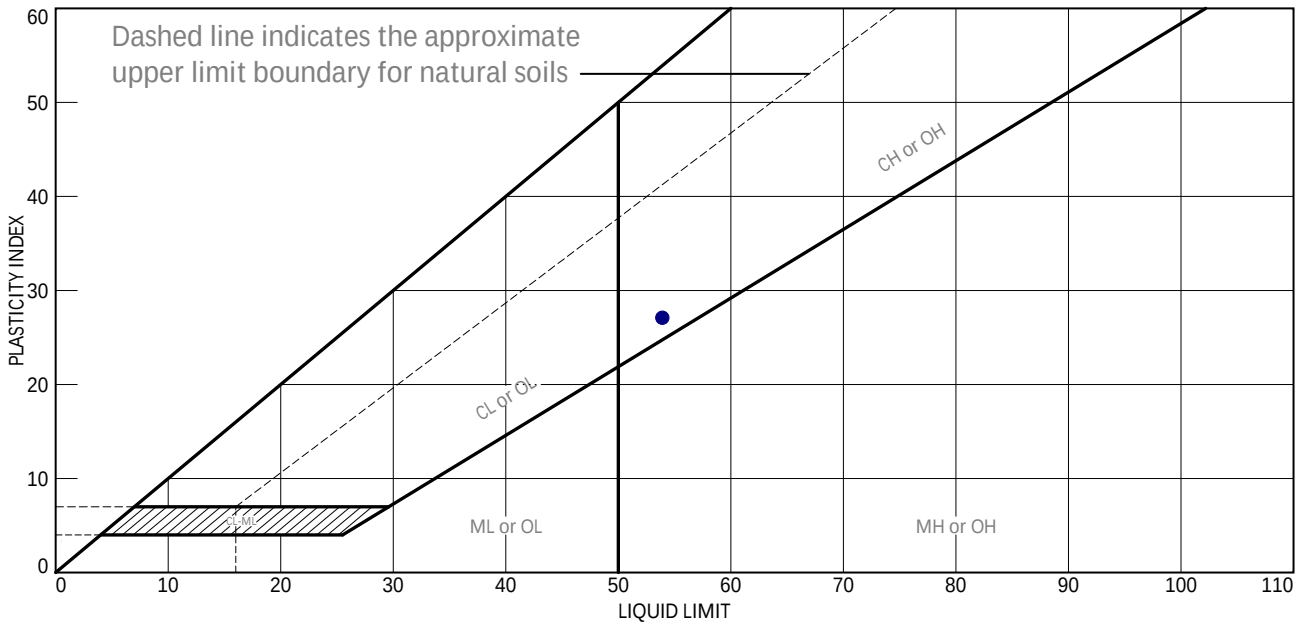
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

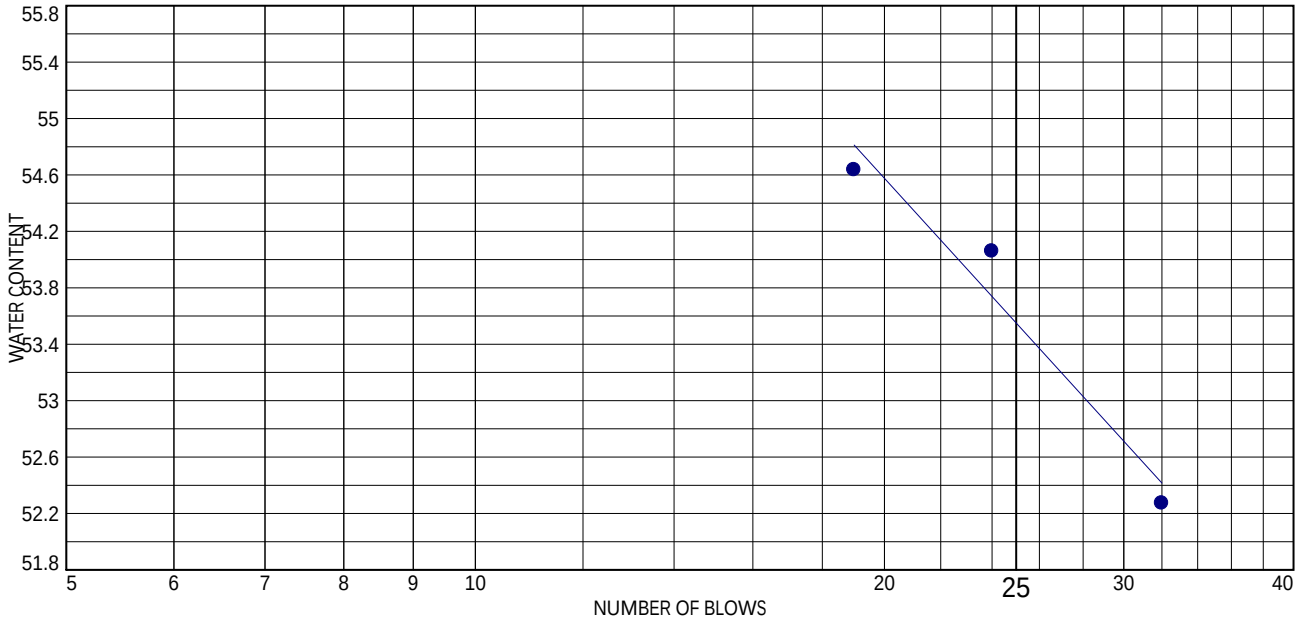
Indianapolis, Indiana

Remarks:

Tested By: J. Rogers Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark gray and gray CLAY with trace sand and trace organic matter	54	27	27			CH

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-16 Depth: 6.0-7.5 feet
Sample Number: SS-3

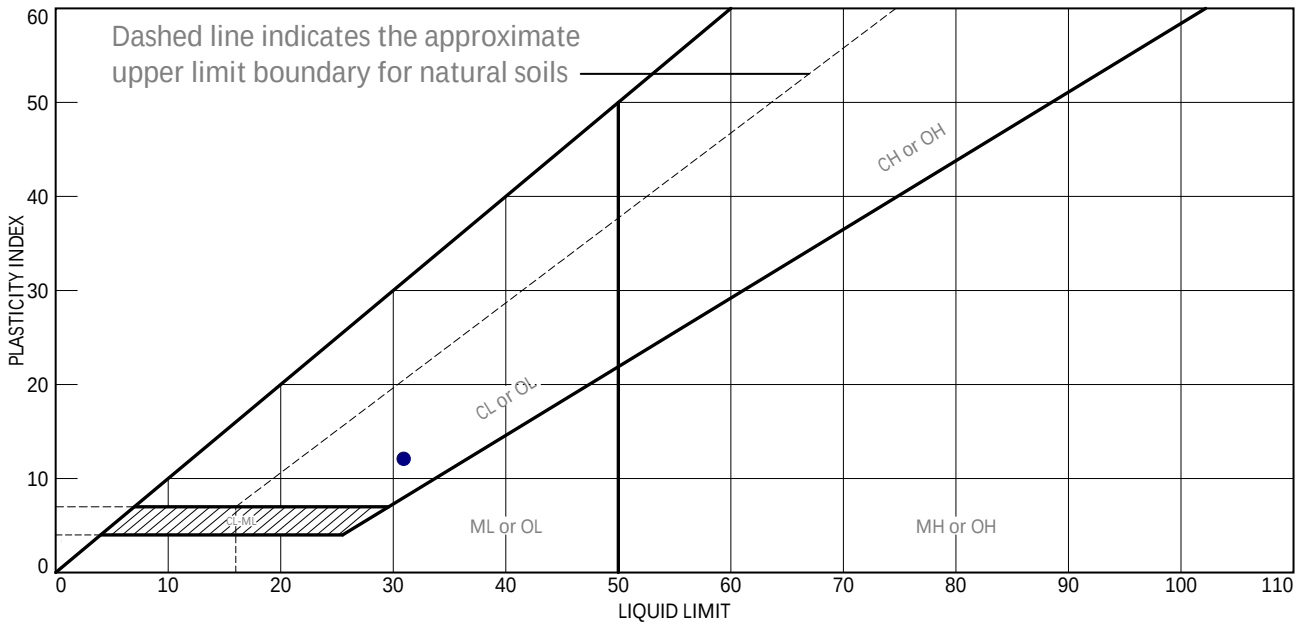
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

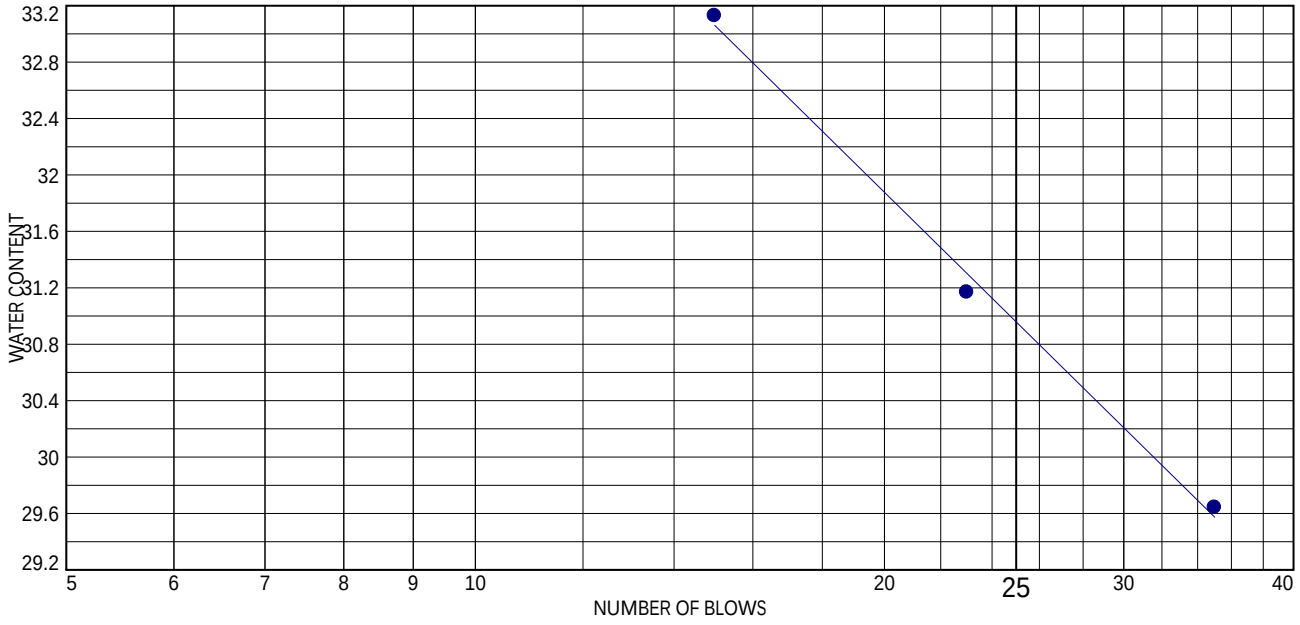
Indianapolis, Indiana

Remarks:

Tested By: J. Rogers Checked By: S. Lauletta

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown and gray SANDY CLAY with trace gravel and trace organic matter	31	19	12			CL

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Source of Sample: B-18 Depth: 0.0-5.0 feet

Sample Number: Bulk

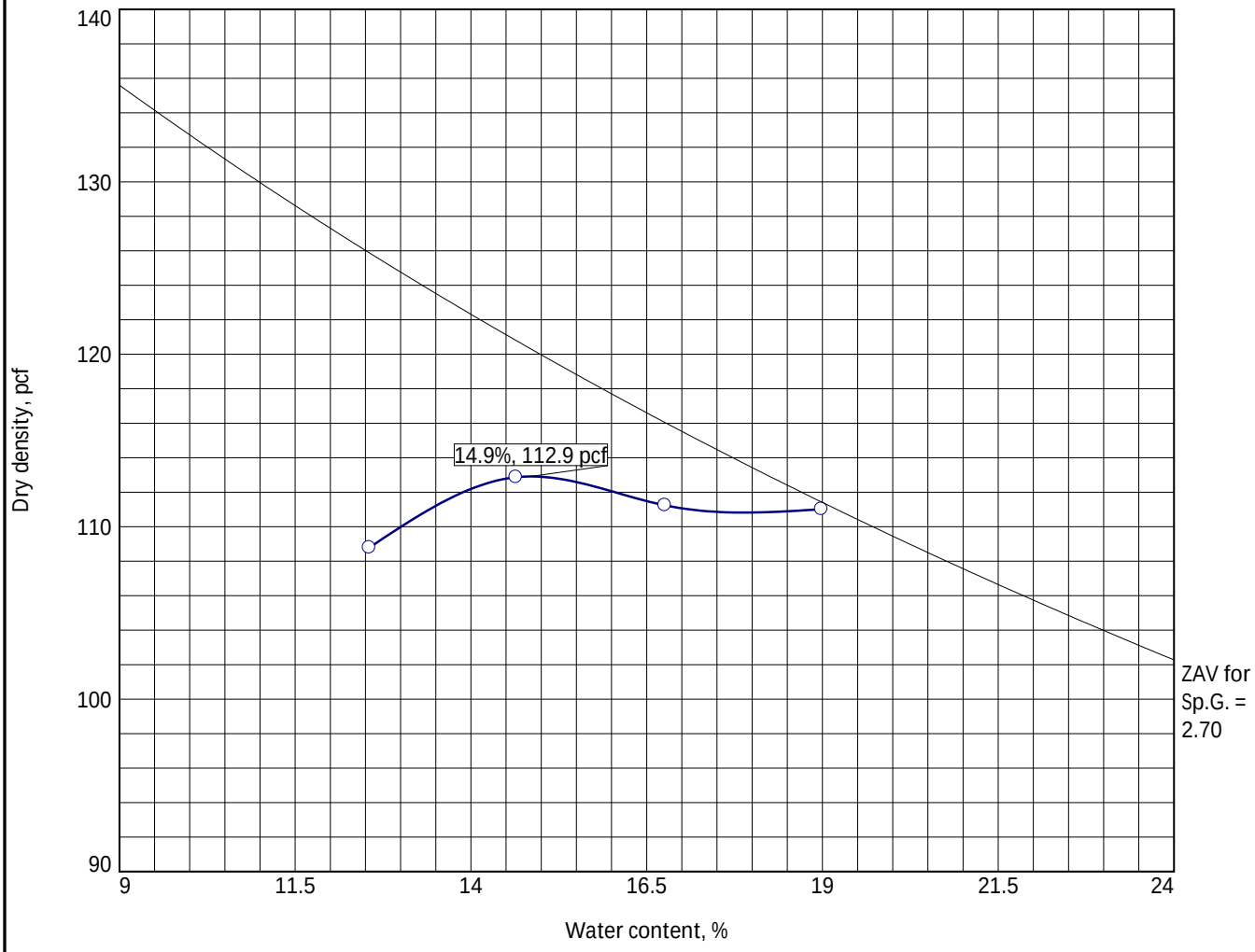
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

Indianapolis, Indiana

Remarks:

Tested By: E. Bergel Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method B Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0.0-5.0 feet	CL		30.8	2.7	41	19	7.4	

ROCK CORRECTED TEST RESULTS

Maximum dry density = 112.9 pcf

Optimum moisture = 14.9 %

MATERIAL DESCRIPTION

Brown and gray SILTY CLAY with trace sand and trace organic matter

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Date: 05/22/2024

○ Source of Sample: B-1 Sample Number: Bulk

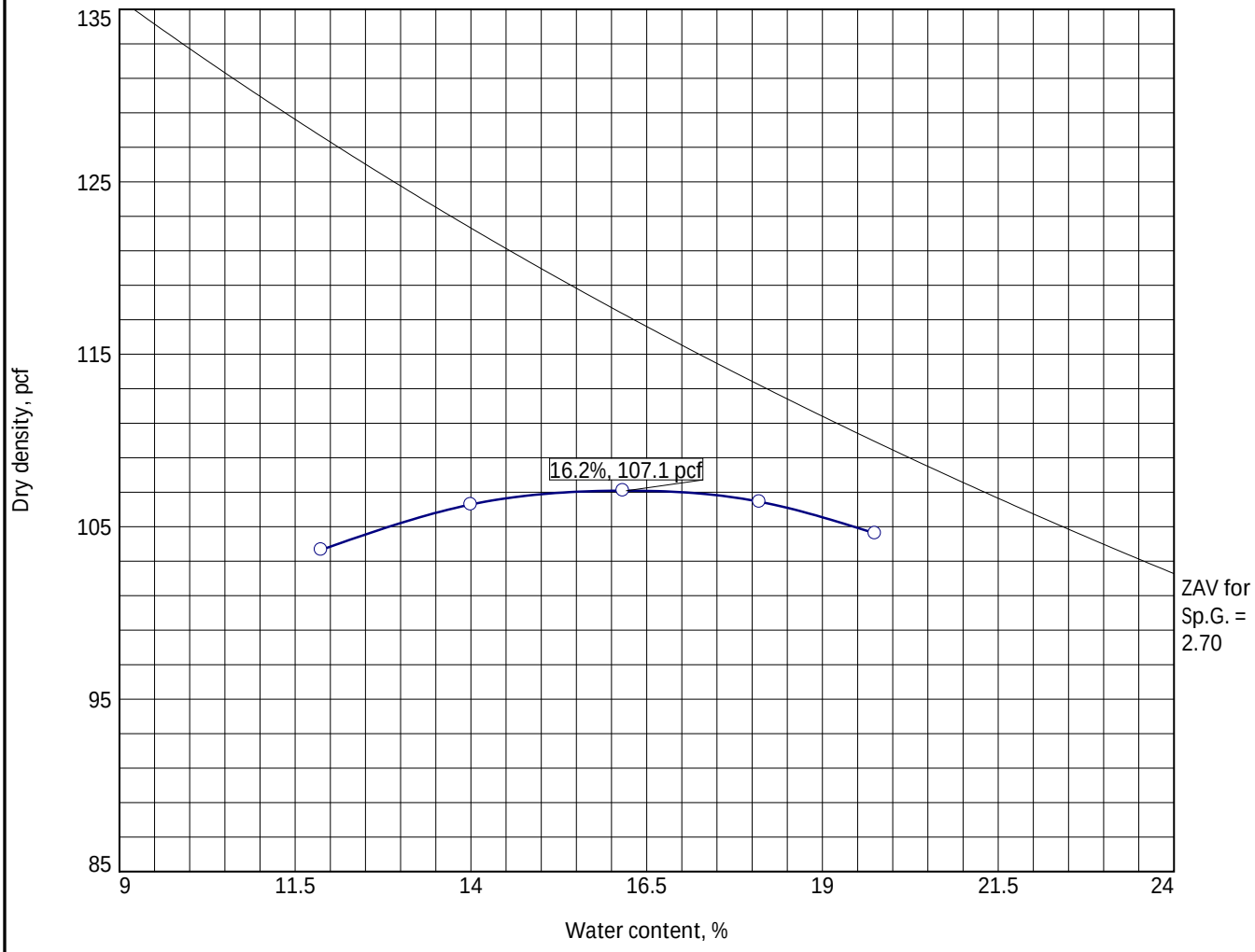
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
5.0-10.0 feet	CL		27.7	2.7	41	19	2.1	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 107.1 pcf Optimum moisture = 16.2 %	Brown and gray SILTY CLAY with trace sand and trace organic matter

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Date: 05/21/2024

○ Source of Sample: B-2 Sample Number: Bulk

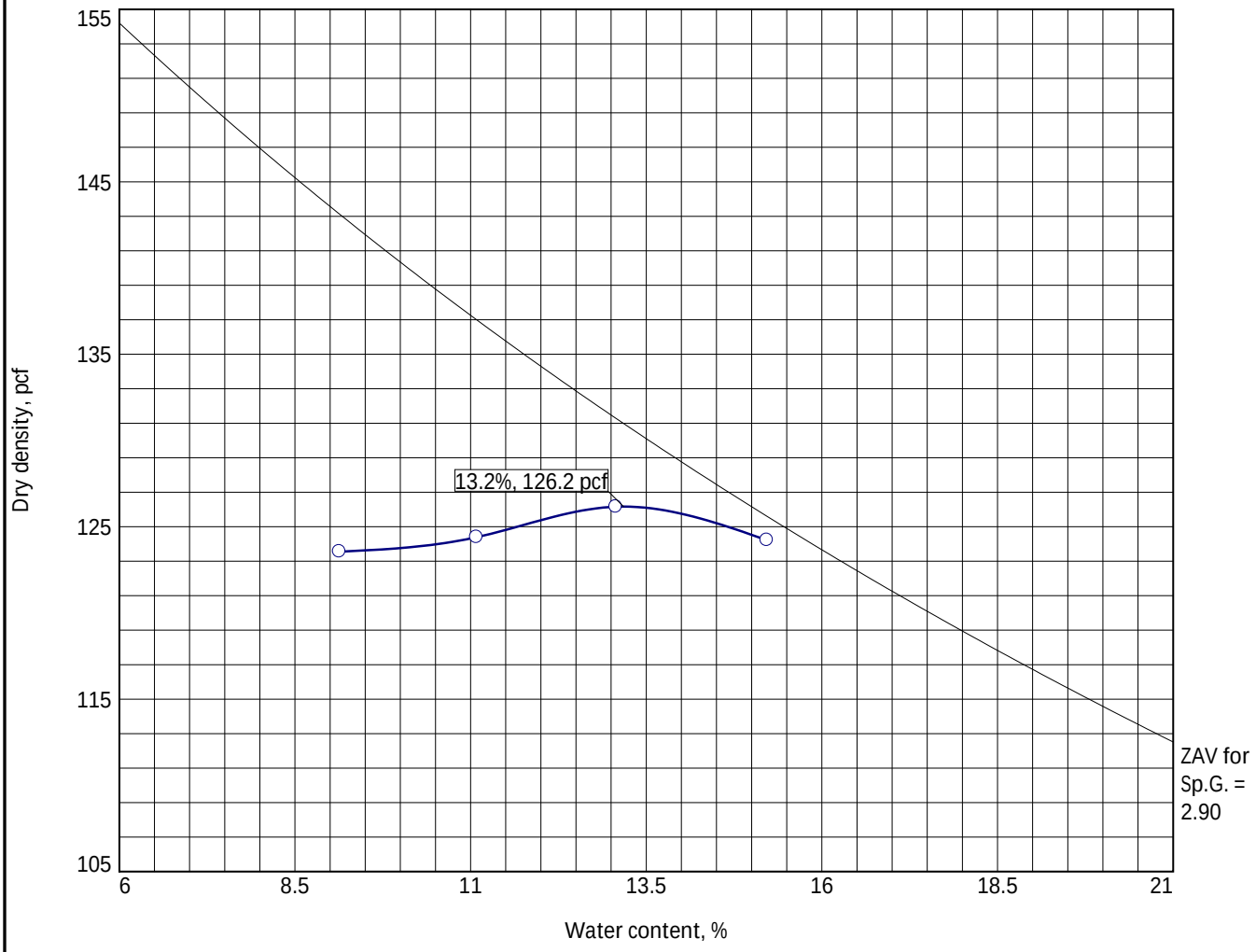
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method B Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
10.0-15.0 feet	CL		30.1	2.7	33	11	29.0	

ROCK CORRECTED TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 126.2 pcf Optimum moisture = 13.2 %	Brown SILTY CLAY with trace sand, trace gravel, and trace organic matter

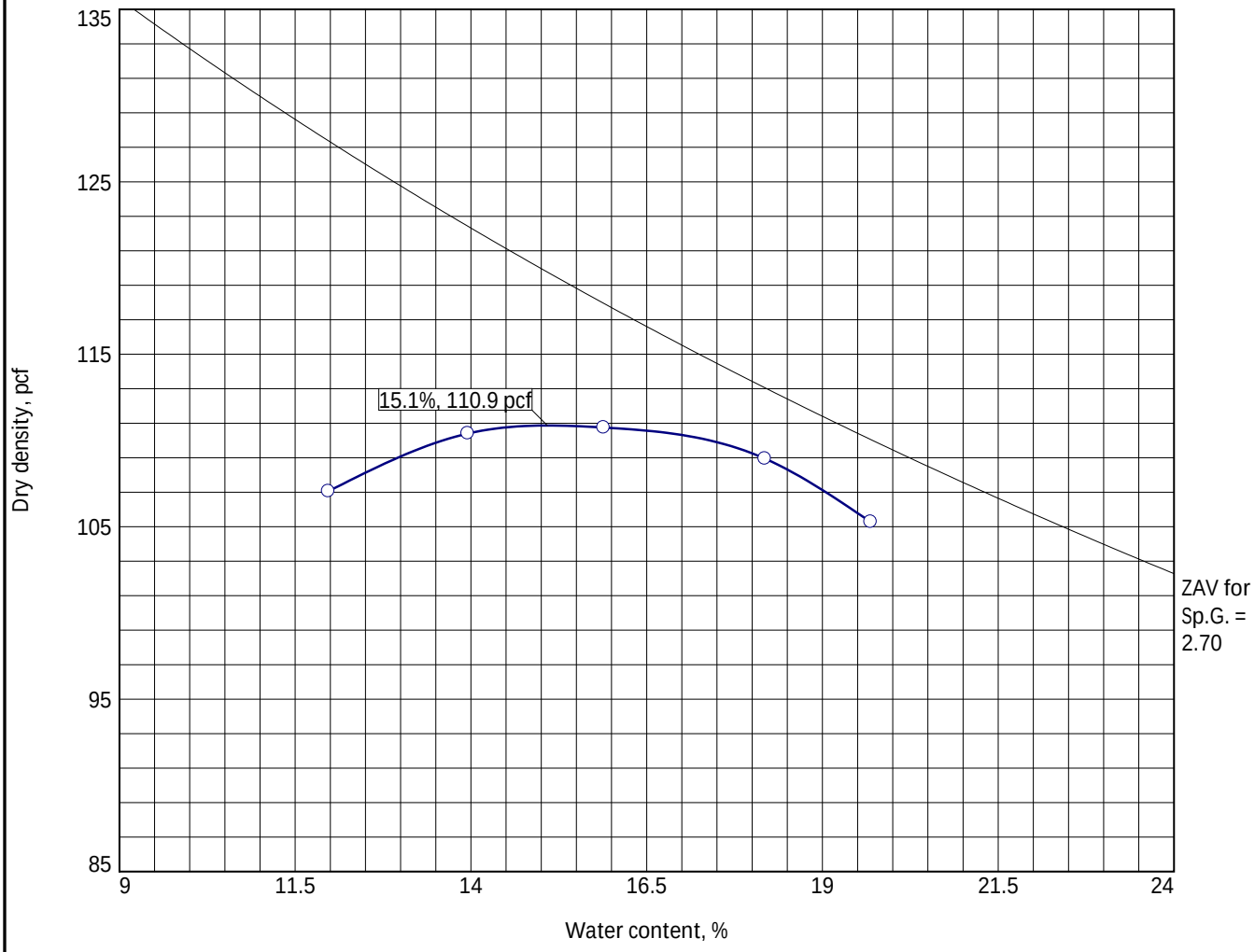
Project No. 24-0274-07G Client: Merrick & Company
Project: West Carrollton River Park GEO
Date: 05/21/2024
○ Source of Sample: B-4 Sample Number: Bulk

PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.
Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method B Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0.0-5.0 feet	CL		27.9	2.7	37	17	0.4	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 110.9 pcf Optimum moisture = 15.1 %	Brown and gray SILTY CLAY with trace to little sand, trace gravel, and trace organic matter

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Date: 05/24/2024

○ Source of Sample: B-5 Sample Number: Bulk

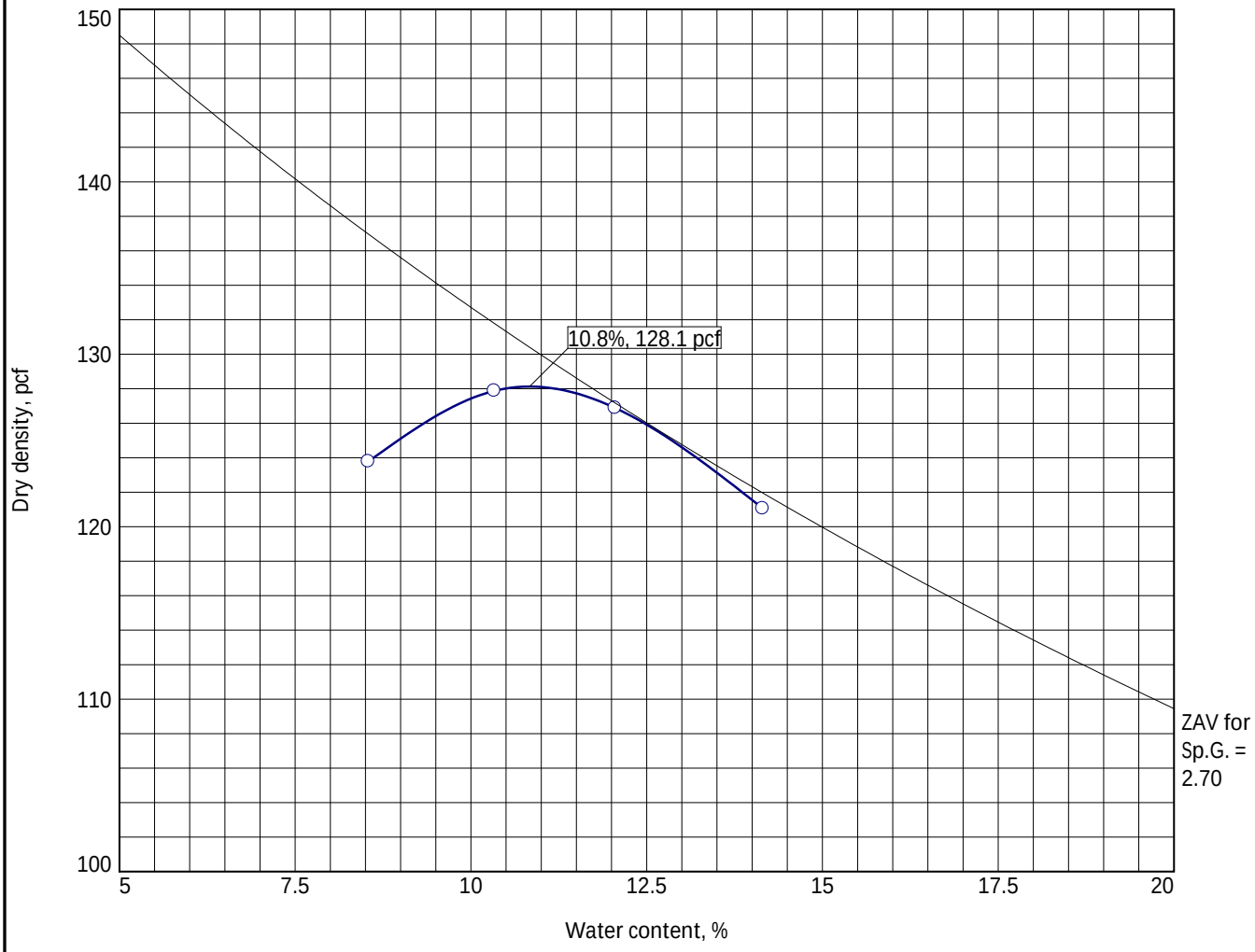
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method B Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
5.0-10.0 feet	CL		16.9	2.7	26	10	12.7	

ROCK CORRECTED TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 128.1 pcf Optimum moisture = 10.8 %	Gray and brown SILTY CLAY with trace sand and trace organic matter

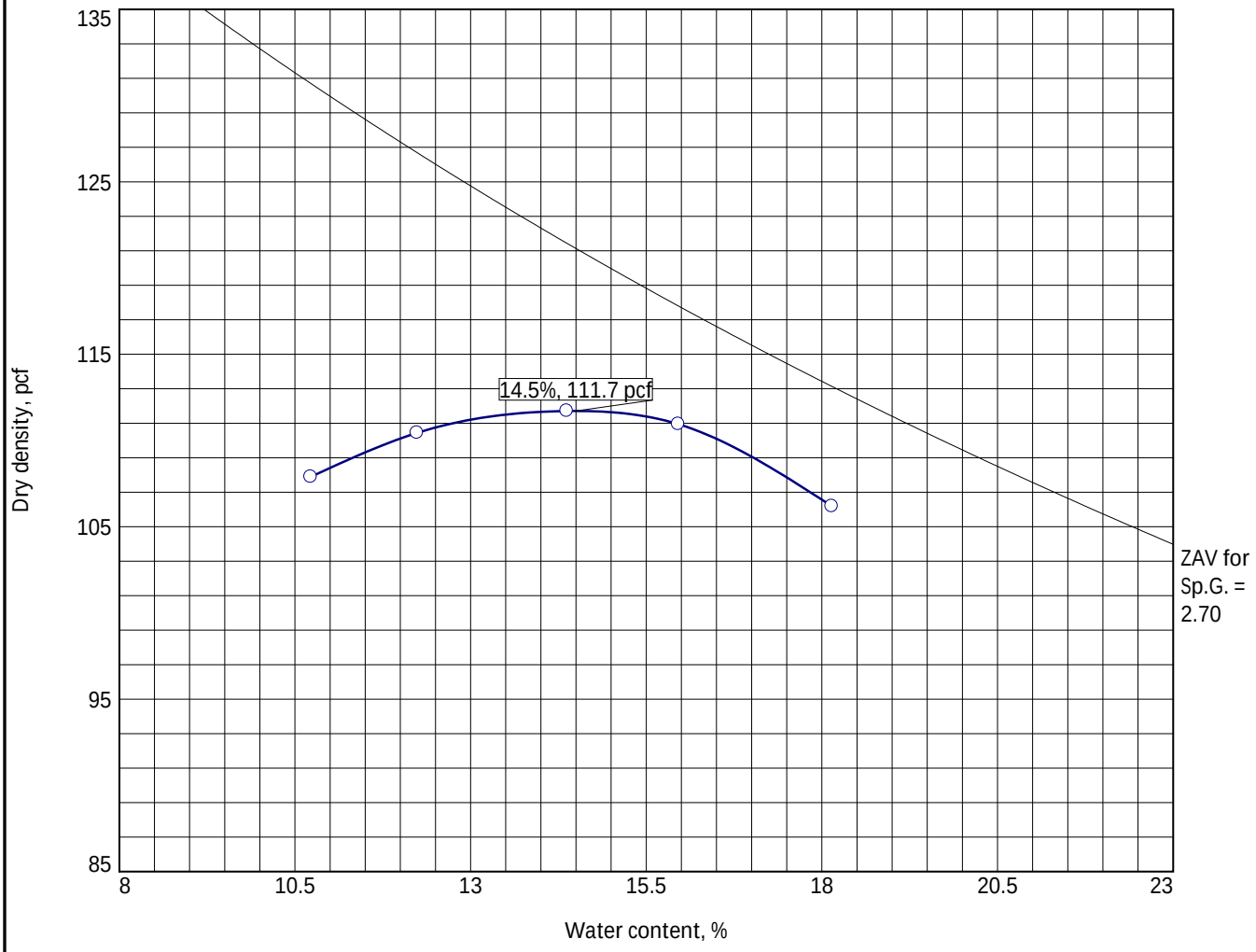
Project No. 24-0274-07G Client: Merrick & Company
Project: West Carrollton River Park GEO
Date: 05/21/2024
○ Source of Sample: B-8 Sample Number: Bulk

PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.
Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
10.0-15.0 feet	SP-SM		25.9	2.7	NP	NP	0.1	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 111.7 pcf Optimum moisture = 14.5 %	Brown, fine to medium grained, SAND and gravel with trace silt and trace organic matter

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Date: 05/21/2024

○ Source of Sample: B-10 Sample Number: Bulk

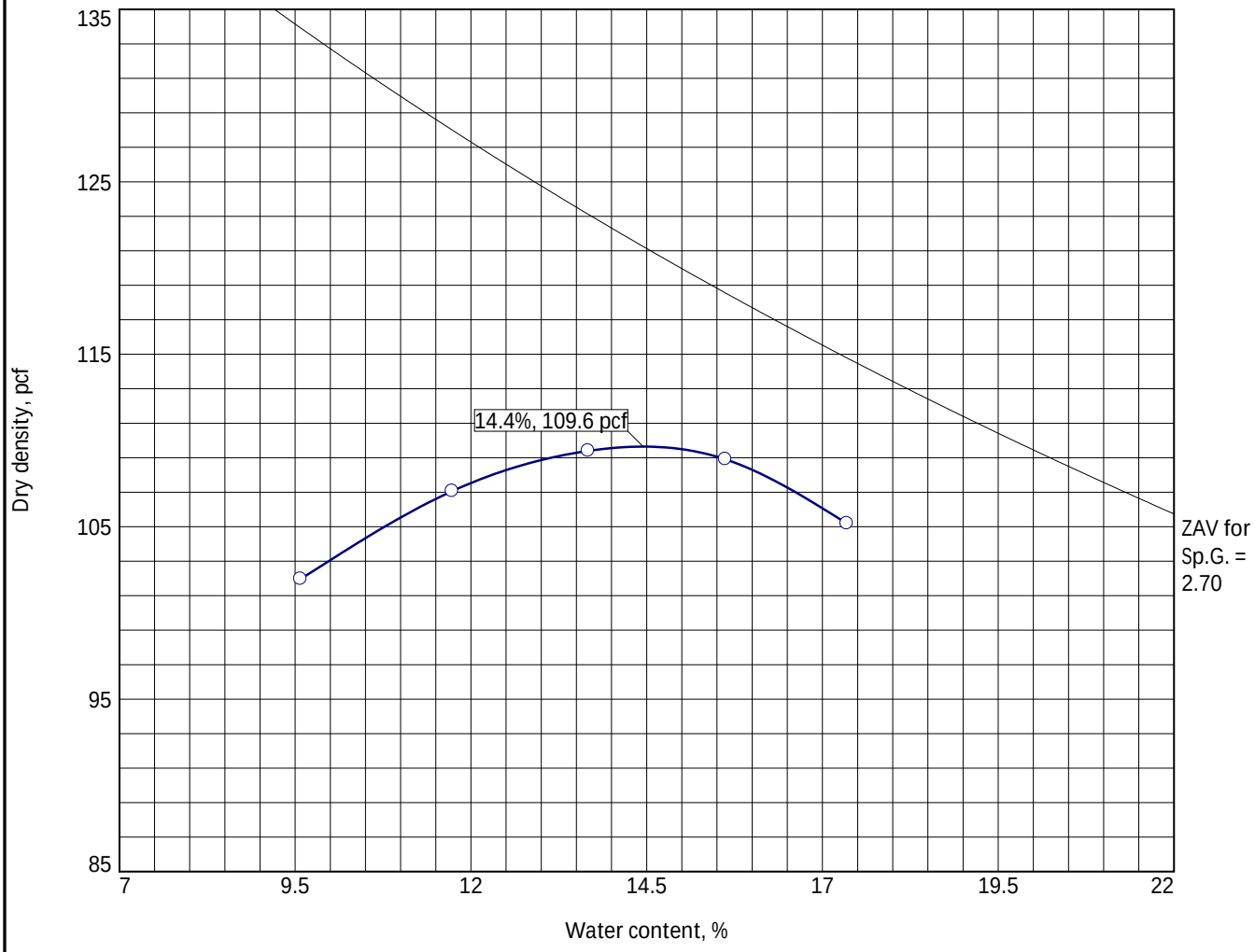
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method B Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0.0-5.0 feet	CL		24.9	2.7	40	19	2.1	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 109.6 pcf Optimum moisture = 14.4 %	Brown SILTY CLAY with trace sand and trace organic matter

Project No. 24-0274-07G Client: Merrick & Company

Project: West Carrollton River Park GEO

Date: 05/24/2024

○ Source of Sample: B-11 Sample Number: Bulk

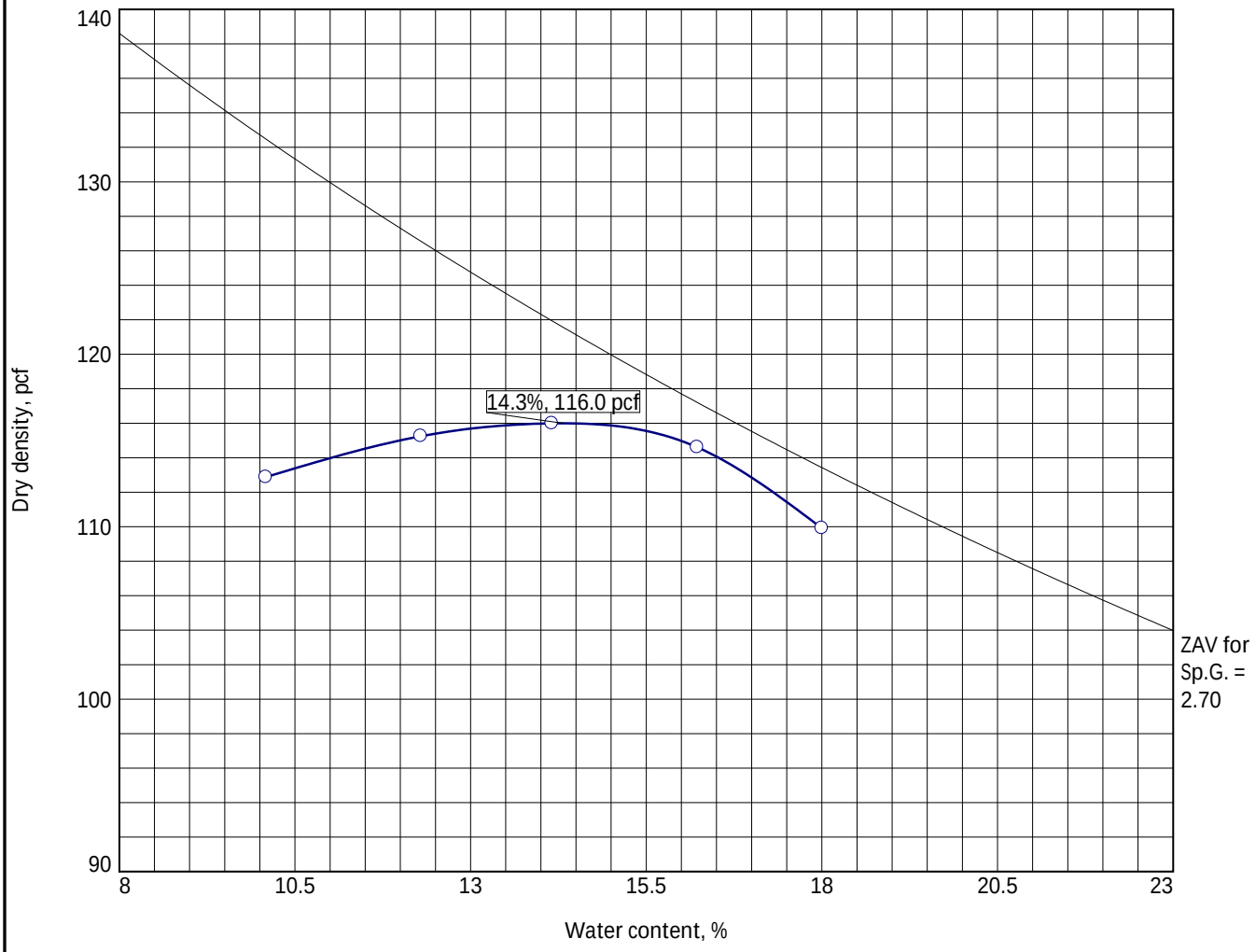
PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.

Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method A Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
5.0-10.0 feet	CL		23.5	2.7	33	14	7.9	

ROCK CORRECTED TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 116.0 pcf Optimum moisture = 14.3 %	Gray and brown SILTY CLAY with trace sand, trace organic matter, and interbedded sand seams

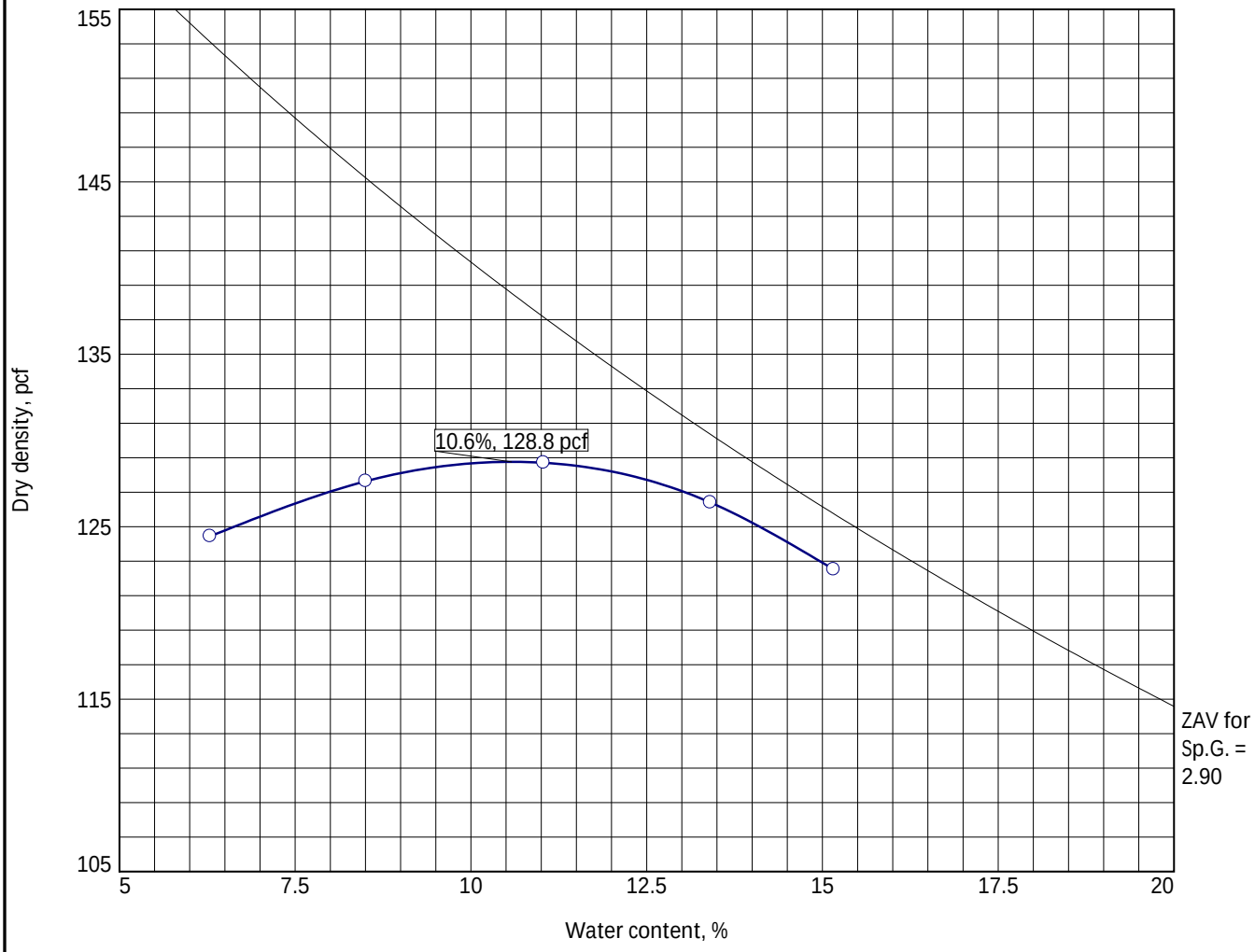
Project No. 24-0274-07G Client: Merrick & Company
Project: West Carrollton River Park GEO
Date: 05/21/2024
○ Source of Sample: B-15 Sample Number: Bulk

PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.
Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method B Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
10.0-15.0 feet	CL		15.5	2.7	23	8	17.5	

ROCK CORRECTED TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 128.8 pcf Optimum moisture = 10.6 %	Gray, dark gray, and brown SILTY CLAY with some sand and trace organic matter

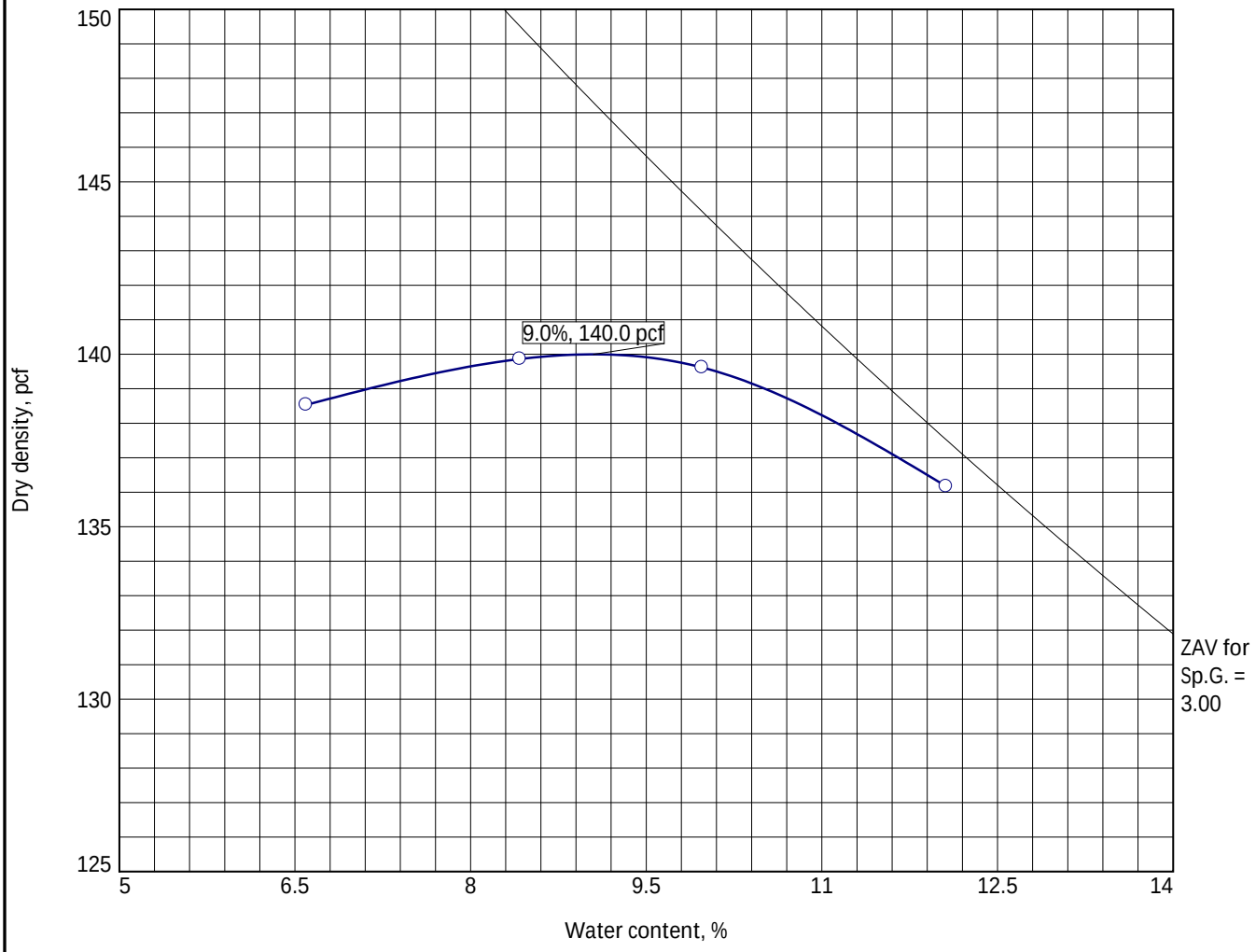
Project No. 24-0274-07G Client: Merrick & Company
Project: West Carrollton River Park GEO
Date: 05/28/2024
○ Source of Sample: B-16 Sample Number: Bulk

PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.
Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

COMPACTION TEST REPORT



Test specification: ASTM D 698-12(2021) Method B Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0.0-5.0 feet	CL		8.5	2.7	31	12	38.1	

ROCK CORRECTED TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 140.0 pcf Optimum moisture = 9.0 %	Brown and gray SANDY CLAY with trace gravel and trace organic matter

Project No. 24-0274-07G Client: Merrick & Company
Project: West Carrollton River Park GEO
Date: 05/20/2024
○ Source of Sample: B-18 Sample Number: Bulk

PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.
Indianapolis, Indiana

Remarks:

Tested By: C. Stec Checked By: S. Lauletta

PATRIOT ENGINEERING and Environmental, Inc.
Engineering Value for Project Success
Consulting Environmental, Geotechnical and Materials Engineers

LOSS ON IGNITION (LOI)

ASTM D2974
Test Method "A"
■ Original ☐ Amended

		Client:	Merrick & Company
Project Name:	West Carrollton River Park GEO	Sampled By:	E. Thomas
Project Number:	24-0274-07G	Tested By:	T. Cruea
Date Received:	4/1/2024	Checked By:	S. Lauletta
Date @ 110°C:	4/25/2024	Date @ 455°C:	4/26-4/30
		Time in Furnace:	6 Hours

Boring No.	Sample No.	Tare No.	Tare Wt. (g)	Dry+Tare Wt. (g)	Dry Weight (g)	Ash+Tare Wt. (g)	Ash Weight (g)	Organic Content (%)
B-1	Bulk	5	38.77	87.99	49.22	86.60	47.83	2.8
B-2	Bulk	14	43.30	85.25	41.95	84.16	40.86	2.6
B-3	S-1	10	38.93	66.94	28.01	66.21	27.28	2.6
B-4	Bulk	3	65.00	183.13	118.13	179.52	114.52	3.1
B-5	S-3	B4	48.44	82.86	34.42	81.88	33.44	2.8
B-5	Bulk	16	45.49	89.32	43.83	88.27	42.78	2.4
B-8	Bulk	11	41.76	100.00	58.24	99.44	57.68	1.0
B-9	S-4	B2	52.71	81.89	29.18	80.71	28.00	4.0
B-10	Bulk	10	38.95	87.25	48.30	85.98	47.03	2.6
B-11	Bulk	2	60.59	138.59	78.00	135.63	75.04	3.8
B-12	S-3	B3	53.81	79.38	25.57	78.47	24.66	3.6
B-15	S-3	16	45.50	59.49	13.99	58.98	13.48	3.6
B-15	Bulk	15	37.42	88.86	51.44	87.88	50.46	1.9
B-16	S-3	9	34.44	54.75	20.31	53.56	19.12	5.9
B-16	Bulk	14	43.31	106.15	62.84	105.47	62.16	1.1
B-18	Bulk	9	34.40	92.58	58.18	91.66	57.26	1.6

AASHTO ACCREDITATION PROGRAM

APPENDIX C

SEISMIC SITE CLASS EVALUATION

This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

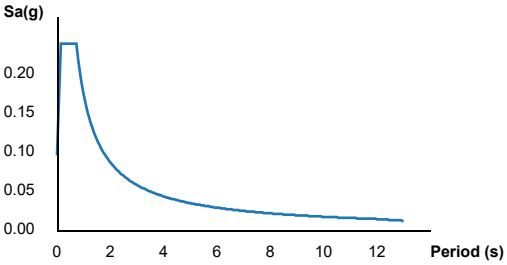
The ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Hazards by Location

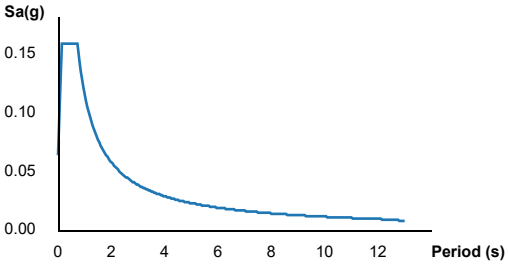
Search Information

Coordinates:	39.67954414188394, -84.24850828736852
Elevation:	710 ft
Timestamp:	2024-06-07T18:22:02.191Z
Hazard Type:	Seismic
Reference Document:	IBC-2015
Risk Category:	IV
Site Class:	D

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.149	MCE_R ground motion (period=0.2s)
S_1	0.072	MCE_R ground motion (period=1.0s)
S_{MS}	0.239	Site-modified spectral acceleration value
S_{M1}	0.174	Site-modified spectral acceleration value
S_{DS}	0.159	Numeric seismic design value at 0.2s SA
S_{D1}	0.116	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	C	Seismic design category
F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s
CR_S	0.924	Coefficient of risk (0.2s)
CR_1	0.886	Coefficient of risk (1.0s)
PGA	0.072	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.116	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
SsRT	0.149	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.162	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.072	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.082	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)

PGAd	0.6	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

APPENDIX D

GENERAL QUALIFICATIONS

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

GENERAL QUALIFICATIONS

of Patriot Engineering's Geotechnical Engineering Investigation

This report has been prepared at the request of our client for his use on this project. Our professional services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test borings logs regarding vegetation types, odors or staining of soils, or other unusual conditions observed are strictly for the information of our client and the owner.

This report may not contain sufficient information for purposes of other parties or other uses. This company is not responsible for the independent conclusions, opinions or recommendations made by others based on the field and laboratory data presented in this report. Should there be any significant differences in structural arrangement, loading or location of the structure, our analysis should be reviewed.

The recommendations provided herein were developed from the information obtained in the test borings, which depict subsurface conditions only at specific locations. The analysis, conclusions, and recommendations contained in our report are based on site conditions as they existed at the time of our exploration. Subsurface conditions at other locations may differ from those occurring at the specific drill sites. The nature and extent of variations between borings may not become evident until the time of construction. If, after performing on-site observations during construction and noting the characteristics of any variation, substantially different subsurface conditions from those encountered during our explorations are observed or appear to be present beneath excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary.

If there is a substantial lapse of time between the submission of our report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we urge that our report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

We urge that Patriot be retained to review those portions of the plans and specifications that pertain to earthwork and foundations to determine whether they are consistent with our recommendations. In addition, we are available to observe construction, particularly the compaction of structural backfill and preparation of the foundations, and such other field observations as may be necessary.

In order to fairly consider changed or unexpected conditions that might arise during construction, we recommend the following verbiage (Standard Clause for Unanticipated Subsurface Conditions) be included in the project contract.

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

"The owner has had a subsurface exploration performed by a soils consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the exploration. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions as described in that report. It is recognized that a subsurface exploration may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of a subsurface exploration and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

At any time during construction operations that the contractor encounters conditions that are different than those anticipated by the soils consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. If the owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the consultant's report, he shall immediately (within 24 hours) bring this fact to the contractor's attention. Once a fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the consultant has concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contract agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and materials basis."

Another example of a changed conditions clause can be found in paper No. 4035 by Robert F. Borg, published in ASCE Construction Division Journal, No. CO2, September 1964, page 37.

REPORT OF
GEOTECHNICAL ENGINEERING EXPLORATION

WEST CARROLLTON RIVER PARK
PLANNING AREA 3
WEST CARROLLTON, OHIO

PREPARED FOR:

MERRICK & COMPANY
5970 GREENWOOD PLAZA BOULEVARD
GREENWOOD VILLAGE, COLORADO 80111

Patriot Engineering and Environmental, Inc.
2568 Kohnle Drive
Miamisburg, Ohio 45342

June 10, 2024

PATRIOT
ENGINEERING AND ENVIRONMENTAL, INC.

June 10, 2024

Ms. Christi Wisleder, PE
Merrick & Company
5970 Greenwood Plaza Boulevard
Greenwood Village, Colorado 80111

Re: Report of Geotechnical Engineering Exploration
West Carrollton River Park – Planning Area 3
Alex Road/Hydraulic Road
West Carrollton, Ohio
Patriot Project No.: 24-0274-07G

Dear Christi:

Attached is the report of our geotechnical engineering exploration for the above referenced project. This exploration was completed in general accordance with our proposal dated February 14th, 2024.

This report includes detailed and graphic logs of twelve (12) soil borings drilled at the proposed project site. Also included in the report are the results of laboratory tests performed on samples obtained from the site, and geotechnical recommendations pertinent to the site development, foundation design, and construction.

We appreciate the opportunity to perform this geotechnical engineering exploration and are looking forward to working with you during the construction phase of the project. If you have any questions regarding this report or if we may be of any additional assistance regarding any geotechnical aspect of the project, please do not hesitate to contact our office.

Respectfully submitted,
Patriot Engineering and Environmental, Inc.

Logan Young, P.E.
Project Engineer

William D. Dubois, P.E.
Senior Principal Engineer

2568 Kohnle Drive, Miamisburg, Ohio 45342
Ph. 937-847-9707 • Fax 937-847-9720 • Web www.patrioteng.com
INDIANA - Bloomington, Evansville, Fort Wayne, Indianapolis, Lafayette, Terre Haute
KENTUCKY - Louisville, OHIO - Cincinnati, Dayton

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Appendix A: Site Vicinity Map (Figure No. 1)
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Appendix C: General Qualifications
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REPORT OF GEOTECHNICAL ENGINEERING EXPLORATION

West Carrollton River Park – Planning Area 3
Alex Road/Hydraulic Road
West Carrollton, Ohio
Patriot Project No.: 24-0274-07G

1.0 INTRODUCTION

1.1 General

The City of West Carrollton, in conjunction with Merrick & Company, are planning the design and construction of a river park that will be located along Alex Road/Hydraulic Road in West Carrollton, Ohio. The results of our geotechnical engineering exploration for the project are presented in this report.

1.2 Purpose and Scope

The purpose of this exploration is to determine the general near surface and subsurface conditions within the project area and to develop the geotechnical engineering recommendations necessary for the design and construction of the proposed river park. This was achieved by drilling soil borings, and by conducting laboratory tests on samples taken from the borings. This report contains the results of our findings, an engineering interpretation of these results with respect to the available project information, and recommendations to aid in the design and construction of the proposed river park.

2.0 PROJECT INFORMATION

The proposed West Carrollton River Park Project is a part of the West Carrollton River District Project that is set to transform the city's riverfront into a hub of entertainment, recreation, and community activity. There are three (3) areas planned for the West Carrollton River Park Project. "Planning Area 1" consists of the whitewater park, "Planning Area 2" consists of the motorized boat launch and tie-up, and "Planning Area 3" consists of the uplands structures. This Geotechnical Engineering Report focuses on "Planning Area 3".

"Planning Area 3" will be the primary support area for the whitewater park and outdoor adventure center at the former wastewater treatment plant. This area will include a day use area, adventure park, livery/outfitter support, overnight area, and support buildings. This

area will include parking lots, a laydown area and storage yard, outdoor amphitheater, food truck area, outdoor pavilion, nature playground, BMX off-road track, pickleball courts, picnic area, and campground area. This area will also include single-story structures of slab-on-grade construction. These structures include a maintenance building (approximately 3,000 square feet), an outfitter building (approximately 1,100 square feet), an administrative building (approximately 1,800 square feet), a 3-seasons restroom and 4-seasons changing building (approximately 1,450 square feet) and a covered breezeway. The former clarifiers will be repurposed to an underground storage area and an area that will include a climbing structure, rock wall, or fishing pond.

No structural loading information is available to us at the time of this report. We assume that the proposed structures will have wall loads not exceeding 3,000 pounds per lineal feet (plf), isolated column loads not exceeding 60 kips, and that floor loads will not exceed 150 pounds per square foot (psf). Additionally, based on visual observations of the existing site, it is assumed that any grade raise fill to complete the construction of building pads, finished pavement subgrades, etc., will not exceed 5 feet above the existing ground or pavement surface.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The project site is presently an abandoned wastewater treatment plant to the west of the Greater Miami River. All of the structures of the wastewater treatment plant are still existing, which includes two (2) large lagoons. The structures will be demolished and/or repurposed and the lagoons will be filled for the future development.

The surrounding area is generally an area of residential development and industrial use. The topography in the area proposed for construction is generally relatively flat to slightly rolling with ground surface elevations at the boring locations ranging from 714.4 to 721.3 feet. The elevation data was gathered utilizing the *Tremble DA2* with an accuracy of approximately 6 inches.

3.2 General Subsurface Conditions

Our interpretation of the subsurface conditions is based upon twelve (12) soil borings drilled at the approximate locations shown on the Boring Location Map (Figure No. 2) in Appendix

"A". All depths discussed below refer to depths below the existing ground or pavement surface. Based on the results of the soil borings completed at the site, the following subsurface profile is presented. A description of each general soil unit has been identified and is described below:

Table No. 1: Summary of Boring Locations

Boring Numbers	Location of Borings	Approximate Depth of Borings (Feet)
B-1 through B-18	Planning Area 1	30 to 60
B-19 through B-30	Planning Area 3	10 to 40

Topsoil, a surficial layer of material that is a blend of silts, sands, and clays, with varying amounts of organic matter, was encountered at the ground surface at five (5) of the twelve (12) boring locations. The topsoil layer was about 1 to 10 inches thick in the borings.

A mixture of sand and gravel or crushed stone was encountered at the ground surface at two (2) of the twelve (12) soil borings and was approximately 4 to 9 inches in thickness.

Pavement sections were encountered at the ground surface of five (5) of the twelve (12) boring locations. The pavement section consisted of asphalt or concrete and was underlain by crushed stone. The asphalt or concrete was approximately 5 to 8 inches thick, and the crushed stone was approximately 4 to 6 inches thick.

The surficial layers are underlain by medium stiff to stiff, **SILTY or SANDY CLAY (CL)** in four (4) of the twelve (12) borings. The silty or sandy clay layers typically extend to depths of 3 ½ to 6 feet below the existing ground surface. Standard Penetration Test N-values (blow counts) in this material varied from 5 to 15 blows per foot (bpf).

A layer of loose, **CLAYEY SAND (SC)** was encountered below the surficial material and extends to approximately 3 ½ feet in Boring B-20. Standard Penetration Test N-values (blow counts) in this material was 8 bpf.

Below the surficial layers and silty or sandy clay layers, medium dense to very dense, **SAND (SP-SM)** was generally encountered to the predetermined boring termination depths of 10 and 40 feet below existing grade. Standard Penetration Test N-values in this sand varied from 12 to more than 50 bpf.

Below the surficial material in Borings B-29 and B-30 and within the sand layers, hard, **SANDY CLAY (CL)** was encountered at various depths. Standard Penetration Test N-values (blow counts) in this material varied from 47 to more than 50 bpf.

The soil conditions described above are general, and some variations in the descriptions should be expected; for more specific information, please refer to the boring logs presented in Appendix "A". It should be noted that the dashed stratification lines shown on the soil boring logs indicate approximate transitions between soil types. In-situ stratification changes could occur gradually or at different depths.

Please note that *Patriot* has completed multiple environmental borings on this project site, and it is known that soil contamination is present in portions of the onsite material. If contaminated soils are encountered during construction, they must be handled and disposed of properly within national, state, and local regulations.

3.3 Groundwater Conditions

The term groundwater pertains to any water that percolates through the soil found on site. This includes any overland flow that permeates through a given depth of soil, perched water that occurs below the "water table", a zone that remains saturated and water-bearing year-round.

Groundwater was observed during drilling in five (5) of the twelve (12) soil borings performed at the site at depths between 15 ½ to 25 feet below the existing ground or pavement surface. Groundwater was not observed in the remaining borings during drilling. Immediately after the borings were completed and the augers were removed from the boreholes, groundwater was observed at depths between 3 and 6 feet below the existing ground surface or pavement in three (3) of the twelve (12) soil borings. The remaining borings were dry at the cave-in depths shown on the boring logs.

It should be recognized that fluctuations in the groundwater level should be expected over time due to variations in rainfall and other environmental or physical factors. The true static groundwater level can only be determined through observations made in cased holes over a long period of time, the installation of which was beyond the scope of this exploration.

Table No. 2: Groundwater Summary Table

Boring Number	Groundwater Level During Drilling (feet)(1)	Groundwater Level After Drilling (feet)(1)
B-19	25	4
B-20	Dry	Dry
B-21	Dry	Dry
B-22	Dry	Dry
B-23	23 ½	Dry
B-24	Dry	Dry
B-25	23 ½	3
B-26	Dry	Dry
B-27	18 ½	6
B-28	Dry	Dry
B-29	Dry	Dry
B-30	15 ½	Dry

(1) Represents depth below existing ground surface.

4.0 DESIGN RECOMMENDATIONS

4.1 Basis

Our recommendations are based on data presented in this report, which include soil borings, laboratory testing, and our experience with similar projects. Subsurface variations that may not be indicated by a dispersive exploratory boring program can exist on any site. If such variations or unexpected conditions are encountered during construction, or if the project information is incorrect or changed, we should be informed immediately since the validity of our recommendations may be affected.

4.2 Foundations

The proposed structures can be supported on spread footings bearing on the medium stiff to stiff clays (N-values of 7 or greater) or medium dense sands encountered at shallow depths or on new well-compacted structural fill overlying the same. These footings should be proportioned using a net allowable soil bearing pressure not exceeding 2,000 pounds per square foot (psf) for column footings or 1,500 psf for wall (strip) footings. For proper performance at the recommended design bearing pressure, foundations must be

constructed in compliance with the recommendations for footing excavation inspection that are discussed in Section 5.0 *"Construction Considerations"*.

Alternatively, the foundations may be designed to bear in the **hard sandy clays** or **dense to very dense sands**, encountered below frost depths to approximately 6 feet using a net maximum allowable soil bearing pressure not exceeding 4,000 psf for column footings or 3,000 psf for strip footings. However, it may be necessary to undercut the excavation at isolated locations to accommodate the design bearing capacity. Careful field control during construction by *Patriot* will be necessary to confirm that the exposed material is capable of supporting the design bearing pressure and minimize the post construction settlement potential. ***A structural engineer should evaluate the uplift and overturning of open-air structures.***

In using the above net allowable soil bearing pressures, the weight of the foundation and backfill over the foundation need not be considered. Hence, only loads applied at or above the minimum finished grade adjacent to the footing need to be used for dimensioning the foundations. Each new foundation should be positioned so it does not induce significant pressure on adjacent foundations; otherwise, the stress overlap must be considered in the design.

All exterior foundations and foundations in unheated areas should be located at a depth of at least 30 inches below final exterior grade for frost protection. However, interior foundations in heated areas can bear at depths of approximately 24 inches below the finished floor. We recommend that wall (strip) footings be at least 18 inches wide and column footings be at least 24 inches wide for bearing capacity considerations.

We estimate that the total foundation settlement should not exceed approximately 1 inch and that differential settlement should not exceed about ¾ inch. Careful field control during construction is necessary to minimize the actual settlement that will occur.

Positive drainage of surface water, including downspout discharge, should be maintained away from structure foundations to avoid wetting and weakening of the foundation soils both during construction and after construction is complete.

4.3 Floor Slabs

The near surface or shallow subgrade soils encountered within the proposed building footprints generally consist of medium stiff to hard clays or medium dense sands, which if properly prepared are suitable for floor slab support.

We recommend that all floor slabs be designed as "floating", that is, fully ground supported and not structurally connected to walls or foundations. This is to minimize the possibility of cracking and displacement of the floor slabs because of differential movements between the slab and the foundation. Although the movements are estimated to be within the tolerable limits for the structural safety, such movements could be detrimental to the slabs if they were rigidly connected to the foundations. Additionally, we recommend that all slabs should be liberally jointed and designed with the appropriate reinforcement for the anticipated loading conditions.

The building floor slabs should be supported on a minimum 6-inch-thick well-compacted, well-graded, granular base course bearing on a suitably prepared subgrade (Refer to Section 5.0 *"Construction Considerations"*). The granular base course is expected to help distribute loads and equalize moisture conditions beneath the slab.

Provided that the recommendations above for floor slab design and construction are followed, a modulus of subgrade reaction, "K_{30}" value of 75 pounds per cubic inch (pci) for medium stiff clays and a "K_{30}" value of 125 pci for very stiff to hard clays or medium dense to dense sands, is recommended for the design of ground supported floor slabs. It should be noted that the "K_{30}" modulus is based on a 30-inch diameter plate load empirical relationship.

4.4 Excavation of Existing Foundations/Underground Utilities

We recommend that an attempt be made to obtain drawings of all past or existing underground structures onsite. We also recommend that these documents including this report be made available to the project contractors. Buried foundations and slabs may prove to be obstructions for the proposed construction at the project site. We also recommend that existing foundations, pavements, utilities, and backfill be excavated at least 2 feet beyond the proposed structures construction and underground utility limits. Backfill required to reach the design subgrade should be performed in accordance with Section 5.3 *"Structural Fill and Fill Placement Control"*.

No structural elements of the proposed project should be placed over old foundations or slabs, which can create “hard spots” or over vacated utility lines or “voids”, unless structurally designed to handle the hard and soft spots. In addition, if basement walls are encountered, we recommend cutting these 2 feet below proposed subgrade and backfilling with structural fill as specified above.

It should also be noted that the sandy soils encountered in the borings should be expected to be free-flowing and tend to readily cave and/or slough into excavations; therefore, over-excavation, benching and/or shoring may be required in order to maintain the side slopes within isolated portions of excavations.

4.5 Pavement

The near surface or shallow subgrade soils encountered within the proposed pavement areas generally consist of medium stiff to hard clays or medium dense sands, which if properly prepared are suitable for pavement support.

If construction is performed during a wet or cold period, the contractor will need to exercise care during the grading and fill placement activities in order to achieve the necessary subgrade soil support for the pavement section (Refer to Section 5.0 “Construction Considerations”). The base soil for the pavement section will need to be firm and dry. The subgrade should be sloped properly in order to provide good base drainage. To minimize the effects of groundwater or surface water conditions, the base section for the pavement system should be sufficiently high above adjacent ditches and properly graded to provide pavement surface and pavement base drainage.

Based upon the near surface soils encountered in the borings, we recommend using a California Bearing Ratio (CBR) value of 3.0 for the design of flexible (hot mix asphalt (HMA)) pavement sections. For design of rigid (concrete) pavement sections, we recommend using a modulus of subgrade reaction value of 75 pounds per cubic inch (pci). It should be recognized though, that the recommended CBR and modulus of subgrade reaction values provided are based on empirical relationships only, and laboratory tests may determine higher allowable values.

4.6 Pickleball Courts

Borings B-21, B-22 and B-23 was completed in the area of the proposed pickleball courts (or similar style court) or nearby, which encountered medium stiff to stiff clay or medium

dense sands, which are suitable for support of the courts. Provided the above recommendations are followed, the pickleball courts can be constructed in the medium stiff to stiff clays or medium dense to dense sands encountered at shallow depths and should be proportioned using a net allowable soil bearing pressure not exceeding 1,500 pounds per square foot (psf).

For mat foundations/slabs bearing on natural medium stiff to stiff clays, medium dense sands, or on newly well-compacted structural fills, a modulus of subgrade reaction (K_{v1}) of 75 pounds per cubic inch (pci) should be used. Other details including treatment of unsuitable foundation soils and observation of foundation excavations as outlined in this report are applicable for the design and construction of a mat foundation/slab at the site.

The subgrade modulus (K_v) for the mat/slab is affected by the size of the mat foundation/slab and would vary according to the following equation:

$$K_v = K_{v1} \times (B+1)^2 / 4B^2$$

Where: K_{v1} is the modulus of vertical subgrade reaction
B is the width of the mat foundation.

Thus, for a width of B = 150 ft. bearing on the suitably prepared subgrade soils, the subgrade modulus would be:

$$K_v = 75 \times (150+1)^2 / (4 \times 150^2) = 20 \text{ pci}$$

We recommend limiting construction traffic on the subgrade and installing a 12-inch working mat consisting of open graded gravel or crushed stone as a base course for construction if the subgrade conditions begin to deteriorate with continued construction vehicle traffic or if the subgrade area is saturated. Concrete should not be placed on disturbed soils or in an excavation that contains standing water. Disturbed soils or soft soils should be replaced or compacted and tested prior to the placement of footing forms and reinforcing steel.

We estimate that the total foundation settlement for these mats should not exceed approximately 1 inch depending on the loading and foundation configuration. Careful field control during construction is necessary to minimize the actual settlement that will occur.

Depending on the weather conditions at the time of construction, scarifying and drying and/or chemical modification (Refer to Section 5.4 "Chemical Modification Considerations") may be necessary to manage moisture contents in the clays in order to achieve the necessary subgrade soil support prior to the placement of pavements or any grade raise fill.

Construction Considerations:

Because pickleball court pavements (or similar style courts) are lightly loaded (little to no vehicular traffic), long-term performance of asphalt pavement pickleball courts will be most influenced by materials and environmental factors such as surface drainage and control joint design, aggregates and concrete material, the subgrade conditions and preparation, and the subsurface drainage conditions.

Subgrade preparation and as necessary grade raise fill requirements for the pickleball courts should be in accordance with Sections 5.1 and 5.2, respectively. The pickleball court surface should have control joints sawed between playing surfaces and along the nets. The purpose of the control joints is to mitigate cracking by providing relief of stresses that can be caused by environmental factors (e.g. thermal changes). These joints should be sealed with a hot poured rubberized asphalt sealant, checked annually, and maintained as needed to prevent infiltration of water and debris.

Surface preparation for application of the pickleball court surface coating should be in accordance with the surface manufacturer's recommendations. Typically, we recommend that the concrete slab be left uncoated until the concrete is cured. The owner should be advised that the service life of the surfacing may be reduced if the concrete is not allowed to cure sufficiently, and as a result, re-application may be necessary the following year.

Chain link fence and pickleball court net post foundations should be installed to a minimum depth of 30 inches below the surface. If vertical holes (foundation excavations) for the post foundations cannot be maintained until concrete placement due to sloughing, then the foundations should be formed with sonotubes or similar type casings to prevent a "mushrooming" effect near the ground surface. These procedures are recommended to prevent frost heaving of the concrete foundations which can lead to premature cracking of the concrete around the posts.

Drainage:

The pickleball courts pavement system must be properly drained to reduce the potential for frost heaving and softening of the subgrade soil due to water infiltrating through cracks. The infiltrated water, if not properly drained, is expected to adversely affect the pickleball courts' performance. Where feasible, we recommend re-grading surrounding greenbelt areas to slope downward away from the pickleball courts pavement surface to provide drainage away from the courts.

The pickleball court subgrade should be sloped similar to the surface to encourage drainage of water that accumulates within the aggregate base. Additionally, we recommend installation of underdrains below the proposed pickleball court pavements. We recommend the underdrains consists of a minimum of 6-inch diameter perforated plastic drainpipe, wrapped with a filter fabric (e.g. Mirafi® 140N or equivalent) and surrounded by 6 inches of a filter material. The underdrains should be connected to a storm-sewer or daylighted to a drainage swale or basin.

4.7 Seismic Considerations

For structural design purposes, we recommend using a ***Site Classification of "C"*** as defined by the current Ohio Building Code (modified International Building Code (IBC)). Furthermore, along with using a Site Classification of "C", we recommend the use of the maximum considered spectral response acceleration and design spectral response acceleration coefficients provided in Table No. 3 below. Refer to Appendix "B" for *"Seismic Site Class Evaluation"* report summary.

Table No. 3: Seismic Design Spectral Response Acceleration Coefficients

Period (seconds)	Maximum Considered Spectral Response Acceleration Coefficient	Soil Factor	Design Spectral Response Acceleration Coefficient
0.2	S_S = 0.150 g	1.2	S_{DS} = 0.120 g
1.0	S_1 = 0.072 g	1.7	S_{D1} = 0.082 g

These values were obtained from the *"ATC Hazards by Location"* program for seismic design, developed by the Applied Technology Council (ATC), utilizing latitude 39.68143°

(degrees) north and longitude 84.25184° (degrees) west as the designation for identifying the location of the parcel. Other earthquake resistant design parameters should be applied consistent with the minimum requirements of the current Ohio Building Code.

4.8 Subsurface Utilities

For installation of subsurface utilities (i.e. water lines, storm-sewer lines, sanitary-sewer lines, manholes, culverts, etc.) the soil conditions encountered in our borings should be readily excavated using conventional earthwork equipment. However, some additional effort may be necessary to excavate very stiff to hard clay layers or dense to very dense sands, which were encountered in the upper 10 feet of soil. ***Additionally, depending on the invert elevations of the proposed subsurface utilities, sand layers and seams could be encountered which are expected to be free-flowing and will tend to readily cave and/or slough into excavations; therefore, over-excavation, benching and/or shoring should be expected in order to maintain the side slopes of the trench excavations.***

Depending on seasonal conditions and the invert elevations of the proposed subsurface utilities, there is potential of localized and sporadic groundwater infiltration, which could cause infiltration into the subsurface utility excavations (Refer to Section 5.4 *"Groundwater Considerations"*). Furthermore, it should also be noted that there may be the potential for encountering heaving of sand layers near the groundwater elevations during construction.

In regards to bearing and support of the subsurface utilities, the soil conditions encountered in our borings, if properly prepared, are suitable for support of the proposed subsurface utilities. ***It should be recognized though, that depending on the invert elevations of the proposed subsurface utilities, loose sand layers may be encountered at the bearing grade which require undercutting and replacement with compacted structural backfill or in-place compaction to achieve suitable bearing for support of the utilities.***

4.9 Lateral Earth Pressures

For the design of retaining walls, including basement and loading dock walls, the magnitude of the lateral earth pressure on the walls is dependent on the method of backfill placement behind the walls, the type of backfill soil, drainage provisions and whether or not the wall is permitted to yield during and/or after placement of the backfill. When a

retaining wall is held rigidly against horizontal movement, the lateral pressure against the wall is greater than the "active" earth pressure that is typically used in the design of free-standing retaining walls. Therefore, rigid walls should be designed for higher "at-rest" pressures (using an at-rest lateral earth pressure coefficient, K_o), while yielding walls can be designed for active pressures (using an active lateral earth pressure coefficient, K_a).

The retaining, dock, or basement walls proposed for the project are expected to be rigid walls. ***It should be noted that the on-site clayey soils are <u>not</u> suitable for use as backfill immediately against the loading dock walls.*** Therefore, provided ***a clean well-graded granular material is used for backfill***, a total soil unit weight (γ_t) of 125 pounds per cubic foot (pcf), an at-rest lateral earth pressure coefficient (K_o) of 0.45, an active lateral earth pressure coefficient (K_a) of 0.30, and a passive lateral earth pressure coefficient (K_p) of 3.4 can be used for calculating the lateral earth pressures. An equivalent fluid active pressure of 38 psf per foot of wall height is recommended for design purposes in conditions where the top of the wall is allowed to yield during backfilling. However, if the top of the wall will be fixed, an equivalent fluid at-rest pressure of 57 psf per foot of wall height is recommended for design purposes. This equivalent fluid pressure would increase linearly from zero (0) psf at the ground surface, to a maximum at the base of the wall.

When calculating passive earth pressure, the upper 3 feet of soil should be neglected due to the potential for frost disturbance or otherwise insufficiently compacted soil to appropriately generate the specified passive pressure. Additionally for design purposes, it should be recognized that in order for passive earth pressures to be fully developed, the wall must move laterally about 0.04H (where “H” equals the wall height). ***In most cases, passive earth pressures behind walls should not be considered in design.***

If hydrostatic pressure due to water build-up against the retaining, dock, or basement walls is anticipated, the equivalent fluid pressure method will be changed for the soil. Rather, the lateral <u>earth</u> pressure should be computed using a total soil unit weight of 125 pcf above the highest anticipated water level, and a buoyant soil unit weight of 63 pcf below the highest anticipated water level. The earth pressure coefficient indicated above should be used above <u>and</u> below the water level to compute the lateral earth pressure. The <u>hydrostatic</u> pressure should be computed using the highest anticipated water level.

The lateral earth pressure and hydrostatic pressure should be added to obtain the total lateral pressure on the wall.

Furthermore, in conjunction with and as a direct result of the lateral earth pressures defined above, the shear resistance against base sliding can be computed by multiplying the minimum normal force on the base of the footing times a coefficient of friction (μ) of 0.3. We recommend that for evaluation of sliding stability that a minimum factor of safety (F_S) of 1.5 is utilized for design purposes. Additionally for design, the toe pressure for the retaining, dock, or basement wall footings should not exceed the maximum allowable bearing pressure provided in Section 4.2 *"Foundations"*.

Table No. 4: Summary of Lateral Earth Design Pressures for Retaining Walls

Soil Unit Weight (γ_t)	At-Rest Coefficient (K_o)	Active Coefficient (K_a)	Passive Coefficient (K_p)	Coefficient of Friction (μ)	Minimum Factor of Safety (FS)
125 pcf	0.45	0.30	3.4	0.3	1.5

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Site Preparation

All areas that will support foundations, floors, pavements, or newly placed structural fill must be properly prepared. All loose surficial soil or "topsoil" and other unsuitable materials must be removed. Unsuitable materials include frozen soil, relatively soft material, relatively wet soils, deleterious material, or soils that exhibit a high organic content. ***Additionally, all existing trees, underbrush and associated root-mass must also be completely removed within the proposed building and pavement areas prior to construction.***

Approximately 1 to 10 inches of loose surficial topsoil was encountered in the borings. The topsoil was measured at discrete locations as shown on the Boring Location Map (Figure No. 2) in Appendix "A". The topsoil thickness measured at the boring locations may or may not be representative of the overall average topsoil thickness at the site. Thicker layers of material may be found in areas due to the use of the property for agricultural cultivation.

Therefore, it is possible that the actual stripping depth could significantly vary from this data. The data presented should be viewed only as a guide to the minimum stripping depth that will be required to remove organic material at the surface. Additional field exploration by *Patriot* would be required to provide an accurate estimate of the stripping depth. This limited data indicates that a minimum stripping depth will be required to remove the organic material at the surface, followed by the potential for additional stripping and/or scarification and recompaction as may be required to achieve suitable subgrade support. ***Additionally, if saturated conditions exist with the surface soils, light tracked equipment could be required to avoid pushing organics deeper into the suitable subgrade soils.*** A *Patriot* representative should verify the stripping depth at the time grading operations occur.

Prior to construction of floor slabs, pavements or the placement of new structural fill, the exposed subgrade must be evaluated by a Patriot representative, which will include proofrolling of the subgrade. Proofrolling should consist of repeated passes of a loaded, pneumatic-tired vehicle such as a tandem-axle dump-truck or scraper. The proofrolling operations should be observed by a *Patriot* representative, and the proofrolling vehicle should be loaded as directed by *Patriot*. Any area found to rut, pump, or deflect excessively should be compacted in-place or, if necessary, undercut and replaced with structural fill, compacted as specified in Section 5.3 *"Structural Fill and Fill Placement Control"*.

Care must be exercised during grading and fill placement operations. ***The combination of heavy construction equipment traffic and excess surface moisture can cause pumping and deterioration of the near surface soils. The severity of this potential problem depends to a great extent on the weather conditions prevailing during construction.*** The contractor must exercise discretion when selecting equipment sizes and also make a concerted effort to control construction traffic and surface water while the subgrade soils are exposed. We recommend that heavy construction equipment (i.e. dump trucks, scrapers, etc.) be rerouted away from the building and pavement areas. If such problems do arise, the operations in the affected area should be halted and the *Patriot* representative contacted to evaluate the condition.

5.2 Foundation Excavation

Excavation will be performed on sandy soils that can be easily disturbed. If the subgrade soil is disturbed, it should be re-compacted, or a crushed stone layer should be placed at the subgrade level.

Upon completion of the foundation excavations and prior to the placement of reinforcing steel, a *Patriot* representative should check the exposed subgrade to confirm that a bearing surface of adequate strength has been reached. Any localized soft soil zones encountered at the bearing elevations should be further excavated until adequate support soils are encountered. The cavity should be backfilled with structural fill as defined below, or the footing can be poured at the excavated depth. Structural fill used as backfill beneath footings should be limited to lean concrete, well-graded sand and gravel, or crushed stone placed and compacted in accordance with Section 5.3 *"Structural Fill and Fill Placement Control"*.

If it is necessary to support spread footings on structural fill, the fill pad must extend laterally a minimum distance beyond the edge of the footing. The minimum structural pad width would correspond with a point at which an imaginary line extending downward from the outside edge of the footing at a 1H:2V (horizontal: vertical) slope intersects the surface of the natural soils. For example, if the depth to the bottom of excavation is 4 feet below the bottom of the foundation, the excavation would need to extend laterally beyond the edge of the footing at least 2 feet, as shown in Illustration "A" found at the conclusion of this report.

Excavation slopes should be maintained within all requirements set-forth by the Occupational Safety and Health Standards (OSHA), but specifically Section 1926 Subpart "P" – *"Excavations"*. We recommend that any surcharge fill or heavy equipment be kept at least 5 feet away from the edge of the excavation.

In addition, excavations that occur near existing in-use foundations should be carefully performed making a conscious effort not to undermine the support of the in-use foundations. If it is necessary to excavate soil adjacent to and below the bearing elevation of any in-use foundations, *Patriot* should be contacted to make further recommendations regarding these excavations. Please refer to Illustration "B" at the end of this report for further details.

Construction traffic on the exposed surface of the bearing soil will potentially cause some disturbance of the subgrade and consequently loss of bearing capacity. However, the degree of disturbance can be minimized by proper protection of the exposed surface.

5.3 Structural Fill and Fill Placement Control

Structural fill, defined as any fill which will support structural loads, should be clean and free of organic material, debris, deleterious materials, and frozen soils. Samples of the proposed

fill materials should be tested prior to initiating the earthwork and backfilling operations to determine the classification, the natural and optimum moisture contents and maximum dry density and overall suitability as a structural fill. ***Structural fill should have a liquid limit less than 40 and a plasticity index less than 20.***

All structural fill beneath floor slabs, adjacent to foundations and over foundations, should be compacted to at least 95 percent (%) of its maximum Standard Proctor dry density (ASTM D-698). This minimum compaction requirement should be increased to 100 percent (%) of the maximum Standard Proctor dry density for fill supporting footings, provided these are designed as outlined Section 4.0 *"Design Recommendations"*.

Structural fill supporting, around and over utilities should be compacted to at least 95 percent (%) of its maximum Standard Proctor dry density (ASTM D-698) for utilities underlying structural areas (i.e., buildings, pavements, sidewalks, etc.). However, the minimum compaction requirement can be reduced for backfill around and over the utilities to 90 percent (%) of the maximum Standard Proctor dry density where utilities underlie greenbelt areas (i.e., grassy lawns, landscaping, etc.). It is recommended that a clean well-grade granular material be utilized as the bedding material, as well as the backfill material around and over the utility lines.

In cut areas, where pavement sections are planned, the upper 10 inches of subgrade should be scarified and compacted to a dry density of at least 100 percent (%) of the Standard Proctor maximum dry density (ASTM D-698). Any grade-raise fill placed within 1 foot of the base of the pavement section should also be compacted to at least 100 percent (%) of the Standard Proctor maximum dry density. This can be reduced to 95 percent (%) for structural fill placed more than 1 foot below the base of the pavement section.

To achieve the recommended compaction of the structural fill, we suggest that the fill be placed and compacted in layers not exceeding 8 inches in loose thickness (the loose lift thickness should be reduced to 6 inches when utilizing small hand compactors) and within the range of 2 percentage (%) points below or above the optimum moisture content value. All fill placements should be monitored by a *Patriot* representative. ***Each lift should be tested for proper compaction at a frequency of at least one (1) test every 2,500 square feet (ft^2) per lift for the building areas, at least one (1) test every 10,000 square feet***

***(ft^2) per lift for the parking and roadway areas, and at a frequency of at least one (1) test for every 50 lineal feet of utility installation*.**

5.4 Groundwater Considerations

Groundwater was observed during our field activities at depths between about 3 and 25 feet below the existing ground surface (Refer to the *"Groundwater Summary Table*" in Section 3.3 *"Groundwater Conditions"*); which could be within the anticipated foundation excavation depths and trench excavation depths for subsurface utilities. Therefore, depending on seasonal conditions, localized and sporadic groundwater infiltration may occur into the building foundation and subsurface utility excavations on this site.

Groundwater inflow into shallow excavations **above** the groundwater table is expected to be adequately controlled by conventional methods such as gravity drainage and/or pumping from sumps. More significant inflow can be expected in deeper excavations **below** the groundwater table requiring more aggressive dewatering techniques, such as well or wellpoint systems. For groundwater to have minimal effects on the construction, foundation excavations should be constructed and poured in the same day, if possible.

6.0 EXPLORATIONAL PROCEDURES

6.1 Field Work

A total of twelve (12) soil borings were drilled, sampled, and tested at the project site between March 22nd and 29th, 2024, at the approximate locations shown on the Boring Location Map (Figure No. 2) in Appendix "A". The depths that the soil borings were advanced to are shown on the Boring Logs in Appendix "A".

The borings were advanced using 3¼ inch inside diameter hollow-stem augers. Samples were recovered in the undisturbed material below the bottom of the augers using the standard drive sample technique in accordance with ASTM D 1586-74. A 2 inch outside diameter by 1^3/$_8$ inch inside diameter split-spoon sampler was driven a total of 18 inches with the number of blows of a 140-pound hammer falling 30 inches recorded for each 6 inches of penetration. The sum of blows for the final 12 inches of penetration is the Standard Penetration Test result commonly referred to as the N-value (or blow-count). Split-spoon samples were recovered at 2.5 feet intervals, beginning at a depth of 1 foot below the

existing surface grade, extending to a depth of 10 feet, and at 5 feet intervals thereafter to the termination of the boring.

Water levels were monitored at each borehole location during drilling and upon completion of the boring. The boreholes were backfilled with auger cuttings and boring performed in pavement areas were patched prior to demobilization.

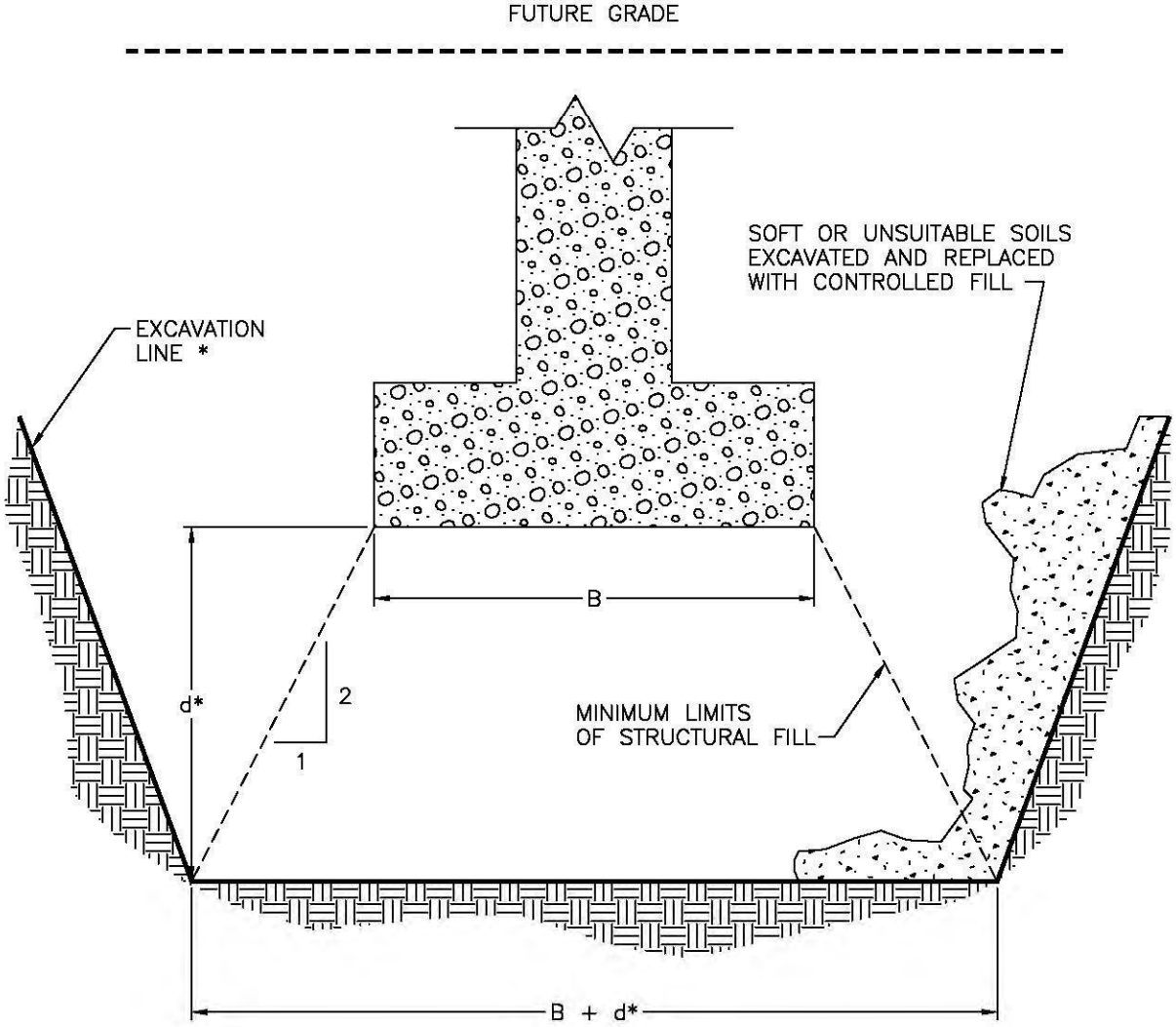
Upon completion of the boring program, samples retrieved during drilling were returned to *Patriot*'s soil testing laboratory where they were visually examined and classified. A laboratory-generated log of each boring was prepared based upon the driller's field log, laboratory test results, and our visual examination. Test boring logs and a description of the classification system are included in Appendix "A" in this report. Indicated on each log are the primary strata encountered, the depth of each stratum change, the depth of each sample, the Standard Penetration Test results, groundwater conditions, and selected laboratory test data. The laboratory logs were prepared for each boring giving the appropriate sample data and the textural description and classification.

6.2 Laboratory Testing

Representative samples recovered in the borings were selected for testing in the laboratory to evaluate their physical properties and engineering characteristics. Laboratory analysis typically includes natural moisture content determinations (ASTM D 2216) and an estimate of the cohesive soil strength was determined utilizing a calibrated hand penetrometer (q_p), ***however, due to the potential of contaminated soils, the sample jars were not exposed to open air and laboratory testing (moisture content and hand penetrometer readings) was not completed.*** Visual classification through the glass jars were completed. The results of laboratory tests are summarized in Section 3.2 *"General Subsurface Conditions"*. Soil descriptions on the boring logs are in accordance with the Unified Soil Classification System (USCS).

7.0 ILLUSTRATIONS

See Illustrations "A" and "B" on the following pages. These illustrations are presented to further visually clarify several of the construction considerations presented in Section 5.2 *"Foundation Excavations"*.



*d IS DEPTH TO SUITABLE SOILS

* IN COMPLIANCE WITH OSHA STANDARDS

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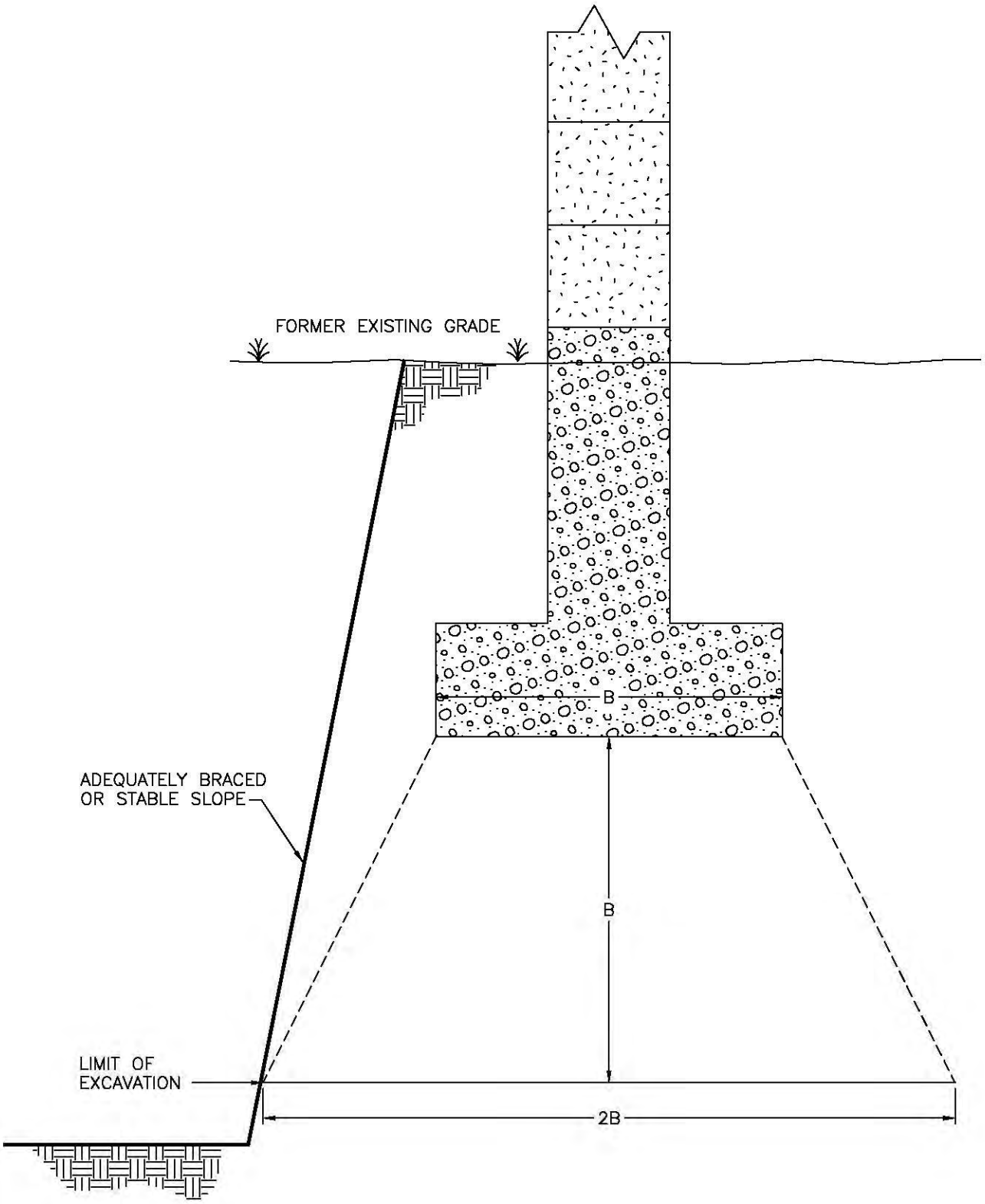
Consulting Environmental, Geotechnical
and Materials Engineers

Excavation for Footings In an Area of Fill
ILLUSTRATION A

job. no.:

figure:



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Excavation Near Existing In Use Foundations
ILLUSTRATION B

job. no.:

figure:

APPENDIX A

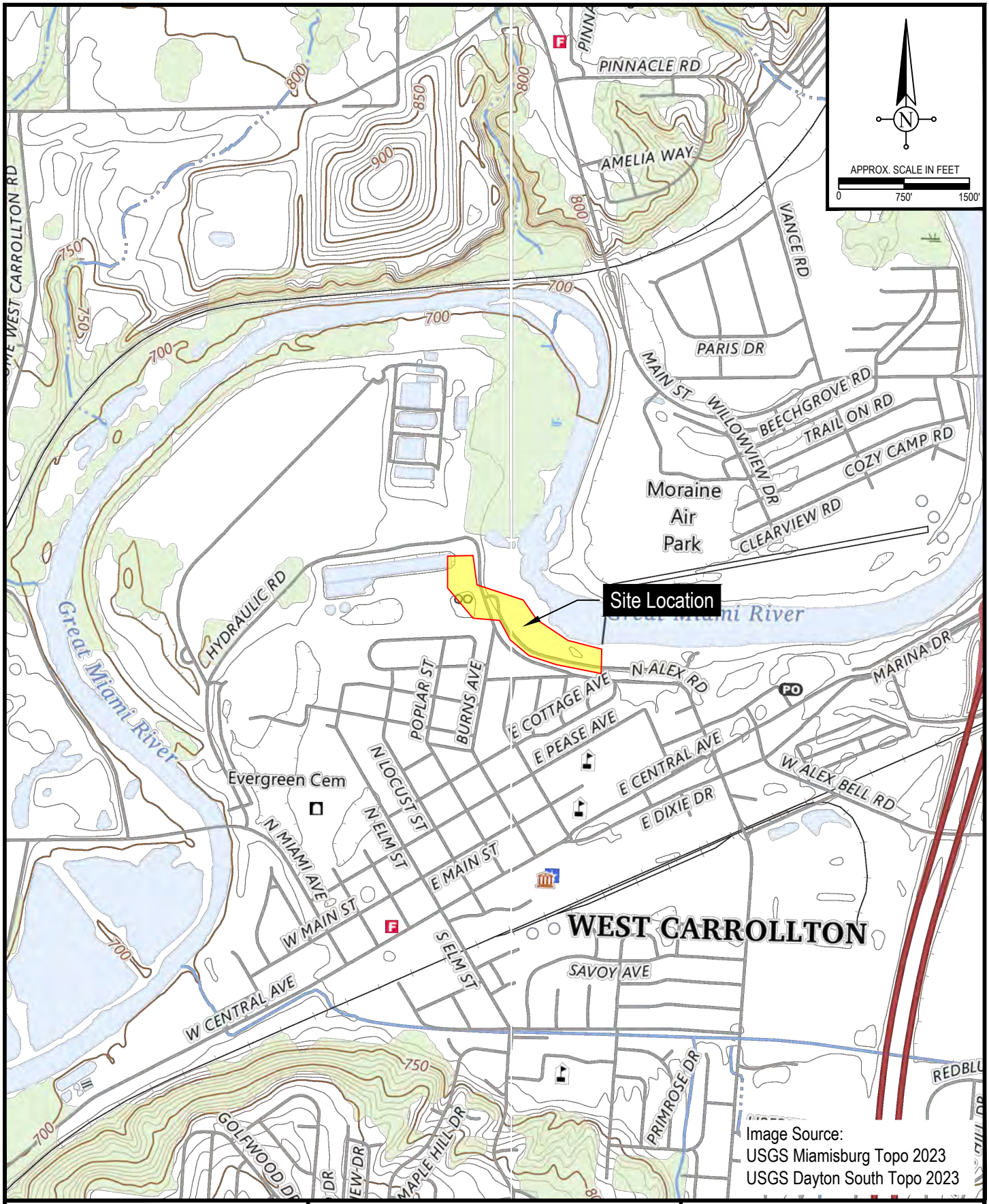
SITE VICINITY MAP (FIGURE NO. 1)

BORING LOCATION MAP (FIGURE NO. 2)

BORING LOGS

BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)



Patriot Engineering & Environmental, Inc.

Project: West Carrollton River Park GEO
Alex Road & Hydraulic Road
West Carrollton, Ohio

	Drawn By: J. DuMond
Project Number:24-0274-07	Approved: L. Young
Date: May 20, 2024	DWG: 24-0274-07_geo

Figure 1

Site Vicinity Map

Patriot Engineering & Environmental, Inc.

LEGEND
- PATRIOT Soil Boring
- B-1 Soil Boring ID

NOTES:
1. Boring locations were staked by PATRIOT. All locations are shown as approximate.
2. All locations were determined in the field with references to existing landmarks.
3. Image Source: Bing Maps
4. Scale as shown.

Project: West Carrollton River Park GEO
Alex Road & Hydraulic Road
West Carrollton, Ohio

	Drawn By: J. DuMond
Project Number: 24-0274-07	Approved: L. Young
Date: May 20, 2024	DWG: 24-0274-07_geo

Figure 2

Soil Boring Location Map
Aerial

Patriot Engineering & Environmental, Inc.

LEGEND

PATRIOT Soil Boring

B-1 Soil Boring ID

NOTES:

1. Boring locations were staked by PATRIOT. All locations are shown as approximate.
2. All locations were determined in the field with references to existing landmarks.
3. Image Source: Client's Concept Plan
4. Scale as shown.

Project: West Carrollton River Park GEO
Alex Road & Hydraulic Road
West Carrollton, Ohio

	Drawn By: J. DuMond
Project Number: 24-0274-07	Approved: L. Young
Date: May 20, 2024	DWG: 24-0274-07_geo

Figure 3

Soil Boring Location Map
Outdoor Adventure Area

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LOG OF BORING B-19

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 716.9 feet
Start Date	: 03/28/2024	Latitude	: 39°40'49.93"N
Drilling Method	: HSA	Longitude	: 84°15'3.85"W

Water Levels
- During Drilling - 25 feet
- After Completion - 4 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 716.9	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					TOPSOIL (6")						
	715		CL		Brown, medium stiff, SILTY CLAY with trace sand	1	89	4/4/4			
		▽	CL		Brown, stiff, SANDY CLAY with trace gravel and interbedded sand seams	2	100	3/6/9			
5	710				Brown, slightly moist, dense to very dense, fine to medium grained, SAND and gravel with trace silt	3	100	5/15/16			
						4	100	15/31/37			
10	705					5	100	21/25/32			
						6	100	18/26/33			
15	700					7	100	25/23/27			
						8	100	15/15/21			
20			SP-SM								
	695										
						9	6	50-4"			
25		▼									Boring caved to 26 feet upon auger removal.
	690										
						10	6	50-1"			
30											
	685										
						11	17	13/22/28			
35											

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LOG OF BORING B-19

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 716.9 feet
Start Date	: 03/28/2024	Latitude	: 39°40'49.93"N
Drilling Method	: HSA	Longitude	: 84°15'3.85"W

Water Levels
- During Drilling - 25 feet
- After Completion - 4 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 716.9	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35											
	680		SP-SM		Brown, slightly moist, dense to very dense, fine to medium grained, SAND and gravel with trace silt						
40			CL		Brown and gray, hard, SANDY CLAY with trace gravel	12	50	23/25/27			
	675				Boring terminated at 40 feet.						
45											
	670										
50											
	665										
55											
	660										
60											
	655										
65											
	650										
70											

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LOG OF BORING B-20

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 721.3 feet
Start Date	: 03/28/2024	Latitude	: 39°40'49.83"N
Drilling Method	: HSA	Longitude	: 84°15'4.69"W

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 721.3	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	720	SC	TOPSOIL (6") Dark brown, slightly moist, loose, CLAYEY SAND with trace gravel	1	100	3/4/4			
5	715	SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	2	100	4/7/10			Sample No. 3: Two attempts were made to obtain a splitspoon sample. Classification is based on field observations.
		SP-SM	Brown, slightly moist, very dense, fine to medium grained, SAND and gravel with trace silt	3	0	8/21/43			
10	710	SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	4	100	7/8/13			Boring caved to 6 feet upon auger removal.
			Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15	705								
20	700								
25	695								
30	690								
35									

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LOG OF BORING B-21

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 719.1 feet
Start Date	: 03/28/2024	Latitude	: 39°40'51.10"N
Drilling Method	: HSA	Longitude	: 84°15'4.38"W

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 719.1	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					ASPHALT (5")						
			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	1	89	5/5/12			
	715		CL		Brown, stiff, SILTY CLAY with trace sand	2	100	4/4/5			Boring caved to 4 feet upon auger removal.
5			SP-SM		Brown, slightly moist, dense, fine to medium grained, SAND and gravel with trace silt	3	100	15/24/17			
	710					4	100	15/17/20			
10					Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
	705										
15											
	700										
20											
	695										
25											
	690										
30											
	685										
35											

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LOG OF BORING B-22

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 719.3 feet
Start Date	: 03/28/2024	Latitude	: 39°40'52.25"N
Drilling Method	: HSA	Longitude	: 84°15'5.32"W

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 719.3	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					ASPHALT (7")						
			CL		Brown, stiff, SANDY CLAY with trace gravel and interbedded sand seams	1	100	4/4/6			Bulk sample collected from 0.0 to 5.0 feet.
	715				Brown, slightly moist, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	2	100	7/8/10			Boring caved to 4 feet upon auger removal.
5			SP-SM			3	100	8/9/12			
	710					4	100	14/19/25			
10					Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
	705										
15											
	700										
20											
	695										
25											
	690										
30											
	685										
35											

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LOG OF BORING B-23

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 715.3 feet
Start Date	: 03/28/2024	Latitude	: 39°40'52.56"N
Drilling Method	: HSA	Longitude	: 84°15'6.82"W

Water Levels
- During Drilling - 23.5 feet
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 715.3	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	715				ASPHALT (7")						
			CL		Brown, medium stiff, SANDY CLAY with trace gravel	1	100	2/2/3			
						2	100	3/3/4			
5	710										
			SP-SM		Brown, slightly moist, dense to medium dense, fine to medium grained, SAND and gravel with trace silt	3	100	9/16/18			
						4	100	8/10/11			
10	705					5	100	8/9/13			
						6	100	22/18/13			
15	700					7	100	19/17/18			
						8	89	10/15/17			
20	695										
		▼				9	100	22/15/11			Boring caved to 24 feet upon auger removal.
25	690		SP-SM		Brown, saturated, medium dense to dense, fine to medium grained, SAND and gravel with trace silt						
						10	100	5/7/10			
30	685										
						11	89	5/17/30			
35											

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LOG OF BORING B-23

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 715.3 feet
Start Date	: 03/28/2024	Latitude	: 39°40'52.56"N
Drilling Method	: HSA	Longitude	: 84°15'6.82"W

Water Levels
- During Drilling - 23.5 feet
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 715.3	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35	680		SP-SM		Brown, slightly moist, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	12	100	27/13/17			
40	675				Boring terminated at 40 feet.						
45	670										
50	665										
55	660										
60	655										
65	650										
70											

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LOG OF BORING B-24

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 714.4 feet
Start Date	: 03/22/2024	Latitude	: 39°40'52.55"N
Drilling Method	: HSA	Longitude	: 84°15'8.32"W

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 714.4	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					CONCRETE (8")						
					Brown, slightly moist, dense to very dense, fine to medium grained, SAND and gravel with trace silt	1	89	38/22/26			
5	710		SP-SM			2	89	34/30/24			
						3	11	50-2"			Boring caved to 7.5 feet upon auger removal.
10	705				Boring terminated at 8.6 feet.	4	11	50-1"			Groundwater was not encountered during drilling, nor upon completion.
15	700										
20	695										
25	690										
30	685										
35	680										

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LOG OF BORING B-25

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 715.6 feet
Start Date	: 03/28/2024	Latitude	: 39°40'53.33"N
Drilling Method	: HSA	Longitude	: 84°15'7.55"W

Water Levels
- During Drilling - 23.5 feet
- After Completion - 3 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 715.6	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	715				CONCRETE (8")						
					Brown, slightly moist, dense to very dense, fine to medium grained, SAND and gravel with trace silt	1	100	10/23/24			
		▽				2	89	23/18/26			
5	710					3	89	17/19/28			
						4	6	50-1"			
10	705		SP-SM			5	100	28/19/24			
						6	100	17/24/28			
15	700					7	100	16/23/25			
						8	100	21/18/20			
20	695										
		▼				9	89	19/21/26			
25	690				Gray, saturated, dense to very dense, fine to medium grained, SAND with trace silt and some gravel						Boring caved to 26 feet upon auger removal.
			SP-SM			10	100	30/21/27			
30	685										
						11	89	25/26/20			
35											

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LOG OF BORING B-25

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 715.6 feet
Start Date	: 03/28/2024	Latitude	: 39°40'53.33"N
Drilling Method	: HSA	Longitude	: 84°15'7.55"W

Water Levels
- During Drilling - 23.5 feet
- After Completion - 3 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 715.6	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35	680		SP-SM		Gray, saturated, dense to very dense, fine to medium grained, SAND with trace silt and some gravel	12	100	21/23/28			
40	675				Boring terminated at 40 feet.						
45	670										
50	665										
55	660										
60	655										
65	650										
70											

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LOG OF BORING B-26

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 716.2 feet
Start Date	: 03/29/2024	Latitude	: 39°40'53.34"N
Drilling Method	: HSA	Longitude	: 84°15'5.86"W

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 716.2	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	715				TOPSOIL (8")						
			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND and gravel with trace silt	1	89	4/5/7			
5	710		SP-SM		Brown, slightly moist, dense to very dense, fine to medium grained, SAND and gravel with trace silt	2	100	9/22/26			Boring caved to 5 feet upon auger removal.
						3	100	25/26/28			
10	705					4	83	14/24/50-3"			
					Boring terminated at 9.6 feet.						Groundwater was not encountered during drilling, nor upon completion.
15	700										
20	695										
25	690										
30	685										
35											

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LOG OF BORING B-27

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 716.3 feet
Start Date	: 03/29/2024	Latitude	: 39°40'54.06"N
Drilling Method	: HSA	Longitude	: 84°15'6.73"W

Water Levels
- During Drilling - 18.5 feet
- After Completion - 6 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 716.3	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	715				TOPSOIL (1")	1	33	50-1"			
					Brown, slightly moist, dense to medium dense, fine to medium grained, SAND and gravel with trace silt	2	100	27/23/24			
5	710	▽				3	33	50-1"			
						4	11	50-2"			
10	705		SP-SM			5	89	19/28/21			
						6	100	17/23/26			
15	700					7	89	13/16/21			
		▼				8	89	14/10/12			
20	695		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND and gravel with trace silt						
						9	100	46/23/28			
25	690				Brown, saturated, very dense to dense, fine to medium grained, SAND and gravel with trace silt						
			SP-SM			10	100	19/22/24			Boring caved to 28 feet upon auger removal.
30	685										
			SP-SM		Brown, saturated, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	11	89	18/16/13			
35											

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LOG OF BORING B-27

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 716.3 feet
Start Date	: 03/29/2024	Latitude	: 39°40'54.06"N
Drilling Method	: HSA	Longitude	: 84°15'6.73"W

Water Levels
- During Drilling - 18.5 feet
- After Completion - 6 feet
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 716.3	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35	680		SP-SM		Brown, saturated, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	12	100	17/21/15			
40	675				Boring terminated at 40 feet.						
45	670										
50	665										
55	660										
60	655										
65	650										
70											

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PATRIOT ENGINEERING and Environmental Inc.
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LOG OF BORING B-28

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 716.1 feet
Start Date	: 03/29/2024	Latitude	: 39°40'54.14"N
Drilling Method	: HSA	Longitude	: 84°15'8.38"W

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 716.1	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	715				SAND and GRAVEL (4")	1	6	50-1"			
			SP-SM		Brown, slightly moist, very dense to dense, fine to medium grained, SAND and gravel with trace silt	2	67	20/20/23			
5	710		CL		Brown, hard, SANDY CLAY with trace gravel and interbedded sand seams	3	56	18/23/25			Boring caved to 8 feet upon auger removal.
			SP-SM		Brown, slightly moist, very dense, fine to medium grained, SAND with trace silt and some gravel	4	33	22/29/37			
10	705				Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15	700										
20	695										
25	690										
30	685										
35											

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PATRIOT ENGINEERING and Environmental Inc.
Indianapolis, Terre Haute, Evansville, Fort Wayne, Lafayette, Bloomington Louisville, KY Dayton, Cincinnati, OH

LOG OF BORING B-29

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 716.3 feet
Start Date	: 03/29/2024	Latitude	: 39°40'55.44"N
Drilling Method	: HSA	Longitude	: 84°15'8.39"W

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 716.3	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	715		CRUSHED STONE (9")						
		CL	Dark gray and brown, hard, SANDY CLAY with trace gravel	1	44	24/22/25			
5	710	SP-SM	Brown, slightly moist, dense, fine to medium grained, SAND and gravel with trace silt	2	56	19/23/25			Boring caved to 5 feet upon auger removal.
				3	56	20/22/24			
		CL							
		SP-SM	Dark gray, hard, SANDY CLAY with trace gravel	4	44	24/34/40			
10	705		Brown, slightly moist, very dense, fine to medium grained, SAND and gravel with trace silt						Groundwater was not encountered during drilling, nor upon completion.
			Boring terminated at 10 feet.						
15	700								
20	695								
25	690								
30	685								
35									

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PATRIOT ENGINEERING and Environmental Inc.
Indianapolis, Terre Haute, Evansville, Fort Wayne, Lafayette, Bloomington Louisville, KY Dayton, Cincinnati, OH

LOG OF BORING B-30

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 714.8 feet
Start Date	: 03/29/2024	Latitude	: 39°40'55.30"N
Drilling Method	: HSA	Longitude	: 84°15'6.74"W

Water Levels
- During Drilling - 15.5 feet
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 714.8	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (10")						
		CL	Brown, hard, SANDY CLAY with trace gravel and interbedded sand seams	1	89	18/50-1"			
				2	78	19/27/50-1"			
5	710		Brown, slightly moist, very dense to dense, fine to medium grained, SAND and gravel with trace silt	3	100	19/35/45			
		SP-SM		4	100	32/22/28			
10	705			~~5~~	11	50-1"			Boring caved to 11.5 feet upon auger removal.
				6	39	34/50-3"			
15	700		Brown, saturated, very dense, fine to medium grained, SAND and gravel with trace silt	7	56	48/49/22			
		SP-SM		8	50	19/24/30			
20	695								
			Brown, slightly moist, medium dense to dense, fine to medium grained, SAND and gravel with trace silt	9	67	10/9/8			
25	690								
		SP-SM		10	56	18/19/24			
30	685								
				11	56	22/24/25			
35	680								

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PATRIOT ENGINEERING and Environmental Inc.
Indianapolis, Terre Haute, Evansville, Fort Wayne, Lafayette, Bloomington Louisville, KY Dayton, Cincinnati, OH

LOG OF BORING B-30

West Carrollton River Park GEO
Alex Road/Hydraulic Road
West Carrollton, Ohio

Client Name	: Merrick & Company	Driller	: E. Thomas
Project Number	: 24-0274-07G	Sampling	: Splitspoon
Logged By	: J. Rogers	Approx. Elevation	: +/- 714.8 feet
Start Date	: 03/29/2024	Latitude	: 39°40'55.30"N
Drilling Method	: HSA	Longitude	: 84°15'6.74"W

Water Levels
- During Drilling - 15.5 feet
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 714.8	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
35			SP-SM		Brown, slightly moist, very dense, fine to medium grained, SAND and gravel with trace silt	12	56	18/26/27			
40	675				Boring terminated at 40 feet.						
45	670										
50	665										
55	660										
60	655										
65	650										
70	645										

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Engineering Value for Project Success
Consulting Environmental, Geotechnical and Materials Engineers

BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM
FIELD CLASSIFICATION SYSTEM
FOR SOIL EXPLORATION

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	-4 blows/ft. or less
Loose	-5 to 10 blows/ft.
Medium Dense	-11 to 30 blows/ft.
Dense	-31 to 50 blows/ft.
Very Dense	-51 blows/ft. or more

Grain Size Terminology

Soil Fraction	Particle Size	US Standard Sieve Size
Boulders	Larger than 12”	Larger than 12”
Cobbles	3” to12”	3” to 12”
Gravel: Coarse	¾” to 3”	¾” to 3”
Small	4.76mm to ¾”	#4 to ¾”
Sand: Coarse	2.00mm to 4.76mm	#10 to #4
Medium	0.42mm to 2.00mm	#40 to #10
Fine	0.074mm to 0.42mm	#200 to #40
Silt	0.005mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005mm	Smaller than #200

RELATIVE PROPORTIONS FOR SOILS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Unconfined Compressive Strength (tons/sq. ft.)	Field Identification (Approx.) SPT Blows/ft.
Very Soft	Less than 0.25	0 - 2
Soft	0.25 – < 0.5	3 - 4
Medium Stiff	0.5 - < 1.0	5 - 8
Stiff	1.0 - < 2.0	9 -15
Very Stiff	2.0 - < 4.0	16 - 30
Hard	Over 4.0	> 30

Classification on logs are made by visual inspection.

Standard Penetration Test - Driving a 2.0” O.D., $1^{3/8}$” I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for **Patriot** to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6.0 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.).

Strata Changes - In the column “Soil Descriptions” on the drill log the horizontal lines represent strata changes. A solid line (————) represents an actually observed change, a dashed line (- - - - - -) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

Groundwater symbols: ▼-observed groundwater elevation, encountered during drilling; ∇-observed groundwater elevation upon completion of boring.

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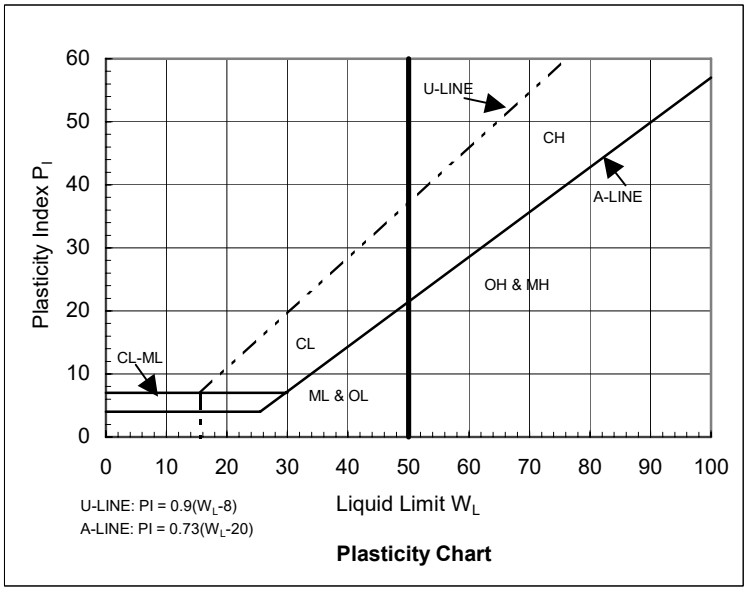
Unified Soil Classification System

Major Divisions			Group Symbol		Typical Names	Classification Criteria for Coarse-Grained Soils		
Coarse-grained soils (more than half of material is larger than No. 200)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	$C_U \geq 4$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{D^2_{30}}{D_{10} D_{60}}$
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW ($C_U < 4$ or $1 > C_C > 3$)		
		Gravels with fines (appreciable amount of fines)	GM	d u l	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A line or $P_I < 4$	Above A line with $4 < P_I < 7$ are borderline cases requiring use of dual symbols	
			GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above A line or $P_I > 7$		
	Sands (more than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_U \geq 6$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{(D_{30})^2}{D_{10} D_{60}}$
			SP		Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW ($C_U < 6$ or $1 > C_c > 3$)		
		Sands with fines (appreciable amount of fines)	SM	d u l	Silty sands, sand-silt mixtures	Atterberg limits below A line or $P_I < 4$	Limits plotting in hatched zone with $4 \leq P_I \leq 7$ are borderline cases requiring use of dual symbols	
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above A line with $P_I > 7$		
Fine-grained soils (more than half of material is smaller than No. 200)	Silt and clays (liquid limit <50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Determine percentages of sand and gravel from grain size curve. 2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5% - GW, GP, SW, SP More than 12% - GM, GC, SM, SC 5-12% - Borderline cases requiring dual symbols		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (liquid limit >50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays or high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		PT		Peat and other highly organic soils			



Plasticity Chart

APPENDIX B

SEISMIC SITE CLASS EVALUATION

This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

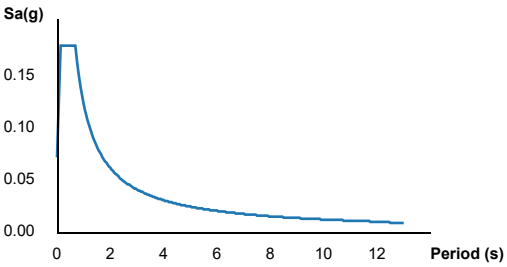
The ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Hazards by Location

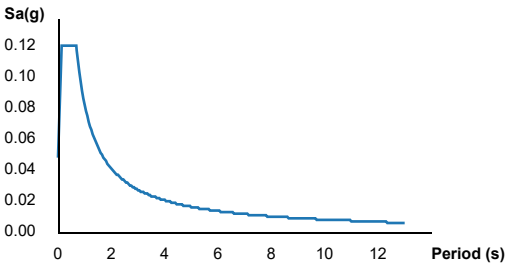
Search Information

Coordinates:	39.681434144532616, -84.25184388054826
Elevation:	716 ft
Timestamp:	2024-05-23T16:17:08.774Z
Hazard Type:	Seismic
Reference Document:	IBC-2015
Risk Category:	IV
Site Class:	C

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.15	MCE_R ground motion (period=0.2s)
S_1	0.072	MCE_R ground motion (period=1.0s)
S_{MS}	0.179	Site-modified spectral acceleration value
S_{M1}	0.123	Site-modified spectral acceleration value
S_{DS}	0.12	Numeric seismic design value at 0.2s SA
S_{D1}	0.082	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	C	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	1.7	Site amplification factor at 1.0s
CR_S	0.924	Coefficient of risk (0.2s)
CR_1	0.886	Coefficient of risk (1.0s)
PGA	0.072	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.087	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
SsRT	0.15	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.162	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.072	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.082	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)

PGAd	0.6	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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APPENDIX C

GENERAL QUALIFICATIONS

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

GENERAL QUALIFICATIONS

of Patriot Engineering's Geotechnical Engineering Investigation

This report has been prepared at the request of our client for his use on this project. Our professional services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test borings logs regarding vegetation types, odors or staining of soils, or other unusual conditions observed are strictly for the information of our client and the owner.

This report may not contain sufficient information for purposes of other parties or other uses. This company is not responsible for the independent conclusions, opinions or recommendations made by others based on the field and laboratory data presented in this report. Should there be any significant differences in structural arrangement, loading or location of the structure, our analysis should be reviewed.

The recommendations provided herein were developed from the information obtained in the test borings, which depict subsurface conditions only at specific locations. The analysis, conclusions, and recommendations contained in our report are based on site conditions as they existed at the time of our exploration. Subsurface conditions at other locations may differ from those occurring at the specific drill sites. The nature and extent of variations between borings may not become evident until the time of construction. If, after performing on-site observations during construction and noting the characteristics of any variation, substantially different subsurface conditions from those encountered during our explorations are observed or appear to be present beneath excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary.

If there is a substantial lapse of time between the submission of our report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we urge that our report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

We urge that Patriot be retained to review those portions of the plans and specifications that pertain to earthwork and foundations to determine whether they are consistent with our recommendations. In addition, we are available to observe construction, particularly the compaction of structural backfill and preparation of the foundations, and such other field observations as may be necessary.

In order to fairly consider changed or unexpected conditions that might arise during construction, we recommend the following verbiage (Standard Clause for Unanticipated Subsurface Conditions) be included in the project contract.

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

"The owner has had a subsurface exploration performed by a soils consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the exploration. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions as described in that report. It is recognized that a subsurface exploration may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of a subsurface exploration and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

At any time during construction operations that the contractor encounters conditions that are different than those anticipated by the soils consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. If the owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the consultant's report, he shall immediately (within 24 hours) bring this fact to the contractor's attention. Once a fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the consultant has concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contract agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and materials basis."

Another example of a changed conditions clause can be found in paper No. 4035 by Robert F. Borg, published in ASCE Construction Division Journal, No. CO2, September 1964, page 37.

Meristem

Where New Growth Happens

West Carrollton Riverside Park

±121.8 acres

Montgomery County, Ohio

Water Resources Delineation Report

April 11th, 2024

Prepared for:

PATRIOT ENGINEERING and Environmental, Inc.

Engineering Value for Project Success

Patriot Engineering
Milford, Ohio

Prepared by:

Meristem, LLC
Avon, Indiana

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1.0 INTRODUCTION

1.1 Introduction

The Study Area is located north of West Carrollton City in Section 16, 22, and 30; Township 1 North and 1 East; Range 6 North and 6 East in Jefferson Township, Montgomery County, Ohio (see Appendix A, Figure 1). The Study Area was delineated by Meristem on March 7th, 2024. Three (3) emergent wetlands (0.354-acre) and one (1) perennial stream (totaling 4,903 LF) were identified within the Study Area during the on-site delineation effort. In addition, one (1) artificial drainage feature totaling 27 LF and two (2) ephemeral waterbodies (totaling 2.648 acres) were identified within the Study Area. A desktop review of the Study Area found two (2) additional wetlands (totaling 3.243 acres) within the ordinary high-water mark (OHWM) of perennial Stream 1 (Great Miami River). At the time of the investigation, these presumably wetland areas were completely inundated and inaccessible.

The perennial stream (Stream 1, Great Miami River), Wetland D, and Wetland E have continuous surface connections to traditionally navigable waters (TNWs) and therefore should be considered “waters of the U.S.” (WOTUS), jurisdictional under the U.S. Army Corps of Engineers (USACE). The identified ephemeral waterbodies appear to have resulted storm water outfall structures combined with a period of heavy rainfall and subsequent flooding and thus should be considered temporary features, non-jurisdictional under the USACE. All other water resources identified lack continuous surface connections with TNWs and thus should not be considered WOTUS, jurisdictional under the USACE.

The 27.1-acre parcel to the west is operating under an active NPDES permit as part of the Montgomery County Wastewater Plant. No data was taken within the parcel boundaries due to concerns regarding potential contamination. As there is an active NPDES permit on this parcel, any water resources within this parcel should be considered exempt from the jurisdiction of the USACE and the Ohio Environmental Protection Agency (OEPA).

1.2 Project Area Description

1.2.1 General Land Use

Land use within the Study Area is primarily maintained lawn and the Great Miami River with a small, forested patch in the northwest and a scrub-shrub/ fallow area to the west. Surrounding land use to the northwest is a mixture of forested land, the Great Miami River, and Montgomery County Wastewater Plant. Land use to the northeast is maintained lawn associated with Moraine Airpark. Land use to the east is the Great Miami River and maintained lawn. Land use to the south is predominantly residential properties past N Alex Road with a small, forested patch separating the residential properties from South Town Self Storage. Surrounding land use to the west is forested land followed by open field.

1.2.2 National Wetland Inventory Mapped Wetlands

The U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) map was reviewed to determine the presence of any NWI polygons within or adjacent to the site. There were three (3) NWI wetland polygons observed within the Study Area boundaries (see Appendix A, Figure 2). Table 1 below outlines the NWI polygons identified within the Study Area as well as their associated water resources.

Table 1: NWI Polygons within Study Area

NWI Polygon	*Description*	*Number within Study Area*	*Associated Water Resources*
R2UBH	Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded	1	Stream 1 (Great Miami River)
R2USA	Riverine, Lower Perennial, Unconsolidated Shore, Temporary Flooded	1	N/A
PUBGx	Palustrine, Unconsolidated Bottom, Intermittently Exposed, Excavated	1	N/A

NWI Polygon R2USA is associated with an upland island within the northern region of the Study Area. NWI Polygon PUBGx is associated with the NPDES facility and was not delineated due to potential contamination.

NWI maps are published by the United States Fish and Wildlife Service (USFWS) to identify potential wetlands and their characteristics. Wetlands published through this service are not always confirmed through field sampling and are not always accurate in identifying water resources.

1.2.3 Topography and Drainage

The Study Area contains moderate topography throughout. Significant changes in elevation occur along the Great Miami River as well as along the northeastern and southeastern boundaries where there are two berms. Topography within the northwestern region of the Study Area varies significantly with elevations ranging between 700 and 724 feet above sea level (ASL). Relief across the Study Area varies from 698 and 726 feet ASL with the lowest point within the Great Miami River and the highest point atop the berm in the southeastern corner (see Appendix A, Figure 3).

1.2.4 Soil Associations and Series Types

The U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Web Soil Survey identifies eight (8) Soil Mapping Unit types throughout the Study Area. The Study Area is predominantly a mosaic of Water (W), Made land (Mb), and the non-hydric Ross-Urban land complex (Rt) soil series with small polygons of additional soil series types along the Study Area boundaries (see Appendix A, Figure 4).

Hydric soils are soils that have formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper layer of the soil. Table 2 on the following page outlines the soil mapping unit types identified within the Study Area.

Table 2: Soil Mapping Units Within the Study Area

Symbol	*Description*	*Hydric*
FlA	Fox loam, 0 to 2 percent slopes	NO
FmA	Fox silt loam, 0 to 2 percent slopes	NO
FuB	Fox-Urban land complex, 2 to 6 percent slopes	NO
Mb	Made land	NO
Rs	Ross silt loam, 0 to 2 percent slopes, occasionally flooded	NO
Rt	Ross-Urban land complex	NO
Stg4AH	Stringley sandy loam, 0 to 2 percent slopes	NO
W	Water	NO

1.2.5 Environmental Protection Agency Level IV Ecoregion

The Study Area is located within the Loamy High Lime Till Plains (55b) Level IV Ecoregion as designated by the U.S. Environmental Protection Agency (EPA). This ecoregion historically contained nearly-level topography and soils developed from loamy, limey, glacial deposits of Wisconsinan age, with higher fertility and better natural drainage than surrounding Eastern Corn Belt Plains Level IV Ecoregions. Much of the original land use has been converted to agriculture.

2.0 REGULATORY BACKGROUND

2.1 Regulatory Agencies

Agencies that regulate impacts to the nation's surface water resources within Ohio include USACE and the Ohio Environmental Protection Agency (Ohio EPA). Jurisdictional waters of the U.S. are protected under Sections 401 and 404 of the Clean Water Act (CWA) and Executive Order 11990 (Protection of Wetlands). USACE has the primary regulatory authority for enforcing Section 404 requirements for waters of the U.S., including wetlands.

2.2 Definitions

2.2.1 Federal

Waters of the U.S. are defined by the USACE, 33 Code of Federal Regulations (CFR) 328.3

- All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
- All interstate waters including interstate wetlands;

- All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters: (i) which are or could be used by interstate or foreign travelers for recreational or other purposes; or (ii) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or (iii) which are used or could be used for industrial purpose by industries in interstate commerce;
- All impoundments of waters otherwise defined as waters of the U.S. under the definition;
- Tributaries of waters of the U.S. identified above;
- The territorial seas;
- Wetlands adjacent to waters (other than waters that are themselves wetlands) identified above. The term adjacent means bordering, contiguous, or neighboring. Wetlands separated from other waters of the U.S. by manmade dikes or barriers, natural river berms, beach dunes and the like are "adjacent wetlands."

Wetlands are a category of waters of the U.S. and are defined by the USACE as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3, USACE; Section 8b). Typical wetlands include bogs, marshes, swamps, and other similar areas. However, temporarily or seasonally flooded depressions that receive overland storm water runoff or overbank floodwaters can meet the criteria for wetlands. This is often due to the prevalence of clay soils that hold water or have a high water table that causes soils to remain saturated for long periods.

Based upon current guidance by the Environmental Protection Agency (EPA), only those wetlands that are adjacent to traditional navigable waters or wetlands that directly abut to non-navigable tributaries having a seasonal (3-month minimum) flow are now considered jurisdictional under the CWA (June 5, 2007 EPA Memo regarding Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States) Following are key points from the EPA memo and are at times referred to as "Rapanos Guidance".

"The agencies will assert jurisdiction over the following waters:

- Traditional navigable waters
- Wetlands adjacent to traditional navigable waters
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months)
- Wetlands that directly abut such tributaries

The agencies will decide jurisdiction over the following waters based on a fact-specific analysis to determine whether they have a significant nexus with a traditional navigable water:

- Non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to but that do not directly abut a relatively permanent non-navigable tributary

The agencies generally will not assert jurisdiction over the following features:

- Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow)
- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water

The agencies will apply the significant nexus standard as follows:

- A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by all wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical and biological integrity of downstream traditional navigable waters
- Significant nexus includes consideration of hydrologic and ecologic factors"

The EPA finalized a New Rule to define "waters of the United States" (WOTUS) on December 30th, 2022. This new definition, as it specifically relates to jurisdiction, became effective March 20th, 2023. A federal judge in North Dakota blocked implementation of the New Rule in 24 states, including Ohio, as of April 12th, 2023. Subsequent to this stay (block), the U.S. Supreme Court ruled on May 25th, 2023 in favor of Sackett (see Sackett vs. EPA). On September 8th, 2023 the EPA modified the New Rule from December 30th, 2022 to be congruent with the Supreme Court ruling on the Sackett Case.

At the time of this report, the stay on the New Rule, including its modified form, is still in place for multiple states, including Ohio. Our professional opinion of federal jurisdiction as it relates to the features addressed in this report were evaluated consistent with the definition of "waters of the United States" found in the pre-2015 regulatory regime and consistent with the Supreme Court's decision in Sackett v. EPA; and, to the extent applicable, the USACE's December 2nd, 2008 USACE's Headquarters guidance entitled Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States.

Therefore, Local Corps Districts and USACE Project Manager's interpretation may differ from the professional opinion stated within this document.

2.2.2 State

"Waters" within the state of Ohio are defined as all streams, lakes, ponds, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water that are within or border the state. This term includes natural and artificially-created water bodies, and encompasses both surface and underground water. This definition does not include privately-owned water bodies that do not connect or form significant nexuses with natural surface or groundwater resources, including sewerage systems, treatment works, or disposal systems (OAC 3745-1-02 (B)(95)). The term includes all waters of the United States, as defined in Section 502(7) of the federal Clean Water Act (33 U.S.C. 1362(7)), that are located in Ohio. (*As added by P.L.1-1996, SEC.1. Amended by P.L.183-2002, SEC.1; P.L.282-2003, SEC.31; P.L.52-2004, SEC.4.)*

The State of Ohio relies on the Corps' (USACE) decision regarding wetland determinations and delineations including whether or not a wetland is isolated or non-isolated.

3.0 DETERMINATION OF WATERS OF THE U.S.

3.1 Methods

3.1.1 Wetlands

The water resources delineation was conducted in accordance with the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the appropriate regional supplement. The presence of potentially jurisdictional wetlands is determined by the positive indication of three criteria: the dominance of hydrophytic (wetland) vegetation, one positive hydric soil indicator, and a minimum of one primary or two secondary indicators for hydrology. A "Wetland Determination Form" was completed for each survey point to record the presence or absence of each criterion.

Wetlands were delineated using a Trimble TDC-100, TDC-600 and/or Trimble R1 and mapped using ArcMap 10.8.2. The final determination on the presence of and jurisdiction of wetlands and "waters of the U.S." is determined by the USACE.

3.1.1.1 Hydrophytic Vegetation

Areal coverage of individual herb, shrub, tree, and vine species were assessed and recorded at each survey point to determine dominance. Plant species are assigned an indicator status based on probability of occurring in wetland conditions regionally. The indicator status of each plant is determined by USACE and is published on the National Wetland Plant List (2020). Definitions of the five primary indicator statuses are:

Obligate (OBL): Occur almost always under natural conditions in wetlands (estimated > 99% probability of occurrence).

Facultative Wetland (FACW): Usually occur in wetlands but occasionally found in non-wetlands (estimated 67% - 99% probability of occurrence).

Facultative (FAC). Equally likely to occur in wetlands and non-wetlands (estimated 34% - 66% probability of occurrence).

Facultative Upland (FACU): Occasionally occur in wetlands, but usually occur in non-wetlands (estimated 1% - 33% probability of occurrence).

Upland (UPL). Occur almost always under natural conditions in non-wetlands in the region specified. (estimated < 1% probability of occurrence).

3.1.1.2 Hydric Soil

Soil samples were taken in areas believed to be potential wetlands such as areas that are indicated as wetlands on the National Wetland Inventory maps; areas that exhibited wetland flora or had signs of hydrology. These soil samples were taken to determine the presence of hydric soils by examining the hue, value, and chroma of the soil using a Munsell color chart. An upland soil sample was also taken near the edge of the wetlands to determine the boundary and surrounding conditions for the wetland.

3.1.1.3 Wetland Hydrology

Evidence of hydrology can often be associated when the soil sample is dug. Saturated soils within the upper 12 inches is documented in addition to the presence of the water table within 12 inches of the surface. Other signs of hydrology may include but are not limited to drainage patterns, surface water, rafted debris, and crayfish chimneys.

3.1.2 Streams

Potential boundaries for streams were delineated in the field at the ordinary high water mark (OHWM). The OHWM is the line on the shore or bank established by flowing and/or standing water, marked by characteristics such as a clear, natural line impressed on the bank, erosion shelving, changes in the character of soil, destruction of terrestrial vegetation, presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas [(33 CFR Part 328.3 (e)].
All waterways with an OHWM were identified as perennial, intermittent, or ephemeral. Determination was made based off field observations, the antecedent precipitation tool (APT) developed by USACE, National Hydrography Dataset (NHD), and other available resources.

3.1.3 Ponds

Water bodies such as lakes, ponds, dammed streams, retention ponds, borrow pits, and similar open water systems are defined by the OHWM near the shoreline or the edge of its littoral fringe.

Ponds lacking vegetation were considered open water systems during the delineation. Ponds that are human made are not considered jurisdictional by USACE.

3.2 Delineation Results

Table 3 on the following page summarizes the characteristics of the water resources delineated.

Table 3. Water Resources Located Within the Study Area

Field Name	Water Resource Type[1]	Area within Study Area (acres)	Linear Feet within Study Area	Average Width at OHWM (feet)	Average Depth at OHWM (feet)	USACE-Jurisdictional
Wetland A	PEM	0.123	N/A	N/A	N/A	NO
Wetland B	PEM	0.169	N/A	N/A	N/A	NO
Wetland C	PEM	0.062	N/A	N/A	N/A	NO
Wetland D	PEM	2.431	N/A	N/A	N/A	YES
Wetland D	PSS	0.743	N/A	N/A	N/A	YES
Wetland E	PEM	0.069	N/A	N/A	N/A	YES
Waterbody 1	EPH	2.583	N/A	N/A	N/A	NO
Waterbody 2	EPH	0.065	N/A	N/A	N/A	NO
Stream 1 (Great Miami River)	PER	N/A	4,903	125	23	YES
Drainage Feature 1	N/A	N/A	27	N/A	N/A	NO
Totals:		**6.245**	**4,930**	-	-	-

[1] PER =Perennial; EPH =Ephemeral; PEM = Emergent; PSS = Scrub-Shrub

3.2.1 Wetlands

A 2021 aerial image of the Study Area is included in Appendix A, Figure 5. There were four emergent wetlands and one emergent/ scrub-shrub wetland identified and delineated within the Study Area during the investigation (see Appendix A, Figure 6). Multiple, representative data points were taken in areas most likely to contain wetland hydrology, soils, and vegetation (see Appendix B).

Wetland A

Wetland A is a 0.123-acre isolated emergent wetland located in the west-central region of the Study Area. Wetland A does not appear to have a continuous surface connection with traditional navigable waters (TNWs) and therefore should not be considered a "waters of the U.S." (WOTUS) jurisdictional under the U.S. Army Corps of Engineers (USACE).

- *Vegetation:* Wetland A contained dominant herbaceous species consisting of reed canary grass (*Phalaris arundinacea,* FACW) and calico aster (*Symphyotrichum lateriflorum,* FACW).

  Upland areas adjacent to Wetland A contained dominant herbaceous species consisting of annual bluegrass (*Poa annua,* FACU) and red fescue (*Festuca rubra,* FACU).

- *Soils*: Wetland A met the Depleted Matrix (F3) hydric soil criterion.

- *Hydrology*: The primary hydrology source for Wetland A appears to be precipitation. Primary hydrology indicators observed included Surface Water (A1) and Saturation (A3). Secondary indicators observed included Stunted or Stressed Plants (D1) and the FAC-Neutral Test (D5).

Wetland B

Wetland B is a 0.169-acre isolated emergent wetland located in the central region of the Study Area. Wetland B did not appear to have a continuous surface connection with TNWs and therefore should not be considered a WOTUS, jurisdictional under the USACE.

- *Vegetation:* Wetland B contained dominant herbaceous species consisting of reed canary grass (FACW).
- Upland areas adjacent to Wetland B contained dominant herbaceous species including annual bluegrass (FACU) and red fescue (FACU).
- *Soils*: Wetland B met the Depleted Matrix (F3) hydric soil criteria.
- *Hydrology*: The primary hydrology source for Wetland B appears to be precipitation. Primary hydrology indicators observed included Surface Water (A1) and Saturation (A3). Secondary indicators observed included Stunted or Stressed Plants (D1) and the FAC-Neutral Test (D5).

Wetland C

Wetland C is a 0.062-acre isolated emergent wetland located in the south-central region of the Study Area. Wetland C did not appear to have a continuous surface connection with TNWs and therefore should not be considered a WOTUS, jurisdictional under the USACE.

- *Vegetation:* Wetland C contained dominant herbaceous species consisting of reed canary grass (FACW).
- Upland areas adjacent to Wetland C contained dominant herbaceous species including ribwort plantain (*Plantago lanceolata,* FACU), reed canary grass (FACW), annual bluegrass (FACU), and red fescue (FACU).
- *Soils*: Wetland C met the Depleted Matrix (F3) hydric soil criteria.
- *Hydrology*: The primary hydrology source for Wetland C appears to be precipitation, with the potential for flooding from the Great Miami River. Primary hydrology indicators observed included Inundation Visible on Aerial Imagery (B7). Secondary indicators observed included Stunted or Stressed Plants (D1) and the FAC-Neutral Test (D5).

Wetland D

Wetland D is a 3.174-acre emergent/ scrub-shrub wetland located within the ordinary high-water mark (OHWM) of the Great Miami River in the north-central region of the Study Area. Wetland D was determined via desktop review. The water level of the Great Miami River during the site investigation was above the presumed wetland, therefore data was not able to be collected. Wetland D lies within the OHWM of a TNW and therefore should be considered a WOTUS, jurisdictional under the USACE.

Wetland E

Wetland E is a 0.069-acre emergent wetland located within the OHWM of the Great Miami River in the central region of the Study Area. Wetland E was determined via desktop review. The water level of the Great Miami River during the site investigation was above the presumed wetland, therefore data was not able to be collected. Wetland E lies within the OHWM of a TNW and therefore should be considered a WOTUS, jurisdictional under the USACE.

3.2.2 Streams and Drainage Features

One (1) perennial stream and one (1) artificial drainage feature were identified within the Study Area during the investigation.

Perennial Streams

Stream 1 (Great Miami River) is a perennial stream totaling 4,903 linear feet (LF) within the Study Area. Stream 1 enters the Study Area through the eastern boundary and runs west through the Study Area before exiting through the northwestern boundary. Within the limits of the Study Area, Stream 1 has an OHWM width of 125 feet and an OHWM depth of 23 feet. Stream 1 is a tributary of the Ohio River, a TNW, and therefore should be considered a WOTUS, jurisdictional under the USACE.

Drainage Features

Drainage Feature 1 (27 LF) is an artificial drainage way located in the northwestern region of the Study Area. Drainage Feature 1 appears to convey water through a pipe, across a trail, and down into Stream 1. Drainage Feature 1 appears to be a man-made drainage way that lacks a continuous surface connection to TNWs and therefore should be considered non-jurisdictional under the USACE.

3.2.3 Ponds and Other Waterbodies

Two (2) ephemeral waterbodies were identified within the Study Area during the investigation.

Waterbody 1

Waterbody 1 (2.583 acres) was identified within the Study Area south of the Great Miami River, covering a portion of an unnamed road north of the Great Miami River Recreational Trail. The waterbody appears to have been the direct result of a storm water outfall structure and flooding of the Great Miami River. Due to the waterbody being an ephemeral feature that directly resulted from a combination of the storm water outfall structure, heavy rainfall, and flooding, the identified waterbody should be considered non-jurisdictional under the USACE.

Waterbody 2

Waterbody 2 (0.065-acre) was identified within the Study Area south of the Great Miami River. The waterbody appears to have been the direct result of a storm water outfall structure and flooding of the Great Miami River. Due to the waterbody being an ephemeral feature that directly resulted from a combination of the storm water outfall structure, heavy rainfall, and flooding, the identified waterbody should be considered non-jurisdictional under the USACE.

4.0 Conclusion

The Study Area located north of West Carrollton City in Montgomery County, Ohio was delineated by Meristem, LLC on March 7th, 2024. Three (3) emergent wetlands (0.354-acre) and one (1) perennial stream (totaling 4,903 LF) were identified within the Study Area during the on-site delineation effort. In addition, one (1) artificial drainage feature totaling 27 LF and two (2) ephemeral waterbodies (totaling 2.648 acres) were identified within the Study Area. A desktop review of the Study Area found two (2) additional wetlands (totaling 3.243 acres) within the OHWM of perennial stream 1 (Great Miami River). At the time of the investigation, these presumably wetland areas were completely inundated and inaccessible.

Perennial Stream 1 (Great Miami River), Wetland D, and Wetland E have continuous surface connections to TNWs and therefore should be considered WOTUS, jurisdictional under the USACE. The identified ephemeral waterbodies appear to have resulted storm water outfall structures combined with a period of heavy rainfall and subsequent flooding and thus should be considered temporary features, non-jurisdictional under the USACE. All other water resources identified lack continuous surface connections with TNWs and thus should not be considered WOTUS, jurisdictional under the USACE.

The 27.1-acre parcel to the west is operating under an active NPDES permit as part of the Montgomery County Wastewater Plant. No data was taken within the parcel boundaries due to concerns regarding potential contamination. As there is an active NPDES permit on this parcel, any water resources within this parcel should be considered exempt from the jurisdiction of the USACE and the OEPA.

This report is based on Meristem's best professional opinion and is limited to the time frame when field work was conducted. Meristem is not responsible for the interpretation or use by others of conclusions described in this report. The USACE and the Ohio EPA have final determination of wetland boundaries and connectivity to "waters of the U.S."

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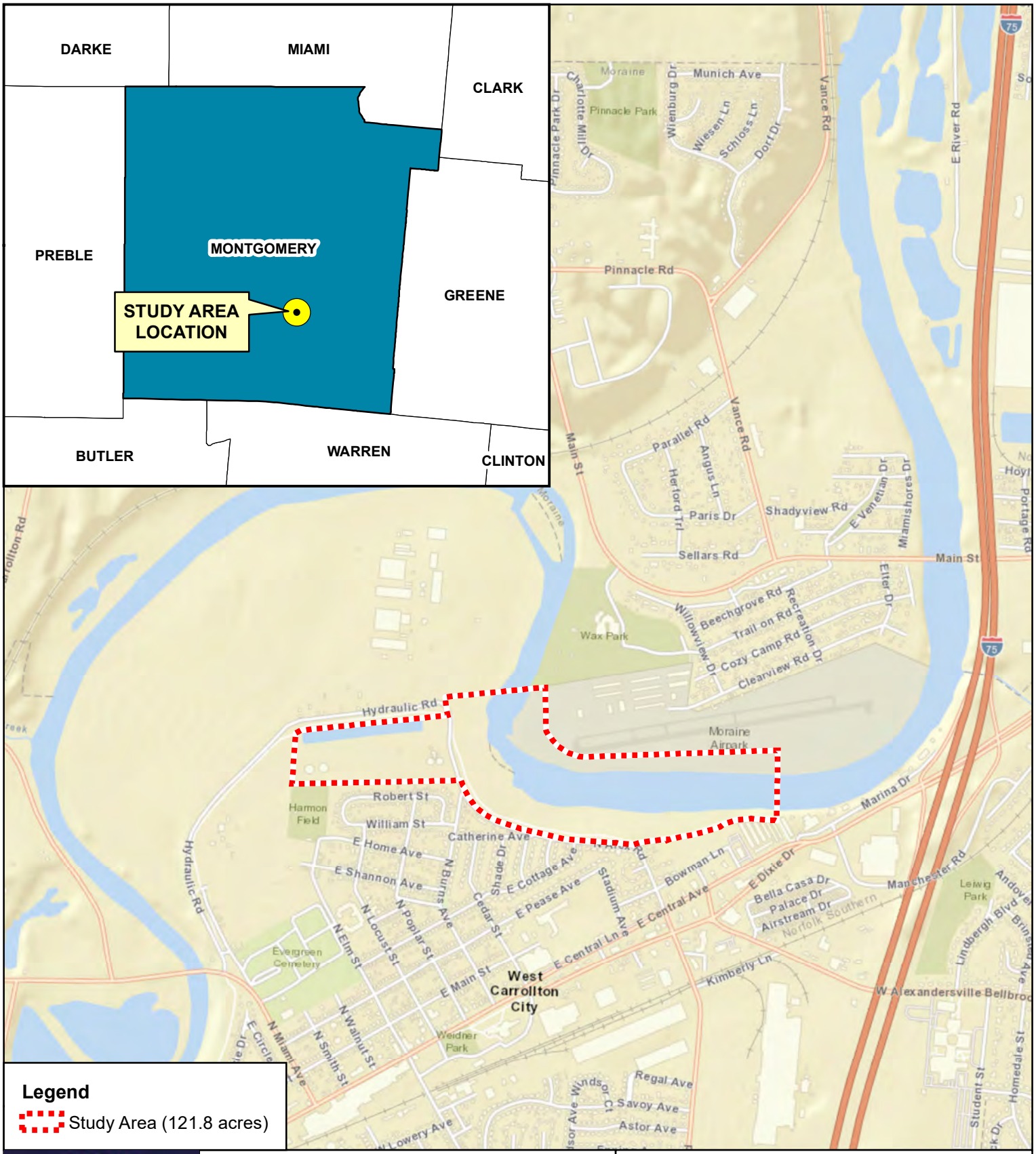
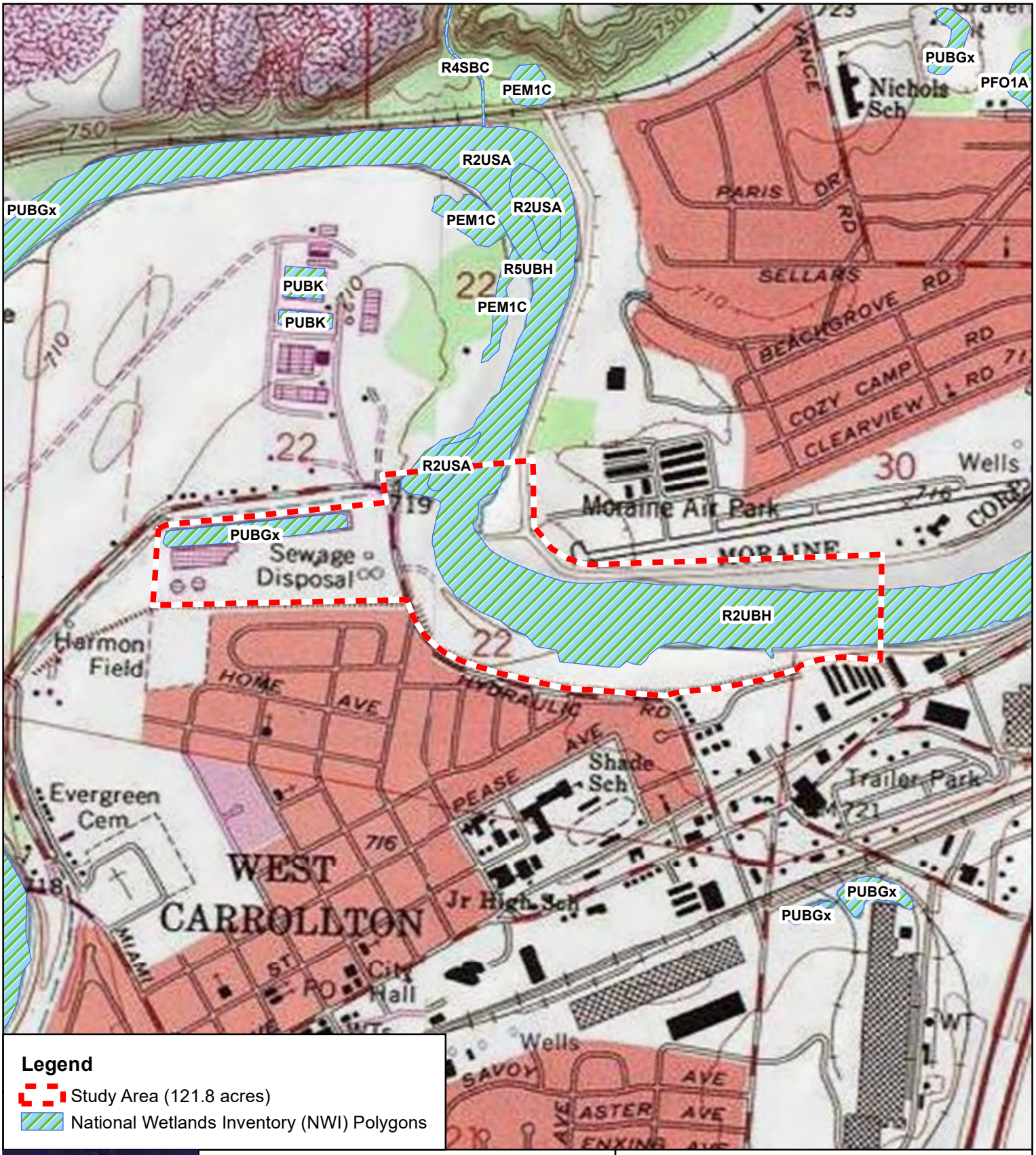
APPENDIX A: Study Area Maps



Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Appendix A, Figure 1:
Study Area Location Map

West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio



Legend

- Study Area (121.8 acres)
- National Wetlands Inventory (NWI) Polygons

N

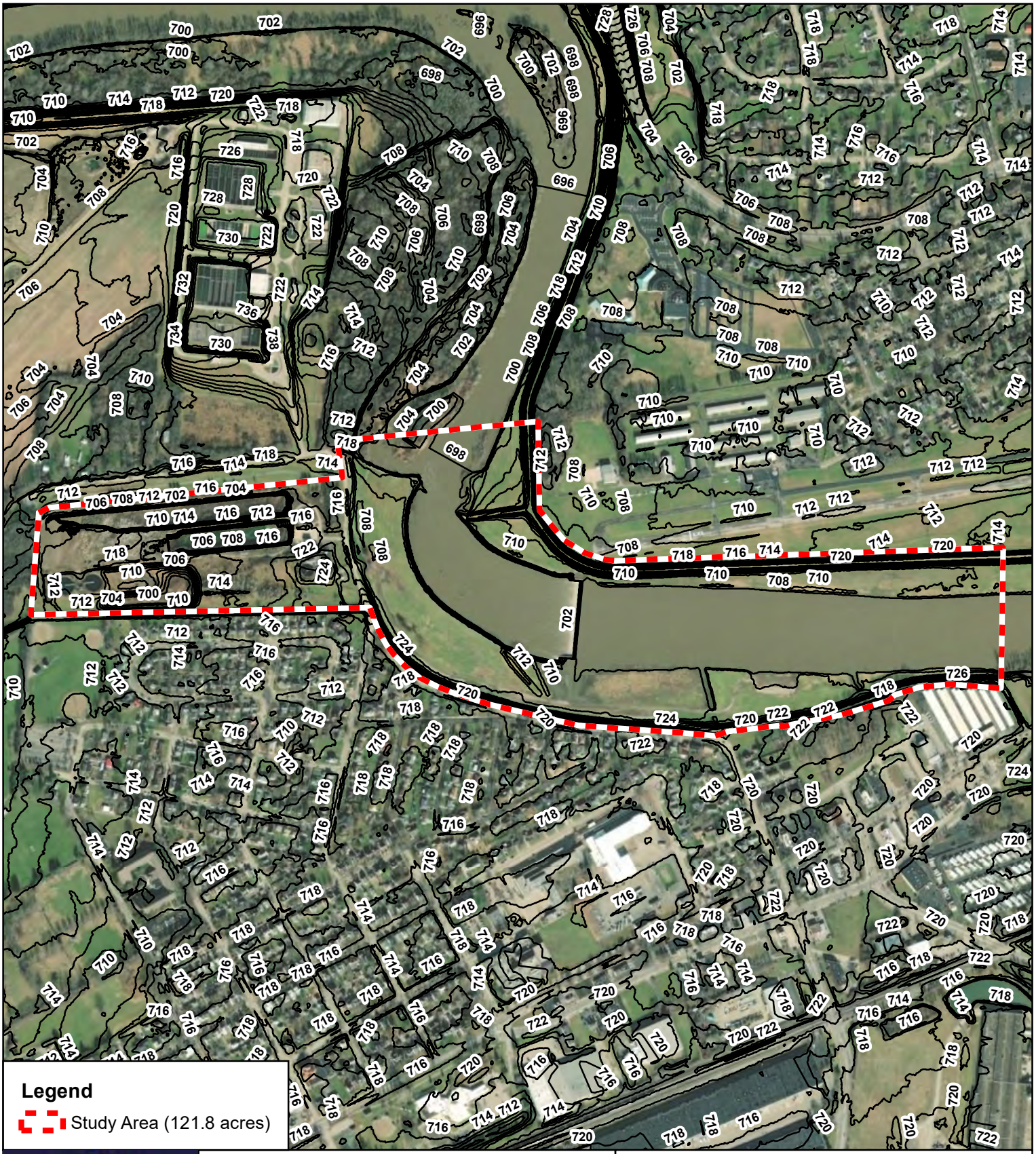
0 500 1,000 2,000 Feet

1 in = 1,000 feet

National Geographic Society, i-cubed. 2013.
U.S. Fish and Wildlife Service, 2005. National Wetlands Inventory website.
U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.
http://www.fws.gov/wetlands/

Appendix A, Figure 2:
Topographic and NWI Map

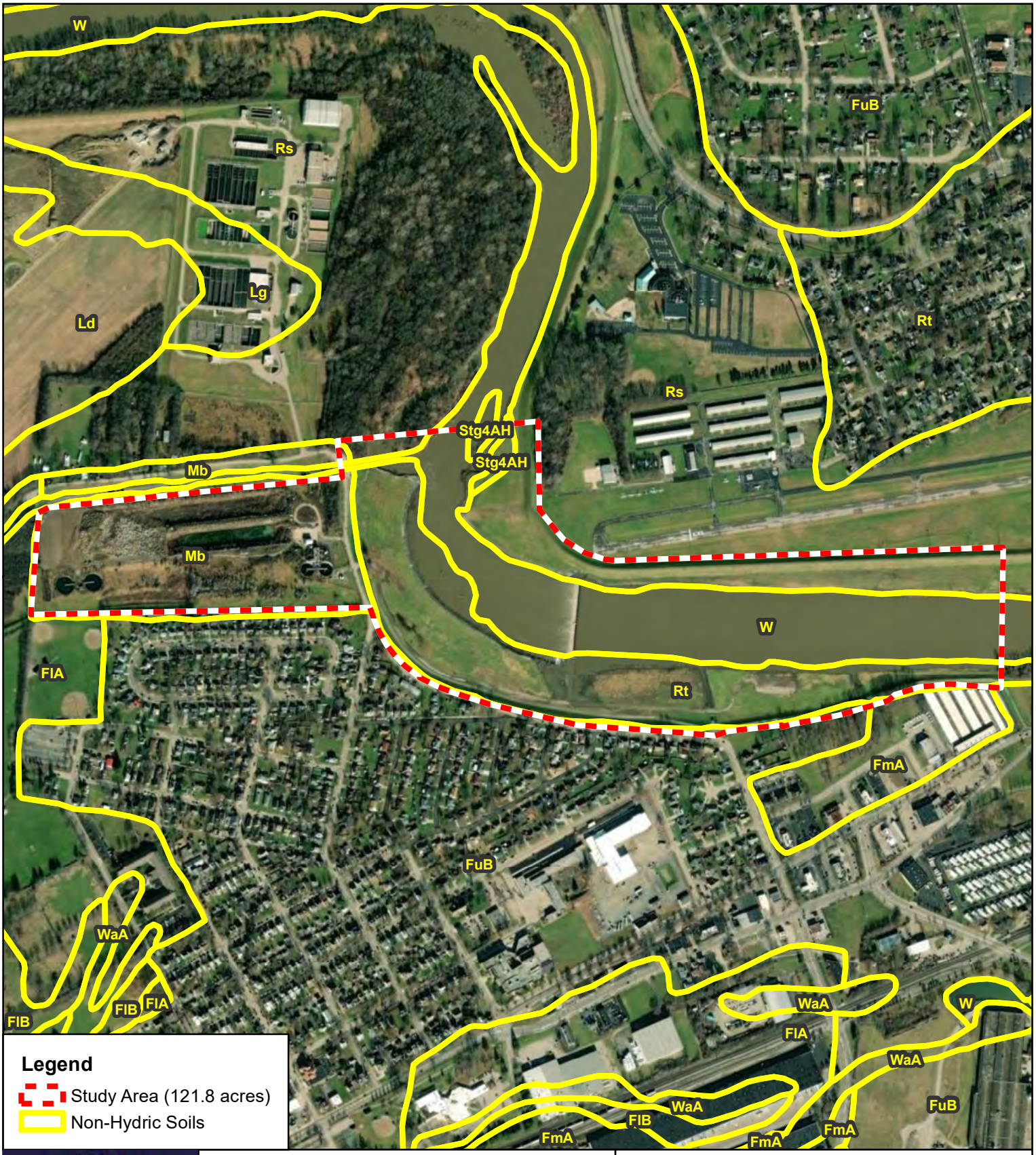
West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Imagery Date: December 26, 2021

Appendix A, Figure 3:
Study Area on Elevation Map

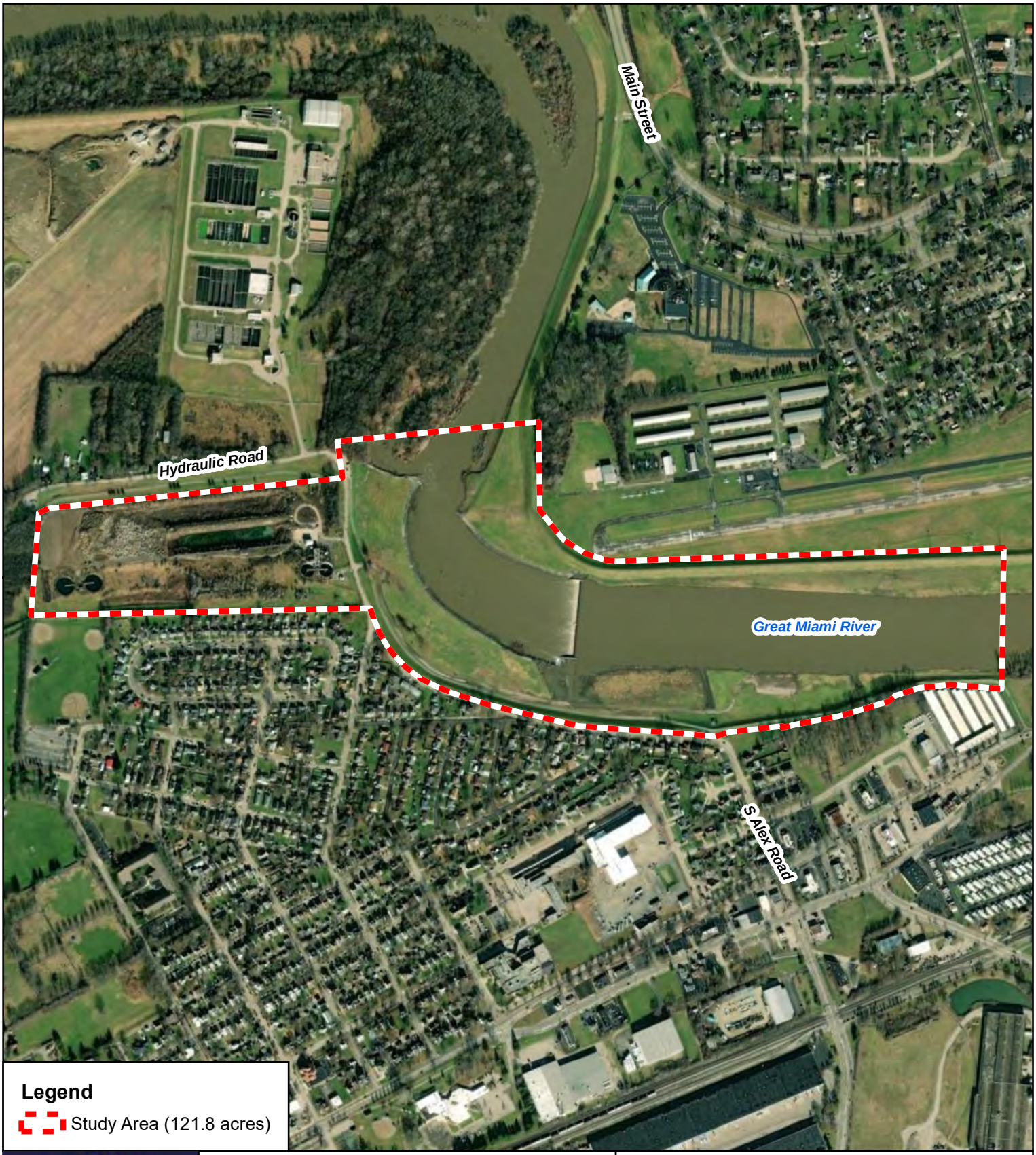
West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio



Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Imagery Date: December 26, 2021

Appendix A, Figure 4:
Study Area on Montgomery County Soils Map

West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio



N

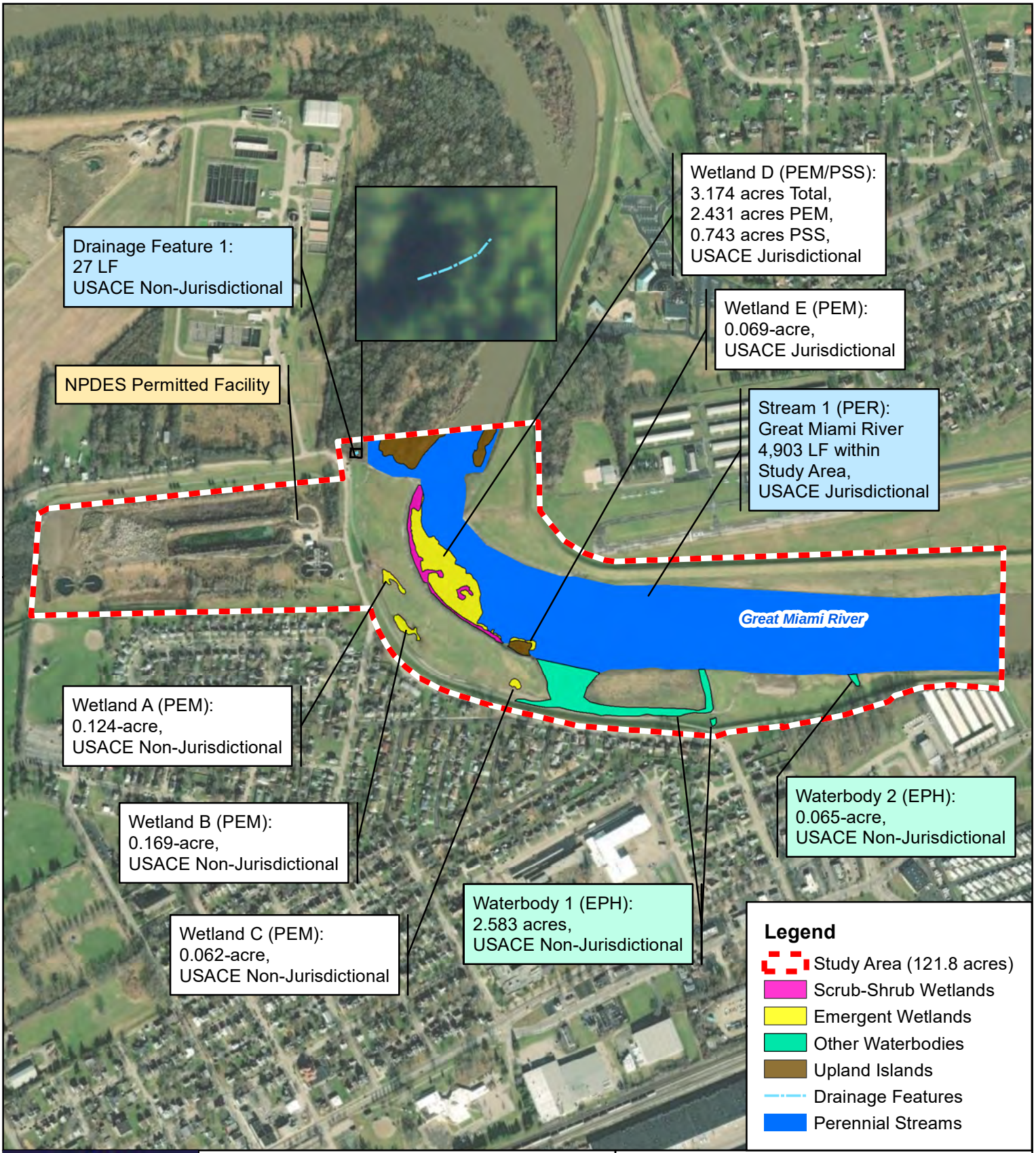
0 375 750 1,500 Feet

1 in = 750 feet

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Imagery Date: December 26, 2021

Appendix A, Figure 5:
Study Area on Aerial Imagery (2021)

West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio



N

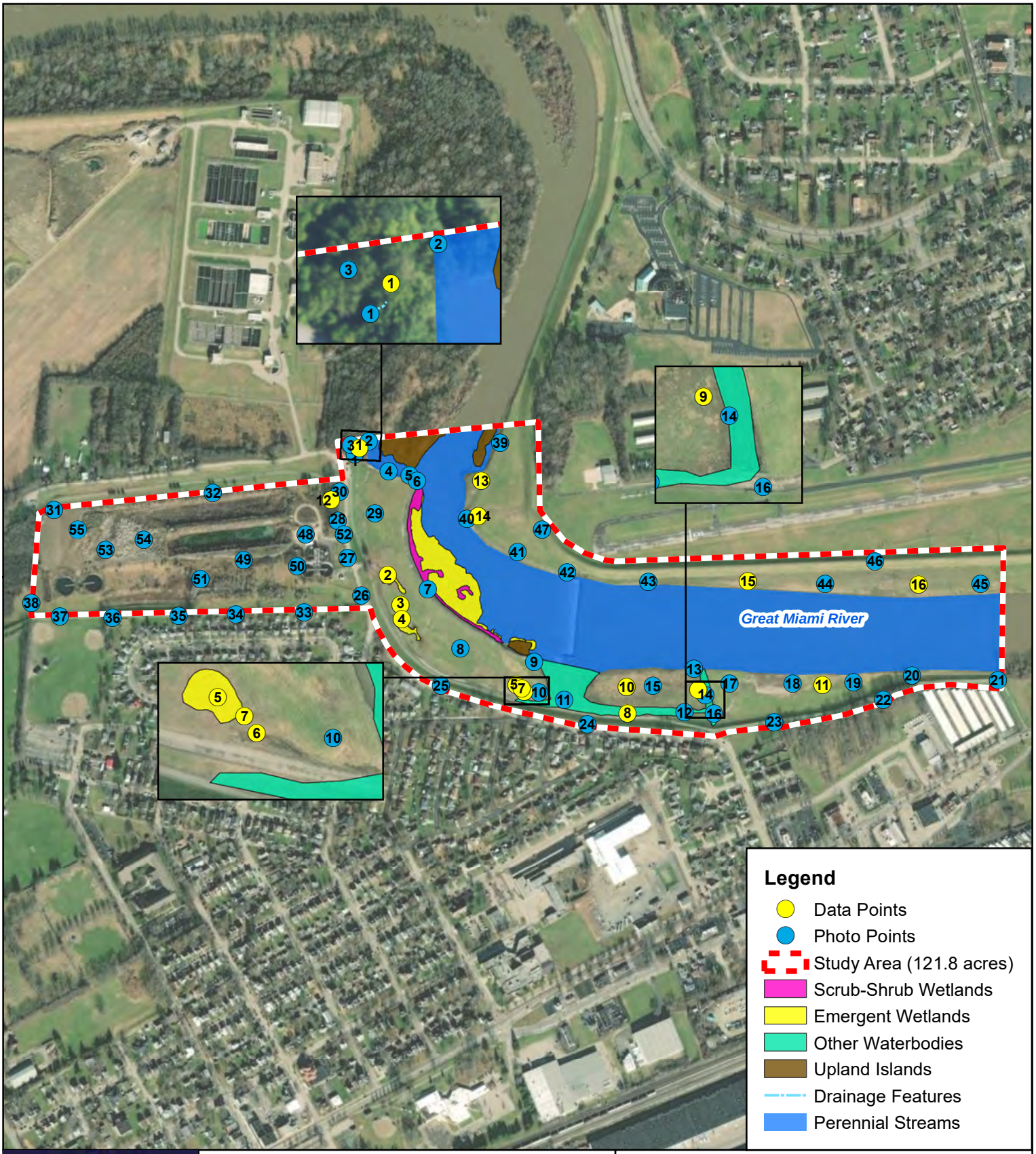
0 375 750 1,500 Feet

1 in = 750 feet

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Esri, USDA Farm Service Agency
Imagery Date: December 26, 2021

Appendix A, Figure 6:
Water Resources Delineation Map

West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio



N

0 375 750 1,500 Feet

1 in = 750 feet

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Esri, USDA Farm Service Agency
Imagery Date: 2021

Appendix A, Figure 7:
Photo and Data Point Locations Map

West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio

APPENDIX B: Wetland Determination Data Forms (Midwest Region)

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 1

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.682821 | Long: -84.250977 | Datum: NAD83

Soil Map Unit Name: Ross silt loam, 0 to 2 percent slopes, occasionally flooded | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes ____	No X		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus deltoides*	10%	No	FAC
2. *Platanus occidentalis*	20%	Yes	FACW
3. *Acer saccharinum*	20%	Yes	FACW
4. *Acer negundo*	15%	Yes	FAC
5.			
	65%	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Lonicera maackii*	30%	Yes	UPL
2. *Acer negundo*	15%	Yes	FAC
3.			
4.			
5.			
	45%	= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Carex sp.*	2%	No	FAC
2. *Phalaris arundinacea*	2%	No	FACW
3. *Ficaria verna*	70%	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	74%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *Toxicodendron radicans*	3%	No	FAC
2.			
	3%	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 83% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species	42%	x2 =	0.84
FAC species	115%	x3 =	3.45
FACU species		x4 =	
UPL species	30%	x5 =	1.5
Column Totals:	1.87 (A)		5.79 (B)

Prevalence Index = B/A = 3.10

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
X 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR 4/2	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	> 20"
Water Table Present?	Yes ___ No X	Depth (inches):	> 20"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 20"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 2

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.680859 | Long: -84.250312 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? Yes X No ____

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Rorippa sylvestris*	5%	No	OBL
2. *Allium vineale*	1%	No	FACU
3. *Plantago lanceolata*	3%	No	FACU
4. *Phalaris arundinacea*	25%	Yes	FACW
5. *Poa annua*	10%	No	FACU
6. *Carex sp.*	3%	No	FAC
7. *Symphyotrichum lateriflorum*	25%	Yes	FACW
8. *Solidago altissima*	15%	No	FACU
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	87%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5%	x1 =	0.05
FACW species	50%	x2 =	1
FAC species	3%	x3 =	0.09
FACU species	29%	x4 =	1.16
UPL species		x5 =	
Column Totals:	0.87 (A)		2.3 (B)

Prevalence Index = B/A = 2.64

Hydrophytic Vegetation Indicators:

- X 1-Rapid Test for Hydrophytic Vegetation
- X 2-Dominance Test is >50%
- X 3-Prevalence Index is ≤3.0[1]
- ____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR 4/1	98	7.5YR 4/6	2	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ___	Depth (inches):	2"
Water Table Present?	Yes ___ No X	Depth (inches):	> 20"
Saturation Present? (includes capillary fringe)	Yes X No ___	Depth (inches):	Surface

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 3

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.68038 | Long: -84.250046 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes ____	No X		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Hemerocallis fulva*	15%	No	UPL
2. *Ficaria verna*	10%	No	FAC
3. *Allium vineale*	5%	No	FACU
4. *Rumex crispus*	7%	No	FAC
5. *Carex sp.*	5%	No	FAC
6. *Taraxacum officinale*	2%	No	FACU
7. *Poa annua*	20%	Yes	FACU
8. *Festuca rubra*	30%	Yes	FACU
9. *Viola sororia*	2%	No	FAC
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	96%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species		x2 =	
FAC species	24%	x3 =	0.72
FACU species	57%	x4 =	2.28
UPL species	15%	x5 =	0.75
Column Totals:	0.96 (A)		3.75 (B)

Prevalence Index = B/A = 3.91

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR 3/3	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 20"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 20"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 4

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.680132 | Long: -84.250024 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? Yes X No ____

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Phalaris arundinacea*	30%	Yes	FACW
2. *Lamium purpureum*	5%	No	UPL
3. *Poa annua*	5%	No	FACU
4. *Taraxacum officinale*	2%	No	FACU
5. *Plantago lanceolata*	5%	No	FACU
6. *Rorippa sylvestris*	5%	No	OBL
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	52%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5%	x1 =	0.05
FACW species	30%	x2 =	0.6
FAC species		x3 =	
FACU species	12%	x4 =	0.48
UPL species	5%	x5 =	0.25
Column Totals:	0.52 (A)		1.38 (B)

Prevalence Index = B/A = 2.65

Hydrophytic Vegetation Indicators:

- X 1-Rapid Test for Hydrophytic Vegetation
- X 2-Dominance Test is >50%
- X 3-Prevalence Index is ≤3.0[1]
- ____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR 4/1	98	7.5YR 4/6	2	C	PL	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ___	Depth (inches):	1"
Water Table Present?	Yes ___ No X	Depth (inches):	> 20"
Saturation Present? (includes capillary fringe)	Yes X No ___	Depth (inches):	Surface

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 5

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.679138 | Long: -84.24765 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? Yes X No ____

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Plantago lanceolata*	7%	No	FACU
2. *Phalaris arundinacea*	25%	Yes	FACW
3. *Poa annua*	2%	No	FACU
4. *Rorippa sylvestris*	5%	No	OBL
5. *Taraxacum officinale*	4%	No	FACU
6. *Solidago altissima*	1%	No	FACU
7. *Symphyotrichum lanceolatum*	1%	No	FAC
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	45%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5%	x1 =	0.05
FACW species	25%	x2 =	0.5
FAC species	1%	x3 =	0.03
FACU species	14%	x4 =	0.56
UPL species		x5 =	
Column Totals:	0.45 (A)		1.14 (B)

Prevalence Index = B/A = 2.53

Hydrophytic Vegetation Indicators:

- X 1-Rapid Test for Hydrophytic Vegetation
- X 2-Dominance Test is >50%
- X 3-Prevalence Index is ≤3.0[1]
- ____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3"	10YR 4/2	85	7.5YR 5/6	15	C	PL	Silt Loam	Gravel throughout
3-6"	10YR 4/2	65	7.5YR 5/6	35	C	PL	Silt Loam	Gravel throughout
								Gravel below 6"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel

Depth (inches): 6 inches

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 6"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 6"

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 6

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.679019 | Long: -84.247488 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes X	No ____		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Plantago lanceolata*	10%	Yes	FACU
2. *Phalaris arundinacea*	10%	Yes	FACW
3. *Trifolium hybridum*	3%	No	FACU
4. *Rumex crispus*	3%	No	FAC
5. *Poa annua*	15%	Yes	FACU
6. *Taraxacum officinale*	2%	No	FACU
7. *Allium vineale*	1%	No	FACU
8. *Festuca rubra*	5%	No	FACU
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	49%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species	10%	x2 =	0.2
FAC species	3%	x3 =	0.09
FACU species	36%	x4 =	1.44
UPL species		x5 =	
Column Totals:	0.49 (A)		1.73 (B)

Prevalence Index = B/A = 3.53

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3"	10YR 4/2	100					Silt Loam	
								Gravel and/or Cement below 3"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel and/or cement

Depth (inches): 3 inches

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ___	Depth (inches):	3"
Water Table Present?	Yes ___ No X	Depth (inches):	> 3"
Saturation Present? (includes capillary fringe)	Yes X No ___	Depth (inches):	Surface

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 7

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.679073 | Long: -84.247536 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X

Hydric Soil Present? Yes ____ No X

Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? Yes ____ No X

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Plantago lanceolata*	5%	No	FACU
2. *Rumex crispus*	7%	No	FAC
3. *Cerastium fontanum*	3%	No	FACU
4. *Plantago major*	1%	No	FAC
5. *Taraxacum officinale*	3%	No	FACU
6. *Festuca rubra*	30%	Yes	FACU
7. *Poa annua*	20%	Yes	FACU
8. *Allium vineale*	5%	No	FACU
9. *Poa pratensis*	7%	No	FAC
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	81%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species		x2 =	
FAC species	15%	x3 =	0.45
FACU species	66%	x4 =	2.64
UPL species		x5 =	
Column Totals:	0.81 (A)		3.09 (B)

Prevalence Index = B/A = 3.81

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3"	10YR 4/2	100					Silt Loam	
								Gravel and/or Cement below 3"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel and/or cement

Depth (inches): 3 inches

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 3"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 3"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 8

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.67872 | Long: -84.245365 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes X	No ____		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Plantago lanceolata*	10%	No	FACU
2. *Poa annua*	5%	No	FACU
3. *Festuca rubra*	15%	Yes	FACU
4. *Poa pratensis*	20%	Yes	FAC
5. *Glechoma hederacea*	5%	No	FACU
6. *Rumex crispus*	3%	No	FAC
7. *Taraxacum officinale*	1%	No	FACU
8. *Rorippa sylvestris*	1%	No	OBL
9. *Solanum carolinense*	1%	No	FACU
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	61%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	1%	x1 =	0.01
FACW species		x2 =	
FAC species	23%	x3 =	0.69
FACU species	37%	x4 =	1.48
UPL species		x5 =	
Column Totals:	0.61 (A)		2.18 (B)

Prevalence Index = B/A = 3.57

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR 4/1	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ___	Depth (inches):	2"
Water Table Present?	Yes ___ No X	Depth (inches):	> 20"
Saturation Present? (includes capillary fringe)	Yes X No ___	Depth (inches):	Surface

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 9

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.679112 | Long: -84.243922 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes ____	No X		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Glechoma hederacea*	10%	No	FACU
2. *Phalaris arundinacea*	15%	No	FACW
3. *Solidago altissima*	3%	No	FACU
4. *Symphyotrichum lanceolatum*	1%	No	FAC
5. *Poa pratensis*	3%	No	FAC
6. *Rumex crispus*	30%	Yes	FAC
7. *Artemisia vulgaris*	20%	Yes	UPL
8. *Ficaria verna*	5%	No	FAC
9. *Solanum carolinense*	7%	No	FACU
10. *Lamium purpureum*	2%	No	UPL
11. *Plantago lanceolata*	4%	No	FACU
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	100%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species	15%	x2 =	0.3
FAC species	39%	x3 =	1.17
FACU species	24%	x4 =	0.96
UPL species	22%	x5 =	1.1
Column Totals:	1.00 (A)		3.53 (B)

Prevalence Index = B/A = 3.53

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18"	10YR 4/2	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 18"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 18"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 10

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.679133 | Long: -84.245394 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: R2UBH

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes ____	No X		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

Herb Stratum (Plot size: 5' radius)			
1. *Phalaris arundinacea*	60%	Yes	FACW
2. *Rumex crispus*	7%	No	FAC
3. *Ficaria verna*	10%	No	FACU
4. *Glechoma hederacea*	3%	No	FACU
5. *Solanum carolinense*	3%	No	FACU
6. *Solidago altissima*	2%	No	FACU
7. *Symphyotrichum lanceolatum*	1%	No	FAC
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	86%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species	60%	x2 =	1.2
FAC species	18%	x3 =	0.54
FACU species	8%	x4 =	0.32
UPL species		x5 =	
Column Totals:	0.86 (A)		2.06 (B)

Prevalence Index = B/A = 2.40

Hydrophytic Vegetation Indicators:

- X 1-Rapid Test for Hydrophytic Vegetation
- X 2-Dominance Test is >50%
- X 3-Prevalence Index is ≤3.0[1]
- ____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-21"	10YR 4/2	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 21"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 21"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 11

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.679229 | Long: -84.241381 | Datum: NAD83

Soil Map Unit Name: Ross-Urban land complex | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X

Hydric Soil Present? Yes ____ No X

Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? Yes ____ No X

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Festuca rubra*	25%	Yes	FACU
2. *Poa pratensis*	20%	Yes	FAC
3. *Ficaria verna*	5%	No	FAC
4. *Plantago lanceolata*	15%	Yes	FACU
5. *Rumex crispus*	7%	No	FAC
6. *Glechoma hederacea*	7%	No	FACU
7. *Artemisia vulgaris*	10%	No	UPL
8. *Phalaris arundinacea*	10%	No	FACW
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	99%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species	10%	x2 =	0.2
FAC species	32%	x3 =	0.96
FACU species	47%	x4 =	1.88
UPL species	10%	x5 =	0.5
Column Totals:	0.99 (A)		3.54 (B)

Prevalence Index = B/A = 3.58

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18"	10YR 4/2	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 18"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 18"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 12

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S22, T1E, R6N

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.681998 | Long: -84.251511 | Datum: NAD83

Soil Map Unit Name: Made land | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes ____	No X		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Celtis occidentalis*	30%	Yes	FAC
2.			
3.			
4.			
5.			
	30%	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1. *Lonicera maackii*	70%	Yes	UPL
2.			
3.			
4.			
5.			
	70%	= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Lonicera maackii*	5%	Yes	UPL
2. *Ficaria verna*	1%	No	FAC
3. *Alliaria petiolata*	1%	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	7%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species		x2 =	
FAC species	32%	x3 =	0.96
FACU species		x4 =	
UPL species	75%	x5 =	3.75
Column Totals:	1.07 (A)		4.71 (B)

Prevalence Index = B/A = 4.40

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6"	10YR 4/2	100					Silt Loam	Gravel throughout
								Gravel below 6"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel

Depth (inches): 6 inches

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 6"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 6"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 13

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.68235 | Long: -84.248445 | Datum: NAD83

Soil Map Unit Name: Stringley sandy loam, 0 to 2 percent slopes, frequently flooded | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X

Hydric Soil Present? Yes ____ No X

Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? Yes ____ No X

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Conium maculatum*	10%	Yes	FACW
2. *Carex sp.*	3%	No	FAC
3. *Silene vulgaris*	3%	No	UPL
4. *Rorippa sylvestris*	1%	No	OBL
5. *Thlaspi arvense*	20%	Yes	FACU
6. *Veronica polita*	10%	Yes	UPL
7. *Rumex crispus*	7%	No	FAC
8. *Viola sororia*	3%	No	FAC
9. *Phalaris arundinacea*	5%	No	FACW
10. *Allium vineale*	3%	No	FACU
11. *Poa pratensis*	10%	Yes	FAC
12. *Ficaria verna*	4%	No	FAC
13. *Lamium purpureum*	10%	Yes	UPL
14. *Festuca rubra*	7%	No	FACU
15. *Lysimachia nummularia*	5%	No	FACW
16.			
17.			
18.			
19.			
20.			
	101%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	1%	x1 =	0.01
FACW species	20%	x2 =	0.4
FAC species	27%	x3 =	0.81
FACU species	30%	x4 =	1.2
UPL species	23%	x5 =	1.15
Column Totals:	1.01 (A)		3.57 (B)

Prevalence Index = B/A = 3.53

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation

____ 2-Dominance Test is >50%

____ 3-Prevalence Index is ≤3.0[1]

____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR 5/3	100					Sandy Loam	Sandy silt loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 20"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 20"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 14

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S30, T1N, R6E

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.681779 | Long: -84.24849 | Datum: NAD83

Soil Map Unit Name: Ross silt loam, 0 to 2 percent slopes, occasionally flooded | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes ____	No X		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Plantago lanceolata*	15%	No	FACU
2. *Trifolium hybridum*	10%	No	FACU
3. *Poa pratensis*	20%	Yes	FAC
4. *Lamium purpureum*	5%	No	UPL
5. *Taraxacum officinale*	2%	No	FACU
6. *Phalaris arundinacea*	40%	Yes	FACW
7. *Juniperus virginiana*	1%	No	FACU
8. *Solidago altissima*	2%	No	FACU
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	95%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species	40%	x2 =	0.8
FAC species	20%	x3 =	0.6
FACU species	30%	x4 =	1.2
UPL species	5%	x5 =	0.25
Column Totals:	0.95 (A)		2.85 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
X 2-Dominance Test is >50%
X 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 14

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6"	10YR 4/3	100					Silt Loam	Gravel throughout
								Gravel below 6"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel

Depth (inches): 6 inches

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 6"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 6"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 15

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S30, T1N, R6E

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.680841 | Long: -84.242945 | Datum: NAD83

Soil Map Unit Name: Ross silt loam, 0 to 2 percent slopes, occasionally flooded | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes ____	No X		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Carex sp.*	2%	No	FAC
2. *Phalaris arundinacea*	30%	Yes	FACW
3. *Lysimachia nummularia*	5%	No	FACW
4. *Rumex crispus*	7%	No	FAC
5. *Solidago altissima*	2%	No	FACU
6. *Ficaria verna*	3%	No	FAC
7. *Allium vineale*	5%	No	FACU
8. *Artemisia vulgaris*	30%	Yes	UPL
9. *Glechoma hederacea*	2%	No	FACU
10. *Festuca rubra*	5%	No	FACU
11. *Poa pratensis*	5%	No	FAC
12. *Plantago lanceolata*	3%	No	FACU
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	99%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species	35%	x2 =	0.7
FAC species	17%	x3 =	0.51
FACU species	17%	x4 =	0.68
UPL species	30%	x5 =	1.5
Column Totals:	0.99 (A)		3.39 (B)

Prevalence Index = B/A = 3.42

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR 4/2	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 20"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 20"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM -- Midwest Region

Project/Site: West Carrollton Riverside Park | City/County: West Carrollton, Montgomery County | Sampling Date: 3/7/2024

Applicant/Owner: Patriot Engineering and Environmental, Inc. | State: OH | Sampling Point: 16

Investigator(s): Bailey Duncan, Kat Pain, Tim Douglas | Section, Township, Range: S30, T1N, R6E

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): None

Slope (%): 1% | Lat: 39.680824 | Long: -84.239448 | Datum: NAD83

Soil Map Unit Name: Ross silt loam, 0 to 2 percent slopes, occasionally flooded | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS -- Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**	
Hydric Soil Present?	Yes ____	No X	**within a Wetland?**	Yes ____ No X
Wetland Hydrology Present?	Yes ____	No X		

Remarks:
Sampling occurred after heavy rain event.

VEGETATION -- Use scientific names of plants.

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Sapling/Shrub Stratum (Plot size: 15' radius)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

Herb Stratum (Plot size: 5' radius)			
1. *Allium vineale*	5%	No	FAC
2. *Phalaris arundinacea*	10%	No	FACW
3. *Poa annua*	3%	No	FACU
4. *Festuca rubra*	60%	Yes	FACU
5. *Ficaria verna*	3%	No	FAC
6. *Viola sororia*	2%	No	FAC
7. *Plantago lanceolata*	3%	No	FACU
8. *Carex sp.*	4%	No	UPL
9. *Lysimachia nummularia*	2%	No	FACW
10. *Glechoma hederacea*	1%	No	FACU
11. *Trifolium hybridum*	3%	No	FACU
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
	96%	= Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x1 =	
FACW species	12%	x2 =	0.24
FAC species	10%	x3 =	0.3
FACU species	70%	x4 =	2.8
UPL species	4%	x5 =	0.2
Column Totals:	0.96 (A)		3.54 (B)

Prevalence Index = B/A = 3.69

Hydrophytic Vegetation Indicators:

____ 1-Rapid Test for Hydrophytic Vegetation
____ 2-Dominance Test is >50%
____ 3-Prevalence Index is ≤3.0[1]
____ 4-Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 16

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR 4/2	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Dark Surface (S7)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches):	N/A
Water Table Present?	Yes ___ No X	Depth (inches):	> 20"
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches):	> 20"

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX C: Ohio Rapid Assessment Method (ORAM) Forms

Background Information

Name:	Bailey Duncan
Date:	03/18/2024
Affiliation:	Meristem, LLC
Address:	877 Port Drive
Phone Number:	812 929 325
e-mail address:	bailey.duncan@meristem.life
Name of Wetland:	Wetland A
Vegetation Communit(ies):	Emergent
HGM Class(es):	Depressional

Location of Wetland: include map, address, north arrow, landmarks, distances, roads, etc.

See Appendix A, Figure 6

Lat/Long or UTM Coordinate	39.680763, -84.250365
USGS Quad Name	Dayton South
County	Montgomery
Township	
Section and Subsection	Section 22,
Hydrologic Unit Code	050800020106
Site Visit	3/6/2024
National Wetland Inventory Map	No
Ohio Wetland Inventory Map	No
Soil Survey	Montgomery County Soil Survey
Delineation report/map	See water resources delineation report

Name of Wetland: Wetland A	
Wetland Size (acres, hectares):	0.123-acre
Sketch: Include north arrow, relationship with other surface waters, vegetation zones, etc.	
Comments, Narrative Discussion, Justification of Category Changes:	
Final score : 19.5 **Category:**	1

Scoring Boundary Worksheet

INSTRUCTIONS. The initial step in completing the ORAM is to identify the "scoring boundaries" of the wetland being rated. In many instances this determination will be relatively easy and the scoring boundaries will coincide with the "jurisdictional boundaries." For example, the scoring boundary of an isolated cattail marsh located in the middle of a farm field will likely be the same as that wetland's jurisdictional boundaries. In other instances, however, the scoring boundary will not be as easily determined. Wetlands that are small or isolated from other surface waters often form large contiguous areas or heterogeneous complexes of wetland and upland. In separating wetlands for scoring purposes, the hydrologic regime of the wetland is the main criterion that should be used. Boundaries between contiguous or connected wetlands should be established where the volume, flow, or velocity of water moving through the wetland changes significantly. *Areas with a high degree of hydrologic interaction should be scored as a single wetland*. In determining a wetland's scoring boundaries, use the guidelines in the ORAM Manual Section 5.0. In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries like property fences, roads, or railroad embankments, wetlands that are contiguous with streams, lakes, or rivers, and estuarine or coastal wetlands. These situations are discussed below, however, it is recommended that Rater contact Ohio EPA, Division of Surface Water, 401/Wetlands Section if there are additional questions or a need for further clarification of the appropriate scoring boundaries of a particular wetland.

#	Steps in properly establishing scoring boundaries	done?	not applicable
Step 1	Identify the wetland area of interest. This may be the site of a proposed impact, a reference site, conservation site, etc.	x	
Step 2	Identify the locations where there is physical evidence that hydrology changes rapidly. Such evidence includes both natural and human-induced changes including, constrictions caused by berms or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.	x	
Step 3	Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction are included within the scoring boundary.	x	
Step 4	Determine if artificial boundaries, such as property lines, state lines, roads, railroad embankments, etc., are present. These should not be used to establish scoring boundaries unless they coincide with areas where the hydrologic regime changes.	x	
Step 5	In all instances, the Rater may enlarge the minimum scoring boundaries discussed here to score together wetlands that could be scored separately.	x	
Step 6	Consult ORAM Manual Section 5.0 for how to establish scoring boundaries for wetlands that form a patchwork on the landscape, divided by artificial boundaries, contiguous to streams, lakes or rivers, or for dual classifications.	x	

End of Scoring Boundary Determination. Begin Narrative Rating on next page.

Narrative Rating

INSTRUCTIONS. Answer each of the following questions. Questions 1, 2, 3 and 4 should be answered based on information obtained from the site visit or the literature *and* by submitting a Data Services Request to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Natural Heritage Data Services, 1889 Fountain Square Court, Building F-1, Columbus, Ohio 43224, 614-265-6453 (phone), 614-265-3096 (fax), http://www.dnr.state.oh.us/dnap . The remaining questions are designed to be answered primarily by the results of the site visit. Refer to the User's Manual for descriptions of these wetland types. Note: "Critical habitat" is legally defined in the Endangered Species Act and is the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. The Rater should contact the Region 3 Headquarters or the Columbus Ecological Services Office for updates as to whether critical habitat has been designated for other federally listed threatened or endangered species. "Documented" means the wetland is listed in the appropriate State of Ohio database.

#	Question	Circle one	
1	**Critical Habitat.** Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service as "critical habitat" for any threatened or endangered plant or animal species? Note: as of January 1, 2001, of the federally listed endangered or threatened species which can be found in Ohio, the Indiana Bat has had critical habitat designated (50 CFR 17.95(a)) and the piping plover has had critical habitat proposed (65 FR 41812 July 6, 2000).	YES Wetland should be evaluated for possible Category 3 status Go to Question 2	NO Go to Question 2
2	**Threatened or Endangered Species.** Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?	YES Wetland is a Category 3 wetland. Go to Question 3	NO Go to Question 3
3	**Documented High Quality Wetland.** Is the wetland on record in Natural Heritage Database as a high quality wetland?	YES Wetland is a Category 3 wetland Go to Question 4	NO Go to Question 4
4	**Significant Breeding or Concentration Area.** Does the wetland contain documented regionally significant breeding or nonbreeding waterfowl, neotropical songbird, or shorebird concentration areas?	YES Wetland is a Category 3 wetland Go to Question 5	NO Go to Question 5
5	**Category 1 Wetlands.** Is the wetland less than 0.5 hectares (1 acre) in size and **hydrologically isolated** and either 1) comprised of vegetation that is dominated (greater than eighty per cent areal cover) by *Phalaris arundinacea, Lythrum salicaria,* or *Phragmites australis*, or 2) an acidic pond created or excavated on mined lands that has little or no vegetation?	YES Wetland is a Category 1 wetland Go to Question 6	NO Go to Question 6
6	**Bogs.** Is the wetland a peat-accumulating wetland that 1) has no significant inflows or outflows, 2) supports acidophilic mosses, particularly *Sphagnum* spp., 3) the acidophilic mosses have >30% cover, 4) at least one species from Table 1 is present, and 5) the cover of invasive species (see Table 1) is <25%?	YES Wetland is a Category 3 wetland Go to Question 7	NO Go to Question 7
7	**Fens.** Is the wetland a carbon accumulating (peat, muck) wetland that is saturated during most of the year, primarily by a discharge of free flowing, mineral rich, ground water with a circumneutral ph (5.5-9.0) and with one or more plant species listed in Table 1 and the cover of invasive species listed in Table 1 is <25%?	YES Wetland is a Category 3 wetland Go to Question 8a	NO Go to Question 8a
8a	**"Old Growth Forest."** Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs?	YES Wetland is a Category 3 wetland. Go to Question 8b	NO Go to Question 8b

8b	**Mature forested wetlands**. Is the wetland a forested wetland with 50% or more of the cover of upper forest canopy consisting of deciduous trees with large diameters at breast height (dbh), generally diameters greater than 45cm (17.7in) dbh?	YES Wetland should be evaluated for possible Category 3 status. Go to Question 9a	NO Go to Question 9a
9a	**Lake Erie coastal and tributary wetlands**. Is the wetland located at an elevation less than 575 feet on the USGS map, adjacent to this elevation, or along a tributary to Lake Erie that is accessible to fish?	YES Go to Question 9b	NO Go to Question 10
9b	Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from Lake Erie due to lakeward or landward dikes or other hydrological controls?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 9c
9c	Are Lake Erie water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or the wetland can be characterized as an "estuarine" wetland with lake and river influenced hydrology. These include sandbar deposition wetlands, estuarine wetlands, river mouth wetlands, or those dominated by submersed aquatic vegetation.	YES Go to Question 9d	NO Go to Question 10
9d	Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?	YES Wetland is a Category 3 wetland Go to Question 10	NO Go to Question 9e
9e	Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 10
10	**Lake Plain Sand Prairies (Oak Openings)** Is the wetland located in Lucas, Fulton, Henry, or Wood Counties and can the wetland be characterized by the following description: the wetland has a sandy substrate with interspersed organic matter, a water table often within several inches of the surface, and often with a dominance of the gramineous vegetation listed in Table 1 (woody species may also be present). The Ohio Department of Natural Resources Division of Natural Areas and Preserves can provide assistance in confirming this type of wetland and its quality.	YES Wetland is a Category 3 wetland. Go to Question 11	NO Go to Question 11
11	**Relict Wet Prairies**. Is the wetland a relict wet prairie community dominated by some or all of the species in Table 1. Extensive prairies were formerly located in the Darby Plains (Madison and Union Counties), Sandusky Plains (Wyandot, Crawford, and Marion Counties), northwest Ohio (e.g. Erie, Huron, Lucas, Wood Counties), and portions of western Ohio Counties (e.g. Darke, Mercer, Miami, Montgomery, Van Wert etc.).	YES Wetland should be evaluated for possible Category 3 status Complete Quantitative Rating	NO Complete Quantitative Rating

Table 1. Characteristic plant species.

invasive/exotic spp	fen species	bog species	0ak Opening species	wet prairie species
Lythrum salicaria	*Zygadenus elegans var. glaucus*	*Calla palustris*	*Carex cryptolepis*	*Calamagrostis canadensis*
Myriophyllum spicatum	*Cacalia plantaginea*	*Carex atlantica var. capillacea*	*Carex lasiocarpa*	*Calamogrostis stricta*
Najas minor	*Carex flava*	*Carex echinata*	*Carex stricta*	*Carex atherodes*
Phalaris arundinacea	*Carex sterilis*	*Carex oligosperma*	*Cladium mariscoides*	*Carex buxbaumii*
Phragmites australis	*Carex stricta*	*Carex trisperma*	*Calamagrostis stricta*	*Carex pellita*
Potamogeton crispus	*Deschampsia caespitosa*	*Chamaedaphne calyculata*	*Calamagrostis canadensis*	*Carex sartwellii*
Ranunculus ficaria	*Eleocharis rostellata*	*Decodon verticillatus*	*Quercus palustris*	*Gentiana andrewsii*
Rhamnus frangula	*Eriophorum viridicarinatum*	*Eriophorum virginicum*		*Helianthus grosseserratus*
Typha angustifolia	*Gentianopsis spp.*	*Larix laricina*		*Liatris spicata*
Typha xglauca	*Lobelia kalmii*	*Nemopanthus mucronatus*		*Lysimachia quadriflora*
	Parnassia glauca	*Schechzeria palustris*		*Lythrum alatum*
	Potentilla fruticosa	*Sphagnum spp.*		*Pycnanthemum virginianum*
	Rhamnus alnifolia	*Vaccinium macrocarpon*		*Silphium terebinthinaceum*
	Rhynchospora capillacea	*Vaccinium corymbosum*		*Sorghastrum nutans*
	Salix candida	*Vaccinium oxycoccos*		*Spartina pectinata*
	Salix myricoides	*Woodwardia virginica*		*Solidago riddellii*
	Salix serissima	*Xyris difformis*		
	Solidago ohioensis			
	Tofieldia glutinosa			
	Triglochin maritimum			
	Triglochin palustre			

End of Narrative Rating. Begin Quantitative Rating on next page.

Site: West Carrollton River Park	**Rater(s):** Bailey Duncan	**Date:** 03/18/2024

Metric 1. Wetland Area (size).

1	1
max 6 pts.	subtotal

Select one size class and assign score.

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [1] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

2	3
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [ ] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [0] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [3] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [1] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

10.5	13.5
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [1] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [X] 100 year floodplain (1)
- [X] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [X] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [ ] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [1] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [X] Seasonally inundated (2)
- [X] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [7] Recovered (7)
- [ ] Recovering (3)
- [1] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

6	19.5
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

- [ ] None or none apparent (4)
- [3] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [1] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [3] Recovering (3)
- [1] Recent or no recovery (1)

Check all disturbances observed

- [X] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

19.5
subtotal this page

last revised 1 February 2001 jjm

Site: West Carrollton River Park	Rater(s): Bailey Duncan	Date: 03/18/2024

19.5
subtotal first page

0 | 19.5
max 10 pts. | subtotal

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

0 | 19.5
max 20 pts. | subtotal

Metric 6. Plant communities, interspersion, microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [ ] Shrub
- [ ] Forest
- [ ] Mudflats
- [1] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [ ] Moderate (3)
- [ ] Moderately low (2)
- [1] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [ ] Extensive >75% cover (-5)
- [-3] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummucks/tussucks
- [ ] Coarse woody debris >15cm (6in)
- [ ] Standing dead >25cm (10in) dbh
- [ ] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

19.5

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES NO	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES NO	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES NO	If yes, Category 3.
	Question 4. Significant bird habitat	YES NO	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES NO	If yes, Category 1.
	Question 6. Bogs	YES NO	If yes, Category 3.
	Question 7. Fens	YES NO	If yes, Category 3.
	Question 8a. Old Growth Forest	YES NO	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES NO	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES NO	If yes, Category 3
	Question 11. Relict Wet Prairies	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	1	
	Metric 2. Buffers and surrounding land use	2	
	Metric 3. Hydrology	10.5	
	Metric 4. Habitat	6	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	0	
	TOTAL SCORE	19.5	Category based on score breakpoints

Complete Wetland Categorization Worksheet.

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold *(including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

Background Information

Name:	Bailey Duncan
Date:	03/18/2024
Affiliation:	Meristem, LLC
Address:	877 Port Drive
Phone Number:	812 929 325
e-mail address:	bailey.duncan@meristem.life
Name of Wetland:	Wetland B
Vegetation Communit(ies):	Emergent
HGM Class(es):	Depressional

Location of Wetland: include map, address, north arrow, landmarks, distances, roads, etc.

See Appendix A, Figure 6

Lat/Long or UTM Coordinate	39.680039, -84.249991
USGS Quad Name	\Dayton South
County	Montgomery
Township	
Section and Subsection	Section 22
Hydrologic Unit Code	050800020106
Site Visit	3/6/2024
National Wetland Inventory Map	No
Ohio Wetland Inventory Map	No
Soil Survey	Montgomery County Soil Survey
Delineation report/map	See water resources delineation report

Name of Wetland: Wetland B	
Wetland Size (acres, hectares):	0.169-acre
Sketch: Include north arrow, relationship with other surface waters, vegetation zones, etc.	
Comments, Narrative Discussion, Justification of Category Changes:	
Final score : 18.5 **Category:**	1

Scoring Boundary Worksheet

INSTRUCTIONS. The initial step in completing the ORAM is to identify the "scoring boundaries" of the wetland being rated. In many instances this determination will be relatively easy and the scoring boundaries will coincide with the "jurisdictional boundaries." For example, the scoring boundary of an isolated cattail marsh located in the middle of a farm field will likely be the same as that wetland's jurisdictional boundaries. In other instances, however, the scoring boundary will not be as easily determined. Wetlands that are small or isolated from other surface waters often form large contiguous areas or heterogeneous complexes of wetland and upland. In separating wetlands for scoring purposes, the hydrologic regime of the wetland is the main criterion that should be used. Boundaries between contiguous or connected wetlands should be established where the volume, flow, or velocity of water moving through the wetland changes significantly. *Areas with a high degree of hydrologic interaction should be scored as a single wetland*. In determining a wetland's scoring boundaries, use the guidelines in the ORAM Manual Section 5.0. In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries like property fences, roads, or railroad embankments, wetlands that are contiguous with streams, lakes, or rivers, and estuarine or coastal wetlands. These situations are discussed below, however, it is recommended that Rater contact Ohio EPA, Division of Surface Water, 401/Wetlands Section if there are additional questions or a need for further clarification of the appropriate scoring boundaries of a particular wetland.

#	Steps in properly establishing scoring boundaries	done?	not applicable
Step 1	Identify the wetland area of interest. This may be the site of a proposed impact, a reference site, conservation site, etc.	x	
Step 2	Identify the locations where there is physical evidence that hydrology changes rapidly. Such evidence includes both natural and human-induced changes including, constrictions caused by berms or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.	x	
Step 3	Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction are included within the scoring boundary.	x	
Step 4	Determine if artificial boundaries, such as property lines, state lines, roads, railroad embankments, etc., are present. These should not be used to establish scoring boundaries unless they coincide with areas where the hydrologic regime changes.	x	
Step 5	In all instances, the Rater may enlarge the minimum scoring boundaries discussed here to score together wetlands that could be scored separately.	x	
Step 6	Consult ORAM Manual Section 5.0 for how to establish scoring boundaries for wetlands that form a patchwork on the landscape, divided by artificial boundaries, contiguous to streams, lakes or rivers, or for dual classifications.	x	

End of Scoring Boundary Determination. Begin Narrative Rating on next page.

Narrative Rating

INSTRUCTIONS. Answer each of the following questions. Questions 1, 2, 3 and 4 should be answered based on information obtained from the site visit or the literature *and* by submitting a Data Services Request to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Natural Heritage Data Services, 1889 Fountain Square Court, Building F-1, Columbus, Ohio 43224, 614-265-6453 (phone), 614-265-3096 (fax), http://www.dnr.state.oh.us/dnap . The remaining questions are designed to be answered primarily by the results of the site visit. Refer to the User's Manual for descriptions of these wetland types. Note: "Critical habitat" is legally defined in the Endangered Species Act and is the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. The Rater should contact the Region 3 Headquarters or the Columbus Ecological Services Office for updates as to whether critical habitat has been designated for other federally listed threatened or endangered species. "Documented" means the wetland is listed in the appropriate State of Ohio database.

#	Question	Circle one	
1	**Critical Habitat.** Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service as "critical habitat" for any threatened or endangered plant or animal species? Note: as of January 1, 2001, of the federally listed endangered or threatened species which can be found in Ohio, the Indiana Bat has had critical habitat designated (50 CFR 17.95(a)) and the piping plover has had critical habitat proposed (65 FR 41812 July 6, 2000).	YES Wetland should be evaluated for possible Category 3 status Go to Question 2	NO Go to Question 2
2	**Threatened or Endangered Species.** Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?	YES Wetland is a Category 3 wetland. Go to Question 3	NO Go to Question 3
3	**Documented High Quality Wetland.** Is the wetland on record in Natural Heritage Database as a high quality wetland?	YES Wetland is a Category 3 wetland Go to Question 4	NO Go to Question 4
4	**Significant Breeding or Concentration Area.** Does the wetland contain documented regionally significant breeding or nonbreeding waterfowl, neotropical songbird, or shorebird concentration areas?	YES Wetland is a Category 3 wetland Go to Question 5	NO Go to Question 5
5	**Category 1 Wetlands.** Is the wetland less than 0.5 hectares (1 acre) in size and **hydrologically isolated** and either 1) comprised of vegetation that is dominated (greater than eighty per cent areal cover) by *Phalaris arundinacea, Lythrum salicaria,* or *Phragmites australis*, or 2) an acidic pond created or excavated on mined lands that has little or no vegetation?	YES Wetland is a Category 1 wetland Go to Question 6	NO Go to Question 6
6	**Bogs.** Is the wetland a peat-accumulating wetland that 1) has no significant inflows or outflows, 2) supports acidophilic mosses, particularly *Sphagnum* spp., 3) the acidophilic mosses have >30% cover, 4) at least one species from Table 1 is present, and 5) the cover of invasive species (see Table 1) is <25%?	YES Wetland is a Category 3 wetland Go to Question 7	NO Go to Question 7
7	**Fens.** Is the wetland a carbon accumulating (peat, muck) wetland that is saturated during most of the year, primarily by a discharge of free flowing, mineral rich, ground water with a circumneutral ph (5.5-9.0) and with one or more plant species listed in Table 1 and the cover of invasive species listed in Table 1 is <25%?	YES Wetland is a Category 3 wetland Go to Question 8a	NO Go to Question 8a
8a	**"Old Growth Forest."** Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs?	YES Wetland is a Category 3 wetland. Go to Question 8b	NO Go to Question 8b

8b	**Mature forested wetlands**. Is the wetland a forested wetland with 50% or more of the cover of upper forest canopy consisting of deciduous trees with large diameters at breast height (dbh), generally diameters greater than 45cm (17.7in) dbh?	YES Wetland should be evaluated for possible Category 3 status. Go to Question 9a	NO Go to Question 9a
9a	**Lake Erie coastal and tributary wetlands**. Is the wetland located at an elevation less than 575 feet on the USGS map, adjacent to this elevation, or along a tributary to Lake Erie that is accessible to fish?	YES Go to Question 9b	NO Go to Question 10
9b	Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from Lake Erie due to lakeward or landward dikes or other hydrological controls?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 9c
9c	Are Lake Erie water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or the wetland can be characterized as an "estuarine" wetland with lake and river influenced hydrology. These include sandbar deposition wetlands, estuarine wetlands, river mouth wetlands, or those dominated by submersed aquatic vegetation.	YES Go to Question 9d	NO Go to Question 10
9d	Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?	YES Wetland is a Category 3 wetland Go to Question 10	NO Go to Question 9e
9e	Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 10
10	**Lake Plain Sand Prairies (Oak Openings)** Is the wetland located in Lucas, Fulton, Henry, or Wood Counties and can the wetland be characterized by the following description: the wetland has a sandy substrate with interspersed organic matter, a water table often within several inches of the surface, and often with a dominance of the gramineous vegetation listed in Table 1 (woody species may also be present). The Ohio Department of Natural Resources Division of Natural Areas and Preserves can provide assistance in confirming this type of wetland and its quality.	YES Wetland is a Category 3 wetland. Go to Question 11	NO Go to Question 11
11	**Relict Wet Prairies**. Is the wetland a relict wet prairie community dominated by some or all of the species in Table 1. Extensive prairies were formerly located in the Darby Plains (Madison and Union Counties), Sandusky Plains (Wyandot, Crawford, and Marion Counties), northwest Ohio (e.g. Erie, Huron, Lucas, Wood Counties), and portions of western Ohio Counties (e.g. Darke, Mercer, Miami, Montgomery, Van Wert etc.).	YES Wetland should be evaluated for possible Category 3 status Complete Quantitative Rating	NO Complete Quantitative Rating

Table 1. Characteristic plant species.

invasive/exotic spp	fen species	bog species	0ak Opening species	wet prairie species
Lythrum salicaria	*Zygadenus elegans var. glaucus*	*Calla palustris*	*Carex cryptolepis*	*Calamagrostis canadensis*
Myriophyllum spicatum	*Cacalia plantaginea*	*Carex atlantica var. capillacea*	*Carex lasiocarpa*	*Calamogrostis stricta*
Najas minor	*Carex flava*	*Carex echinata*	*Carex stricta*	*Carex atherodes*
Phalaris arundinacea	*Carex sterilis*	*Carex oligosperma*	*Cladium mariscoides*	*Carex buxbaumii*
Phragmites australis	*Carex stricta*	*Carex trisperma*	*Calamagrostis stricta*	*Carex pellita*
Potamogeton crispus	*Deschampsia caespitosa*	*Chamaedaphne calyculata*	*Calamagrostis canadensis*	*Carex sartwellii*
Ranunculus ficaria	*Eleocharis rostellata*	*Decodon verticillatus*	*Quercus palustris*	*Gentiana andrewsii*
Rhamnus frangula	*Eriophorum viridicarinatum*	*Eriophorum virginicum*		*Helianthus grosseserratus*
Typha angustifolia	*Gentianopsis spp.*	*Larix laricina*		*Liatris spicata*
Typha xglauca	*Lobelia kalmii*	*Nemopanthus mucronatus*		*Lysimachia quadriflora*
	Parnassia glauca	*Schechzeria palustris*		*Lythrum alatum*
	Potentilla fruticosa	*Sphagnum spp.*		*Pycnanthemum virginianum*
	Rhamnus alnifolia	*Vaccinium macrocarpon*		*Silphium terebinthinaceum*
	Rhynchospora capillacea	*Vaccinium corymbosum*		*Sorghastrum nutans*
	Salix candida	*Vaccinium oxycoccos*		*Spartina pectinata*
	Salix myricoides	*Woodwardia virginica*		*Solidago riddellii*
	Salix serissima	*Xyris difformis*		
	Solidago ohioensis			
	Tofieldia glutinosa			
	Triglochin maritimum			
	Triglochin palustre			

End of Narrative Rating. Begin Quantitative Rating on next page.

Site: West Carrollton River Park	**Rater(s):** Bailey Duncan	**Date:** 03/18/2024

Metric 1. Wetland Area (size).

1	1
max 6 pts.	subtotal

Select one size class and assign score.

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [1] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

2	3
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [ ] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [0] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [3] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [1] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

10.5	13.5
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [1] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [X] 100 year floodplain (1)
- [X] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [X] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [ ] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [1] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [X] Seasonally inundated (2)
- [X] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [7] Recovered (7)
- [ ] Recovering (3)
- [1] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

6	19.5
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

- [ ] None or none apparent (4)
- [3] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [1] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [3] Recovering (3)
- [1] Recent or no recovery (1)

Check all disturbances observed

- [X] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

19.5
subtotal this page

last revised 1 February 2001 jjm

Site: West Carrollton River Park	Rater(s): Bailey Duncan	Date: 03/18/2024

19.5
subtotal first page

0 (max 10 pts.) | 19.5 (subtotal)

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

-1 (max 20 pts.) | 18.5 (subtotal)

Metric 6. Plant communities, interspersion, microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [ ] Shrub
- [ ] Forest
- [ ] Mudflats
- [ ] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [ ] Moderate (3)
- [ ] Moderately low (2)
- [1] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [ ] Extensive >75% cover (-5)
- [-3] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummucks/tussucks
- [ ] Coarse woody debris >15cm (6in)
- [ ] Standing dead >25cm (10in) dbh
- [ ] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

18.5

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES NO	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES NO	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES NO	If yes, Category 3.
	Question 4. Significant bird habitat	YES NO	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES NO	If yes, Category 1.
	Question 6. Bogs	YES NO	If yes, Category 3.
	Question 7. Fens	YES NO	If yes, Category 3.
	Question 8a. Old Growth Forest	YES NO	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES NO	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES NO	If yes, Category 3
	Question 11. Relict Wet Prairies	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	1	
	Metric 2. Buffers and surrounding land use	2	
	Metric 3. Hydrology	10.5	
	Metric 4. Habitat	6	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	-2	
	TOTAL SCORE	17.5	Category based on score breakpoints

Complete Wetland Categorization Worksheet.

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold *(including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

Background Information

Name:	Bailey Duncan
Date:	03/18/2024
Affiliation:	Meristem, LLC
Address:	877 Port Drive
Phone Number:	812 929 325
e-mail address:	bailey.duncan@meristem.life
Name of Wetland:	Wetland C
Vegetation Communit(ies):	Emergent
HGM Class(es):	Depressional

Location of Wetland: include map, address, north arrow, landmarks, distances, roads, etc.

See Appendix A, Figure 6

Lat/Long or UTM Coordinate	39.679156, -84.247717
USGS Quad Name	Dayton South
County	Montgomery
Township	
Section and Subsection	Section 22
Hydrologic Unit Code	050800020106
Site Visit	3/6/2024
National Wetland Inventory Map	No
Ohio Wetland Inventory Map	No
Soil Survey	Montgomery County Soil Survey
Delineation report/map	See water resources delineation report

Name of Wetland: Wetland C	
Wetland Size (acres, hectares):	0.062-acre
Sketch: Include north arrow, relationship with other surface waters, vegetation zones, etc.	
Comments, Narrative Discussion, Justification of Category Changes:	
Final score : 19.5 **Category:**	1

Scoring Boundary Worksheet

INSTRUCTIONS. The initial step in completing the ORAM is to identify the "scoring boundaries" of the wetland being rated. In many instances this determination will be relatively easy and the scoring boundaries will coincide with the "jurisdictional boundaries." For example, the scoring boundary of an isolated cattail marsh located in the middle of a farm field will likely be the same as that wetland's jurisdictional boundaries. In other instances, however, the scoring boundary will not be as easily determined. Wetlands that are small or isolated from other surface waters often form large contiguous areas or heterogeneous complexes of wetland and upland. In separating wetlands for scoring purposes, the hydrologic regime of the wetland is the main criterion that should be used. Boundaries between contiguous or connected wetlands should be established where the volume, flow, or velocity of water moving through the wetland changes significantly. *Areas with a high degree of hydrologic interaction should be scored as a single wetland*. In determining a wetland's scoring boundaries, use the guidelines in the ORAM Manual Section 5.0. In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries like property fences, roads, or railroad embankments, wetlands that are contiguous with streams, lakes, or rivers, and estuarine or coastal wetlands. These situations are discussed below, however, it is recommended that Rater contact Ohio EPA, Division of Surface Water, 401/Wetlands Section if there are additional questions or a need for further clarification of the appropriate scoring boundaries of a particular wetland.

#	Steps in properly establishing scoring boundaries	done?	not applicable
Step 1	Identify the wetland area of interest. This may be the site of a proposed impact, a reference site, conservation site, etc.	x	
Step 2	Identify the locations where there is physical evidence that hydrology changes rapidly. Such evidence includes both natural and human-induced changes including, constrictions caused by berms or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.	x	
Step 3	Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction are included within the scoring boundary.	x	
Step 4	Determine if artificial boundaries, such as property lines, state lines, roads, railroad embankments, etc., are present. These should not be used to establish scoring boundaries unless they coincide with areas where the hydrologic regime changes.	x	
Step 5	In all instances, the Rater may enlarge the minimum scoring boundaries discussed here to score together wetlands that could be scored separately.	x	
Step 6	Consult ORAM Manual Section 5.0 for how to establish scoring boundaries for wetlands that form a patchwork on the landscape, divided by artificial boundaries, contiguous to streams, lakes or rivers, or for dual classifications.	x	

End of Scoring Boundary Determination. Begin Narrative Rating on next page.

Narrative Rating

INSTRUCTIONS. Answer each of the following questions. Questions 1, 2, 3 and 4 should be answered based on information obtained from the site visit or the literature *and* by submitting a Data Services Request to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Natural Heritage Data Services, 1889 Fountain Square Court, Building F-1, Columbus, Ohio 43224, 614-265-6453 (phone), 614-265-3096 (fax), http://www.dnr.state.oh.us/dnap . The remaining questions are designed to be answered primarily by the results of the site visit. Refer to the User's Manual for descriptions of these wetland types. Note: "Critical habitat" is legally defined in the Endangered Species Act and is the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. The Rater should contact the Region 3 Headquarters or the Columbus Ecological Services Office for updates as to whether critical habitat has been designated for other federally listed threatened or endangered species. "Documented" means the wetland is listed in the appropriate State of Ohio database.

#	Question	Circle one	
1	**Critical Habitat.** Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service as "critical habitat" for any threatened or endangered plant or animal species? Note: as of January 1, 2001, of the federally listed endangered or threatened species which can be found in Ohio, the Indiana Bat has had critical habitat designated (50 CFR 17.95(a)) and the piping plover has had critical habitat proposed (65 FR 41812 July 6, 2000).	YES Wetland should be evaluated for possible Category 3 status Go to Question 2	NO Go to Question 2
2	**Threatened or Endangered Species.** Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?	YES Wetland is a Category 3 wetland. Go to Question 3	NO Go to Question 3
3	**Documented High Quality Wetland.** Is the wetland on record in Natural Heritage Database as a high quality wetland?	YES Wetland is a Category 3 wetland Go to Question 4	NO Go to Question 4
4	**Significant Breeding or Concentration Area.** Does the wetland contain documented regionally significant breeding or nonbreeding waterfowl, neotropical songbird, or shorebird concentration areas?	YES Wetland is a Category 3 wetland Go to Question 5	NO Go to Question 5
5	**Category 1 Wetlands.** Is the wetland less than 0.5 hectares (1 acre) in size and **hydrologically isolated** and either 1) comprised of vegetation that is dominated (greater than eighty per cent areal cover) by *Phalaris arundinacea, Lythrum salicaria,* or *Phragmites australis*, or 2) an acidic pond created or excavated on mined lands that has little or no vegetation?	YES Wetland is a Category 1 wetland Go to Question 6	NO Go to Question 6
6	**Bogs.** Is the wetland a peat-accumulating wetland that 1) has no significant inflows or outflows, 2) supports acidophilic mosses, particularly *Sphagnum* spp., 3) the acidophilic mosses have >30% cover, 4) at least one species from Table 1 is present, and 5) the cover of invasive species (see Table 1) is <25%?	YES Wetland is a Category 3 wetland Go to Question 7	NO Go to Question 7
7	**Fens.** Is the wetland a carbon accumulating (peat, muck) wetland that is saturated during most of the year, primarily by a discharge of free flowing, mineral rich, ground water with a circumneutral ph (5.5-9.0) and with one or more plant species listed in Table 1 and the cover of invasive species listed in Table 1 is <25%?	YES Wetland is a Category 3 wetland Go to Question 8a	NO Go to Question 8a
8a	**"Old Growth Forest."** Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs?	YES Wetland is a Category 3 wetland. Go to Question 8b	NO Go to Question 8b

8b	**Mature forested wetlands**. Is the wetland a forested wetland with 50% or more of the cover of upper forest canopy consisting of deciduous trees with large diameters at breast height (dbh), generally diameters greater than 45cm (17.7in) dbh?	YES Wetland should be evaluated for possible Category 3 status. Go to Question 9a	NO Go to Question 9a
9a	**Lake Erie coastal and tributary wetlands**. Is the wetland located at an elevation less than 575 feet on the USGS map, adjacent to this elevation, or along a tributary to Lake Erie that is accessible to fish?	YES Go to Question 9b	NO Go to Question 10
9b	Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from Lake Erie due to lakeward or landward dikes or other hydrological controls?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 9c
9c	Are Lake Erie water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or the wetland can be characterized as an "estuarine" wetland with lake and river influenced hydrology. These include sandbar deposition wetlands, estuarine wetlands, river mouth wetlands, or those dominated by submersed aquatic vegetation.	YES Go to Question 9d	NO Go to Question 10
9d	Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?	YES Wetland is a Category 3 wetland Go to Question 10	NO Go to Question 9e
9e	Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 10
10	**Lake Plain Sand Prairies (Oak Openings)** Is the wetland located in Lucas, Fulton, Henry, or Wood Counties and can the wetland be characterized by the following description: the wetland has a sandy substrate with interspersed organic matter, a water table often within several inches of the surface, and often with a dominance of the gramineous vegetation listed in Table 1 (woody species may also be present). The Ohio Department of Natural Resources Division of Natural Areas and Preserves can provide assistance in confirming this type of wetland and its quality.	YES Wetland is a Category 3 wetland. Go to Question 11	NO Go to Question 11
11	**Relict Wet Prairies**. Is the wetland a relict wet prairie community dominated by some or all of the species in Table 1. Extensive prairies were formerly located in the Darby Plains (Madison and Union Counties), Sandusky Plains (Wyandot, Crawford, and Marion Counties), northwest Ohio (e.g. Erie, Huron, Lucas, Wood Counties), and portions of western Ohio Counties (e.g. Darke, Mercer, Miami, Montgomery, Van Wert etc.).	YES Wetland should be evaluated for possible Category 3 status Complete Quantitative Rating	NO Complete Quantitative Rating

Table 1. Characteristic plant species.

invasive/exotic spp	fen species	bog species	0ak Opening species	wet prairie species
Lythrum salicaria	*Zygadenus elegans var. glaucus*	*Calla palustris*	*Carex cryptolepis*	*Calamagrostis canadensis*
Myriophyllum spicatum	*Cacalia plantaginea*	*Carex atlantica var. capillacea*	*Carex lasiocarpa*	*Calamogrostis stricta*
Najas minor	*Carex flava*	*Carex echinata*	*Carex stricta*	*Carex atherodes*
Phalaris arundinacea	*Carex sterilis*	*Carex oligosperma*	*Cladium mariscoides*	*Carex buxbaumii*
Phragmites australis	*Carex stricta*	*Carex trisperma*	*Calamagrostis stricta*	*Carex pellita*
Potamogeton crispus	*Deschampsia caespitosa*	*Chamaedaphne calyculata*	*Calamagrostis canadensis*	*Carex sartwellii*
Ranunculus ficaria	*Eleocharis rostellata*	*Decodon verticillatus*	*Quercus palustris*	*Gentiana andrewsii*
Rhamnus frangula	*Eriophorum viridicarinatum*	*Eriophorum virginicum*		*Helianthus grosseserratus*
Typha angustifolia	*Gentianopsis spp.*	*Larix laricina*		*Liatris spicata*
Typha xglauca	*Lobelia kalmii*	*Nemopanthus mucronatus*		*Lysimachia quadriflora*
	Parnassia glauca	*Schechzeria palustris*		*Lythrum alatum*
	Potentilla fruticosa	*Sphagnum spp.*		*Pycnanthemum virginianum*
	Rhamnus alnifolia	*Vaccinium macrocarpon*		*Silphium terebinthinaceum*
	Rhynchospora capillacea	*Vaccinium corymbosum*		*Sorghastrum nutans*
	Salix candida	*Vaccinium oxycoccos*		*Spartina pectinata*
	Salix myricoides	*Woodwardia virginica*		*Solidago riddellii*
	Salix serissima	*Xyris difformis*		
	Solidago ohioensis			
	Tofieldia glutinosa			
	Triglochin maritimum			
	Triglochin palustre			

End of Narrative Rating. Begin Quantitative Rating on next page.

Site: West Carrollton River Park	**Rater(s):** Bailey Duncan	**Date:** 03/18/2024

Metric 1. Wetland Area (size).

0	0
max 6 pts.	subtotal

Select one size class and assign score.

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [0] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

2	2
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [ ] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [0] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [3] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [1] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

13.5	15.5
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [1] Precipitation (1)
- [3] Seasonal/Intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [X] 100 year floodplain (1)
- [X] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [X] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [ ] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [1] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [X] Seasonally inundated (2)
- [X] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [7] Recovered (7)
- [ ] Recovering (3)
- [1] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

5	20.5
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

- [ ] None or none apparent (4)
- [3] Recovered (3)
- [ ] Recovering (2)
- [1] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [1] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [3] Recovering (3)
- [1] Recent or no recovery (1)

Check all disturbances observed

- [X] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

20.5
subtotal this page

last revised 1 February 2001 jjm

Site: West Carrollton River Park	Rater(s): Bailey Duncan	Date: 03/18/2024

20.5
subtotal first page

0 (max 10 pts.) | 20.5 (subtotal)

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

-1 (max 20 pts.) | 19.5 (subtotal)

Metric 6. Plant communities, interspersion, microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [ ] Shrub
- [ ] Forest
- [ ] Mudflats
- [ ] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [ ] Moderate (3)
- [ ] Moderately low (2)
- [1] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [ ] Extensive >75% cover (-5)
- [-3] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummucks/tussucks
- [ ] Coarse woody debris >15cm (6in)
- [ ] Standing dead >25cm (10in) dbh
- [ ] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

19.5

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES NO	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES NO	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES NO	If yes, Category 3.
	Question 4. Significant bird habitat	YES NO	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES NO	If yes, Category 1.
	Question 6. Bogs	YES NO	If yes, Category 3.
	Question 7. Fens	YES NO	If yes, Category 3.
	Question 8a. Old Growth Forest	YES NO	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES NO	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES NO	If yes, Category 3
	Question 11. Relict Wet Prairies	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	0	
	Metric 2. Buffers and surrounding land use	2.5	
	Metric 3. Hydrology	13.5	
	Metric 4. Habitat	5	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	-2	
	TOTAL SCORE	19	Category based on score breakpoints

Complete Wetland Categorization Worksheet.

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold *(including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

Background Information

Name:	Bailey Duncan
Date:	03/18/2024
Affiliation:	Meristem, LLC
Address:	877 Port Drive
Phone Number:	812 929 325
e-mail address:	bailey.duncan@meristem.life
Name of Wetland:	Wetland D
Vegetation Communit(ies):	Emergent & Scrub-Shrub
HGM Class(es):	Riverine

Location of Wetland: include map, address, north arrow, landmarks, distances, roads, etc.

See Appendix A, Figure 6

Lat/Long or UTM Coordinate	39.680698, -84.249335
USGS Quad Name	Dayton South
County	Montgomery
Township	
Section and Subsection	Section 22
Hydrologic Unit Code	050800020106
Site Visit	3/6/2024
National Wetland Inventory Map	No
Ohio Wetland Inventory Map	No
Soil Survey	Montgomery County Soil Survey
Delineation report/map	See water resources delineation report

Name of Wetland: Wetland D	
Wetland Size (acres, hectares):	3.174-acre

Sketch: Include north arrow, relationship with other surface waters, vegetation zones, etc.

Comments, Narrative Discussion, Justification of Category Changes:

Wetland was inundated and inaccessible at the time of the site investigation.
Wetland determined via desktop review

Final score : 49.5 **Category:**	2

Scoring Boundary Worksheet

INSTRUCTIONS. The initial step in completing the ORAM is to identify the "scoring boundaries" of the wetland being rated. In many instances this determination will be relatively easy and the scoring boundaries will coincide with the "jurisdictional boundaries." For example, the scoring boundary of an isolated cattail marsh located in the middle of a farm field will likely be the same as that wetland's jurisdictional boundaries. In other instances, however, the scoring boundary will not be as easily determined. Wetlands that are small or isolated from other surface waters often form large contiguous areas or heterogeneous complexes of wetland and upland. In separating wetlands for scoring purposes, the hydrologic regime of the wetland is the main criterion that should be used. Boundaries between contiguous or connected wetlands should be established where the volume, flow, or velocity of water moving through the wetland changes significantly. *Areas with a high degree of hydrologic interaction should be scored as a single wetland*. In determining a wetland's scoring boundaries, use the guidelines in the ORAM Manual Section 5.0. In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries like property fences, roads, or railroad embankments, wetlands that are contiguous with streams, lakes, or rivers, and estuarine or coastal wetlands. These situations are discussed below, however, it is recommended that Rater contact Ohio EPA, Division of Surface Water, 401/Wetlands Section if there are additional questions or a need for further clarification of the appropriate scoring boundaries of a particular wetland.

#	Steps in properly establishing scoring boundaries	done?	not applicable
Step 1	Identify the wetland area of interest. This may be the site of a proposed impact, a reference site, conservation site, etc.	x	
Step 2	Identify the locations where there is physical evidence that hydrology changes rapidly. Such evidence includes both natural and human-induced changes including, constrictions caused by berms or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.	x	
Step 3	Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction are included within the scoring boundary.	x	
Step 4	Determine if artificial boundaries, such as property lines, state lines, roads, railroad embankments, etc., are present. These should not be used to establish scoring boundaries unless they coincide with areas where the hydrologic regime changes.	x	
Step 5	In all instances, the Rater may enlarge the minimum scoring boundaries discussed here to score together wetlands that could be scored separately.	x	
Step 6	Consult ORAM Manual Section 5.0 for how to establish scoring boundaries for wetlands that form a patchwork on the landscape, divided by artificial boundaries, contiguous to streams, lakes or rivers, or for dual classifications.	x	

End of Scoring Boundary Determination. Begin Narrative Rating on next page.

Narrative Rating

INSTRUCTIONS. Answer each of the following questions. Questions 1, 2, 3 and 4 should be answered based on information obtained from the site visit or the literature *and* by submitting a Data Services Request to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Natural Heritage Data Services, 1889 Fountain Square Court, Building F-1, Columbus, Ohio 43224, 614-265-6453 (phone), 614-265-3096 (fax), http://www.dnr.state.oh.us/dnap . The remaining questions are designed to be answered primarily by the results of the site visit. Refer to the User's Manual for descriptions of these wetland types. Note: "Critical habitat" is legally defined in the Endangered Species Act and is the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. The Rater should contact the Region 3 Headquarters or the Columbus Ecological Services Office for updates as to whether critical habitat has been designated for other federally listed threatened or endangered species. "Documented" means the wetland is listed in the appropriate State of Ohio database.

#	Question	Circle one	
1	**Critical Habitat.** Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service as "critical habitat" for any threatened or endangered plant or animal species? Note: as of January 1, 2001, of the federally listed endangered or threatened species which can be found in Ohio, the Indiana Bat has had critical habitat designated (50 CFR 17.95(a)) and the piping plover has had critical habitat proposed (65 FR 41812 July 6, 2000).	YES Wetland should be evaluated for possible Category 3 status Go to Question 2	NO Go to Question 2
2	**Threatened or Endangered Species.** Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?	YES Wetland is a Category 3 wetland. Go to Question 3	NO Go to Question 3
3	**Documented High Quality Wetland.** Is the wetland on record in Natural Heritage Database as a high quality wetland?	YES Wetland is a Category 3 wetland Go to Question 4	NO Go to Question 4
4	**Significant Breeding or Concentration Area.** Does the wetland contain documented regionally significant breeding or nonbreeding waterfowl, neotropical songbird, or shorebird concentration areas?	YES Wetland is a Category 3 wetland Go to Question 5	NO Go to Question 5
5	**Category 1 Wetlands.** Is the wetland less than 0.5 hectares (1 acre) in size and **hydrologically isolated** and either 1) comprised of vegetation that is dominated (greater than eighty per cent areal cover) by *Phalaris arundinacea, Lythrum salicaria,* or *Phragmites australis*, or 2) an acidic pond created or excavated on mined lands that has little or no vegetation?	YES Wetland is a Category 1 wetland Go to Question 6	NO Go to Question 6
6	**Bogs.** Is the wetland a peat-accumulating wetland that 1) has no significant inflows or outflows, 2) supports acidophilic mosses, particularly *Sphagnum* spp., 3) the acidophilic mosses have >30% cover, 4) at least one species from Table 1 is present, and 5) the cover of invasive species (see Table 1) is <25%?	YES Wetland is a Category 3 wetland Go to Question 7	NO Go to Question 7
7	**Fens.** Is the wetland a carbon accumulating (peat, muck) wetland that is saturated during most of the year, primarily by a discharge of free flowing, mineral rich, ground water with a circumneutral ph (5.5-9.0) and with one or more plant species listed in Table 1 and the cover of invasive species listed in Table 1 is <25%?	YES Wetland is a Category 3 wetland Go to Question 8a	NO Go to Question 8a
8a	**"Old Growth Forest."** Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs?	YES Wetland is a Category 3 wetland. Go to Question 8b	NO Go to Question 8b

8b	**Mature forested wetlands**. Is the wetland a forested wetland with 50% or more of the cover of upper forest canopy consisting of deciduous trees with large diameters at breast height (dbh), generally diameters greater than 45cm (17.7in) dbh?	YES Wetland should be evaluated for possible Category 3 status. Go to Question 9a	NO Go to Question 9a
9a	**Lake Erie coastal and tributary wetlands**. Is the wetland located at an elevation less than 575 feet on the USGS map, adjacent to this elevation, or along a tributary to Lake Erie that is accessible to fish?	YES Go to Question 9b	NO Go to Question 10
9b	Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from Lake Erie due to lakeward or landward dikes or other hydrological controls?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 9c
9c	Are Lake Erie water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or the wetland can be characterized as an "estuarine" wetland with lake and river influenced hydrology. These include sandbar deposition wetlands, estuarine wetlands, river mouth wetlands, or those dominated by submersed aquatic vegetation.	YES Go to Question 9d	NO Go to Question 10
9d	Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?	YES Wetland is a Category 3 wetland Go to Question 10	NO Go to Question 9e
9e	Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 10
10	**Lake Plain Sand Prairies (Oak Openings)** Is the wetland located in Lucas, Fulton, Henry, or Wood Counties and can the wetland be characterized by the following description: the wetland has a sandy substrate with interspersed organic matter, a water table often within several inches of the surface, and often with a dominance of the gramineous vegetation listed in Table 1 (woody species may also be present). The Ohio Department of Natural Resources Division of Natural Areas and Preserves can provide assistance in confirming this type of wetland and its quality.	YES Wetland is a Category 3 wetland. Go to Question 11	NO Go to Question 11
11	**Relict Wet Prairies**. Is the wetland a relict wet prairie community dominated by some or all of the species in Table 1. Extensive prairies were formerly located in the Darby Plains (Madison and Union Counties), Sandusky Plains (Wyandot, Crawford, and Marion Counties), northwest Ohio (e.g. Erie, Huron, Lucas, Wood Counties), and portions of western Ohio Counties (e.g. Darke, Mercer, Miami, Montgomery, Van Wert etc.).	YES Wetland should be evaluated for possible Category 3 status Complete Quantitative Rating	NO Complete Quantitative Rating

Table 1. Characteristic plant species.

invasive/exotic spp	fen species	bog species	0ak Opening species	wet prairie species
Lythrum salicaria	*Zygadenus elegans var. glaucus*	*Calla palustris*	*Carex cryptolepis*	*Calamagrostis canadensis*
Myriophyllum spicatum	*Cacalia plantaginea*	*Carex atlantica var. capillacea*	*Carex lasiocarpa*	*Calamogrostis stricta*
Najas minor	*Carex flava*	*Carex echinata*	*Carex stricta*	*Carex atherodes*
Phalaris arundinacea	*Carex sterilis*	*Carex oligosperma*	*Cladium mariscoides*	*Carex buxbaumii*
Phragmites australis	*Carex stricta*	*Carex trisperma*	*Calamagrostis stricta*	*Carex pellita*
Potamogeton crispus	*Deschampsia caespitosa*	*Chamaedaphne calyculata*	*Calamagrostis canadensis*	*Carex sartwellii*
Ranunculus ficaria	*Eleocharis rostellata*	*Decodon verticillatus*	*Quercus palustris*	*Gentiana andrewsii*
Rhamnus frangula	*Eriophorum viridicarinatum*	*Eriophorum virginicum*		*Helianthus grosseserratus*
Typha angustifolia	*Gentianopsis spp.*	*Larix laricina*		*Liatris spicata*
Typha xglauca	*Lobelia kalmii*	*Nemopanthus mucronatus*		*Lysimachia quadriflora*
	Parnassia glauca	*Schechzeria palustris*		*Lythrum alatum*
	Potentilla fruticosa	*Sphagnum spp.*		*Pycnanthemum virginianum*
	Rhamnus alnifolia	*Vaccinium macrocarpon*		*Silphium terebinthinaceum*
	Rhynchospora capillacea	*Vaccinium corymbosum*		*Sorghastrum nutans*
	Salix candida	*Vaccinium oxycoccos*		*Spartina pectinata*
	Salix myricoides	*Woodwardia virginica*		*Solidago riddellii*
	Salix serissima	*Xyris difformis*		
	Solidago ohioensis			
	Tofieldia glutinosa			
	Triglochin maritimum			
	Triglochin palustre			

End of Narrative Rating. Begin Quantitative Rating on next page.

Site: West Carrollton River Park	**Rater(s):** Bailey Duncan	**Date:** 03/18/2024

Metric 1. Wetland Area (size).

3	3
max 6 pts.	subtotal

Select one size class and assign score.

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [3] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

7	10
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [4] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [3] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [ ] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

20.5	30.5
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [1] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [5] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [X] 100 year floodplain (1)
- [X] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [X] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [3] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [ ] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- [X] Semi- to permanently inundated/saturated (4)
- [X] Regularly inundated/saturated (3)
- [ ] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [7] Recovered (7)
- [3] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

13	43.5
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

- [4] None or none apparent (4)
- [3] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [5] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [6] Recovered (6)
- [3] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

43.5
subtotal this page

last revised 1 February 2001 jjm

Site: West Carrollton River Park	Rater(s): Bailey Duncan	Date: 03/18/2024

43.5
subtotal first page

0	43.5
max 10 pts.	subtotal

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

6	49.5
max 20 pts.	subtotal

Metric 6. Plant communities, interspersion, microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [2] Emergent
- [1] Shrub
- [ ] Forest
- [ ] Mudflats
- [ ] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [3] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [0] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummucks/tussucks
- [ ] Coarse woody debris >15cm (6in)
- [ ] Standing dead >25cm (10in) dbh
- [ ] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

49.5

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES NO	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES NO	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES NO	If yes, Category 3.
	Question 4. Significant bird habitat	YES NO	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES NO	If yes, Category 1.
	Question 6. Bogs	YES NO	If yes, Category 3.
	Question 7. Fens	YES NO	If yes, Category 3.
	Question 8a. Old Growth Forest	YES NO	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES NO	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES NO	If yes, Category 3
	Question 11. Relict Wet Prairies	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	3	
	Metric 2. Buffers and surrounding land use	7	
	Metric 3. Hydrology	20.5	
	Metric 4. Habitat	13	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	3	
	TOTAL SCORE	46.5	Category based on score breakpoints

Complete Wetland Categorization Worksheet.

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold *(including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

Background Information

Name:	Bailey Duncan
Date:	03/18/2024
Affiliation:	Meristem, LLC
Address:	877 Port Drive
Phone Number:	812 929 325
e-mail address:	bailey.duncan@meristem.life
Name of Wetland:	Wetland E
Vegetation Communit(ies):	Emergent
HGM Class(es):	Riverine

Location of Wetland: include map, address, north arrow, landmarks, distances, roads, etc.

See Appendix A, Figure 6

Lat/Long or UTM Coordinate	39.679749, -84.247661
USGS Quad Name	Dayton South
County	Montgomery
Township	
Section and Subsection	Section 22
Hydrologic Unit Code	050800020106
Site Visit	3/6/2024
National Wetland Inventory Map	No
Ohio Wetland Inventory Map	No
Soil Survey	Montgomery County Soil Survey
Delineation report/map	See water resources delineation report

Name of Wetland: Wetland E	
Wetland Size (acres, hectares):	0.069-acre

Sketch: Include north arrow, relationship with other surface waters, vegetation zones, etc.

Comments, Narrative Discussion, Justification of Category Changes:

Wetland was inundated and inaccessible at the time of the site investigation.
Wetland determined via desktop review

Final score : 44.5 **Category:**	2

Scoring Boundary Worksheet

INSTRUCTIONS. The initial step in completing the ORAM is to identify the "scoring boundaries" of the wetland being rated. In many instances this determination will be relatively easy and the scoring boundaries will coincide with the "jurisdictional boundaries." For example, the scoring boundary of an isolated cattail marsh located in the middle of a farm field will likely be the same as that wetland's jurisdictional boundaries. In other instances, however, the scoring boundary will not be as easily determined. Wetlands that are small or isolated from other surface waters often form large contiguous areas or heterogeneous complexes of wetland and upland. In separating wetlands for scoring purposes, the hydrologic regime of the wetland is the main criterion that should be used. Boundaries between contiguous or connected wetlands should be established where the volume, flow, or velocity of water moving through the wetland changes significantly. *Areas with a high degree of hydrologic interaction should be scored as a single wetland*. In determining a wetland's scoring boundaries, use the guidelines in the ORAM Manual Section 5.0. In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries like property fences, roads, or railroad embankments, wetlands that are contiguous with streams, lakes, or rivers, and estuarine or coastal wetlands. These situations are discussed below, however, it is recommended that Rater contact Ohio EPA, Division of Surface Water, 401/Wetlands Section if there are additional questions or a need for further clarification of the appropriate scoring boundaries of a particular wetland.

#	Steps in properly establishing scoring boundaries	done?	not applicable
Step 1	Identify the wetland area of interest. This may be the site of a proposed impact, a reference site, conservation site, etc.	x	
Step 2	Identify the locations where there is physical evidence that hydrology changes rapidly. Such evidence includes both natural and human-induced changes including, constrictions caused by berms or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.	x	
Step 3	Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction are included within the scoring boundary.	x	
Step 4	Determine if artificial boundaries, such as property lines, state lines, roads, railroad embankments, etc., are present. These should not be used to establish scoring boundaries unless they coincide with areas where the hydrologic regime changes.	x	
Step 5	In all instances, the Rater may enlarge the minimum scoring boundaries discussed here to score together wetlands that could be scored separately.	x	
Step 6	Consult ORAM Manual Section 5.0 for how to establish scoring boundaries for wetlands that form a patchwork on the landscape, divided by artificial boundaries, contiguous to streams, lakes or rivers, or for dual classifications.	x	

End of Scoring Boundary Determination. Begin Narrative Rating on next page.

Narrative Rating

INSTRUCTIONS. Answer each of the following questions. Questions 1, 2, 3 and 4 should be answered based on information obtained from the site visit or the literature *and* by submitting a Data Services Request to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Natural Heritage Data Services, 1889 Fountain Square Court, Building F-1, Columbus, Ohio 43224, 614-265-6453 (phone), 614-265-3096 (fax), http://www.dnr.state.oh.us/dnap . The remaining questions are designed to be answered primarily by the results of the site visit. Refer to the User's Manual for descriptions of these wetland types. Note: "Critical habitat" is legally defined in the Endangered Species Act and is the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. The Rater should contact the Region 3 Headquarters or the Columbus Ecological Services Office for updates as to whether critical habitat has been designated for other federally listed threatened or endangered species. "Documented" means the wetland is listed in the appropriate State of Ohio database.

#	Question	Circle one	
1	**Critical Habitat.** Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service as "critical habitat" for any threatened or endangered plant or animal species? Note: as of January 1, 2001, of the federally listed endangered or threatened species which can be found in Ohio, the Indiana Bat has had critical habitat designated (50 CFR 17.95(a)) and the piping plover has had critical habitat proposed (65 FR 41812 July 6, 2000).	YES Wetland should be evaluated for possible Category 3 status Go to Question 2	NO Go to Question 2
2	**Threatened or Endangered Species.** Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?	YES Wetland is a Category 3 wetland. Go to Question 3	NO Go to Question 3
3	**Documented High Quality Wetland.** Is the wetland on record in Natural Heritage Database as a high quality wetland?	YES Wetland is a Category 3 wetland Go to Question 4	NO Go to Question 4
4	**Significant Breeding or Concentration Area.** Does the wetland contain documented regionally significant breeding or nonbreeding waterfowl, neotropical songbird, or shorebird concentration areas?	YES Wetland is a Category 3 wetland Go to Question 5	NO Go to Question 5
5	**Category 1 Wetlands.** Is the wetland less than 0.5 hectares (1 acre) in size and **hydrologically isolated** and either 1) comprised of vegetation that is dominated (greater than eighty per cent areal cover) by *Phalaris arundinacea, Lythrum salicaria,* or *Phragmites australis*, or 2) an acidic pond created or excavated on mined lands that has little or no vegetation?	YES Wetland is a Category 1 wetland Go to Question 6	NO Go to Question 6
6	**Bogs.** Is the wetland a peat-accumulating wetland that 1) has no significant inflows or outflows, 2) supports acidophilic mosses, particularly *Sphagnum* spp., 3) the acidophilic mosses have >30% cover, 4) at least one species from Table 1 is present, and 5) the cover of invasive species (see Table 1) is <25%?	YES Wetland is a Category 3 wetland Go to Question 7	NO Go to Question 7
7	**Fens.** Is the wetland a carbon accumulating (peat, muck) wetland that is saturated during most of the year, primarily by a discharge of free flowing, mineral rich, ground water with a circumneutral ph (5.5-9.0) and with one or more plant species listed in Table 1 and the cover of invasive species listed in Table 1 is <25%?	YES Wetland is a Category 3 wetland Go to Question 8a	NO Go to Question 8a
8a	**"Old Growth Forest."** Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs?	YES Wetland is a Category 3 wetland. Go to Question 8b	NO Go to Question 8b

8b	**Mature forested wetlands**. Is the wetland a forested wetland with 50% or more of the cover of upper forest canopy consisting of deciduous trees with large diameters at breast height (dbh), generally diameters greater than 45cm (17.7in) dbh?	YES Wetland should be evaluated for possible Category 3 status. Go to Question 9a	NO Go to Question 9a
9a	**Lake Erie coastal and tributary wetlands**. Is the wetland located at an elevation less than 575 feet on the USGS map, adjacent to this elevation, or along a tributary to Lake Erie that is accessible to fish?	YES Go to Question 9b	NO Go to Question 10
9b	Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from Lake Erie due to lakeward or landward dikes or other hydrological controls?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 9c
9c	Are Lake Erie water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or the wetland can be characterized as an "estuarine" wetland with lake and river influenced hydrology. These include sandbar deposition wetlands, estuarine wetlands, river mouth wetlands, or those dominated by submersed aquatic vegetation.	YES Go to Question 9d	NO Go to Question 10
9d	Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?	YES Wetland is a Category 3 wetland Go to Question 10	NO Go to Question 9e
9e	Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 10
10	**Lake Plain Sand Prairies (Oak Openings)** Is the wetland located in Lucas, Fulton, Henry, or Wood Counties and can the wetland be characterized by the following description: the wetland has a sandy substrate with interspersed organic matter, a water table often within several inches of the surface, and often with a dominance of the gramineous vegetation listed in Table 1 (woody species may also be present). The Ohio Department of Natural Resources Division of Natural Areas and Preserves can provide assistance in confirming this type of wetland and its quality.	YES Wetland is a Category 3 wetland. Go to Question 11	NO Go to Question 11
11	**Relict Wet Prairies**. Is the wetland a relict wet prairie community dominated by some or all of the species in Table 1. Extensive prairies were formerly located in the Darby Plains (Madison and Union Counties), Sandusky Plains (Wyandot, Crawford, and Marion Counties), northwest Ohio (e.g. Erie, Huron, Lucas, Wood Counties), and portions of western Ohio Counties (e.g. Darke, Mercer, Miami, Montgomery, Van Wert etc.).	YES Wetland should be evaluated for possible Category 3 status Complete Quantitative Rating	NO Complete Quantitative Rating

Table 1. Characteristic plant species.

invasive/exotic spp	fen species	bog species	0ak Opening species	wet prairie species
Lythrum salicaria	*Zygadenus elegans var. glaucus*	*Calla palustris*	*Carex cryptolepis*	*Calamagrostis canadensis*
Myriophyllum spicatum	*Cacalia plantaginea*	*Carex atlantica var. capillacea*	*Carex lasiocarpa*	*Calamogrostis stricta*
Najas minor	*Carex flava*	*Carex echinata*	*Carex stricta*	*Carex atherodes*
Phalaris arundinacea	*Carex sterilis*	*Carex oligosperma*	*Cladium mariscoides*	*Carex buxbaumii*
Phragmites australis	*Carex stricta*	*Carex trisperma*	*Calamagrostis stricta*	*Carex pellita*
Potamogeton crispus	*Deschampsia caespitosa*	*Chamaedaphne calyculata*	*Calamagrostis canadensis*	*Carex sartwellii*
Ranunculus ficaria	*Eleocharis rostellata*	*Decodon verticillatus*	*Quercus palustris*	*Gentiana andrewsii*
Rhamnus frangula	*Eriophorum viridicarinatum*	*Eriophorum virginicum*		*Helianthus grosseserratus*
Typha angustifolia	*Gentianopsis spp.*	*Larix laricina*		*Liatris spicata*
Typha xglauca	*Lobelia kalmii*	*Nemopanthus mucronatus*		*Lysimachia quadriflora*
	Parnassia glauca	*Schechzeria palustris*		*Lythrum alatum*
	Potentilla fruticosa	*Sphagnum spp.*		*Pycnanthemum virginianum*
	Rhamnus alnifolia	*Vaccinium macrocarpon*		*Silphium terebinthinaceum*
	Rhynchospora capillacea	*Vaccinium corymbosum*		*Sorghastrum nutans*
	Salix candida	*Vaccinium oxycoccos*		*Spartina pectinata*
	Salix myricoides	*Woodwardia virginica*		*Solidago riddellii*
	Salix serissima	*Xyris difformis*		
	Solidago ohioensis			
	Tofieldia glutinosa			
	Triglochin maritimum			
	Triglochin palustre			

End of Narrative Rating. Begin Quantitative Rating on next page.

Site: West Carrollton River Park	**Rater(s):** Bailey Duncan	**Date:** 03/18/2024

Metric 1. Wetland Area (size).

0 (max 6 pts.) | 0 (subtotal)

Select one size class and assign score.

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [0] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

7 (max 14 pts.) | 7 (subtotal)

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [4] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [3] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [ ] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

20.5 (max 30 pts.) | 27.5 (subtotal)

3a. Sources of Water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [1] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [5] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [X] 100 year floodplain (1)
- [X] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [X] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [3] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [ ] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- [X] Semi- to permanently inundated/saturated (4)
- [X] Regularly inundated/saturated (3)
- [ ] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [7] Recovered (7)
- [3] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

12 (max 20 pts.) | 39.5 (subtotal)

4a. Substrate disturbance. Score one or double check and average.

- [ ] None or none apparent (4)
- [3] Recovered (3)
- [2] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [5] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [6] Recovered (6)
- [3] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

39.5 (subtotal this page)

last revised 1 February 2001 jjm

Site: West Carrollton River Park	Rater(s): Bailey Duncan	Date: 03/18/2024

39.5
subtotal first page

0	39.5
max 10 pts.	subtotal

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

5	44.5
max 20 pts.	subtotal

Metric 6. Plant communities, interspersion, microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [2] Emergent
- [ ] Shrub
- [ ] Forest
- [ ] Mudflats
- [ ] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [3] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [0] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummucks/tussucks
- [ ] Coarse woody debris >15cm (6in)
- [ ] Standing dead >25cm (10in) dbh
- [ ] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

44.5

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES NO	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES NO	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES NO	If yes, Category 3.
	Question 4. Significant bird habitat	YES NO	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES NO	If yes, Category 1.
	Question 6. Bogs	YES NO	If yes, Category 3.
	Question 7. Fens	YES NO	If yes, Category 3.
	Question 8a. Old Growth Forest	YES NO	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES NO	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES NO	If yes, Category 3
	Question 11. Relict Wet Prairies	YES NO	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	0	
	Metric 2. Buffers and surrounding land use	7	
	Metric 3. Hydrology	20.5	
	Metric 4. Habitat	12	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	3	
	TOTAL SCORE	42.5	Category based on score breakpoints

Complete Wetland Categorization Worksheet.

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold *(including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

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Appendix D:
Study Area Photographs

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Meristem

Where New Growth Happens

West Carrollton Riverside Park

Montgomery County, Ohio

Endangered, Threatened, and Rare (ETR) Species and Habitat Assessment

April 11th, 2024

Prepared for:

PATRIOT ENGINEERING and Environmental, Inc.

Engineering Value for Project Success

Patriot Engineering
Milford, Ohio

Prepared by:

Meristem, LLC
Avon, Indiana

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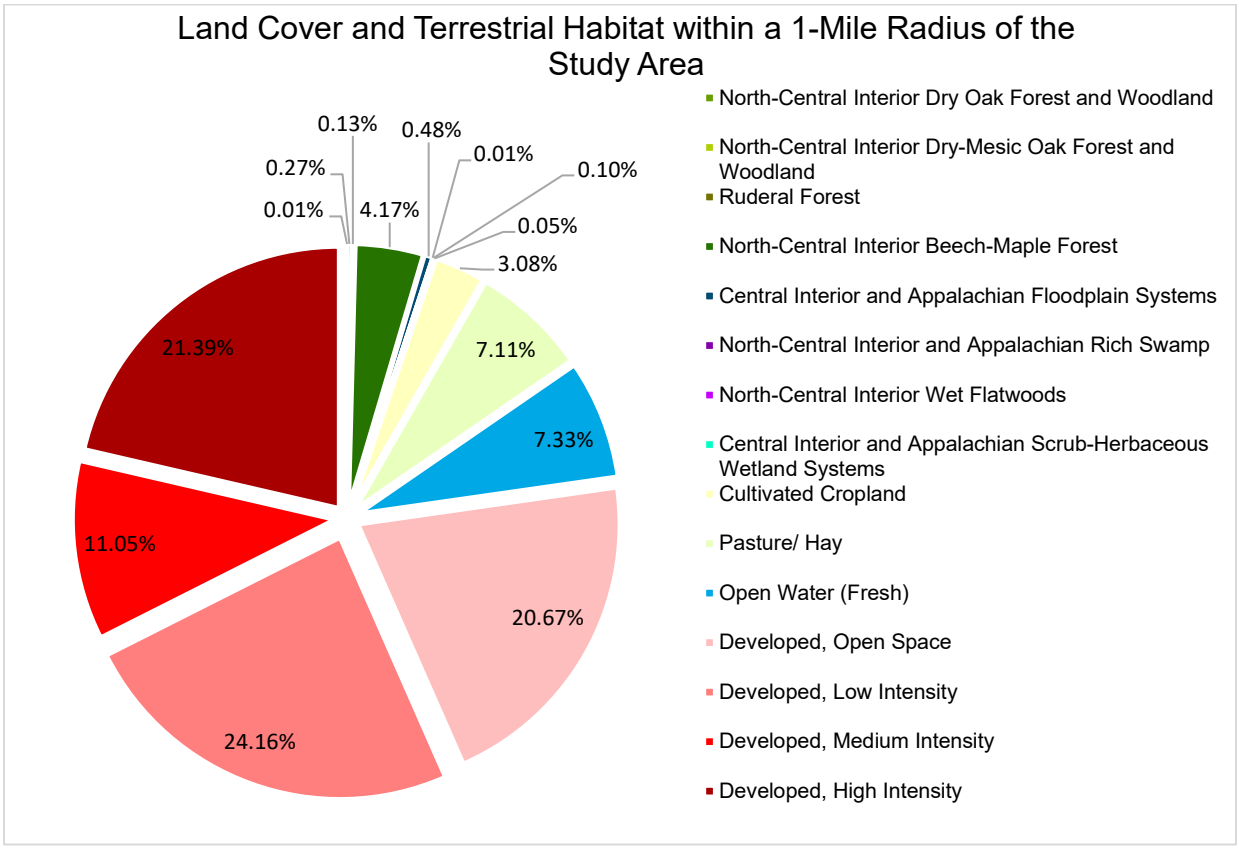
1.0 INTRODUCTION

1.1 Site Description

The Study Area is a 121.8-acre property located north of West Carrollton City in Section 16, 22, and 30; Township 1N and 1E; Range 6N and 6E in Jefferson Township, Montgomery County, Ohio. The Study Area was delineated and surveyed by Meristem on March 7th, 2024. The Study Area is located within the Loamy High Lime Till Plains (55b) Level IV Ecoregion as designated by the U.S. Environmental Protection Agency (EPA). This ecoregion historically contained nearly-level topography and soils developed from loamy, limey, glacial deposits of Wisconsinan age, with higher fertility and better natural drainage than surrounding Eastern Corn Belt Plains Level IV Ecoregions. Much of the original land use has been converted to agriculture.

Land use within a 1-mile radius of the Study Area is primarily agricultural land, open fresh water, and open space to developed areas (i.e., roadways and commercial development). Land use within the Study Area is primarily open fresh water with open space and medium intensity development. The 2011 GAP/LANDFIRE terrestrial habitat data indicates that the land use surrounding the Study Area is approximately 56.6% developed land, 20.67% open space, 10.19% agricultural (including cultivated cropland and pasture/hay), 7.33% open fresh water, 4.58% deciduous forests (predominantly north-central interior beech-maple forest), 0.48% central interior and Appalachian floodplain systems, 0.06% north-central interior and Appalachian rich swamp and scrub-herbaceous wetland systems, and 0.1% north-central interior wet flatwoods (see Figure 1 below). Figure 1 below corresponds with Appendix A.



1.2 Purpose and Scope

The purpose of this report is to identify potential endangered, threatened, and rare (ETR) species concerns, as well as potential bat roost tree habitat within the Study Area that may trigger additional studies or coordination with state and federal agencies. This report identifies the environmental and ecological characteristics and parameters identified within the Study Area, based on Meristem's best professional understanding and interpretation of current federal and Ohio state code, regulations, and promulgation. The environmental concerns analyzed and identified for this study include the following:

- Special Habitat and Natural Communities
- Endangered, Threatened, and Rare (ETR) Species and Special Habitat
- Indiana and Northern Long-eared Bat Roost Habitat

2.0 Methodology

2.1 Special Habitat and Natural Communities

A meandering, qualitative field survey was performed to assess the habitat types, significant natural habitat areas, and high-quality natural communities located within and immediately adjacent to the Study Area. Special terrestrial habitat and natural community types were characterized by the dominant woody vegetation species observed. The canopy cover and relative dominance of each woody species were estimated qualitatively for each identified forest community type during the delineation effort.

The woody species observations were used to ascertain the presence or absence of high-quality natural communities within the Study Area, and to predict the probability of occurrence for endangered, threatened, and rare (ETR) plant and animal species found within the county.

Additionally, streams with higher flow regimes (intermittent and perennial) and pool and riffle complexes were noted during the field survey as potential habitat for ETR mussel species with medium-sized to large-sized stream preference.

2.2 Endangered, Threatened, and Rare (ETR) State- and Federally-Listed Species and Special Habitat

ETR species are protected at both the state and federal level (OC §1531.25 and 50 CFR § 17.11 through 17.12, respectively). Both laws prohibit the take, possession, transport, export, processing, sale or offer for sale, or shipment of endangered species. The Ohio Code defines "take" as every attempt to kill or capture and every act of assistance to any other person in killing or capturing or attempting to kill or capture a wild animal (OC § 1531.01-G).

A request was sent to Ohio Department of Natural Resources (ODNR) Division of Natural Areas and Preserves for a Natural Heritage Database (NHD) search for documented occurrences of ETR species within the project area.

A meandering field survey was performed to assess the potential of occurrence for listed ETR species known to occur within Montgomery County. Species specific presence/absence surveys were not performed or included under the scope of this assessment.

Tables summarizing the results of ETR species as they relate to the habitat observed within the Study Area are included in Appendix D. Natural Heritage Database review results (from ODNR) along with suggested recommendations and/or required agency coordination for risk management purposes are included in Appendices E and F. Correspondence from ODNR's Division of Natural Areas and Preserves is included in Appendix E.

2.3 Indiana and Northern Long-eared Bat Roost Habitat

The Indiana bat (*Myotis sodalis,* federally endangered) and northern long-eared bat (*Myotis septentrionalis,* federally endangered) are protected under the Endangered Species Act (ESA), which is managed by the U.S. Fish and Wildlife Service (USFWS). Both bat species are known to occur within Montgomery County, according to the official ETR species list obtained from the USFWS Information for Planning and Consultation (IPaC) database.

Suitable roosting and foraging habitat typically includes wooded areas in uplands, forested wetlands, and riparian areas (along streams); but may also include fencerows or trees located adjacent to agricultural fields and pastures. Potential roost trees include individuals that are live, dead (snags), or dying, with exfoliating bark, crevices, cracks, or cavities. Potential roost trees are at least 5 inches in diameter at breast height (DBH) for Indiana bats and at least 3 inches DBH for northern long-eared bat. The following is a list of tree species known to be utilized as roosts by Indiana bats, according to the U.S. Forest Service:

- Maples (*Acer* spp.), predominantly red maple (*A. rubrum*) and sugar maple (*A. saccharum*)
- Oaks (*Quercus* spp.), predominantly white oak (*Q. alba*), northern red oak (*Q. rubra*), pin oak (*Q. palustris*), scarlet oak (*Q. coccinea*), post oak (*Q. stellata*), and shingle oak (*Q. imbricaria*)
- Eastern cottonwood (*Populus deltoides*)
- Hickories (*Carya* spp.), predominantly shagbark hickory (*C. ovata*), bitternut hickory (*C. cordiformis*), mockernut hickory (*C. tomentosa*), and pignut hickory (*C. glabra*)
- Elms (*Ulmus* spp.), including American elm (*U. americana*) and slippery elm (*U. rubra*)
- Honey locust (*Gleditsia triacanthos*)
- Sourwood (*Oxydendron arboretum*)
- Ashes (*Fraxinus* spp.), including green ash (*F. pennsylvanica*) and white ash (*F. americana*)
- Virginia pine (*Pinus virginiana*)
- Sycamore (*Platanus occidentalis*)
- Sassafras (*Sassafras albidum*

Trees omitted from the scope of 'potential habitat' are those located more than 1,000 feet from a wooded or forested habitat, or those located in a highly urban setting. In addition to trees and snags, the Indiana and northern long-eared bat may utilize old barns, bat houses, utility poles with adequate cavities, and bridges.

If any suitable bat roost habitat is identified within the Study Area, a narrative describing the approximate number and type of potential roost tree(s) will be included in Section 3, and a map depicting the location of potential roost trees in various forested habitat areas will be included in Appendix B. The official ETR species list from the USFWS (including any information about potential occurrence of both bat species) and any relevant ODNR and USFWS coordination will be included in Appendices E and F. Additionally, a photo log containing photographs of each potential bat roost tree and their diameter at breast height (DBH), as well as any potentially suitable structures are included in Appendix G.

3.0 Results and Discussion

3.1 Special Habitat and Natural Communities

3.2.1 Terrestrial and Forested Habitat

A meandering, qualitative field survey was performed to assess the habitat types, significant natural habitat areas, and high-quality natural communities located within and immediately adjacent to the Study Area.

A total of six (6) dominant tree species were observed within the Study Area, which included American sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), boxelder maple (*Acer negundo*), common hackberry (*Celtis occidentalis*), honey locust (*Gleditsia triacanthos*), and unidentified snags. At least six (6) live, dead, and dying trees within the Study Area showed exfoliating bark and cavities suitable for ETR bat species habitat. Appendix B illustrates the locations of each individual potential roost tree, and Appendix G includes representative photos of various potential roost trees throughout the site.

3.2.2 Aquatic Habitat

Appendix C illustrates the location of each habitat type observed within the Study Area. The Great Miami River was identified within the Study Area. This water resource was deemed to be potentially suitable habitat for the following aquatic ETR species: *Epioblasma triquetra* (snuffbox), *Villosa fabalis* (rayed bean), *Alasmidonta marginata* (elktoe)**,** *Cyclonaias tuberculate* (purple wartyback)**,** *Lasmigona compressa* (creek heelsplitter), and *Lampsilis fasciola* (wavy-rayed lampmussel).

An ephemeral waterbody, formed due to flooding from the Great Miami River, was identified within the Study Area. The ephemeral waterbody was deemed suitable for ETR species that are reliant on stagnant aquatic habitat for a portion of their lifecycle and included the following: *Gomphurus ventricosus* (skillet clubtail), *Gomphus externus* (plains clubtail), *Argia alberta* (Paiute dancer), *Erpetogomphus designates* (eastern ringtail), *Argia bipunctulata* (seepage dancer), *Ladona deplanata* (blue corporal), *Epitheca costalis* (slender baskettail), and *Libellula auripennis* (golden- winged skimmer).

3.2 Endangered, Threatened, and Rare (ETR) State- and Federally-Listed Species

Several information sources were consulted to further define the potential habitat of Montgomery County-listed ETR species. Tables D-1 and D-2, located in Appendix D, contain a list of ETR species known to occur within Montgomery County and their predicted potential to occur within the Study Area based on on-site habitat observations during the field investigation.

ETR species with a general preference for deciduous mesic forests edges and floodplains, medium to large rivers and riverbanks, open grasslands and roadsides, scrub-shrub and emergent wetlands, and open-water ponds were deemed to have low to moderate probabilities of occurrence within the Study Area. Table 1 below lists the habitat types and associated ETR species with low to moderate potential of occurrence within each type.

Table 1: ETR Species Potential of Occurrence by Identified Habitat Type

Habitat Type	Potential ETR Species
Deciduous Mesic Forest Edges and Floodplains	**Animals:** • *Antrostomus carolinensis* (Chuck-will's-widow) - Moderate • *Accipiter striatus* (sharp-shinned hawk) - Low • *Setophaga cerulea* (cerulean warbler) - Low **Plants:** • *Fraxinus profunda* (pumpkin ash) - Moderate
Medium to Large Rivers and Riverbanks	**Animals:** • *Epioblasma triquetra* (snuffbox) - Moderate • *Villosa fabalis* (rayed bean) – Moderate • *Alasmidonta marginata* (elktoe) – Moderate • *Cyclonaias tuberculate* (purple wartyback) – Moderate • *Lasmigona compressa* (creek heelsplitter) – Moderate • *Gomphurus ventricosus* (skillet clubtail) – Moderate • *Gomphus externus* (plains clubtail) - Moderate • *Lampsilis fasciola* (wavy-rayed lampmussel) – Low • *Argia alberta* (Paiute dancer) – Low • *Erpetogomphus designates* (eastern ringtail) - Low • **Plants:** • *Arabis pycnocarpa var. adpressipilis* (southern hairy rock cress) – Moderate • *Carex timida* (timid sedge) – Moderate • *Gentianopsis procera* (small fringed gentian) - Moderate • *Juncus interior* (inland rush) – Moderate • *Lipocarpha micrantha* (dwarf bulrush) – Moderate
Open Grasslands and Roadsides	**Animals:** • *Circus hudsonius* (northern harrier) - Moderate • *Bartramia longicauda* (upland sandpiper) - Moderate • *Taxidea taxus* (American badger) - Low **Plants:** • *Draba reptans* (Carolina whitlow- grass) – Moderate • *Penstemon pallidus* (downy white beard-tongue) - Moderate • *Juncus secundus* (one-sided rush) - Low

Scrub-shrub and Emergent Wetlands	**Animals:** • *Clonophis kirtlandii* (Kirtland's snake) - Moderate • *Cistothorus platensis* (sedge wren) – Moderate • *Nyctanassa violacea* (yellow-crowned night-heron) – Moderate
Open-water Ponds	**Animals:** • *Argia bipunctulata* (seepage dancer) – Moderate • *Ladona deplanata* (blue corporal) - Moderate • *Epitheca costalis* (slender baskettail) - Moderate • *Libellula auripennis* (golden- winged skimmer) - Moderate

The Natural Heritage Database was checked on April 9th, 2024, and it was determined that no state or federally listed species have been documented within one mile of the Study Area. Coordination with the Ohio Division of Wildlife (DOW) found that the Study Area is within the range of following listed species: Indiana bat (*Myotis sodalis*), northern long-eared bat (*M. septentrionalis*), little brown bat (*M. lucifugus*), tricolored bat (*Perimyotis subflavus*), clubshell (*Pleurobema clava*), rayed bean (*Villosa fabalis*), snuffbox (*Epioblasma triquetra*), pocketbook (*Lampsilis ovate*), channel darter (*Percina copelandi*), eastern massasauga (*Sistrurus catenatus*), and Kirtland's snake (*Clonophis kirtlandii*) (see Appendix E).

Coordination was also undertaken with the USFWS IPaC database to determine if the project would potentially impact ETR species. Based on the official ETR species list generated by the database, there was no Critical Habitat documented within the Study Area. The Endangered Species Act (ESA)-included species were the aforementioned Indiana and northern long-eared bats (*M. sodalis* and *M. septentrionalis*) endangered species, the tricolored bat (*Perimyotis subflavus*) proposed endangered species, the monarch butterfly (*Danaus plexippus*) candidate species, and the whooping crane (*Grus americana*) non-essential experimental population. Suitable habitat for the Indiana bat, northern long-eared bat, tricolored bat, and the monarch butterfly of the IPaC-listed species was observed within the Study Area, but no individuals of any of the species above were observed during the investigation.

Agency coordination and official lists are included in Appendices E and F.

3.3 Indiana and Northern Long-eared Bat Roost Habitat

A meandering survey of the Study Area, excluding the NPDES facility parcel, was conducted to identify areas containing potential Indiana and northern long-eared bat roost habitat. Based on Meristem's field inspection and our best professional judgment, there were at least six (6) suitable bat roost habitat trees within or immediately adjacent to the Study Area. In addition, at least five (5) utility poles were noted as potentially suitable habitat for the Indiana and northern long-eared bat. See Appendix B for locations of potentially suitable bat habitat. Table 2 on the following page summarizes the potential bat roost tree areas within the Study Area.

Table 2: Potential Bat Roost Tree Habitat within Study Area

Tree ID Number	Roost Tree Species:	DBH (inches)	Tree Health
1	Silver Maple (*Acer saccharinum*)	20”	Good
2	Silver Maple (*Acer saccharinum*)	18”	Good
3	Silver Maple (*Acer saccharinum*)	19”	Good
6	Honey Locust (*Gleditsia triacanthos*)	39”	Fair
10	Unidentified Snag	10”	Poor
11	Common Hackberry (*Celtis occidentalis)*	19”	Fair

The USFWS is the regulatory authority responsible for making the final determination as to the status and presence of Indiana and northern long-eared bats within the Study Area.

4.0 Summary and Conclusion

An Endangered, Threatened, and Rare (ETR) Species Assessment was performed for the 121.8-acre property located north of West Carrollton City in Section 16, 22, and 30; Township 1N and 1E; Range 6N and 6E in Jefferson Township, Montgomery County, Ohio. The Study Area was delineated and surveyed by Meristem on March 7th, 2024. Five distinct habitat types were identified within the Study Area to better inform and identify potential probabilities of occurrence for the ETR species listed in the county.

No ETR species were documented within or adjacent to the Study Area during the site investigation; however, several species have low to moderate probabilities of occurrence for deciduous mesic forest edges and floodplains, medium to large rivers and riverbanks, open grasslands and roadsides, emergent and scrub-shrub wetlands, and open-water ponds within the Study Area. ETR species with moderate probabilities of occurrence in deciduous mesic forest edges and floodplain habitat included Chuck-will’s-widow and pumpkin ash. ETR species with moderate probabilities of occurrence in medium to large rivers and riverbank habitat included the snuffbox, rayed bean, elktoe, purple wartyback, creek heelsplitter, skillet clubtail, plains clubtail, southern hairy rock cress, timid sedge, small fringed gentian, inland rush, and dwarf bulrush. ETR Species with moderate probabilities of occurrence in open grassland and roadside habitat included the northern harrier, upland sandpiper, Carolina whitlow-grass, and downy white beard-tongue. ETR species with moderate probabilities of occurrence in emergent and scrub-shrub wetland habitat included Kirtland’s snake, sedge wren, and yellow-crowned night-heron. ETR species with moderate probabilities of occurrence in open- water pond habitat included seepage dancer, blue corporal, slender baskettail, and golden- winged skimmer.

The ODNR Natural Heritage Database search (dated April 9th, 2024) indicated that no ETR species records were present within or adjacent to the Study Area. The Ohio Division of Wildlife (DOW) states that the Study Area falls within the range of seven (7) listed species (see Appendix E). At least six (6) suitable bat roost habitat trees were identified within or immediately adjacent to the Study Area and included three (3) silver maples, one (1) honey locust, one (1) unidentified snag, and one (1) common hackberry. In addition, at least five (5) utility poles were noted as potentially suitable habitat for the Indiana and northern long-eared bat. Further ETR coordination with ODNR may be required, and removal of any potential bat trees must occur prior to April or after October, outside of bat roosting season.

5.0 BIBLIOGRAPHY

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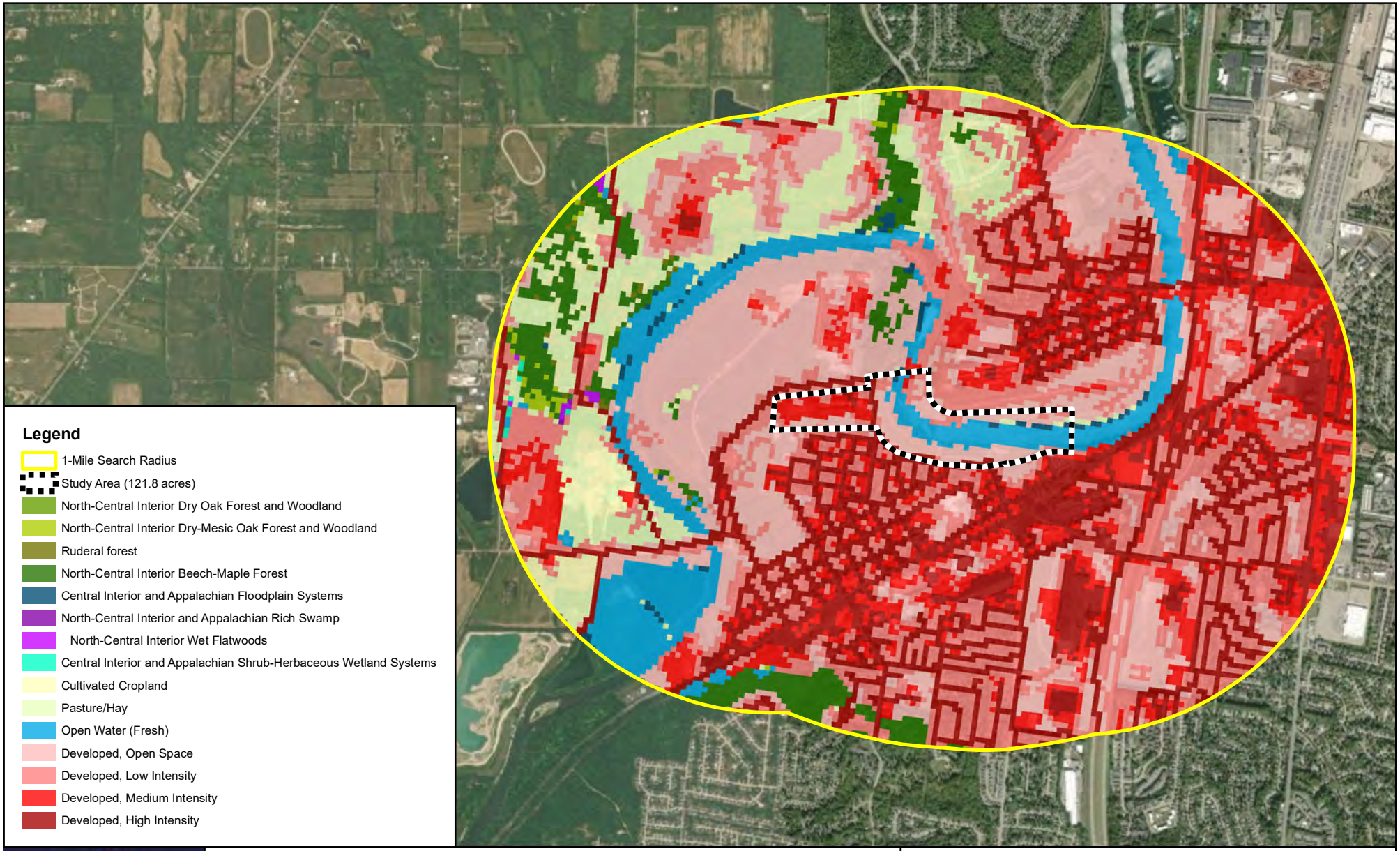
* See Appendix D, Tables D-1 and D-2, for the list of references related to preferred habitat of ETR species.

APPENDIX A - C: Study Area Maps



N

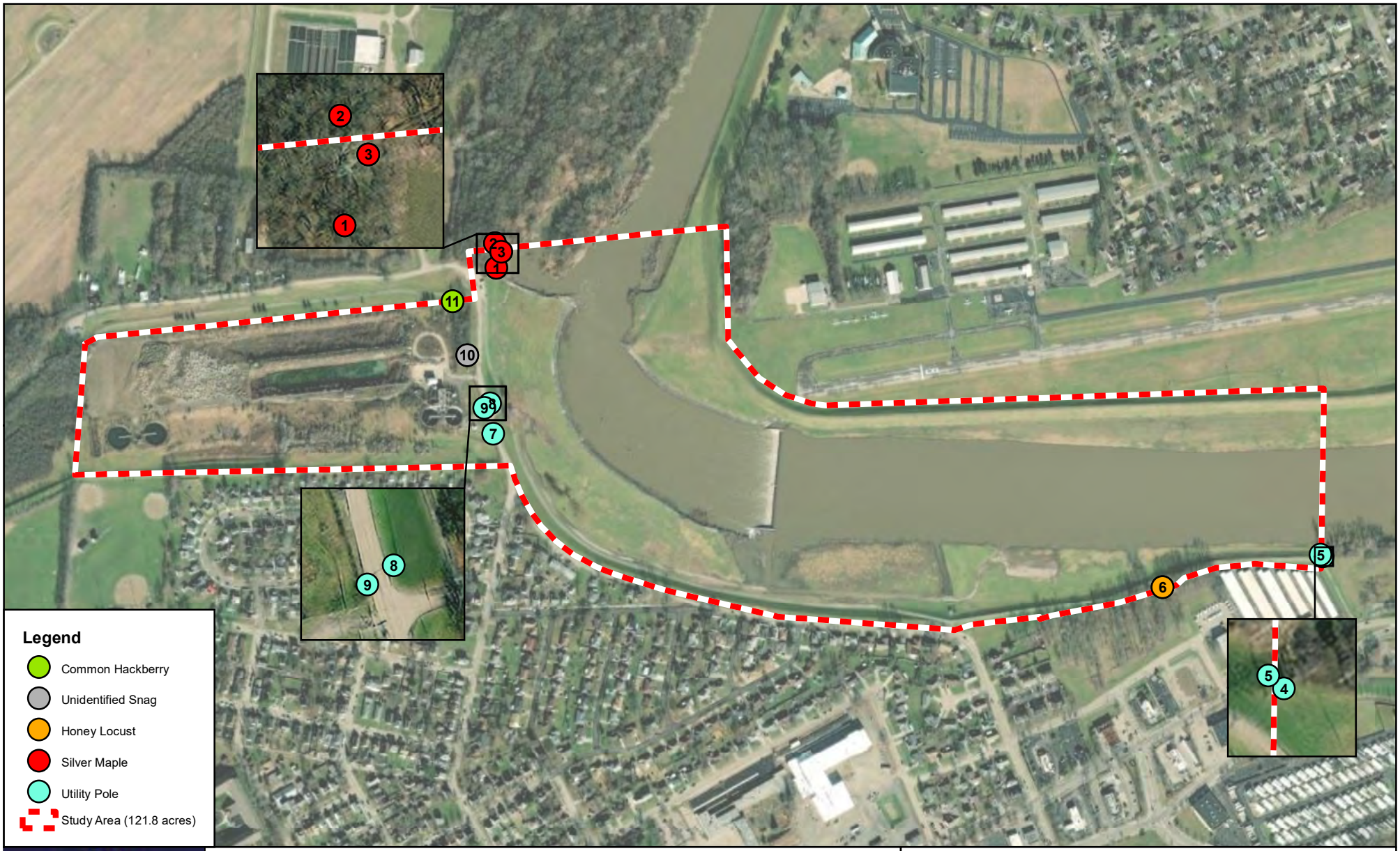
0 2,500 5,000 10,000 Feet

1 in = 2,500 feet

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Imagery Date: 2021

Appendix A:
Terrestrial Habitat Land Cover Map

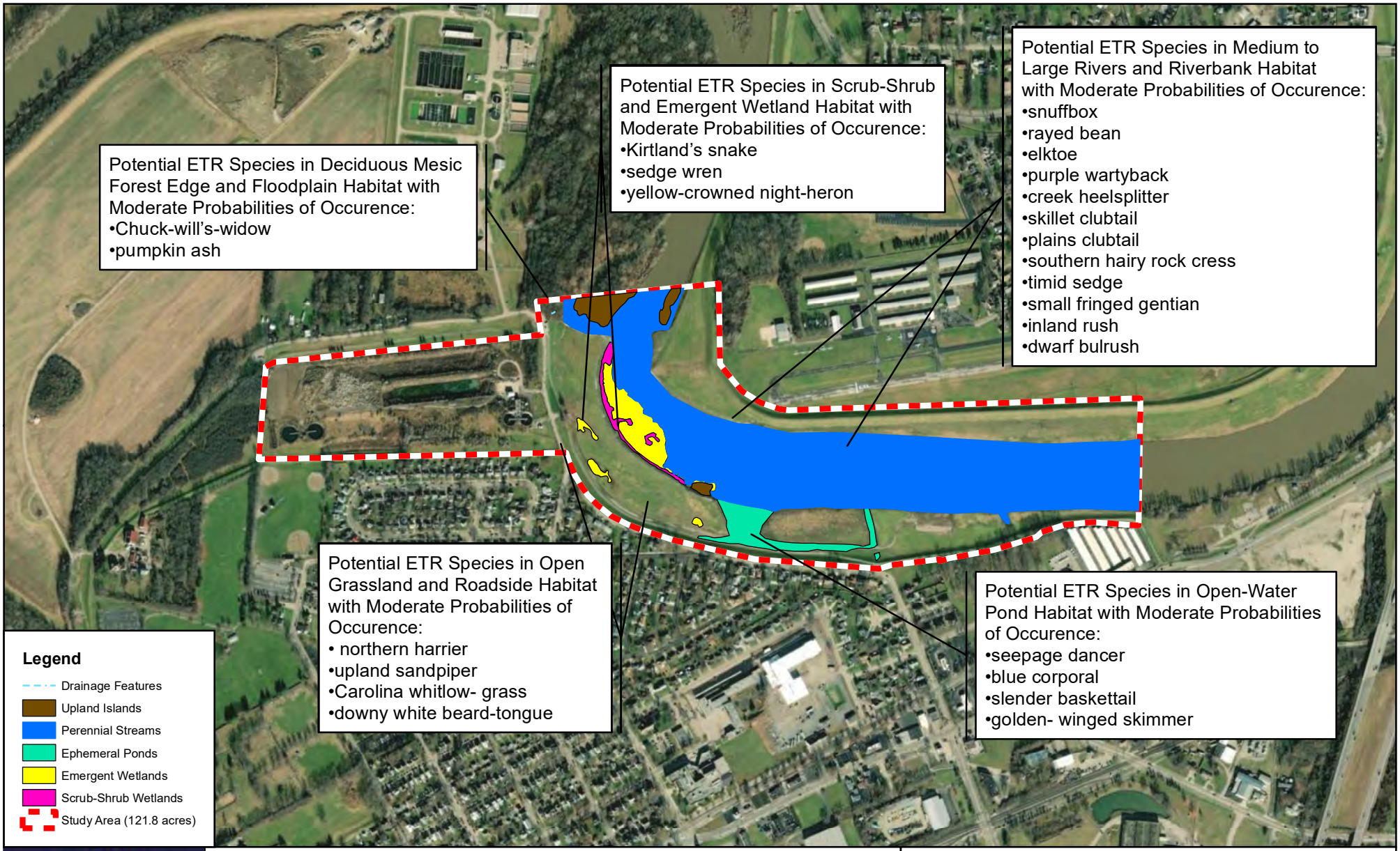
West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Imagery Date: 2021

Appendix B:
Potential Bat Roost Locations

West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio



N

0 850 1,700 3,400 Feet

1 in = 850 feet

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Imagery Date: 2021

Appendix C:
Potential ETR Species Habitat Map

West Carrollton Riverside Park
Jefferson Township
Montgomery County, Ohio

APPENDIX D: ETR Species Probability of Occurrence Tables

Appendix D1: Listed Species of Fauna Known to Occur within Montgomery County, OH and their Potential of Occurrence within the Study Area								
Scientific Name	**Common Name**	**FED**	**STATE**	**GRANK**	**SRANK**	**Habitat**	**Breeding Period**	**Probability of Occurrence**
MOLLUSKS								
Epioblasma triquetra	Snuffbox	E	SE	G2	S1	Riffles of small and medium creeks, in large rivers, and in shoals and wave-washed shores of lakes. Usually burrowed deep in sand, gravel, or cobble substrates.	Unknown	Moderate: some suitable habitat observed within site
Alasmidonta viridis	Slippershell Mussel		ST	G4	S2	Found in riffles of headwater streams typically, in substrates of sand and fine gravel, but may thrive in mud and sand along roots of aquatic vegetation.	Unknown	Very Low: no suitable habitat observed within site
Villosa fabalis	Rayed Bean	E	SE	G2	S1	Typically small headwater creeks, occasionally larger rivers. Usually found in or near shoal or riffle areas, in the shallow wave-washed areas of glacial lakes, in gravel or sandy substrate. Typically buried among the roots of aquatic vegetation.	Unknown	Moderate: some suitable habitat observed within site
Alasmidonta marginata	Elktoe		SSC	G4	S3	Typically occurs in smaller streams but can survive in large to medium sized streams. Often found in swift current in firmly packed fine to course gravel substrate. Preferred habitat varies from small streams with good current and sand or gravel bottoms at depths of several inches to two feet to mainstream rivers, to shallow rivers with a moderately fast current.	Long term breeder	Moderate: some suitable habitat observed within site
Cyclonaias tuberculata	Purple Wartyback		SSC	G5	S3	This species typically inhabits a gravel/mud bottom, usually in areas of current at depths of less than two to up to 20 feet; however different forms may inhabit medium to small sized streams or even in the main channel of large rivers.	Unknown	Moderate: some suitable habitat observed within site
Lampsilis fasciola	Wavy-rayed lampmussel		SSC	G5	S3	Mainly found in and around riffle areas of clear, hydrologically stable small- to medium-sized streams and rivers of various sizes and depths of up to 1 m. Requires clean substrates of gravel and sand stabilized with cobble and boulders	Unknown	Low: minimal suitable habitat observed within site
Lasmigona compressa	Creek Heelsplitter		SSC	G5	S3	Typically found in streams and rivers of various sizes in subsrates of gravel, sand, or mud. Rare within lakes	Unknown	Moderate: some suitable habitat observed within site
INSECTS (Odonata)								
Argia alberta	Paiute Dancer		ST	G4	S2	Associated with slow moving stoney streams and rivers. Nymphs found on undersides of rocks and adults found rocks, logs, and woodland paths.	Unknown	Low: minimal suitable habitat observed within site
Argia bipunctulata	Seepage Dancer		ST	G4	S2	Associated with sunny sphagnum seepages, small lakes, ponds and streams.	Unknown	Moderate: some suitable habitat observed within site
Ladona deplanata	Blue Corporal		SSC	G5	S3	Prefers still, infertile waters of ponds, lakes and pits with primarily sand bottoms.	Unknown	Moderate: some suitable habitat observed within site
Epitheca costalis	Slender Baskettail		SE	G5	S1	Mainly found near slow moving or still water of ponds, lakes, and pools. Less common in slow moving rivers and streams.	Unknown	Moderate: some suitable habitat observed within site
Erpetogomphus designatus	Eastern Ringtail		SSC	G5	S3	Within riffles in clean shallow areas of rivers in substrates of gravel and sand.	Unknown	Low: minimal suitable habitat observed within site

Appendix D1: Listed Species of Fauna Known to Occur within Montgomery County, OH and their Potential of Occurrence within the Study Area								
Scientific Name	**Common Name**	**FED**	**STATE**	**GRANK**	**SRANK**	**Habitat**	**Breeding Period**	**Probability of Occurrence**
Gomphurus ventricosus	Skillet Clubtail		SE	G3	S1	Larvae inhabit large rivers with soft mud substrates and deep pools	Unknown	Moderate: some suitable habitat observed within site
Gomphus externus	Plains Clubtail		ST	G5	S2	Moderate rivers to large streams with sand or mud substrates, Prefers moderate currents and grassy or wooded banks.	Unknown	Moderate: some suitable habitat observed within site
Libellula auripennis	Golden-winged Skimmer		SE	G5	S1	Inhabits ponds, lakes, marshes, and ditches. Typically found open and sunny areas.	Unknown	Moderate: some suitable habitat observed within site
FISH								
Etheostoma microperca	Least Darter		SSC	G5	S3	Habitat includes quiet, vegetated lakes, headwaters, creeks, and small rivers, where the species usually occurs over mud and sand (Page and Burr 2011).	February in southern part of range and May - July in northern part of range	Very Low: no suitable habitat observed within site
REPTILE								
Clonophis kirtlandii	Kirtland's Snake		ST	G2	S2	Occurs in relict Prairie Peninsula habitats such as: fens, wet meadows,wet prairies and associated open and wooded wetlands, seasonal marshes, open swamps, sparsely wooded hillsides, and in the general vicinity of ponds and sluggish creeks.	February, March, May, August, & September	Moderate: some suitable habitat observed within site
BIRD								
Circus hudsonius	Northern Harrier		SE	G5	S2	Reliant on open habitat with abundant herbaceous vegetation for hunting and nesting.	March- June	Moderate: some suitable habitat observed within site
Accipiter striatus	Sharp-shinned Hawk		SSC	G5	S3	Forest and open woodland, coniferous, mixed, or deciduous, primarily in coniferous in more northern and mountainous portion of range. Primary habitat is boreal forest. Nests in young, dense, mixed or coniferous woodlands. Where coniferous species are lacking, cottonwoods, poplars, and other members of the Betulaceae may be used	Late March to June	Low: minimal suitable habitat observed within site
Antrostomus carolinensis	Chuck-will's-widow		SSC	G5	S3	Inahbits dry to mesic deciduous forests and edges of clearings. Forages over fields and clearings. Also in open woodland, scrub, old second growth, tall hedgerows, and thickets at forest edge.	Migratory, in Costa Rica October - April	Moderate: some suitable habitat observed within site
Bartramia longicauda	Upland Sandpiper		SE	G5	S2	Restricted primarily to extensive, open tracts of short grassland habitat. Nest in native prairie, dry meadows, pastures, domestic hayfields, short-grass savanna, plowed fields, along highway rights-of-way and on airfields, and (in the north) peatlands and scattered woodlands near timberline (Forbush 1925, Higgins et al. 1969, AOU 1983, Osborne and Peterson 1984, Godfrey 1986).	April - May	Moderate: some suitable habitat observed within site

Appendix D1: Listed Species of Fauna Known to Occur within Montgomery County, OH and their Potential of Occurrence within the Study Area								
Scientific Name	**Common Name**	**FED**	**STATE**	**GRANK**	**SRANK**	**Habitat**	**Breeding Period**	**Probability of Occurrence**
Cistothorus platensis	Sedge Wren		SSC	G5	S3B	Wet grasslands and meadows	May - September	Moderate: some suitable habitat observed within site
Nyctanassa violacea	Yellow-crowned Night-heron		SI	G5	S1	Marshes, swamps, lakes, lagoons, and mangroves.Nests in trees in wooded areas near water.	Early Spring - Mid Summer	Moderate: some suitable habitat observed within site
Setophaga cerulea	Cerulean Warbler		SSC	G4	S4	Breeds in mature hardwood forest in mesic or wetter areas, with closed canopy. Migrates and winters in various forest, woodland, second growth, and scrub habitat.	May - July	Low: minimal suitable habitat observed within site
MAMMAL								
Taxidea taxus	American Badger		SSC	G5	S2	Prefers open areas and may also frequent brushlands with little groundcover. Occupies underground burrow when inactive.	Spring (March - May)	Low: minimal suitable habitat observed within site

1. Fed: LE = Endangered; LT = Threatened; C = candidate; PDL = proposed for delisting.

State: SE = state endangered; ST = state threatened; SR = state rare; SSC = state species of special concern; SX = state extirpated; SI = state species of special interest; WL = watch list.

GRANK (Global Heritage Rank): G1 = critically imperiled globally; G2 = imperiled globally; G3 = rare or uncommon globally; G4 = widespread and abundant globally but with long-term concerns; G5 = widespread and abundant globally; G? = unranked; GX = extinct; Q =

SRANK (State Heritage Rank): S1 = critically imperiled in state; S2 = imperiled in state; S3 = rare or uncommon in state; S4 = widespread and abundant in state but with long-term concerns; SG = state significant; SH = historical in state; SX = state extirpated;

S? = unranked; SNR = unranked; SNA = nonbreeding status unranked

2. Highlighted rows are species listed in U.S. Fish & Wildlife and/ or Ohio Department of Natural Resources Natural Heritage listings

3. NatureServe Explorer (2022). Accessible at: https://explorer.natureserve.org/
4. Wisconsin Aquatic and Terrestrial Resources Inventory, Wisconsin Odonata Survey. Wisconsin Department of Natural Resources. Accessible at: https://wiatri.net/inventory/odonata/
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9. Cornell University Lab of Ornithology, All About Birds Guide. Accessible at: https://www.allaboutbirds.org/guide/

Appendix D2: Listed Species of Flora Known to Occur within Montgomery County, OH and their Potential of Occurrence within the Study Area								
Scientific Name	**Common Name**	**FED**	**STATE**	**GRANK**	**SRANK**	**Habitat**	**Flowering/Fruiting Period**	**Probability of Occurrence**
Arabis pycnocarpa var. adpressipilis	Southern Hairy Rock Cress		SP	T4	S3	part shade to sun in open woods, prairies, streambanks, rock outcrops, cliffs, and gravel bars	May - July	Moderate: some suitable habitat observed within site
Carex timida	Timid Sedge		ST	G3	S2	Lime- rich substrates in mesic deciduous forests and woodlands, juniper woodlands, and occasionally along rivers or creeks	May - July	Moderate: some suitable habitat observed within site
Draba reptans	Carolina Whitlow-grass		ST	G5	S2	Dry sandy or rocky soil in prairies, rock outcrops, and roadsides	April - May	Moderate: some suitable habitat observed within site
Fraxinus profunda	Pumpkin Ash		SP	G4	S3	Low woods, floodplains, swamps, and bottomlands	April - May	Moderate: some suitable habitat observed within site
Gentianopsis procera	Small Fringed Gentian		ST	G5	S2	Moist soils in wet meadows, thickets, stream banks, and low woods	August - September	Moderate: some suitable habitat observed within site
Juncus interior	Inland Rush		SP	G4	S2	Sandy or rocky soils in prairies, outcrops, banks, and shores	July - August	Moderate: some suitable habitat observed within site
Juncus secundus	One-sided Rush		SP	G5	S2	Sandy shallow soils in dry open areas	late spring - summer	Low: minimal suitable habitat observed within site
Lipocarpha micrantha	Dwarf Bulrush		ST	G5	S2	Sandy or mucky shores, pond and lake margins, bogs, along streams, rivers, and within vernal wetlands	July - October	Moderate: some suitable habitat observed within site
Muhlenbergia cuspidata	Plains Muhlenbergia		SE	G5	S1	Dry sandy or rocky soil within prairies, outcrops, bluffs, and grassy slopes	August - October	Very Low: no suitable habitat observed within site
Penstemon pallidus	Downy White Beard-tounge		SP	G5	S2	Average to dry rocky soil within wooded slopes, prairies, railroads, roadsides, and bluffs	May - June	Moderate: some suitable habitat observed within site
Pycnanthemum pilosum	Hairy Mountain-mint		ST	G5	SNR	Rocky slopes, outcrops, along railroad tracks, open woods, stream valleys and thickets	Summer - Fall	Very Low: no suitable habitat observed within site
Veratrum woodii	Wood-s-hellebore		ST	G5	S2	Mesic forests and stream terraces, rare in disturbed areas	July - September	Very Low: no suitable habitat observed within site

1. Fed: LE = Endangered; LT = Threatened; C = candidate; PDL = proposed for delisting.

State: SE = state endangered; ST = state threatened; SR = state rare; SSC = state species of special concern; SX = state extirpated; SG = state significant; SP = state potentially threatened; WL = watch list.

GRANK (Global Heritage Rank): G1 = critically imperiled globally; G2 = imperiled globally; G3 = rare or uncommon globally; G4 = widespread and abundant globally but with long-term concerns; G5 = widespread and abundant globally; G? = inexact numeric rank; GX = extinct;

SRANK (State Heritage Rank): S1 = critically imperiled in state; S2 = imperiled in state; S3 = rare or uncommon in state; S4 = widespread and abundant in state but with long-term concerns; SG = state significant; SH = historical in state; SX = state extirpated; B = breeding status; S? = unranked; SNR = unranked; SNA = nonbreeding status unranked

2. NatureServe Explorer (2022). Accessible at: https://explorer.natureserve.org/

3. Minnesota Wildflowers, Environment and Natural Resources Trust Fund (2022). Accessible at: https://www.minnesotawildflowers.info/

4. Michigan Natural Features Inventory, MSU Extension. Michigan State University. Accessible at: https://mnfi.anr.msu.edu/

5. Lady Bird Johnson Wildflower Center Plant Database. University of Texas at Austin (2022). Accessible at: https://www.wildflower.org/plants/

6. Flora of North America Association. Accessible at: http://floranorthamerica.org/

APPENDIX E: Ohio DNR Heritage Database Search Correspondence

Office of Real Estate
Tara Paciorek, Chief
2045 Morse Road – Bldg. E-2
Columbus, Ohio 43229
Phone: (614) 265-6661
Fax: (614) 267-4764

April 9, 2024

Kat Pain
Meristem
877 Port Drive
Avon, Indiana 46123

Re: 24-0415_West Carrollton Riverside Park

Project: The proposed project involves the construction of a riverside park.

Location: The proposed project is located in Harrison and Miami townships, Montgomery County, Ohio.

The Ohio Department of Natural Resources (ODNR) has completed a review of the above referenced project. These comments were generated by an inter-disciplinary review within the Department. These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the National Environmental Policy Act, the Coastal Zone Management Act, Ohio Revised Code and other applicable laws and regulations. These comments are also based on ODNR's experience as the state natural resource management agency and do not supersede or replace the regulatory authority of any local, state, or federal agency nor relieve the applicant of the obligation to comply with any local, state, or federal laws or regulations.

Natural Heritage Database: A review of the Ohio Natural Heritage Database indicates there are no records of state or federally listed plants or animals within one mile of the specified project area. Records searched date from 1980.

Please note that Ohio has not been completely surveyed and we rely on receiving information from many sources. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area.

Fish and Wildlife: The Division of Wildlife (DOW) has the following comments.

The DOW recommends that impacts to streams, wetlands and other water resources be avoided and minimized to the fullest extent possible, and that Best Management Practices be utilized to minimize erosion and sedimentation.

The project is within the vicinity of records for the Indiana bat (*Myotis sodalis*), a state endangered and federally endangered species. Because presence of state endangered bat species has been established in the area, summer tree cutting is not recommended, and additional summer surveys would not constitute presence/absence in the area. However, limited summer tree cutting inside this buffer may be acceptable after further consultation with DOW (contact Eileen Wyza at Eileen.Wyza@dnr.ohio.gov).

In addition, the entire state of Ohio is within the range of the Indiana bat (*Myotis sodalis*), a state endangered and federally endangered species, the northern long-eared bat (*Myotis septentrionalis*), a state endangered and federally endangered species, the little brown bat (*Myotis lucifugus*), a state endangered species, and the tricolored bat (*Perimyotis subflavus*), a state endangered species. During the spring and summer (April 1 through September 30), these bat species predominately roost in trees behind loose, exfoliating bark, in crevices and cavities, or in the leaves. However, these species are also dependent on the forest structure surrounding roost trees. The DOW recommends tree cutting only occur from October 1 through March 31, conserving trees with loose, shaggy bark and/or crevices, holes, or cavities, as well as trees with DBH ≥ 20 if possible.

The DOW also recommends that a desktop habitat assessment is conducted, followed by a field assessment if needed, to determine if a potential hibernaculum is present within the project area. Direction on how to conduct habitat assessments can be found in the current USFWS "*RANGE-WIDE INDIANA BAT & NORTHERN LONG-EARED BAT SURVEY GUIDELINES*." If a habitat assessment finds that a potential hibernaculum is present within 0.25 miles of the project area, please send this information to Eileen Wyza for project recommendations. If a potential or known hibernaculum is found, the DOW recommends a 0.25-mile tree cutting and subsurface disturbance buffer around the hibernaculum entrance, however, limited summer or winter tree cutting may be acceptable after consultation with the DOW. If no tree cutting or subsurface impacts to a hibernaculum are proposed, this project is not likely to impact these species.

The project is within the range of the following listed mussel species.

Federally Endangered
clubshell (*Pleurobema clava*)
rayed bean (*Villosa fabalis*)
snuffbox (*Epioblasma triquetra*)

State Endangered
pocketbook (*Lampsilis ovate*)

This project must not have an impact on native mussels. This applies to both listed and non-listed species, as all species of mussel are protected in Ohio. Per the Ohio Mussel Survey Protocol (2022), all Group 2, 3, and 4 streams (Appendix A) require a mussel survey. Per the Ohio Mussel Survey Protocol, Group 1 streams (Appendix A) and unlisted streams with a watershed of 5 square miles or larger above the point of impact should be assessed using the Reconnaissance Survey for Unionid Mussels (Appendix B) to determine if mussels are present. Mussel surveys may be recommended for these streams as well. Therefore, if in-water work is planned in any stream that meets any of the above criteria, the DOW recommends the applicant provide information to indicate no mussel impacts will occur. If this is not possible, the DOW recommends a professional malacologist conduct a mussel survey in the project area. If mussels that cannot be avoided are found in the project area, the DOW recommends a professional malacologist collect and relocate the mussels to suitable and similar habitat upstream of the project site. Mussel surveys and any subsequent mussel relocation should be done in accordance with the Ohio Mussel Survey Protocol. If there is no in-water work proposed, impacts to mussels are not likely.

The project is within the range of the channel darter (*Percina copelandi*), a state threatened fish. The DOW recommends no in-water work in perennial streams from March 15 through June 30 to reduce impacts to indigenous aquatic species and their habitat. If no in-water work is proposed in a perennial stream, this project is not likely to impact this or other aquatic species.

The project is within the range of the eastern massasauga (*Sistrurus catenatus*), a state endangered and federally threatened snake species. The eastern massasauga uses a range of habitats including wet prairies, fens, and other wetlands, as well as drier upland habitat. Due to the location, the type of habitat within the project area, and the type of work proposed, this project is not likely to impact this species.

The project is within the range of the Kirtland's snake (*Clonophis kirtlandii*), a state threatened species. This secretive species prefers wet meadows and other wetlands. Due to the location, the type of habitat within the project area, and the type of work proposed, this project is not likely to impact this species.

Due to the potential of impacts to federally listed species, as well as to state listed species, we recommend that this project be coordinated with the US Fish & Wildlife Service.

Water Resources: The Division of Water Resources has the following comment.

The local floodplain administrator should be contacted concerning the possible need for any floodplain permits or approvals for this project.

ODNR appreciates the opportunity to provide these comments. Please contact Mike Pettegrew at mike.pettegrew@dnr.ohio.gov if you have questions about these comments or need additional information.

Mike Pettegrew
Environmental Services Administrator

APPENDIX F: U.S. Fish and Wildlife Service IPaC Official ETR Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, OH 43230-8355
Phone: (614) 416-8993 Fax: (614) 416-8994

In Reply Refer To: 03/15/2024 20:23:08 UTC
Project Code: 2024-0063801
Project Name: West Carrollton Riverside Park

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, OH 43230-8355
(614) 416-8993

PROJECT SUMMARY

Project Code: 2024-0063801
Project Name: West Carrollton Riverside Park
Project Type: Acquisition of Lands
Project Description: Montgomery County
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.680830900000004,-84.24763337585449,14z

Counties: Montgomery County, Ohio

ENDANGERED SPECIES ACT SPECIES

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

BIRDS

NAME	STATUS
Whooping Crane *Grus americana* Population: U.S.A. (AL, AR, CO, FL, GA, ID, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, NM, OH, SC, TN, UT, VA, WI, WV, western half of WY) No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/758	Experimental Population, Non-Essential

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

APPENDIX G: Potential Bat Roost Habitat Photographs

Appendix G:
Potential Bat Roost Habitat Photographs

Habitat Photo 1: Silver Maple, DBH 20” (3/7/24)

Habitat Photo 2: Silver Maple, DBH 18” (3/7/24)

Habitat Photo 3: Silver Maple, DBH 19” (3/7/24)

Habitat Photo 4: Utility Pole (3/7/24)

Habitat Photo 5: Utility Pole (3/7/24)

Habitat Photo 6: Honey Locust, DBH 39” (3/7/24)

Appendix G:
Potential Bat Roost Habitat Photographs

Habitat Photo 7: Utility Pole (3/7/24)

Habitat Photo 8: Utility Pole (3/7/24)

Habitat Photo 9: Utility Pole (3/7/24)

Habitat Photo 10: Unidentified Snag, DBH 10” (3/7/24)

Habitat Photo 11: Common Hackberry, DBH 19” (3/7/24)

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WEST CARROLLTON DAM PROJECT ON THE GREAT MIAMI RIVER - MUSSEL SURVEY REPORT

MONTGOMERY COUNTY, OH

PREPARED FOR:
Meristem

SUBMITTED TO:
Ohio Division of Natural Resources

PREPARED BY:
BioSurvey Group

DATE: 10.20.2024

PO Box 593
Morgantown, WV 26507
(304) 282-9493

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Figure 3 – Mussel Abundance by Transect Segment, West Carrollton Dam Modification Project, Great Miami River, Montgomery County.

Figure 4 – Habitat and Depth by Transect Segment, West Carrollton Dam Modification Project, Great Miami River, Montgomery County.

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Table 1 – Total Number and Relative Abundance of Mussel Species Collected.

Table 2 – Depth and Mussel Habitat by Transect Segment.

Appendices

Appendix A – ODNR Approval

Appendix B - ODNR Scientific Collection Permit

Appendix C – Project Photolog

Introduction

This project consists of a series of modifications proposed at the West Carrollton Dam in West Carrollton, Montgomery County, Ohio (39.680158, -84.246489) (Figure 1). This project proposes a redesign to the existing low-head dam to allow for a side channel along the left-descending bank of the Great Miami River (GMR) to allow for increased accessibility. The proposed impacts are estimated to not exceed more than 320 meters upstream and 420 meters downstream of the dam. Impacts are also planned for the already existing side channel located at the downstream extent of the impact area (39.68257, -84.25033).

Project Need

According to the 2024 Ohio Mussel Survey Protocol (Protocol), the Ohio Division of Natural Resources (ODNR) has classified this reach of the GMR as a Group 3 mussel stream, meaning federally threatened and endangered species are not known to occur. Projects on Group 3 streams must be coordinated with ODNR. The proposed dam modifications may impact freshwater mussels occurring within the project area of direct impact (ADI). All mussels are protected in the State of Ohio pursuant to Section 1533.324 of the Ohio Revised Code; therefore, ODNR will require a mussel survey be completed and any live mussels found within the project ADI or associated salvage zones be relocated to an upstream location prior to construction initiation to obtain the regulatory permits required for this project.

Methods

Phase 1 Mussel Survey

According to the Protocol, the Phase 1 survey buffers for a dam modification project are project specific, and buffers were determined via coordination with ODNR. BioSurvey Group proposed buffers of 50 m upstream and 100 m downstream and transect spacing at 50 m intervals. The project ADI is estimated to be approximately 740 m long and spans the GMR bank to bank (approximately 135 m at the existing dam). In total, the survey area covered 890 linear meters of the GMR. A total of 18 transects were surveyed, each spanning bank to bank (approximately 135m), for a total approximate transect survey length of 2,430 m.

Divers searched a 1m wide swath along each survey transect which was divided into 10 m segments. Search rates included a minimum effort of 1.0 min/m^2 in areas of heterogeneous substrate and 0.5 min/m^2 in areas of homogenous substrate (bedrock, mud, silt, and sand). The visual search along each transect included moving cobble and woody debris; hand sweeping away silt, sand and/or small detritus; and disturbing/probing the upper 5cm (2in) of substrate to better view the mussels which may have been there.

Data was compiled and recorded for each 10 m transect segment, including substrate (Wentworth Scale) and depth. In each segment, mussels observed (live and dead) were bagged and brought to the surface for further processing and positive identification. Live mussels were kept cool and moist on the surface and were not out of the water for more than five minutes. Dead mussel shells were scored as fresh dead, weathered dead, or subfossil. Mussel nomenclature followed that of the Freshwater Mollusk Conservation Society (2023). Photo vouchers of all representative species collected and any odd, questionably identified individuals were taken.

Results

The BioSurvey Group team completed the project mussel survey on two dates: August 22, 2024 and September 21, 2024, led by permitted malacologist Mr. Matthew Gilkay. Documentation of ODNR's approval of the survey plan can be found in Appendix A, and a copy of Mr. Gilkay's state scientific collecting permit can be found in Appendix B. Weather conditions were favorable on both survey days with mostly sunny skies and an average temperature of approximately 32ºC (90ºF). The USGS gage 03270500 on the GMR in Dayton, Ohio showed flows near the seasonal median. Visibility was >30 in at depth. The water temperature was approximately 24ºC (75ºF). Wetted width ranged from 25 to 170 m (Table 1). Representative photos of the site and mussels collected can be found in Appendix C. Due to its proximity to the dam, transect 7 was not surveyed (Figure 2).

Mussels

Approximately 1,740 m of transect was searched for an effort of 1,400 minutes using both snorkel and surface-supplied air methods. A total of 17 mussels representing seven species were located within the survey area (Table 1). The dominant species were Flutedshell (*Lasmigona costata*; n=5) and Plain Pocketbook (*Lampsilis cardium*; n=5), both with a relative abundance of 29.4%. Mussels were most dense immediately downstream of the dam, and sparsely located throughout the rest of the survey area (Figure 3). Live and weathered dead zebra mussels (*Dreissena polymorpha*) were observed but were not numerous.

Habitat

The survey area upstream of the dam consisted of deep pool habitat averaging approximately 10.0 ft with a substrate composition high in silt and sand (Figure 4). Below the dam, habitat ranged from shallow riffles and runs with spots of deep pool habitat surrounding the location of an old concrete structure, most likely a historical dam. Riffles averaged approximately 0.5 ft, with runs averaging 2.0 ft, and the deepest pool depth recorded at approximately 26.0 ft. Substrate composition below the dam varied greatly, but was often dominated by cobble, boulder, and/or gravel (Table 2). Habitat overall was suitable for mussel colonization below the dam, with the pool habitat upstream of the dam offering suboptimal conditions. Mussels were found sparsely throughout the survey area.

Discussion

The results of the survey indicate a low-density mussel assemblage occurs within the project area with the greatest concentration occurring immediately downstream of the West Carrollton Dam. No federally listed mussels were observed. Further discussion and coordination with the project stake holders and ODNR is needed to determine the scope of future mussel relocation needs and/ or potential alternatives to ensure the resources are adequately protected. The results of this mussel survey are valid for five years.

Figures

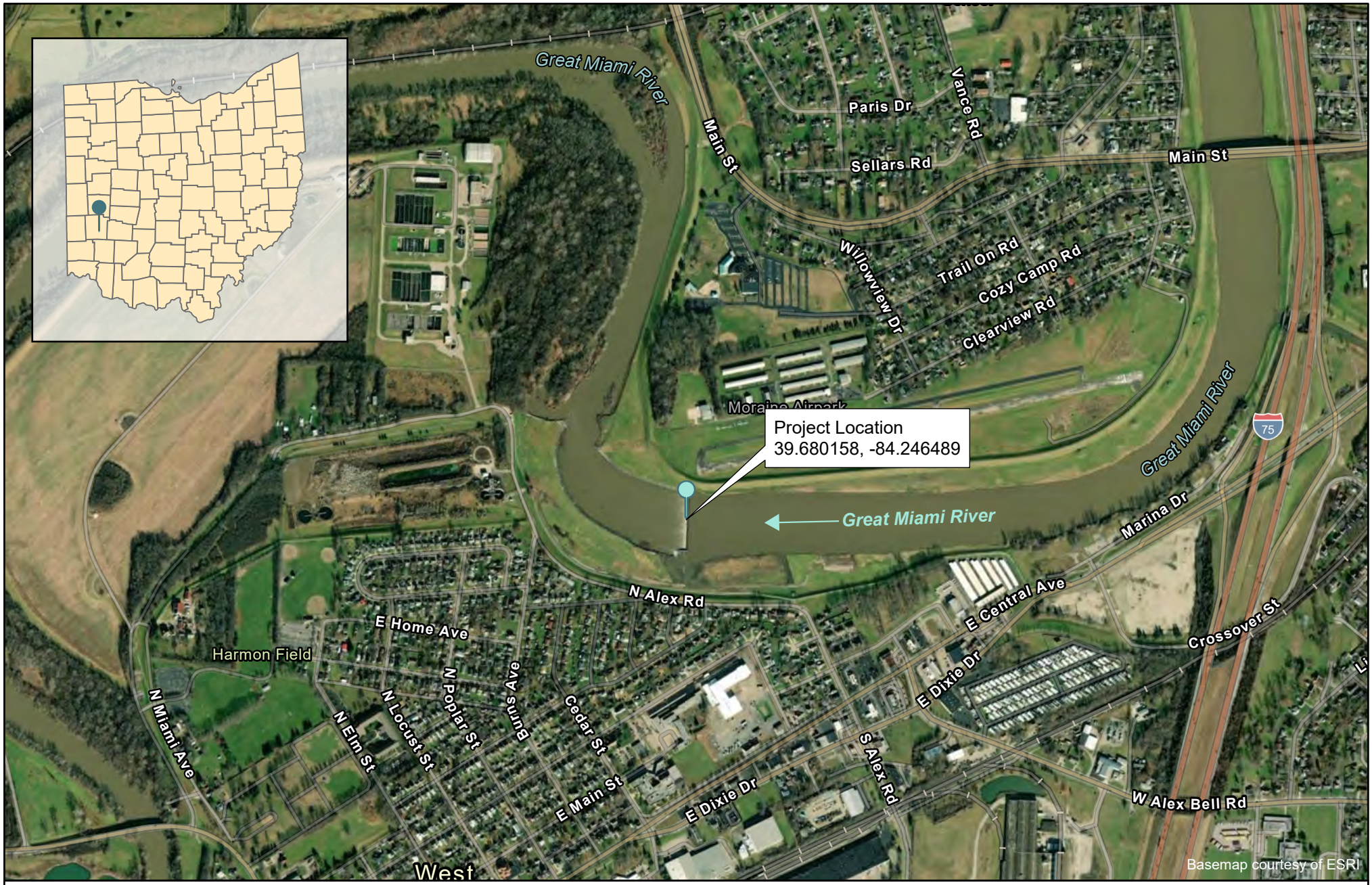


Figure 1. Project Location Map, West Carrollton Dam Modification Project, Great Miami River, Montgomery County.

Project Location

N

0 100 200 400 Meters

BioSurvey Group

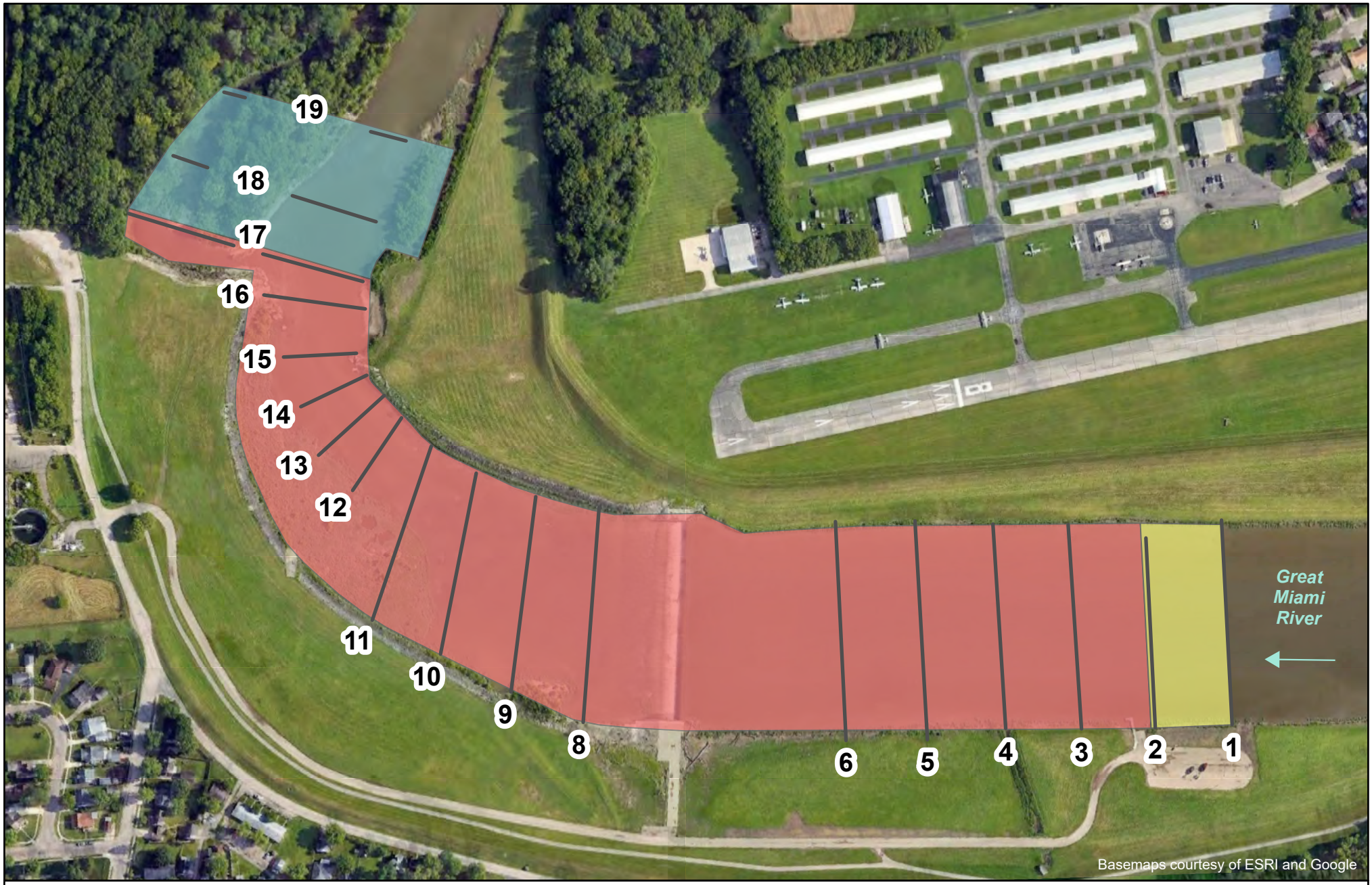


Figure 2. Mussel Survey Design Map, West Carrollton Dam Modification Project, Great Miami River, Montgomery County.

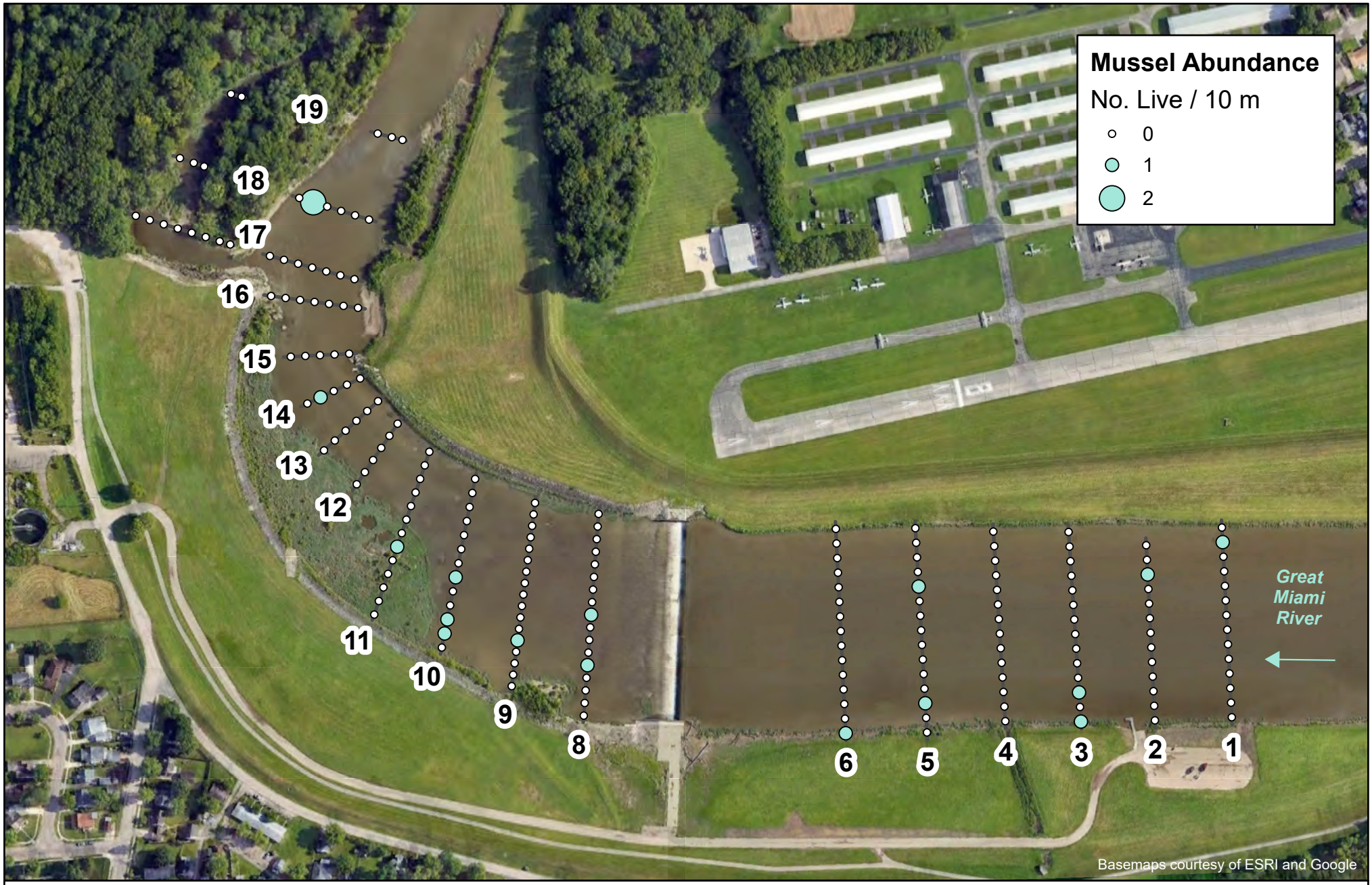


Figure 3. Mussel Abundance by Transect Segment, West Carrollton Dam Modification Project, Great Miami River, Montgomery County.

Transects

N

0 30 60 120 Meters

BioSurvey Group

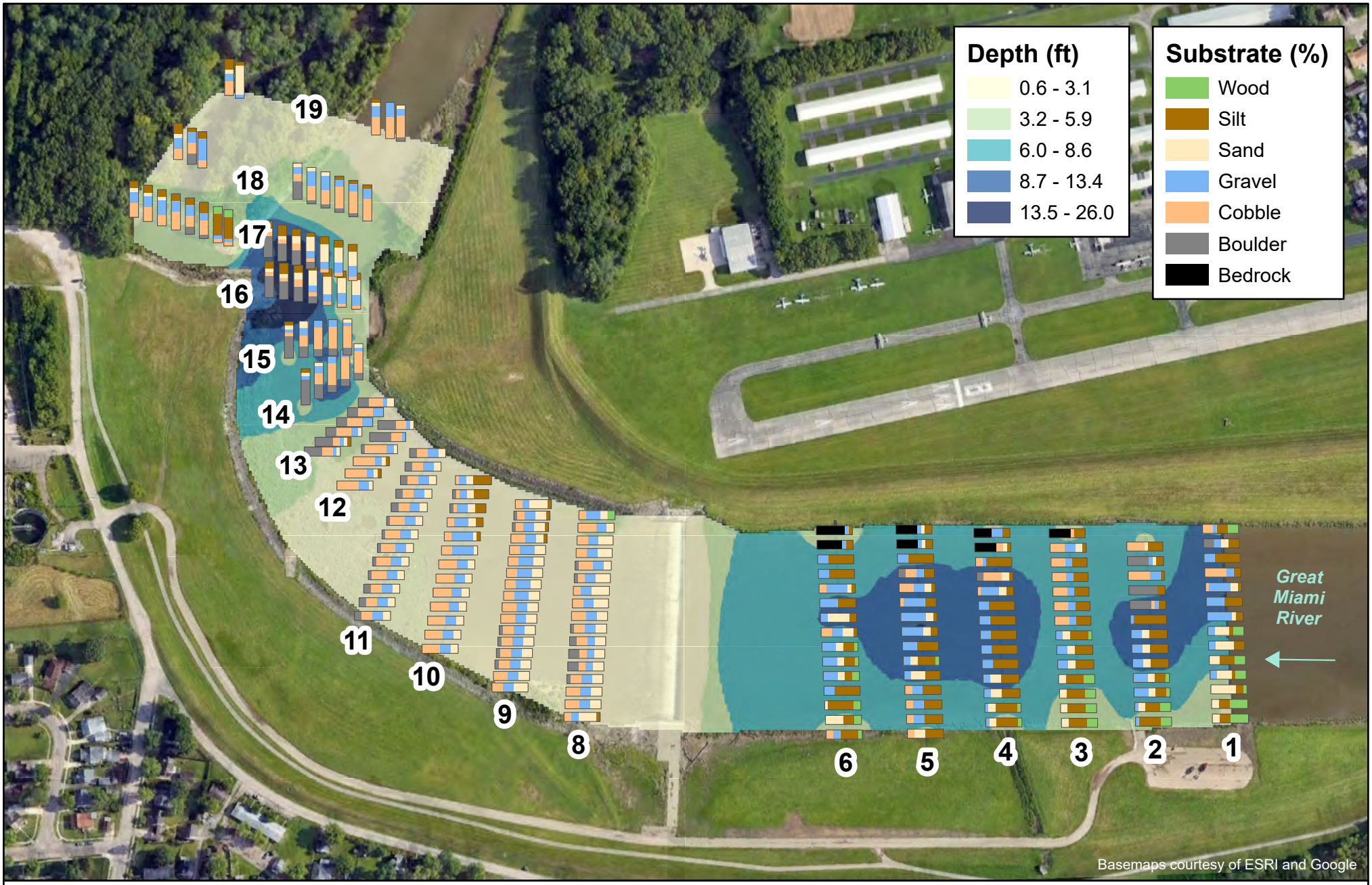


Figure 4. Habitat and Depth by Transect Segment, West Carrollton Dam Modification Project, Great Miami River, Montgomery County.

Transects

N

0 30 60 120 Meters

BioSurvey Group

Tables

Table 1. Total Number and Relative Abundance of Mussel Species Collected.

Species	Common Name	Quantitative	Relative Abundance
Alasmidonta marginata	Elktoe	1	5.9%
Lampsilis cardium	Plain Pocketbook	5	29.4%
Lampsilis siliquoidea	Fatmucket	1	5.9%
Lasmigona costata	Flutedshell	5	29.4%
Pyganodon grandis	Giant Floater	3	17.6%
Quadrula quadrula	Mapleleaf	1	5.9%
Utterbackia imbecillis	Paper Pondshell	1	5.9%
Totals:		**17**	100.0%

Table 2. Mussel Habitat by Transect Segment.

Transect	Segment	Max Depth	% Wood	% Silt	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	# Mussels
1										
	0-10	2.0	50	30	20	0	0	0	0	0
	10-20	2.0	50	30	20	0	0	0	0	0
	20-30	6.0	10	20	70	0	0	0	0	0
	30-40	6.0	30	10	40	20	0	0	0	0
	40-50	6.0	30	40	30	0	0	0	0	0
	50-60	6.0	0	30	50	20	0	0	0	0
Upstream Buffer	60-70	6.0	30	10	40	20	0	0	0	0
	70-80	8.0	0	20	10	70	0	0	0	0
	80-90	15.0	0	50	0	50	0	0	0	0
	90-100	12.0	0	10	20	60	10	0	0	0
	100-110	12.0	0	20	0	20	60	0	0	0
	110-120	10.0	0	70	0	30	0	0	0	0
	120-130	10.0	0	30	20	20	0	30	0	1
	130-140	7.0	30	30	0	10	30	0	0	0
2										
	0-10	4.0	30	60	0	10	0	0	0	0
	10-20	6.0	30	40	20	10	0	0	0	0
	20-30	7.0	10	30	20	40	0	0	0	0
	30-40	7.0	10	30	20	40	0	0	0	0
	40-50	11.0	0	50	20	30	0	0	0	0
	50-60	11.0	0	50	20	30	0	0	0	0
Upstream Buffer	60-70	11.0	0	50	20	30	0	0	0	0
	70-80	10.0	0	90	0	10	0	0	0	0
	80-90	9.0	0	20	0	10	10	60	0	0
	90-100	8.0	0	20	0	0	0	80	0	0
	100-110	7.0	0	10	0	30	60	0	0	1
	110-120	7.0	0	20	10	10	0	60	0	0
	120-130	5.0	0	40	10	0	50	0	0	0
3										
	0-10	4.0	30	50	20	0	0	0	0	1
	10-20	4.0	30	50	20	0	0	0	0	0
	20-30	6.0	30	50	20	0	0	0	0	1
	30-40	6.0	30	50	20	0	0	0	0	0
	40-50	7.0	0	50	20	30	0	0	0	0
	50-60	7.0	0	50	20	30	0	0	0	0
Area of Direct Impact	60-70	7.0	10	50	20	20	0	0	0	0
	70-80	8.0	0	40	0	20	40	0	0	0
	80-90	8.0	0	40	0	20	40	0	0	0
	90-100	8.0	0	40	0	20	40	0	0	0
	100-110	8.0	0	40	0	20	40	0	0	0
	110-120	8.0	0	40	0	20	40	0	0	0
	120-130	6.0	0	10	20	30	40	0	0	0
	130-140	5.0	0	30	0	0	10	0	60	0

Table 2. Mussel Habitat by Transect Segment.

Transect	Segment	Max Depth	% Wood	% Silt	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	# Mussels
4										
	0-10	4.0	10	60	20	10	0	0	0	0
	10-20	7.0	0	50	30	20	0	0	0	0
	20-30	9.0	0	50	30	20	0	0	0	0
	30-40	9.0	0	70	0	30	0	0	0	0
	40-50	10.0	0	70	0	30	0	0	0	0
	50-60	10.0	0	70	0	30	0	0	0	0
Area of Direct Impact	60-70	10.0	0	70	0	30	0	0	0	0
	70-80	10.0	0	70	0	30	0	0	0	0
	80-90	10.0	0	20	20	50	10	0	0	0
	90-100	10.0	0	10	20	0	50	20	0	0
	100-110	10.0	0	70	0	10	20	0	0	0
	110-120	8.0	0	10	10	0	20	0	60	0
	120-130	7.0	0	20	0	30	0	0	50	0
	130-140	5.0	0	20	0	30	0	0	50	0
5										
	0-10	5.0	0	50	30	0	20	0	0	0
	10-20	7.0	0	50	0	30	20	0	0	0
	20-30	7.0	0	50	0	30	20	0	0	1
	30-40	7.0	0	50	0	30	20	0	0	0
	40-50	10.0	0	40	40	20	0	0	0	0
	50-60	10.0	10	50	20	20	0	0	0	0
	60-70	8.0	0	60	0	40	0	0	0	0
Area of Direct Impact	70-80	15.0	0	20	20	60	0	0	0	0
	80-90	13.0	0	10	20	70	0	0	0	0
	90-100	10.0	0	30	0	60	10	0	0	0
	100-110	10.0	0	10	20	30	40	0	0	1
	110-120	9.0	0	30	0	20	30	20	0	0
	120-130	8.0	0	70	0	30	0	0	0	0
	130-140	8.0	0	20	10	10	0	0	60	0
	140-150	5.0	0	20	10	10	0	0	60	0
6										
	0-10	3.0	10	50	0	20	20	0	0	1
	10-20	5.0	20	30	50	0	0	0	0	0
	20-30	8.0	20	70	10	0	0	0	0	0
	30-40	8.0	0	70	0	30	0	0	0	0
	40-50	8.0	20	20	20	40	0	0	0	0
	50-60	8.0	10	30	20	40	0	0	0	0
Area of Direct Impact	60-70	8.0	10	30	20	40	0	0	0	0
	70-80	8.0	0	10	30	30	30	0	0	0
	80-90	10.0	0	20	60	20	0	0	0	0
	90-100	10.0	0	50	0	50	0	0	0	0
	100-110	7.0	0	10	10	60	20	0	0	0
	110-120	7.0	0	70	0	30	0	0	0	0
	120-130	7.0	0	70	0	30	0	0	0	0
	130-140	5.0	0	20	0	10	0	0	70	0
	140-150	3.0	0	10	0	10	0	0	80	

Table 2. Mussel Habitat by Transect Segment.

Transect	Segment	Max Depth	% Wood	% Silt	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	# Mussels
7		Skipped due to dam proximity								
8										
Area of Direct Impact	0-10	0.5	0	10	50	20	20	0	0	0
	10-20	2.5	0	0	30	30	40	0	0	0
	20-30	2.0	0	0	30	30	40	0	0	0
	30-40	2.0	0	0	30	30	30	10	0	0
	40-50	2.0	0	0	30	20	20	30	0	1
	50-60	2.5	0	0	30	20	20	30	0	0
	60-70	2.5	0	0	30	20	30	20	0	0
	70-80	1.5	0	0	30	30	30	10	0	0
	80-90	1.5	0	0	30	30	40	0	0	1
	90-100	1.0	0	0	40	30	30	0	0	0
	100-110	1.0	0	0	50	30	20	0	0	0
	110-120	0.5	0	0	40	30	20	10	0	0
	120-130	1.5	0	0	20	30	40	10	0	0
	130-140	2.0	0	0	40	30	30	0	0	0
	140-150	3.0	0	0	40	30	30	0	0	0
	150-160	5.0	0	0	20	30	50	0	0	0
	160-170	3.5	20	0	20	40	20	0	0	0
9										
Area of Direct Impact	0-10	1.0	0	0	40	30	30	0	0	0
	10-20	0.5	0	0	30	30	40	0	0	0
	20-30	1.0	0	0	30	30	30	10	0	0
	30-40	1.0	0	0	30	30	30	10	0	0
	40-50	1.5	0	0	30	30	30	10	0	1
	50-60	0.5	0	0	30	30	30	10	0	0
	60-70	0.5	0	0	30	30	40	0	0	0
	70-80	0.5	0	0	30	30	40	0	0	0
	80-90	1.0	0	0	30	40	30	0	0	0
	90-100	1.0	0	0	30	40	30	0	0	0
	100-110	2.5	0	0	30	40	30	0	0	0
	110-120	2.0	0	0	30	40	30	0	0	0
	120-130	1.5	0	0	30	40	30	0	0	0
	130-140	1.5	0	10	20	30	40	0	0	0
	140-150	1.5	0	10	30	30	20	10	0	0
	150-160	1.5	0	10	30	30	20	10	0	0
	160-170	1.0	0	10	50	20	20	0	0	0
10										
Area of Direct Impact	0-10	1.0	0	0	20	30	50	0	0	0
	10-20	1.5	0	0	20	30	50	0	0	1
	20-30	1.5	0	0	20	30	50	0	0	1
	30-40	1.5	0	0	20	30	50	0	0	0
	40-50	1.5	0	0	20	30	50	0	0	0
	50-60	2.0	0	0	20	30	50	0	0	1
	60-70	1.5	0	0	20	30	50	0	0	0
	70-80	1.5	0	0	10	60	30	0	0	0
	80-90	2.0	0	10	10	60	20	0	0	0
	90-100	2.5	0	20	20	40	20	0	0	0
	100-110	2.5	0	30	20	30	10	10	0	0
	110-120	3.0	0	40	20	20	10	10	0	0
	120-130	3.0	0	50	20	20	10	0	0	0

Table 2. Mussel Habitat by Transect Segment.

Transect	Segment	Max Depth	% Wood	% Silt	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	# Mussels
11										
Area of Direct Impact	0-10	0.5	0	0	20	30	30	20	0	0
	10-20	0.5	0	0	20	30	30	20	0	0
	20-30	1.0	0	0	20	30	30	20	0	0
	30-40	1.0	0	0	20	30	40	10	0	0
	40-50	1.5	0	0	20	30	40	10	0	0
	50-60	1.5	0	0	20	30	40	10	0	1
	60-70	1.0	0	0	20	30	40	10	0	0
	70-80	1.0	0	0	20	30	40	10	0	0
	80-90	1.0	0	0	20	30	30	20	0	0
	90-100	1.0	0	0	20	30	30	20	0	0
	100-110	0.5	0	0	20	30	30	20	0	0
	110-120	0.5	0	0	20	30	30	20	0	0
	120-130	0.5	0	0	20	30	30	20	0	0
12										
Area of Direct Impact	0-10	1.0	0	0	10	30	60	0	0	0
	10-20	2.0	0	10	10	20	60	0	0	0
	20-30	3.0	0	10	10	20	60	0	0	0
	30-40	2.5	0	0	10	20	60	10	0	0
	40-50	2.5	0	0		10	30	60	0	0
	50-60	1.5	0	0	10	10	30	50	0	0
13										
Area of Direct Impact	0-10	2.0	0	0	10	10	30	50	0	0
	10-20	4.0	0	10	10	10	20	50	0	0
	20-30	6.0	0	0	10	20	40	30	0	0
	30-40	5.0	0	0	0	30	40	30	0	0
	40-50	4.5	0	0	0	30	40	30	0	0
	50-60	1.5	0	0	20	10	40	30	0	0
14										
Area of Direct Impact	0-10	5.0	0	10	10	10	0	70	0	0
	10-20	9.0	0	0	10	20	30	40	0	1
	20-30	10.0	0	0	0	20	60	20	0	0
	30-40	10.0	0	0	0	20	60	20	0	0
	40-50	4.0	0	0	10	10	60	20	0	0
15										
Area of Direct Impact	0-10	4.0	0	10	10	10	10	60	0	0
	10-20	8.0	0	0	20	20	30	30	0	0
	20-30	9.0	0	0	0	20	60	20	0	0
	30-40	10.0	0	0	0	20	60	20	0	0
	40-50	4.0	0	0	10	10	60	20	0	0
16										
Area of Direct Impact	0-10	8.0	0	20	10	0	10	60	0	0
	10-20	25.0	0	30	10	0	10	50	0	0
	20-30	23.0	0	20	20	0	20	40	0	0
	30-40	15.0	0	10	40	20	10	20	0	0
	40-50	6.0	0	20	50	20	10	0	0	0
	50-60	3.5	0	20	40	30	10	0	0	0
	60-70	2.5	0	20	40	30	10	0	0	0

Table 2. Mussel Habitat by Transect Segment.

Transect	Segment	Max Depth	% Wood	% Silt	% Sand	% Gravel	% Cobble	% Boulder	% Bedrock	# Mussels
17										
Area of Direct Impact	0-10	9.0	0	20	10	0	10	60	0	0
	10-20	26.0	0	30	10	0	10	50	0	0
	20-30	22.0	0	20	20	0	20	40	0	0
	30-40	14.0	0	10	40	20	10	20	0	0
	40-50	7.0	0	20	50	20	10	0	0	0
	50-60	3.0	0	20	40	30	10	0	0	0
	60-70	2.5	0	20	40	30	10	0	0	0
18										
Downstream Buffer	0-10	3.0	0	0	10	20	20	50	0	0
	10-20	3.5	0	0	10	40	40	10	0	2
	20-30	3.5	0	0	10	40	40	10	0	0
	30-40	3.5	0	10	0	20	60	10	0	0
	40-50	3.5	0	10	0	20	60	10	0	0
	50-60	3.0	0	10	0	30	60	0	0	0
19										
Downstream Buffer	0-10	1.0	0	10	10	30	50	0	0	0
	10-20	2.5	0	0	0	40	60	0	0	0
	20-30	1.5	0	0	10	20	60	10	0	0
17										
Area of Direct Impact (Side Channel)	0-10	2.5	0	20	10	30	40	0	0	0
	10-20	3.5	0	20	10	30	40	0	0	0
	20-30	4.0	0	20	10	40	30	0	0	0
	30-40	6.0	0	20	0	30	50	0	0	0
	40-50	5.5	0	20	0	30	30	20	0	0
	50-60	6.0	0	30	0	20	40	10	0	0
	60-70	2.0	20	60	0	10	10	0	0	0
	70-75	0.5	20	60	0	10	10	0	0	0
18										
Downstream Buffer (Side Channel)	0-10	1.0	0	30	10	30	30	0	0	0
	10-20	4.0	0	10	0	30	30	30	0	0
	20-25	1.0	0	20	0	60	20	0	0	0
19										
Downstream Buffer (Side Channel)	0-10	1.5	0	30	10	20	40	0	0	0
	10-15	1.0	0	10	80	10	0	0	0	0

Appendix A
ODNR Approval

Outlook

RE: Survey Plan for West Carrollton Dam Mussel Survey

From John.Navarro@dnr.ohio.gov <John.Navarro@dnr.ohio.gov>
Date Wed 8/14/2024 3:56 PM
To Matthew Gilkay <Matthew@BioSurveyGroup.com>
Cc Sarah Veselka <sarah@BioSurveyGroup.com>; Ryan Schwegman <Ryan@BioSurveyGroup.com>

Please proceed

John Navarro
Aquatic Stewardship Program Administrator
Ohio Department of Natural Resources
Division of Wildlife
2045 Morse Rd, Columbus, Ohio 43229
614-265-6346
John.navarro@dnr.ohio.gov

From: Matthew Gilkay <Matthew@BioSurveyGroup.com>
Sent: Wednesday, August 14, 2024 2:08 PM
To: Navarro, John <John.Navarro@dnr.ohio.gov>
Cc: Sarah Veselka <sarah@BioSurveyGroup.com>; Ryan Schwegman <Ryan@BioSurveyGroup.com>
Subject: Survey Plan for West Carrollton Dam Mussel Survey

Hi John,

Please find attached a survey plan for your approval. The survey is for a proposed dam modification project at the West Carrollton Low-Head Dam in Montgomery County on the Great Miami River. Please let me know if you have any comments or questions.

Thank you for your time,

Matthew Gilkay
Mussel Biologist
763.222.5107 | Matthew@BioSurveyGroup.com | www.BioSurveyGroup.com

BioSurvey Group

CAUTION: This is an external email and may not be safe. If the email looks suspicious, please

do not click links or open attachments and forward the email to csc@ohio.gov or click the Phish Alert Button if available.

Appendix B
OH Scientific Collection Permit

DIVISION OF WILDLIFE
Ohio Department of Natural Resources

Division of Wildlife Headquarters
2045 Morse Road, Bldg. G
Columbus, Ohio 43229-6693
1-800-WILDLIFE

Chief: Kendra S. Wecker

Scientific Collection

License Number: SC220104

Effective Date: 06/16/2022
Expiration Date: 03/15/2025

Permit Holder:

MATTHEW GILKAY
6552 WEST SHORE DRIVE
KENT, OH 44240

ENVIROSCIENCE INC.
5070 STOW ROAD
STOW, OH 44224
COUNTY: SUMMIT

Others authorized on permit: NO

The permittee is hereby granted permission to take, possess, and transport at any time and in any manner specimens of wild animals, subject to the conditions and restrictions listed below or any documents accompanying this permit.

The Chief of the Division of Wildlife will not issue permit for Dangerous Wild Animal (DWA) species (ORC 935.01) except native DWA, required for specific projects. The permit issued by the Chief does not relieve the permittee of any responsibility to obtain a permit pursuant to R.C. Chapter 935 except as specified for the animals and purposes permitted herein. The permittee must adhere to all additional requirements under R.C. Chapter 935.

THIS PERMIT IS RESTRICTED AS FOLLOWS:

All native freshwater mussels are protected in the State of Ohio (Section 1533.324 of the Ohio Revised Code). In addition, federally listed species are protected by the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Impacts to all freshwater mussels, including State and Federally protected mussels, and their habitats should be avoided and minimized to the maximum extent practicable. If impacts cannot be avoided, all streams which contain mussels or potential mussel habitat must be surveyed prior to any proposed stream disturbance following the Ohio Mussel Survey Protocol - April 2022 (link below).

https://ohiodnr.gov/static/documents/wildlife/permits/dow-protocol-ohio-mussel-survey.pdf

Mussel surveys are based on stream size and the potential presence of Federally Listed Species (FLS). Accordingly, for purposes of determining survey efforts, Ohio streams have been divided into the five categories listed below and are specifically named in Appendix A of the Ohio Mussel Survey Protocol:

-Unlisted: Streams not listed in the protocol with watersheds >5 mi2 with the potential for mussels.
-Group 1: Small to mid-sized streams, FLS not expected.
-Group 2: Small to mid-sized streams, FLS expected.
-Group 3: Large Rivers, FLS not expected.
-Group 4: Large Rivers, FLS expected.

This permit authorizes you and those working under your direct on-site supervision to work with freshwater mussels in Group 1 and 3 streams, including work with state-list designated endangered or threatened species (state-listed species). For work in Group 2 and 4 streams, a current federal permit for working with mussels is also required. All mussel surveyors in Ohio are required to be certified by the state of Ohio, and you may only work in the systems that you have been approved for (link below):

https://ohiodnr.gov/static/documents/wildlife/permits/dow-list-approved-mussel-surveyors.pdf

This permit allows you to collect specimens of freshwater mussels, including state-listed species for survey and inventory purposes, to add dead specimens of mussels salvaged during fieldwork to an approved repository, to continue to monitor mussel beds of mussels in Ohio, and to locate additional populations of mussel in Ohio. This permit does not authorize the use of lethal means.

DIVISION OF WILDLIFE
Ohio Department of Natural Resources

Division of Wildlife Headquarters
2045 Morse Road, Bldg. G
Columbus, Ohio 43229-6693
1-800-WILDLIFE

This permit is conditioned on the following requirements:

1. At least 15 days prior to the initiation of a mussel survey in Group 1 & 3 systems, please provide John Navarro (john.navarro@dnr.ohio.gov) with a study plan specifying the objectives, location, dates, and all other details, for Division of Wildlife review and approval. For mussel surveys in Group 2 & 4 systems, contact the USFWS (Angela Boyer at angela_boyer@fws.gov).

2. May only work in the systems that you have been approved for (Reconnaissance, Groups 1 & 3, Groups 2 & 4).

3. If approved, may collect mussels, including listed species, for survey and inventory. May also collect non-endangered fish. Sportfish greater than six (>6) inches must be immediately released.

4. At least 24 hours prior to collection activities, the permittee must contact the local wildlife officer (attachment) to advise locations and sampling duration (messages are acceptable). Permission must be obtained from private landowners.

5. Any and all work conducted on federally listed mussels, as well as identification of mussels, must be conducted by federal permittees following restrictions of a current Federal permit. Assistants are only permitted to work under the direct, on-site supervision of federal permittees.

6. Specimens may be temporarily held per guidelines outlined in the mussel protocol and released within 3 hours to the collection location. Live specimens must be maintained at the Columbus Zoo's Freshwater Mussel Conservation and Research Center.

7. All voucher specimens collected are to be deposited at The Ohio State University Museum of Biological Diversity, Cleveland Museum of Natural History, or the Cincinnati Museum Center, unless otherwise specified in the permit.

8. Collection is prohibited on Division of Wildlife property without explicit written permission from the Division of Wildlife. Sampling is further restricted in streams that may have federally listed mussels. See Appendix A of the Ohio Mussel Survey Protocol for locations of federally listed mussels.

9. Please notify John Navarro by email or phone at 614-265-6346 within 24-hours if a new location for a state-listed species is found.

10. A report of your mussel survey findings for Group 1 and 3 systems should be sent to John Navarro (john.navarro@dnr.state.oh.us) and for Group 2 and 4 streams should be sent to Angela Boyer (angela_boyer@fws.gov).

11. An annual electronic report must be submitted in the Wildlife Diversity Database Excel spreadsheet format to the Permit Coordinator at wildlife.permits@dnr.ohio.gov by March 15th of each year. The file may be downloaded from wildohio.gov or obtained from the Permit Coordinator.

Note that a separate permit under Section 10 of the Endangered Species Act (ESA) is necessary in the case where you might hold live federally listed species longer than 45 days. Permit requests under Section 10 of the ESA should be directed to U.S. Fish and Wildlife Service (USFWS) at https://fwsepermits.servicenowservices.com/fws. If you have questions about whether any proposed activities are covered under this authority or need any other assistance, please contact Angela Boyer at the USFWS, at (614) 416-8993, ext. 122, or angela_boyer@fws.gov.

Locations of Collecting:

Statewide

Equipment and method used in collection:

Scuba/Diving

Name and number of each species to be collected:

DIVISION OF WILDLIFE
Ohio Department of Natural Resources

Division of Wildlife Headquarters
2045 Morse Road, Bldg. G
Columbus, Ohio 43229-6693
1-800-WILDLIFE

Unionid Mussels (Site Dependent)

NO ENDANGERED SPECIES OR AQUATIC NUISANCE SPECIES MAY BE TAKEN WITHOUT WRITTEN PERMISSION FROM THE CHIEF

DIVISION OF WILDLIFE
Ohio Department of Natural Resources

Division of Wildlife Headquarters
2045 Morse Road, Bldg. G
Columbus, Ohio 43229-6693
1-800-WILDLIFE

RECEIPT

Permit Holder:
MATTHEW GILKAY
6552 WEST SHORE DRIVE
KENT, OH 44240
COUNTY: PORTAGE

ENVIROSCIENCE INC.
5070 STOW ROAD
STOW, OH 44224
COUNTY: SUMMIT

Purchase Date: 06/16/2022

Scientific Collection:	$75.00
Convenience Fee:	$1.88
TOTAL FEES:	**$76.88**

Appendix C
Project Photolog

West Carrollton Dam Project – Mussel Survey Photo Log

Digital Image 1. View looking downstream at the Great Miami River from the downstream buffer of the project area.

Digital Image 2. View looking upstream at the Great Miami River from the downstream buffer of the project area.

Digital Image 3. View of the Great Miami River looking downstream from the approximate center of the project ADI (West Carrollton Dam).

Digital Image 4. View of the Great Miami River looking upstream from the approximate center of the project ADI (West Carrollton Dam).

Digital Image 5. View of the Great Miami River looking downstream from the upstream buffer of the project area.

Digital Image 6. View of the Great Miami River looking upstream from the upstream buffer of the project area.

Digital Image 7. View of the left valve of a live Elktoe (*Alasmidonta marginata*) collected from the project site.

Digital Image 8. View of the right valve of a live Elktoe (*Alasmidonta marginata*) collected from the project site.

Digital Image 9. View of the umbo of a live Elktoe (*Alasmidonta marginata*) collected from the project site.

Digital Image 10. View of the left valve of a live Plain Pocketbook (*Lampsilis cardium*) collected from the project site.

Digital Image 11. View of the right valve of a live Plain Pocketbook (*Lampsilis cardium*) collected from the project site.

Digital Image 12. View of the umbo of a live Plain Pocketbook (*Lampsilis cardium*) collected from the project site.

Digital Image 13. View of the left valve of a live Fatmucket (*Lampsilis siliquoidea*) collected from the project site.

Digital Image 14. View of the right valve of a live Fatmucket (*Lampsilis siliquoidea*) collected from the project site.

Digital Image 13. View of the umbo of a live Fatmucket (*Lampsilis siliquoidea*) collected from the project site.

Digital Image 14. View of the left valve of a live Flutedshell (*Lasmigona costata*) collected from the project site.

Digital Image 15. View of the right valve of a live Flutedshell (*Lasmigona costata*) collected from the project site.

Digital Image 16. View of the umbo of a live Flutedshell (*Lasmigona costata*) collected from the project site.

Digital Image 17. View of the left valve of a live Giant Floater (*Pyganodon grandis*) collected from the project site.

Digital Image 18. View of the right valve of a live Giant Floater (*Pyganodon grandis*) collected from the project site.

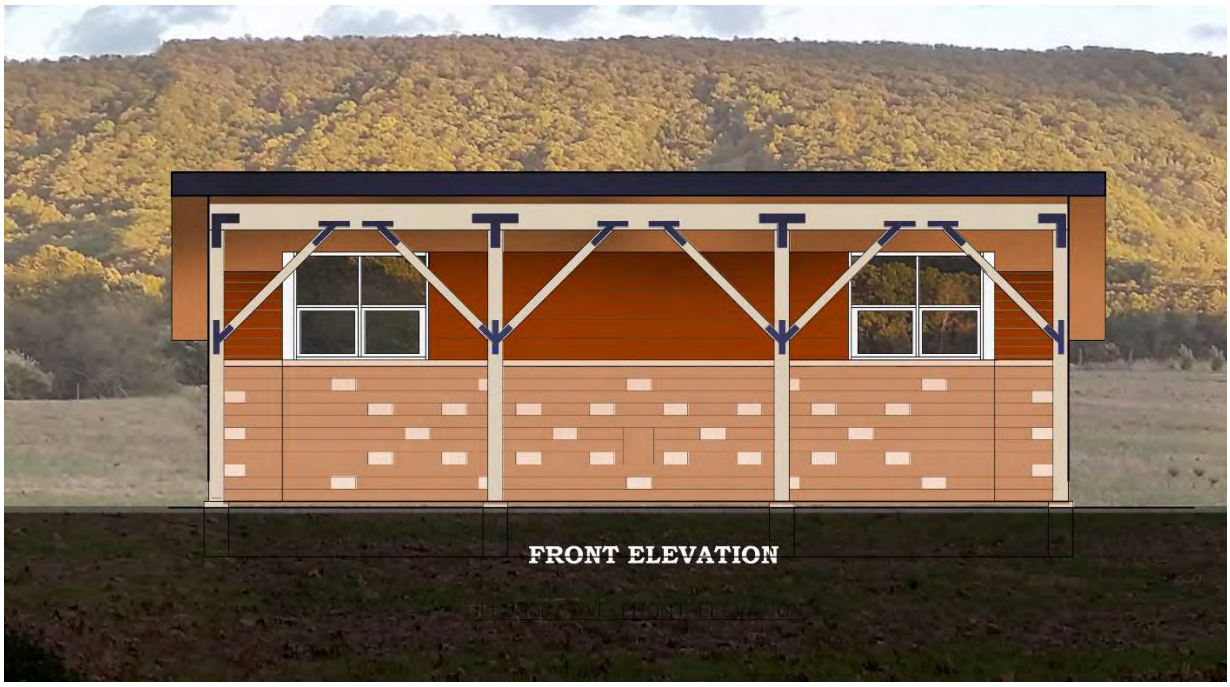
Digital Image 19. View of the umbo of a live Giant Floater (*Pyganodon grandis*) collected from the project site.

Digital Image 20. View of the left valve of a live Paper Pondshell (*Utterbackia imbecillis*) collected from the project site.

Digital Image 21. View of the right valve of a live Paper Pondshell (*Utterbackia imbecillis*) collected from the project site.

Digital Image 22. View of the umbo of a live Paper Pondshell (*Utterbackia imbecillis*) collected from the project site.

ARCHITECURAL DESIGN REPORT



John Anderson, RA for McLaughlin Whitewater

August 2024

Contents

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Maintenance Building 7

Attachment 1 Drawings

Attachment 2 Code / Zoning Review for Restroom Building

Attachment 3 PowerPoint presentations from preliminary design

Attachment 4 Outline Specification

DRAFT

Introduction

The master plan phase for Uplands Planning Area 3 includes parking and support buildings for the whitewater park. These facilities will also support the multipurpose trail that runs along the river corridor and passes though the site and are fully depicted in the site masterplan prepared by McLaughlin Whitewater.

1. Restrooms
2. Outfitter administration building
3. Maintenance building

The restroom building is developed to a 30 percent design level and is the main subject of this report. The remaining two are developed to a pre-design level to inform the master planning work and the final design. There is also a campground in Planning Area 3, but it is not included in this report.

The architecture is envisioned to be of the same quality as the public/private development of the West Carrollton River District near the I-75 interchange at East Central Avenue. After all, a major goal of river park is to link this new development to the river. The River District developer intends quality development and will have architectural guidelines for the build-out.

Figure 1 Representative architectural guidelines by the River District developer for another project in Ohio.

DRAFT

Restrooms

Comparable Facilities

The restrooms are sized according to our experience with similar parks with the understanding that they may be slightly undersized a few crush summer weekends and only lightly used in the spring and fall. For special events and especially busy times we assume that they will be supplemented by porta-pots at the river.

Project Name	Restrooms (sf)	Changing (sf)	Admin/Sales (sf)	Maitenance Building (sf)
Argo Canoe Livery , Ann Arbor, Michigan	Porta pots	None	450	?
Gallup Livery, Ann Arbor, Michigan	550?	None	1500	?
WOKA whitewater Park, Watts OK	492	822	Pop ups	1711
Siloam Springs Whitewater Park, AK	Porta pots	500	none	none
West Carrollton	**350**	**610**	**2000**	**3000**

Figure 2 Table of comparable projects showing the full range of possible support facilities.

This Project

Several plan options and exterior "looks" were presented over the course of the design and the presented plan is the one favored by the City. (The prior options and their development are documented in PowerPoint presentations in Attachment 3.) Each half of the building is divided into a changing area and toilet rooms. The interior circulation allows patrons to access to each area without having to pass through the other. A custodial closet is in the middle of the plan. As directed by the City, the toilet rooms will have seasonal heat while the changing areas will be unheated. The later will be available all year while the bathrooms will be shut down and pipes drained.

Each space has high clerestory windows on two sides with operable windows that provide natural light for cross ventilation. Each room has two skylights to reduce dependence on artificial light. Light on two sides of a room is a long-recognized way to increase user satisfaction with a space[1] The space is envisioned to be light-filled and uplifting. A space that is appreciated is less likely to be abused.

[1] See *A Pattern Language*, Christopher Alexander, 1977

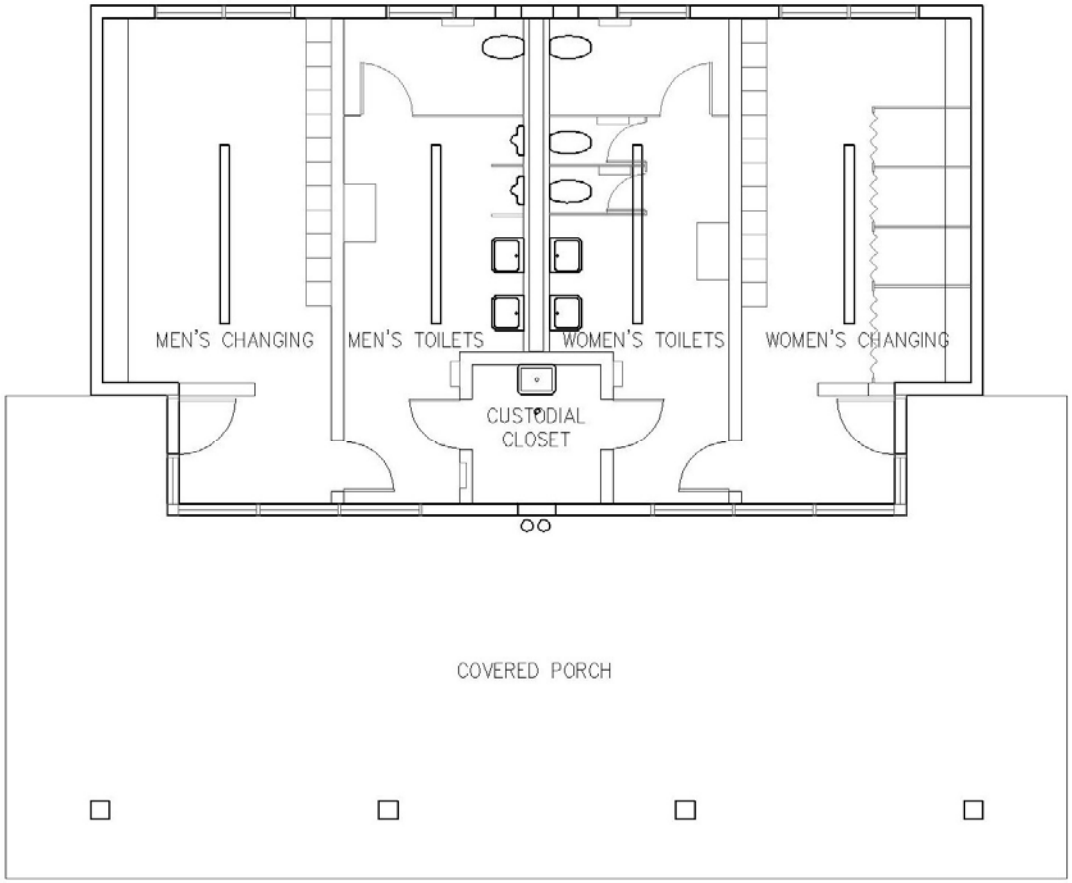

Figure 3 Restroom building plan

Figure 4 Exterior materials are split-face concrete block, wood siding, metal fascia, aluminum storefront, and laminated timbers.

Administration Building

The administration building was developed to the pre-design programing level. It is based chiefly on our knowledge of the whitewater park in Ann Arbor, Michigan. We strongly recommend a site visit and interview with Ann Arbor staff prior to embarking on design.

Administration Building		SF	Remarks
	Meeting room 12-15 people	300	
	Admin offices (2) Director and HR	300	with doors (not open office)
	Unisex staff toilet	50	Universal accessible
	Admin space with reception, open plan	700	6 to 12 cubicles
	Support area	100	copier, server, ofice supplies, web cam gear etc.
	Break room	200	sink, frig, counter microwave
	Ticket sales and incidental goods	200	Walk up window only. Generally do not want cusomers inside.
	Subtotal	1850	
	circulation 10%	185	
	Total	2035	

Figure 5 Preliminary program square footages

Notes for Administration Building

1. Bike rentals may be included in the site offerings but will be provided by a pop-up vendor who will set up on site. No major facilities will be provided other than a piece of ground.
2. Sales window with adjoining covered space for customers[2] to rent equipment and sundry sales help cover site operating costs.
    a. Logo merchandise
    b. Necessities (sunscreen glasses retainers)
    c. Snacks and bottled water-packaged (vending machines?)
3. The meeting room could be made available for rent (corporate events, private events, community education, etc.). See Ann Arbor comparable.

[2] We do not envision customers being inside unless there is an issue, or they are renting a space.

DRAFT

Figure 6, programmatic plan for the administration building

Maintenance Building

The maintenance building is envisioned to be a metal building, back of house structure, within the maintenance yard and screened from the neighbors.

Maintenance Building		SF	Remarks	HVAC Notes
	Drive thru bay	2650		Ventilation fan only
	Staff office	200		Mini-split heat and AC.
	Staff break room	200		
	Staff toilet	50	Universal accessible	elec resistance w/ exh. Fan
	Supply closet and coats and personal gear	30		
	Electrical switchgear	-	included in maintenance bay	
	Waveshaper equipment	-	located elsewhere	
	Exterior covered bays for grounds equipment (4)	640	not included in interior footage	
	Other	100		
	Total	3230		

Figure 7 Maintenance building square footages

Notes on Maintenance Building

1. Exterior bays for lawn and grounds maintenance equipment including a tractor or small backhoe with log grapple for clearing woody debris
2. Raft repair area
3. Storage Yard (screened per City regs) approximately 15,000 sf
    a. Turning and parking for trailered equipment
    b. Rafts and inflatables on flatbed trailers
    c. Canoes and kayaks on racked trailers
    d. Storage racks for canoes and kayaks not in circulation– three to four high
    e. Shipping container for rafts, inflatables (or building).
    f. Shipping container for bikes (or trailer)
    g. Trailer for PFD's, helmets, and paddles.

Two plan options are shown below depicting two types of construction: 1) wood pole barn with metal siding and roof and 2) prefabricated metal building.

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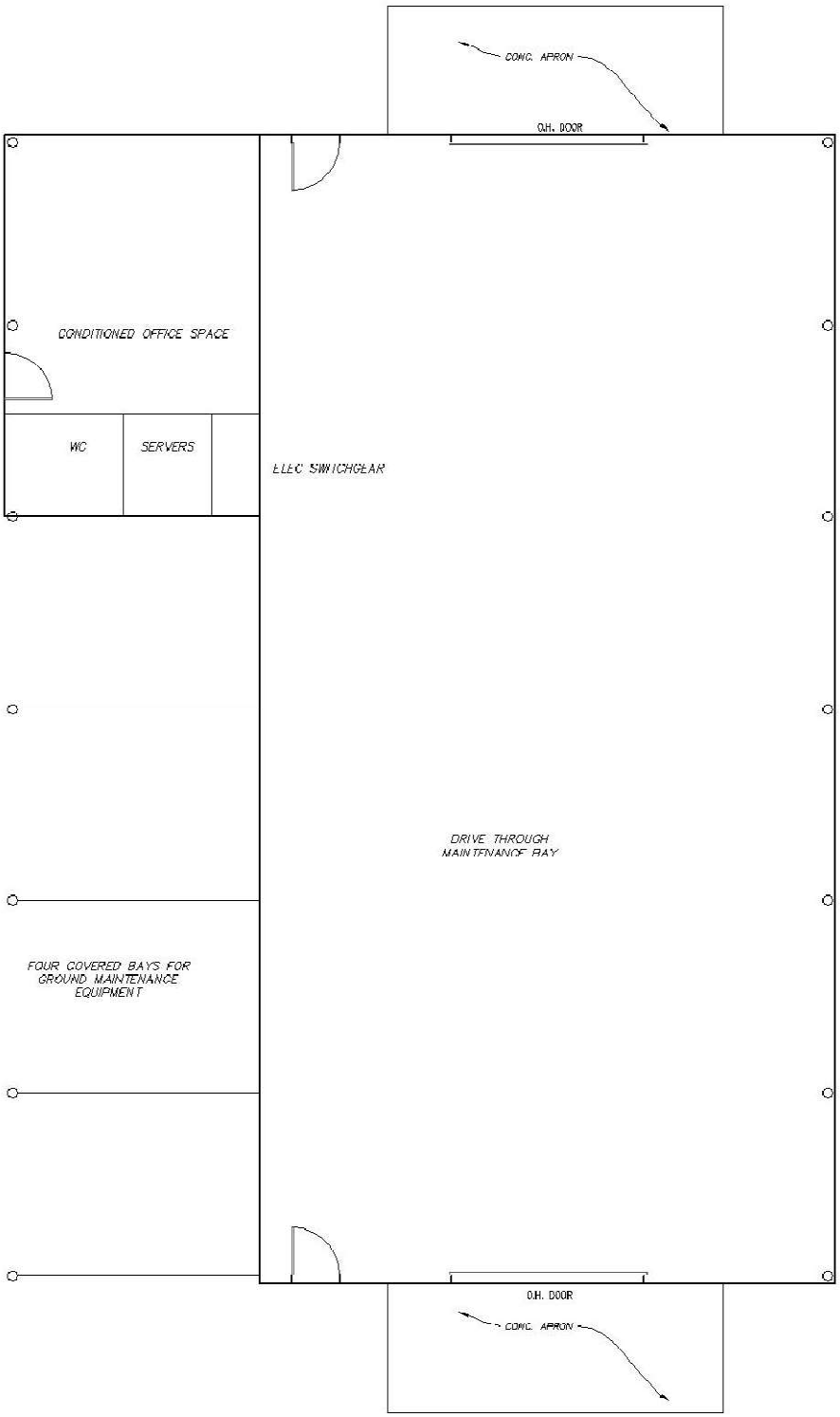

Figure 8 Maintenance building--structural bays proportioned to pole barn construction

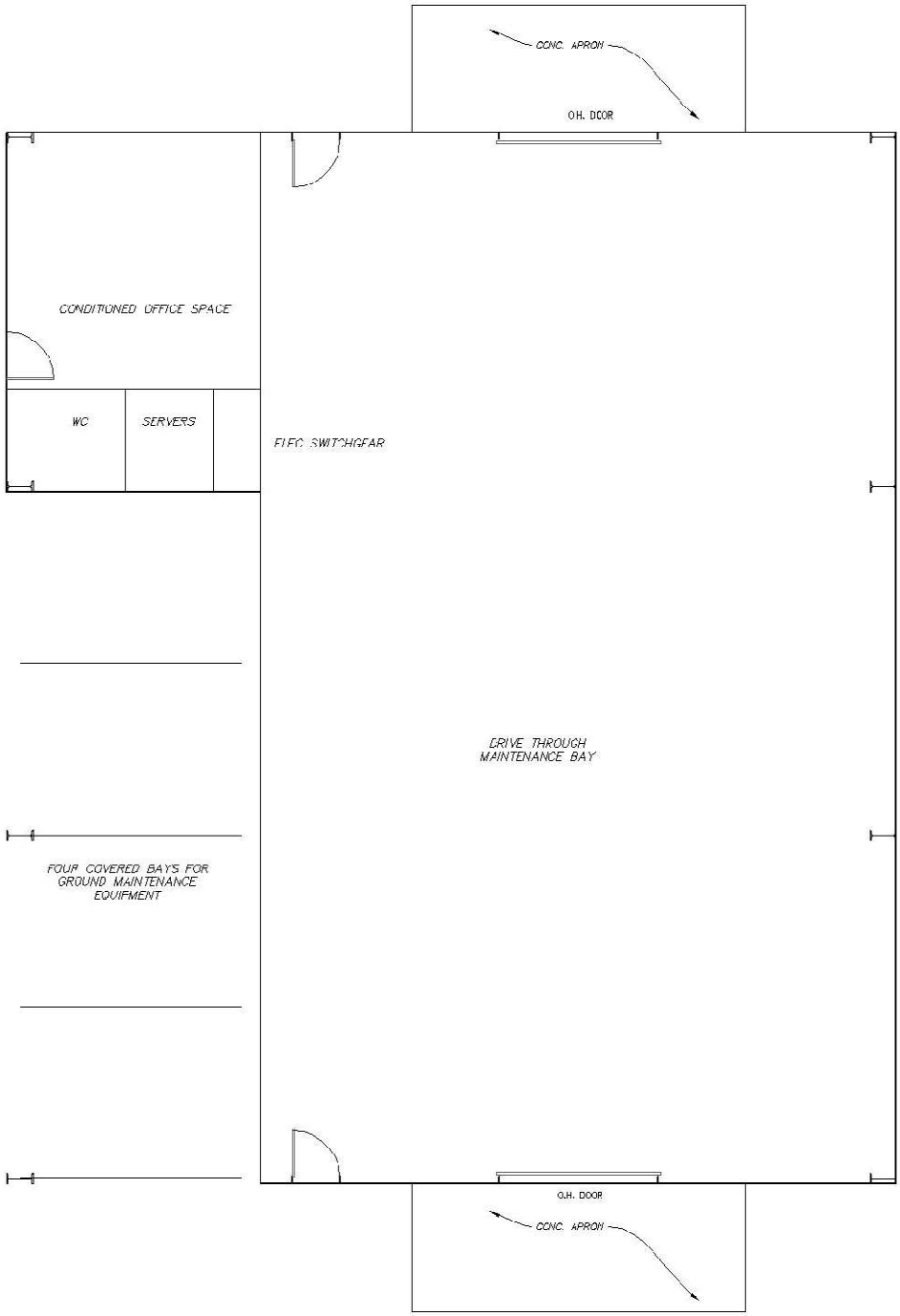

Figure 9 Maintenance building, structural bays proportioned to prefabricated metal building

End of Report

ATTACHMENT 1 DRAWINGS

Drawing List

04-A-1	Floor Plan, Roof Plan
04-A-2	Building Section, Elevations
04-A-3	Schedules and Details
04-A-4	Reflected Ceiling Plan
04-A-5	Restroom Interiors
04-S-1	Schematic Foundation Plan, Roof Framing Plan, Details
04-M-1	Mechanical Schematic

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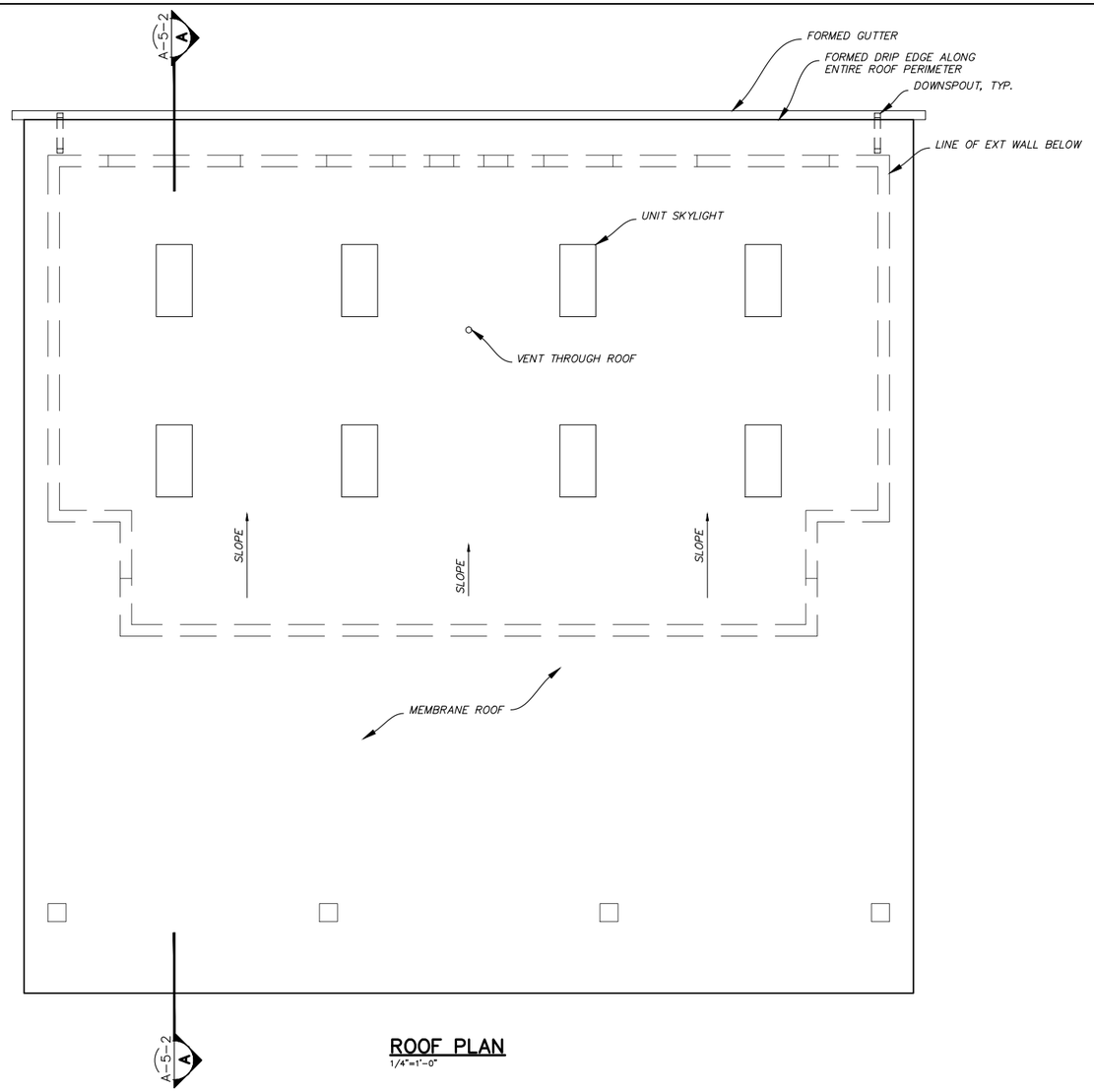

ROOF PLAN
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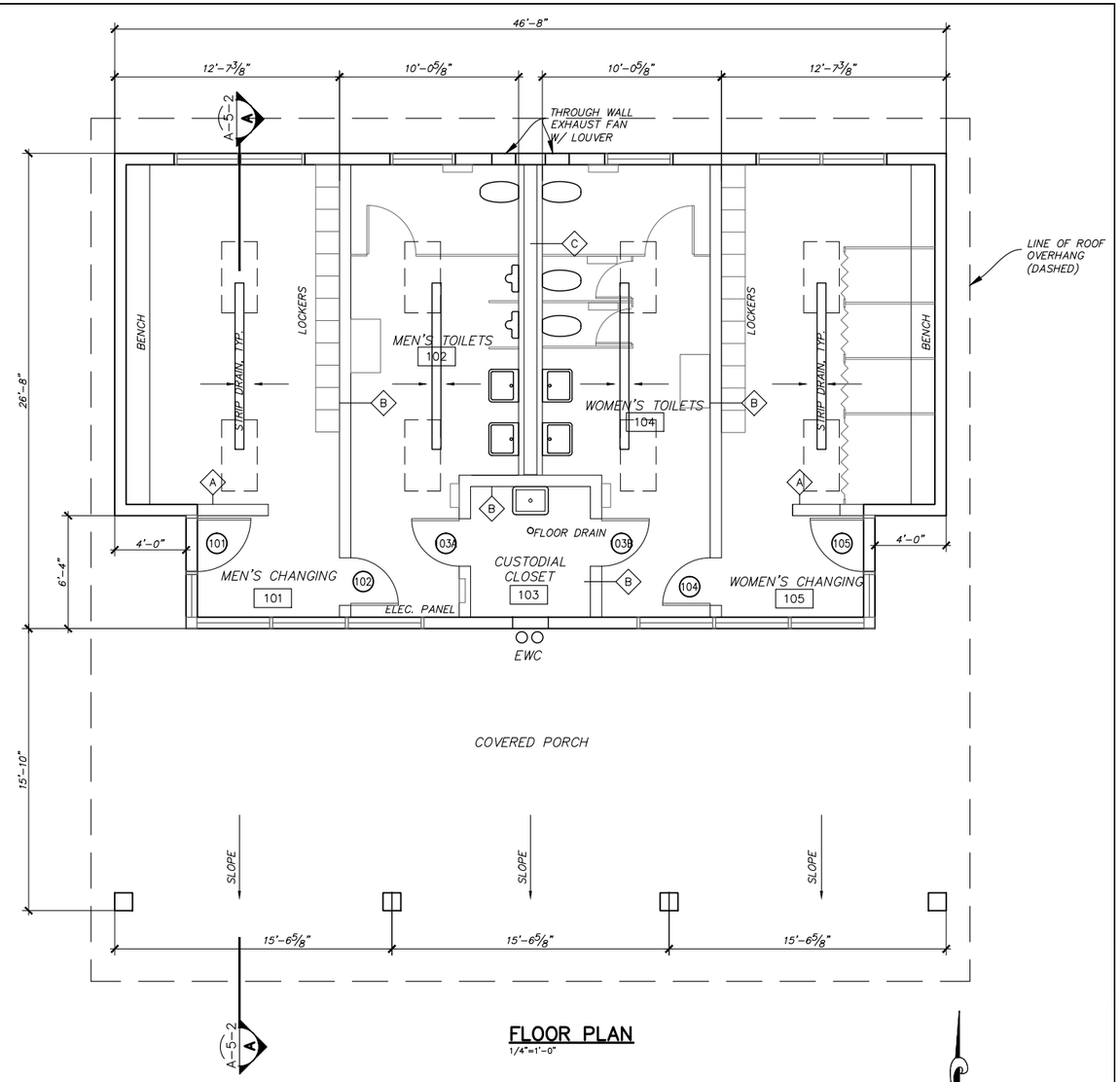

FLOOR PLAN
1/4"=1'-0"

KEY

- 034 DOOR NUMBER
- 103 ROOM NUMBER
- B PARTITION TYPE

NORTH

4 0 4 8

1/4 inch = 1 foot

SCALE BAR
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1
IF NOT ONE INCH ON THIS DRAWING ADJUST SCALES ACCORDINGLY

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FLOOR PLAN
ROOF PLAN

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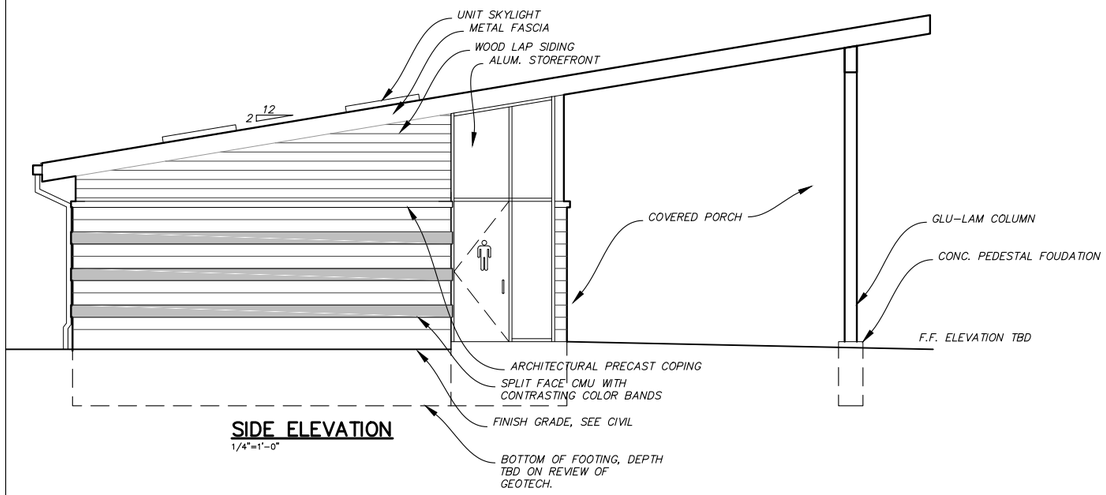
SHEET **04-A-1**
DRAWING NO.
OF 42



SIDE ELEVATION
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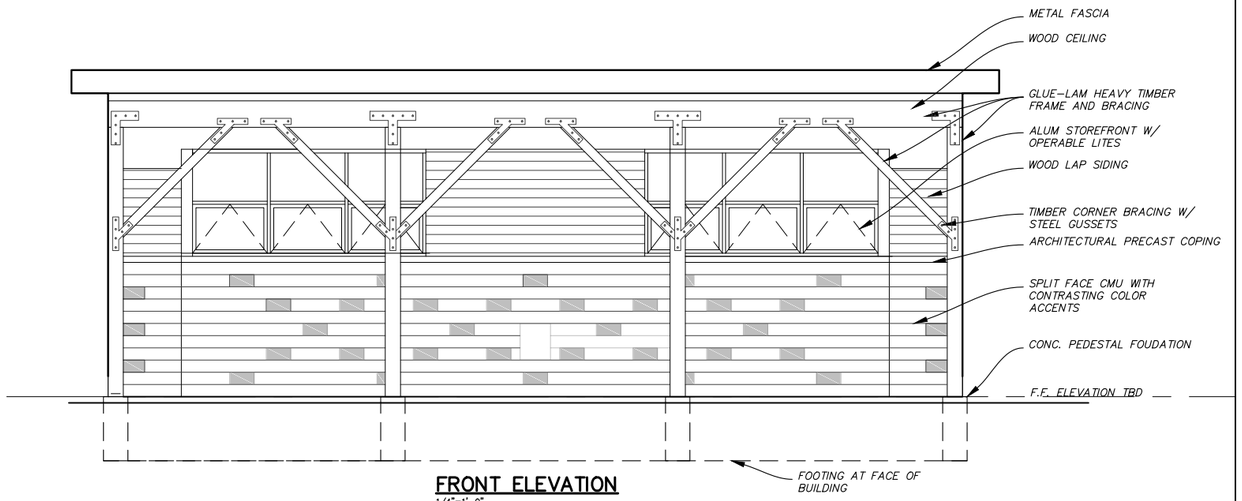

FRONT ELEVATION
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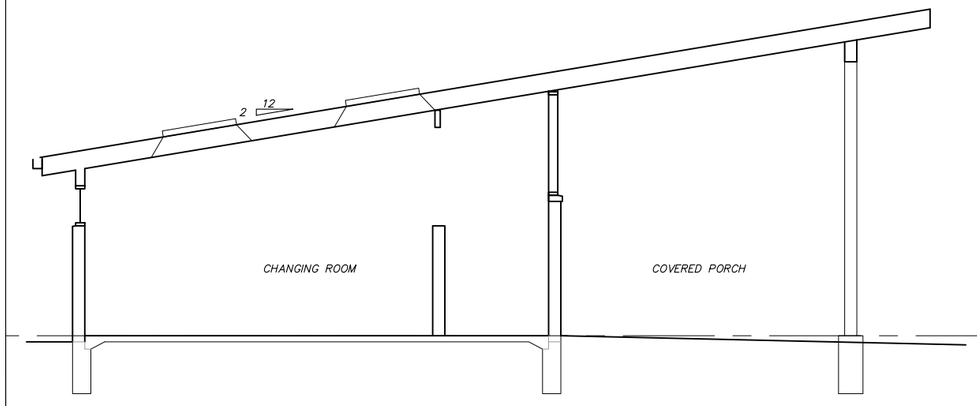

SECTION A-A
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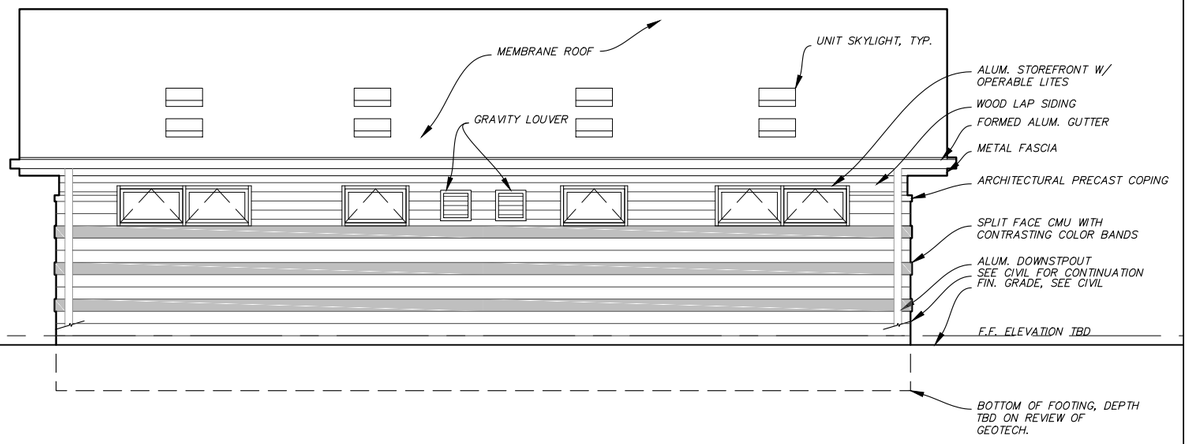

REAR ELEVATION
1/4"=1'-0"

4 0 4 8
1/4 inch = 1 foot

SCALE BAR
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ELEVATIONS
BUILDING SECTION

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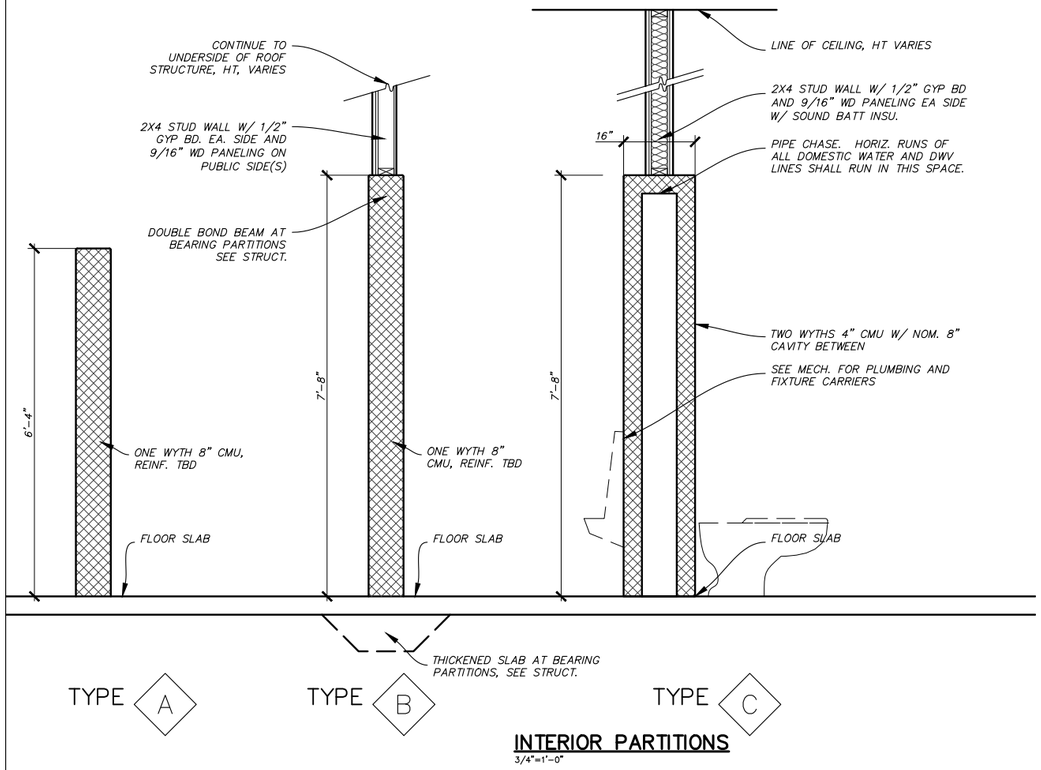
04-A-2
DRAWING NO.
OF 42



INTERIOR PARTITIONS
3/4"=1'-0"

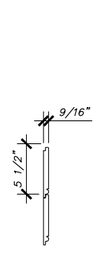
Door Schedule

Mark	From	To	Door Type	Door Size	Door Matl.	Door Rating	Jamb Type	Jamb Matl.	Jamb Rating	Hardware Group	Lock/Latch Function	Remarks
101	Exterior	Men's Changing 101	A	3-0x7-8x1-3/4"	Storefont	-		Alum	-		Restroom	Owner's time lock system
102	Men's Changing 101	Men's Toilets 102	C	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Restroom	
103a	Men's Toilet 102	Custodial Closet 103	B	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Store Rm	
103b	Women's Toilet 105	Custodial Closet 103	B	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Store Rm	
104	Women's Changing 105	Women's To let 104	C	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Restroom	
105	Exterior	Women's Changing 105	A	3-0x7-8x1-3/4"	Storefront	-		Alum	-		Restroom	Owner's time lock system

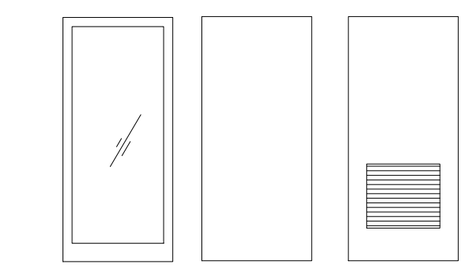
FINISH SCHEDULE

Room/ Area:	RM. No.	Walls North	Walls East	Walls South	Walls West	Floor	Ceiling Finish	Ceiling Height	Base	Remarks:
		Epoxy Paint CMU/ Paint Wd	Epoxy Paint CMU/ Paint Wd	Epoxy Paint CMU/ Paint Wd	Epoxy Paint CMU/ Paint Wd					
Men's Chang ng	101	Panel ng Lpoxy Paint CMU/ Paint Wrl	Panel-ng Lpoxy Paint CMU/ Paint Wrl	Paneling Lpoxy Paint CMU/ Paint Wrl	Panel-ng Lpoxy Paint CMU/ Paint Wrl	Paint Concrete Wood	transp. Fin	varies	None	
Men's Toilet	102	Panel ng Epoxy Paint CMU/ Paint Wd	Panel-ng Epoxy Paint CMU/ Paint Wd	Paneling Epoxy Paint CMU/ Paint Wd	Paneling Epoxy Paint CMU/ Paint Wd	Paint Concrete Wood	transp. Fin	varies	None	
Closet	103	Panel:ng Epoxy Paint CMU/ Paint Wd	Panel:ng Epoxy Paint CMU/ Paint Wd	Paneling Epoxy Paint CMU/ Paint Wd	Paneling Epoxy Paint CMU/ Paint Wd	Paint Concrete Wood	transp. Fin	varies	None	
Women's To'et	105	Panel-ng Epoxy Paint CMU/ Paint Wd	Panel-ng Epoxy Paint CMU/ Paint Wd	Paneling Epoxy Paint CMU/ Paint Wd	Paneling Epoxy Paint CMU/ Paint Wd	Paint Concrete Wood	transp. Fin	varies	None	
Women's Changing	106	Panel-ng	Panel-ng	Panel-ng	Panel-ng	Paint Concrete Wood	transp. Fin	varies	None	

SCHEDULES



WOOD PANELING DETAIL
3"=1'-0"



DOOR TYPES
NO SCALE

4 0 4 8
1/4 inch = 1 foot

SCALE BAR
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0 1
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DOORS, PARTITIONS SCHEDULES

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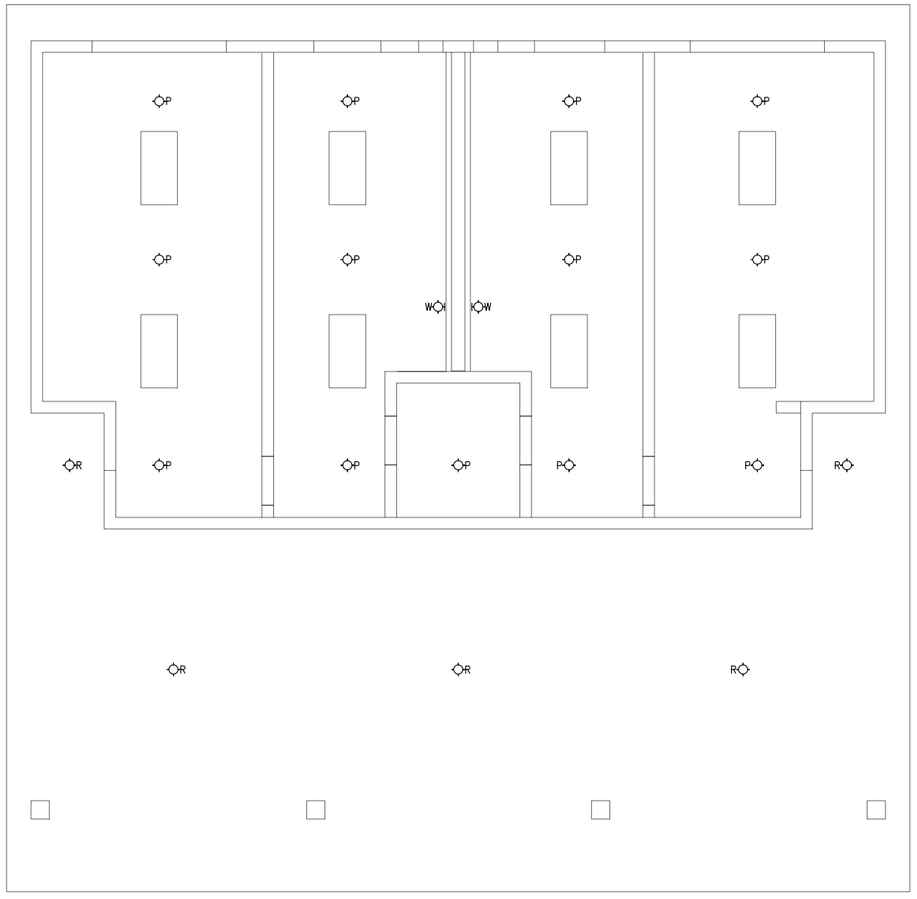
SHEET: **04-A-3**
DRAWING NO.
OF 42

LIGHTING KEY

- P PENDANT
- W WALL
- R RECESSED



FIRST FLOOR REFLECTED CEILING PLAN

1/4"=1'-0"

NORTH

4 0 4 8

1/4 inch = 1 foot

SCALE BAR
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DRAWING
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REFLECTED CEILING PLAN

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DATE
AUGUST, 2024

SHEET
04-A-4

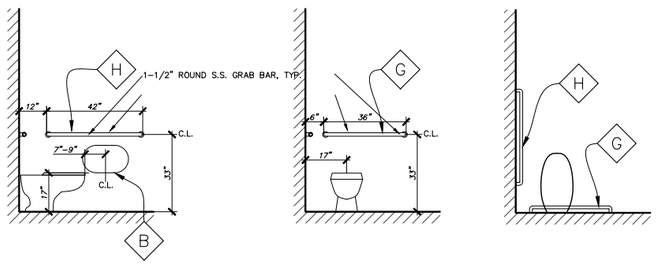
DRAWING NO.
OF 42

TOILET ACCESSORY SCHEDULE

Mark	Item	Representative Manufacturer	Model No.	Mounting Height Above Floor	Remarks
A	Waste Receptical-surface mount	Bobrick	B277	24" to 36"	to top of rim
B	Dual Toilet Paper Holder	Bradley	5425	20" to bot	Provide one per each toilet stall
C	Touchless Soap Dispenser (lavs)	Rubbermaid	Lumicel	36"	Mount between sinks, see dwgs
D	Fem. Napkin Disposal	Bradley	4781-11	36"	
E	Garment Hook	Bobrick	B 6827	40" ADA, 54" others	Only per toilet compartment door
I	Channel Framed Mirror	Bobrick	B165 2436	Per Drawings	
G	Grab Bar-36"	Bradley	812	Per Drawings	
H	Grab Bar-42"	Bradley	812	Per Drawings	
J	Baby Changing Station	Rubbermaid	FG 781888	Per Drawings	Horizontal deployment
K	Touchless Paper Towel Dispenser	Bradley	2494	Per Dawings	8" towel roll
L	Robe Hook	Bradley	9118	Per Drawings	
M	Bench support	Rakks	EH-1416	Per Drawings	48" o.c.
N	Shower Curtain	Bobrick	B 240 3		Length varies, hang on OH brace of changing compartment

KEY

B — TOILET ACCESSORY, SEE SCHEDULE



ACCESSIBLE TOILET STALL GRAB BARS

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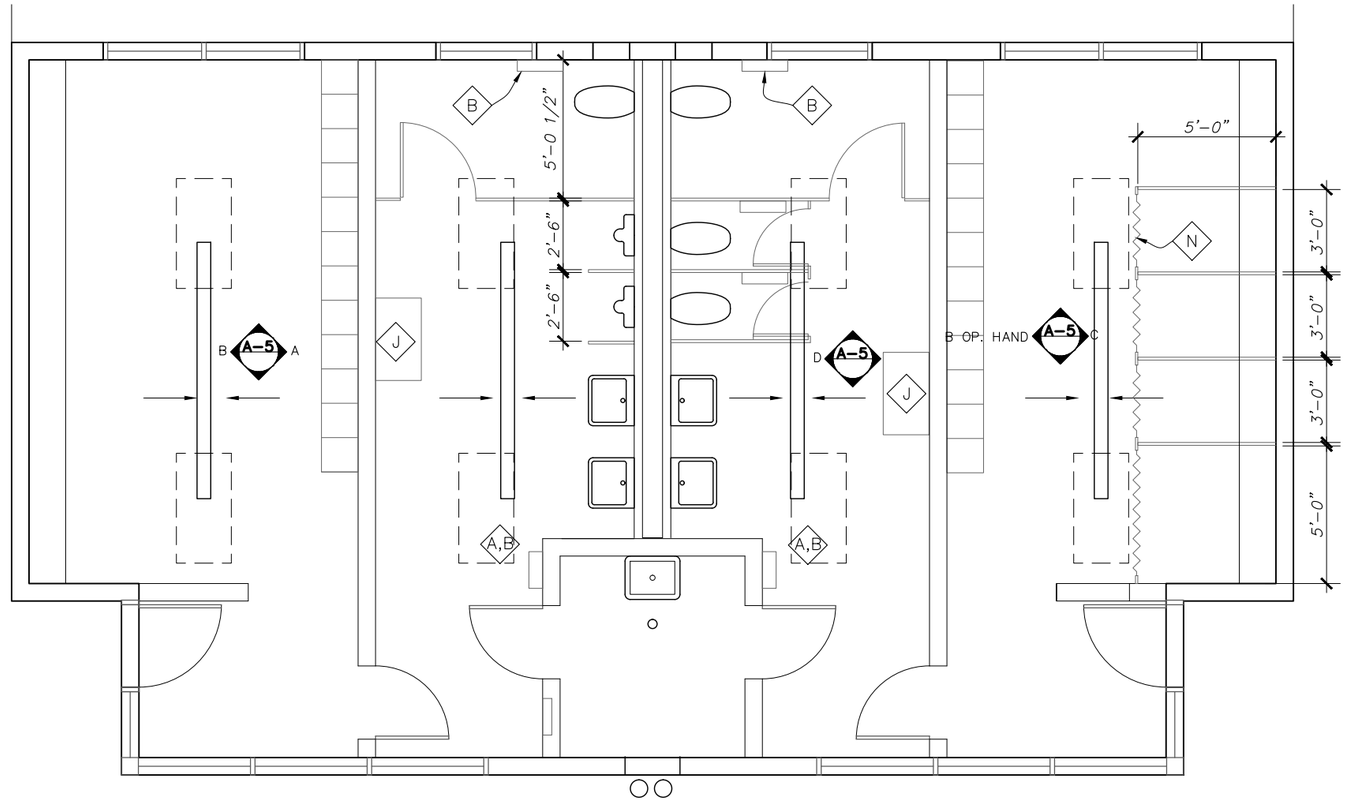

ENLARGED PLAN

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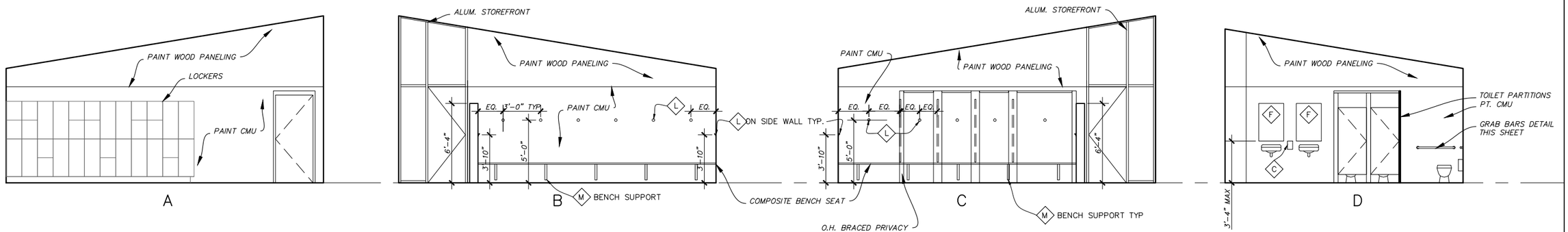

INTERIOR ELEVATIONS

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4 0 4 8

1/4 inch = 1 foot

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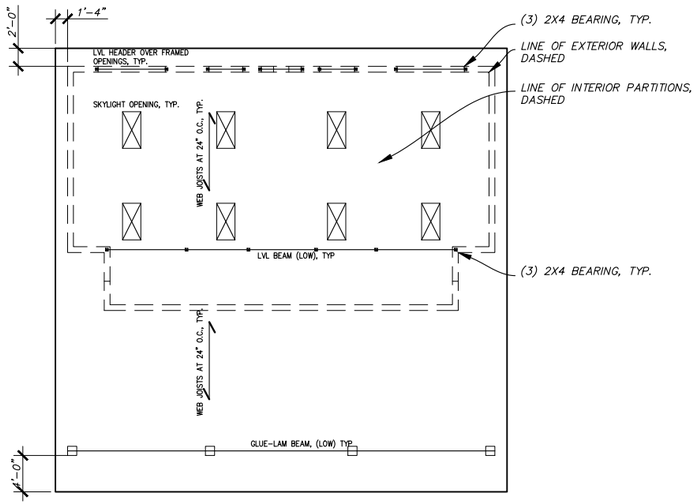
RESTOOM INTERIORS

PROJECT NUMBER 65421267
DATE AUGUST, 2024
SHEET 04-A-5
DRAWING NO. OF 42



DIAGRAMATIC ROOF FRAMING PLAN
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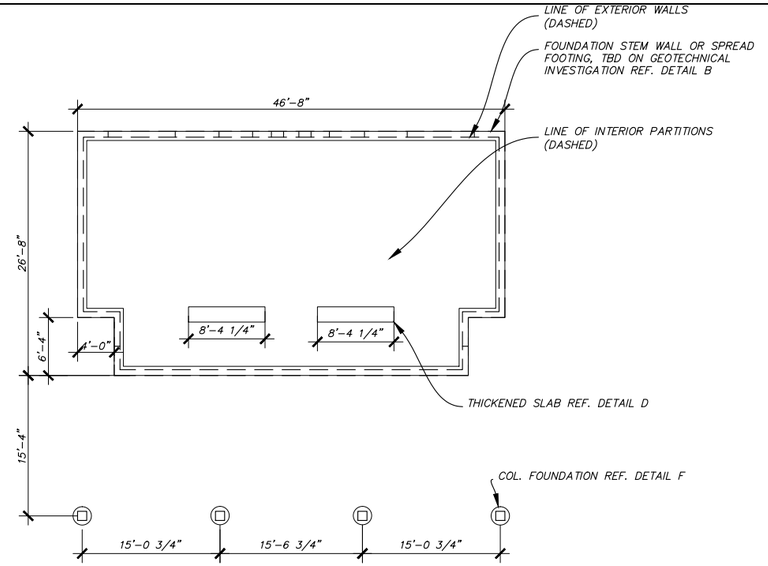

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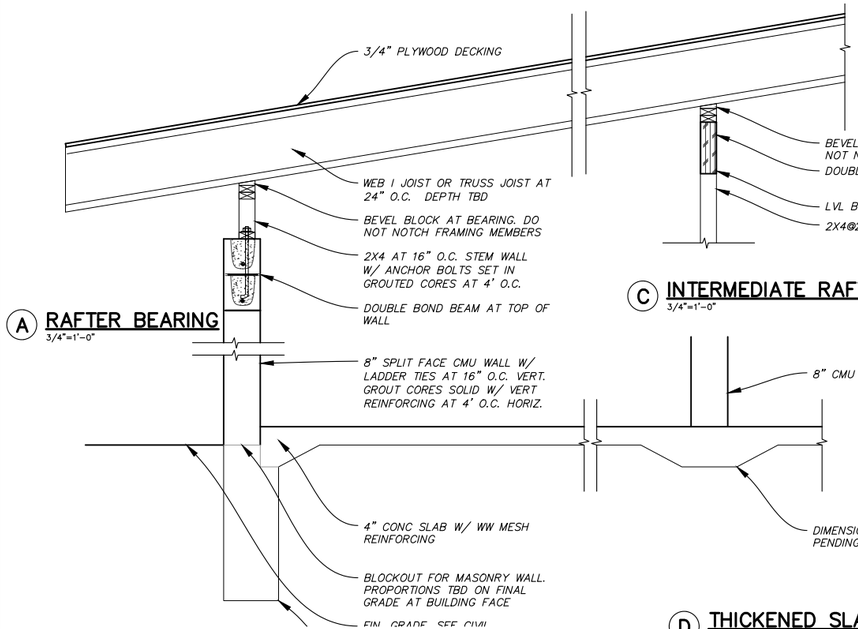

A RAFTER BEARING
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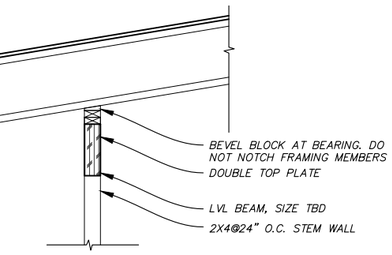
B STEM WALL STRIP FOOTING
3/4"=1'-0"



C INTERMEDIATE RAFTER BEARING
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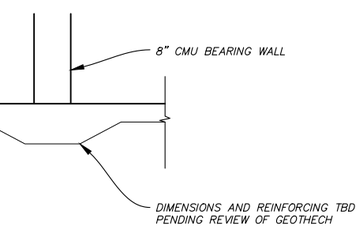

D THICKENED SLAB
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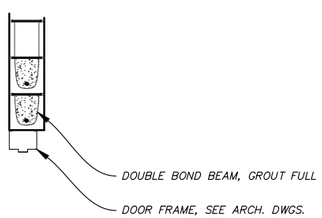

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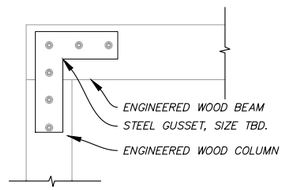

G COLUMN TO BEAM
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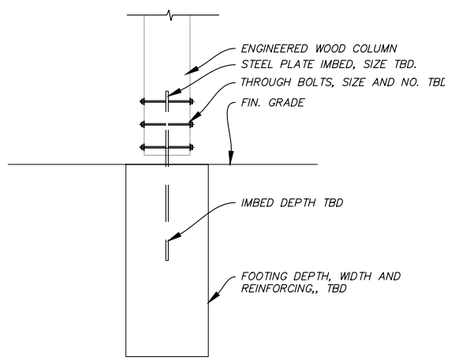

F COLUIMN FOOTING
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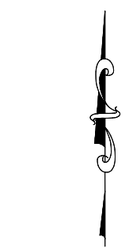

NORTH
8 0 8 16
1/8 inch = 1 foot

SCALE BAR
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0 1
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RIVER DISTRICT
WEST CARROLLTON

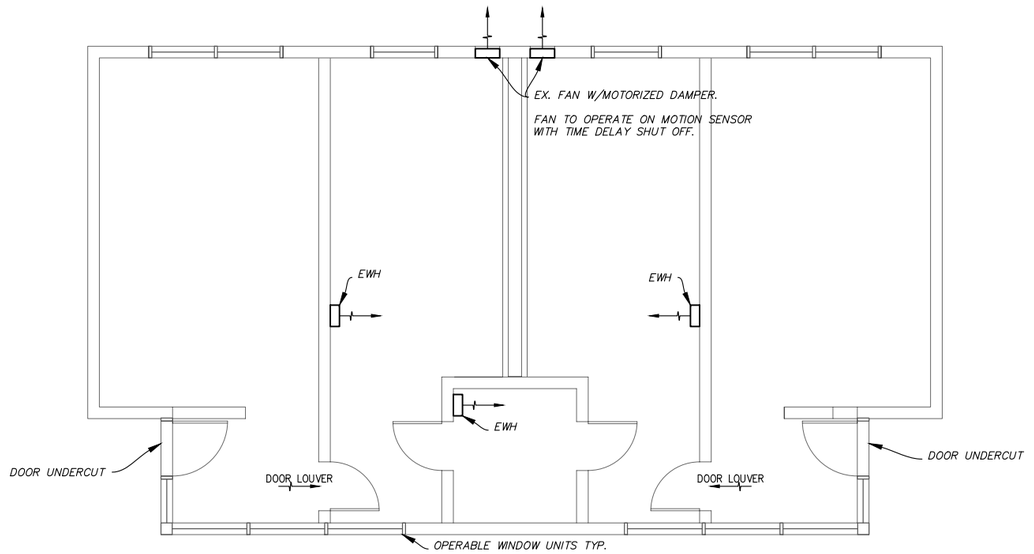
McLAUGHLIN WHITEWATER
2480 W. 26TH AVENUE, UNIT B225, DENVER, COLORADO, 80211
TEL. 303-964-3333
www.merrick.com

PE STAMP
ISSUED FOR REVIEW
FOR AND ON BEHALF OF MERRICK AND COMPANY

DESIGNED BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:

TITLE
WEST CARROLLTON RIVER PARK
FOUNDATION PLAN
FRAMING SCHEMATIC
DETAILS

PROJECT NUMBER 65421267
DATE AUGUST, 2024
SHEET **04-S-1**
DRAWING NO. OF 42



FIRST FLOOR MECHANICAL PLAN

1/4"=1'-0"

NORTH

4 0 4 8

1/4 inch = 1 foot

SCALE BAR
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1
IF NOT ONE INCH ON THIS DRAWING ADJUST SCALES ACCORDINGLY

REV	REVISION DESCRIPTION	DATE	DSGN	CHKD	APPR

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DESIGNED BY:
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TITLE

WEST CARROLLTON RIVER PARK

MECHANICAL PLAN

PROJECT NUMBER
65421267

DATE
AUGUST, 2024

SHEET
06-M-1

DRAWING NO.
OF 42

J O H N A N D E R S O N

A R C H I T E C T L L C

Attachment 2 Code and Zoning Review

August 2024

Zoning

The upland site is zoned LD, limited development. The text of the zoning code is attached in Appendix 1. Generally the LD zone, due to the possibility of flooding limits buildings in order to not raise flood elevations at surrounding properties. The zone is not appropriate for intense development, but accessory buildings are allowed subject to review of MCD for flood impacts. Communications with the City[1] indicate that vertical construction should be limited in the spirit of the law. The master plan for the site includes restrooms (the subject of this memo); [2]outfitter support buildings—bike and boat storage, maintenance building; and support for the campground—bath and shower house.

Flooding

The majority of the 27 acre project area lies within Zone X in the most recent FIRM map FEMA (Figure 1). FEMA Zone X is defined as area of 0.2% annual flood; areas of 1% annual chance of flood with average depths less than one foot depth….and areas protected by levees from 1% annual chance of flood. The tentative site for the building is shown on a yellow star on the figure: it within the FEMA Zone X and close to the Great Miami River Trail.

However, the closest location to the whitewater park is 100 yards further east at the intersection of Hydraulic Road and the access road to the park where flood elevations are established at 716. The ground surface is approximately 714. Should the building be sited here, the floor would have to be raised above the base flood elevation or accept intermittent flooding.

[1] Mike Lucking personal communication March 9, 2023

[2] Tim Hobgood, City of West Carrollton Planning and Community Development, personal communication 937 689 5680 - 3/10/23

Figure 1 Part of Firm panel 0242 E. The yellow star indicates the location for the restrooms that is closest to the Great Miami River Recreation Trail, and the whitewater park, yet is out of the Zone AE hazard area.

Building Codes

Effective Codes

This link to the City of West Carrollton provides the latest codes in effect: https://www.westcarrollton.org/wp-content/uploads/2024/02/2024-Ohio-Building-Code-Rules-Effective-March-1-2024.pdf

The Ohio Building Code (OBC) follows the International Building Code (IBC) 2021 with amendments. The scope of this review of the OBC is for general building planning, height, area and construction classification. Other referenced codes such as Accessibility were reviewed for general provisions.

General Building Description

The proposed restroom building is to serve the whitewater park and the riverine trail system. The building is one story in height and has changing rooms, toilet rooms, a custodial closet and a covered porch. Buildings of this nature are typically 1,500 to 2,000 square feet, one story in height, having masonry walls and interior partitions, and a wood framed roof. The modest size is within the height and area limits for even the least restrictive construction classification (wood frame). For durability and lower maintenance, however, we propose masonry construction. Masonry construction would normally allow a tabular increase in height and area, but such increases are not required.

Later phases in the upland development will include outfitter administrative building, maintenance building, a store and service buildings for a campground.

General Code Requirements for Restroom Building

	Proposed	Allowable/Required	Ohio Modifications
Use Group	U - Utility and Miscellaneous.	NA	None
Construction Classification	Type V-B unprotected, no fire suppression	NA	None
Area (Building)	2,186 sf. including covered exterior porch (1,102 sf interior space)	9,000 sf, (table 506.2)	None
Area (Zoning)	1,194 sf		
Height	1 story, 15 feet	2 story, 40 feet	None
Height and Area modifications	None Proposed	Allowed for one story height and frontage	
Number of exits provided	One each bathroom or other space	One each	None
Occupant load (interior rooms only)	22 Table 1004.1 Locker rooms: 1/50 sf.		None
Fire-resistance rating for building elements	Zero: primary structural frame, all bearing and non-bearing walls, floor construction, roof construction	Zero (table 601)	None
Fire separation distance	>30 feet	NA	

Energy Code

The building will to have seasonal heat in the toilet rooms to prevent pipes freezing. This is considered to be a low energy consumption building is therefore not subject to the energy code.[34]

[3] Tim Hobgood, City of West Carrollton Planning and Community Development, personal communication.

[4] At the time of this report, Mr. Hobgood has retired. This issue should be revisited prior to permit submission.

Proposed Toilet Fixture Count

The fixture count below derives from the general building program and comparable facilities (see preliminary design report.)

West Carrollton Adventure Park						
	Lavoratory	Toilet	Urinals	Showers	Drinking Fountain	Service Sink
Men	2	1	2	0		
Women	2	3		0		
						1
Exterior				1	1	
Total	4	4	2	1	1	1

APPENDIX 1

Zoning Regulations for zone LD, Limited Development

L-D LIMITED DEVELOPMENT DISTRICT

§ 154.10.001 L-D LIMITED DEVELOPMENT DISTRICT.

The purpose of the Limited Development District is:

(A) To protect storm water channels so that they will be able to carry abnormal flows of water in time of high water and flooding;

(B) To designate areas which are not suitable for intensive community development due to flooding by preventing the encroachment into these areas by uses, buildings, and structures which will materially obstruct the flow of water, thereby increasing the magnitude of flooding;

(C) To preserve from development areas that will be needed for expansion and improvement of groundwater drainage; and

(D) To prevent the loss of life and excessive property damage.

HISTORY: (Formerly § 154.159; Ord. 2306, passed 2-23-82)

§ 154.10.002 PRINCIPAL PERMITTED USES.

Provided that no principal building or structure is located in an area subject to flooding in such a way as to materially obstruct the flow of water as determined by the Miami Conservancy District, the following uses are permitted in this district:

(A) Accessory building and structures as regulated by § 154.16.01.

(B) Accessory uses as regulated by § 154.16.01.

(C) Dwelling – Expansion of residential dwellings constructed prior to September 27, 1988 to an extent not exceeding 50% of the market value of the principal structure before the expansion is started.

(D) Farming and agricultural production, and related farm uses.

(E) Parking, On-site.

(F) Parkland – Community parkland and public open space.

(G) Recreation – River-related recreational uses such as boat livery, boat rentals, and other such similar nature uses.

(H) Recreation – Private, noncommercial areas and facilities.

HISTORY: (Newly proposed; Formerly § 154.160)

§ 154.10.003 CONDITIONALLY PERMITTED USES.

Provided that no principal building or structure is located in an area subject to flooding in such a way as to materially obstruct the flow of water as determined by the Miami Conservancy District, and the general conditions and supplemental requirements in this Chapter, the following uses are conditionally permitted in this district:

(A) Contractor office

(B) Contractor shop

(C) Contractor storage yard

(D) Parking, Commercial.

(E) Parking, Shared.

(F) Public utility substation and transmission facilities.

(G) Resource and mineral extractions.

(H) Wireless telecommunications facility.

(I) New dwellings, provided they are not located in the Special Flood Hazard Area as indicated on the FEMA Flood Rate Insurance Maps for Montgomery County, Ohio.

(Ord. 3309. Passed 11-8-05; Ord. 3592. Passed 10-11-16.)

West Carrollton River Park

Changing/Restroom Building

Part II

11/28/2023

Presented to: City of West Carrollton

5970 Greenwood Plaza Blvd. Greenwood Village, CO 80111

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1

Road Map

Part I ~ Scope and Basic Direction (complete September 2023)

Part II ~ Basic Plan Types and Function (now)

Part III ~ Alternative Exterior Looks (December 2023)

Part IV ~ Final Concept (early 2024)

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2

Alternative Approach 1 ~ Super Minimalist

Siloam Springs AK

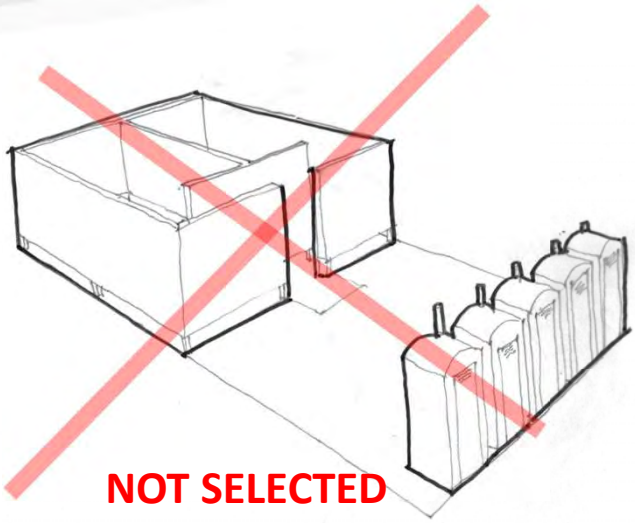
$

Open air structure

Seasonal porta pots

No electricity

Sites within 5 year or less floodplain



NOT SELECTED

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3

Alternative Approach 2 ~ No running water

$$

Naturally ventilated structure

Natural lighting

No heat

Waterless vault toilets -vented

Minimal electricity

Sites within 5 year or greater floodplain

NOT SELECTED

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4

Alternative Approach 3
Middle of the Road

$$$

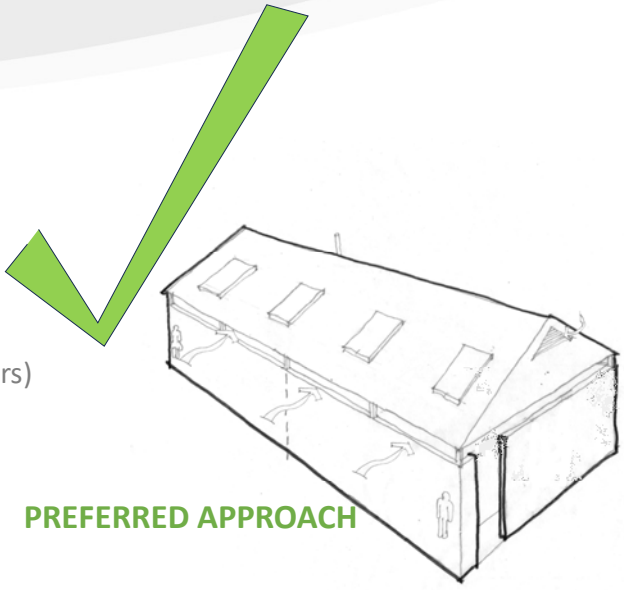
Naturally ventilated structure

Natural lighting

Seasonal heat

Full plumbing – sinks and toilets (no showers)

Sites within 50 year or greater floodplain



PREFERRED APPROACH

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Alternative Approach 4 ~ Maximalist

$$$$$

Mechanically ventilated structure

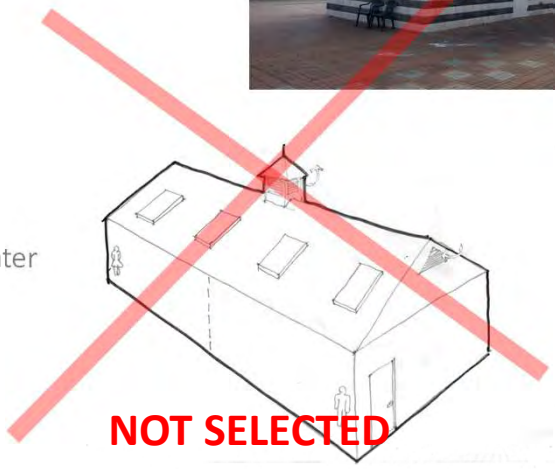
Natural lighting

Four season with heat

Full plumbing – sinks and toilets, hot water

Fully insulated building envelope

Sites outside 100 year floodplain



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PRINCIPALS

COVERED OUTSIDE SPACE, SHADE

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PRINCIPALS

Natural Ventilation

Natural Light

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PRINCIPALS
Security

- LOCKABLE AFTER HOURS
- DAMAGE RESISTANT EXTERIOR
- SIMPLE BUT ATTRACTIVE INTERIOR FINISHES

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9

Principals (Plan)
Customer Flow

- Avoid crossing paths (turbulence)
- Provide good eddies
- Good wayfinding

Zoned Heating and Ventilation

- Natural ventilation wherever possible
- Supplemental mechanical ventilation as needed
- Heating at restrooms only

Low Maintenance

- Hard, impervious interior finishes
- Durable exterior finishes

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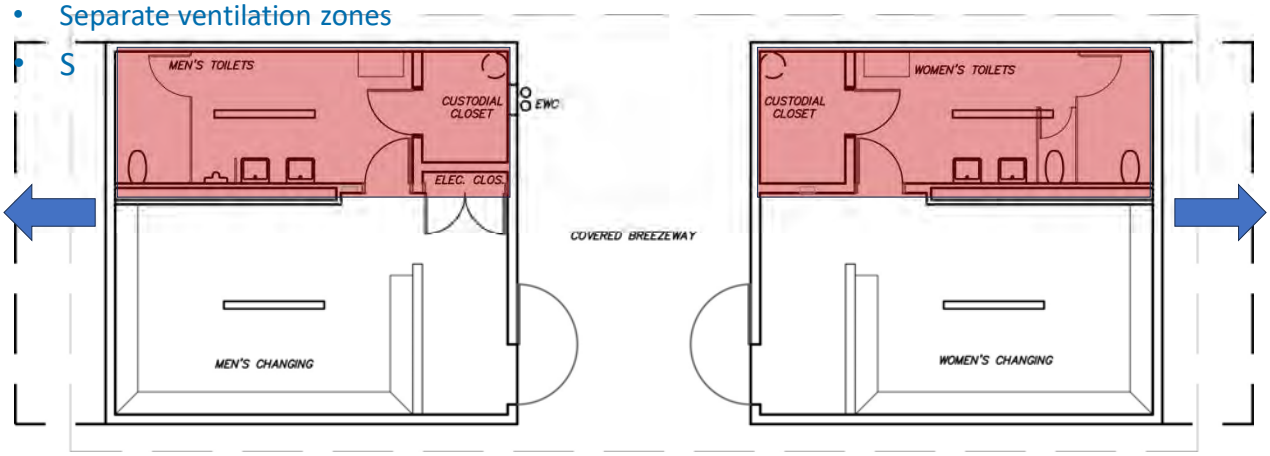
10

Plan Alternative 1
Separate Buildings with Breezeway

- Combined restroom and changing
- Separate heating zones
- Separate ventilation zones
- S



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Plan Alternative 1
Separate Buildings with Breezeway

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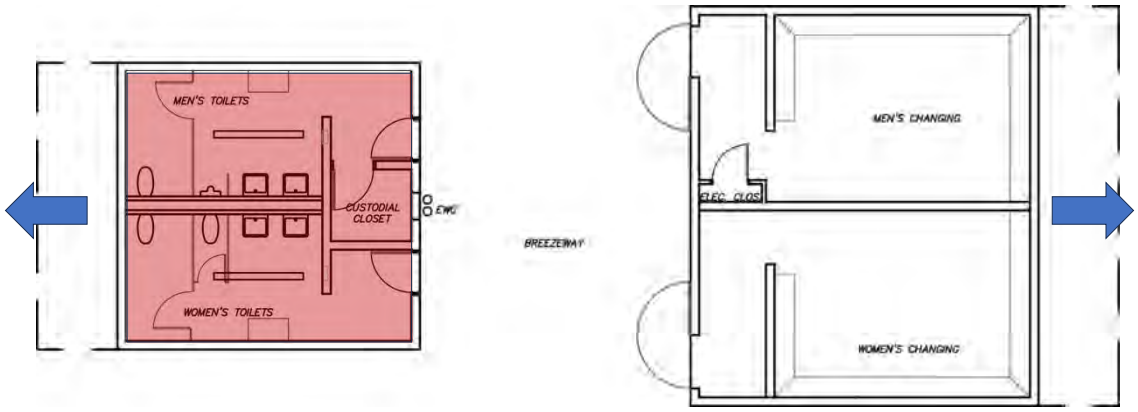
Plan Alternative 2
Separate Buildings

- Optimized for natural ventilation
- Zoned according to space heating/ventilation needs



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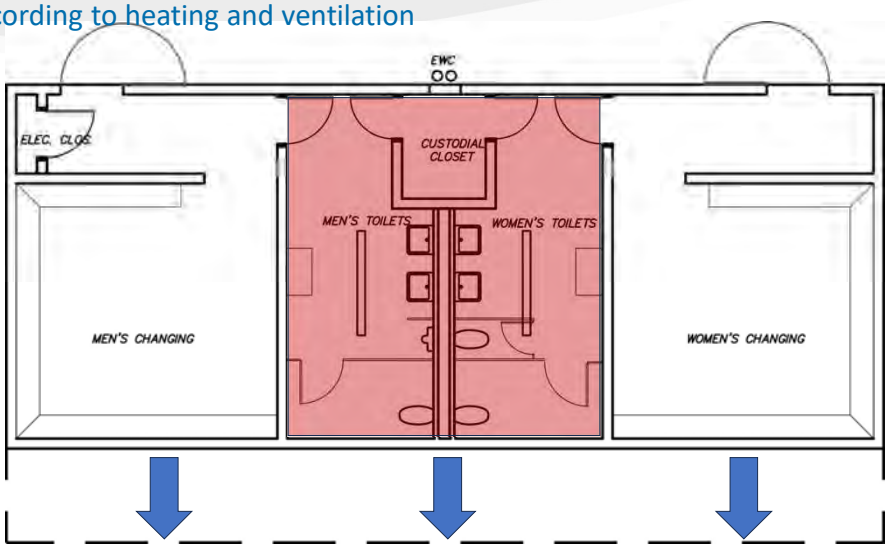
Plan Alternative 3
One Building

- Zoned according to heating and ventilation



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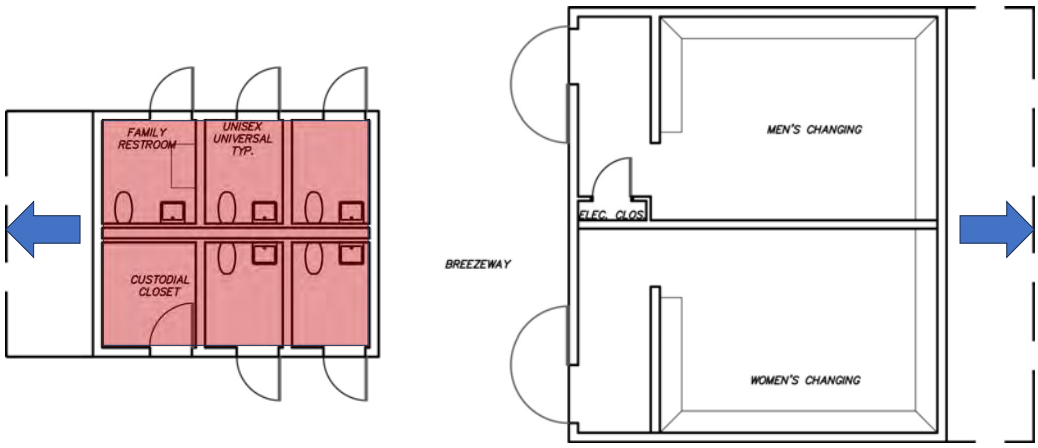
Plan Alternative 4
Individual-Universal Access



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Plan Alternative 4
Individual-Universal Access

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Design of Commercial District

Brick/Precast Concrete

Storefront Glass/Awnings

Gable Roof/Flat Roof

Pedimented Fronts

AERIAL RENDERING

REV. #1
JUNE, 2022

Dillin

WARREN PENINSULA

Paresi

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17

Design of Commercial District

Brick/Precast Concrete

Storefront Glass/Awnings

Gable Roof/Flat Roof

Pedimented Fronts

WARREN PENINSULA

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18

What is our mission?

MEET US AT the River

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Environmental Adds

SOLAR

RAIN GARDEN

GREEN ROOF

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West Carrollton River Park

Architectural Exteriors

1/31/2024

Presented to: Client

5970 Greenwood Plaza Blvd. Greenwood Village, CO 80111

McLAUGHLIN WHITEWATER

1

Design of Commercial District

Brick/Precast Concrete

Storefront Glass/Awnings

Gable Roof/Flat Roof

Pedimented Fronts

WARREN PENINSULA

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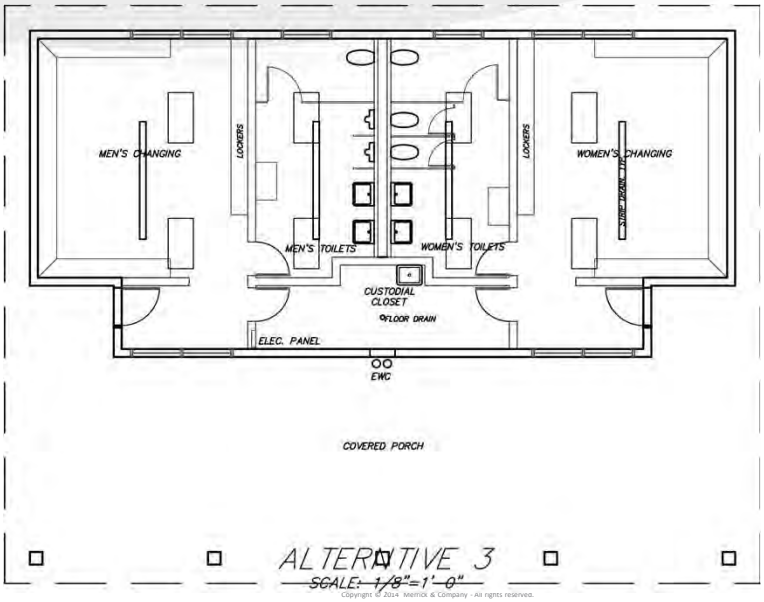
Current Preferred Plan



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Columbus Botanical Garden

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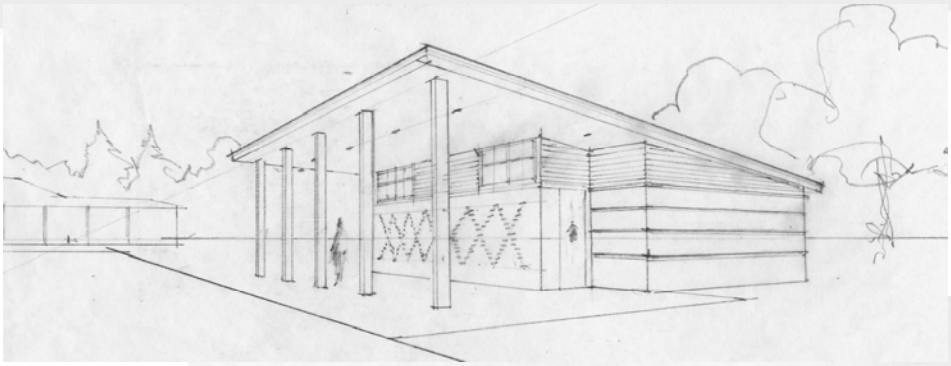
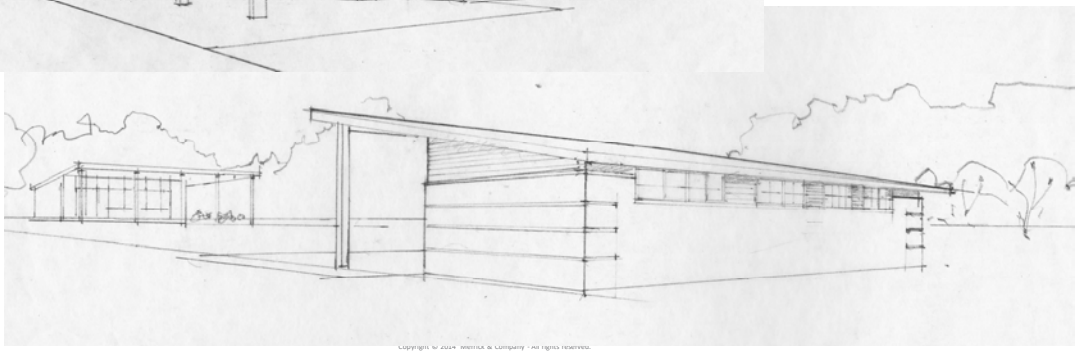
Exterior Alternative 1





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"A Day at the Beach"

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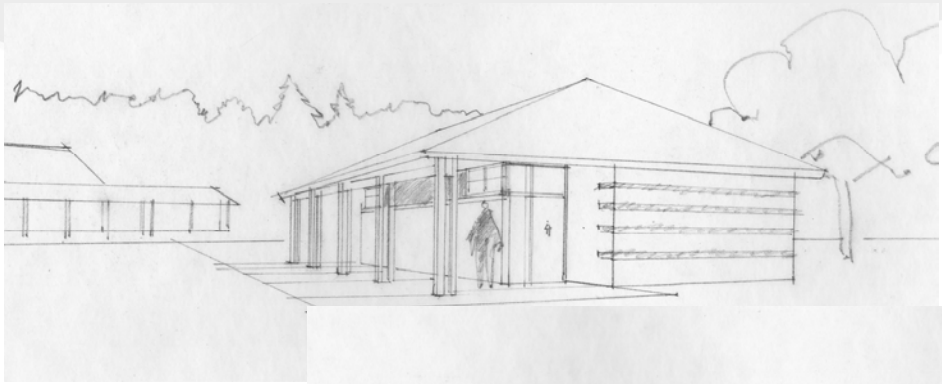
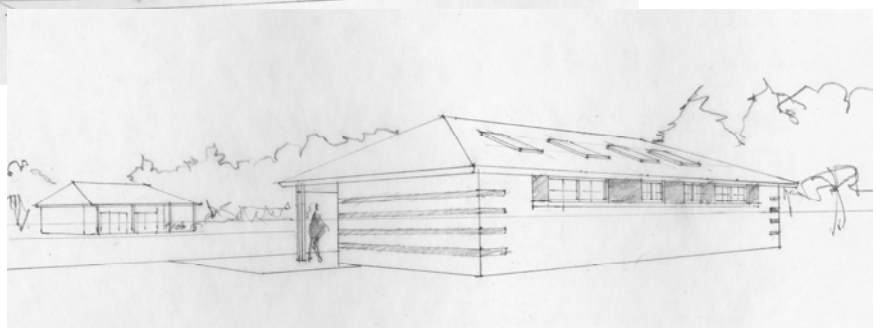
Exterior Alternative 2





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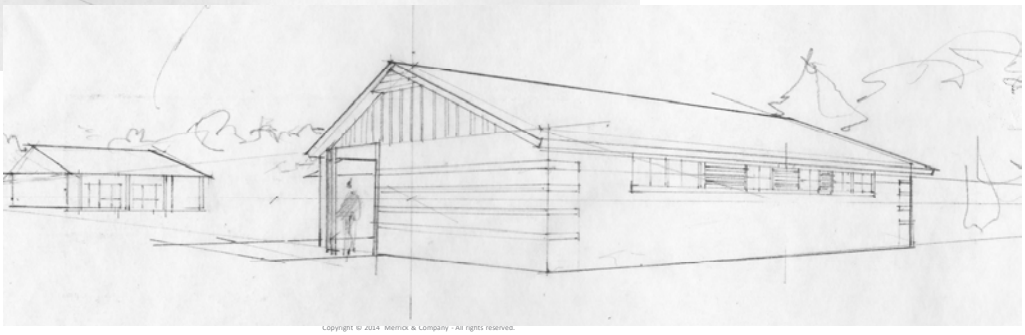
Exterior Alternative 2A



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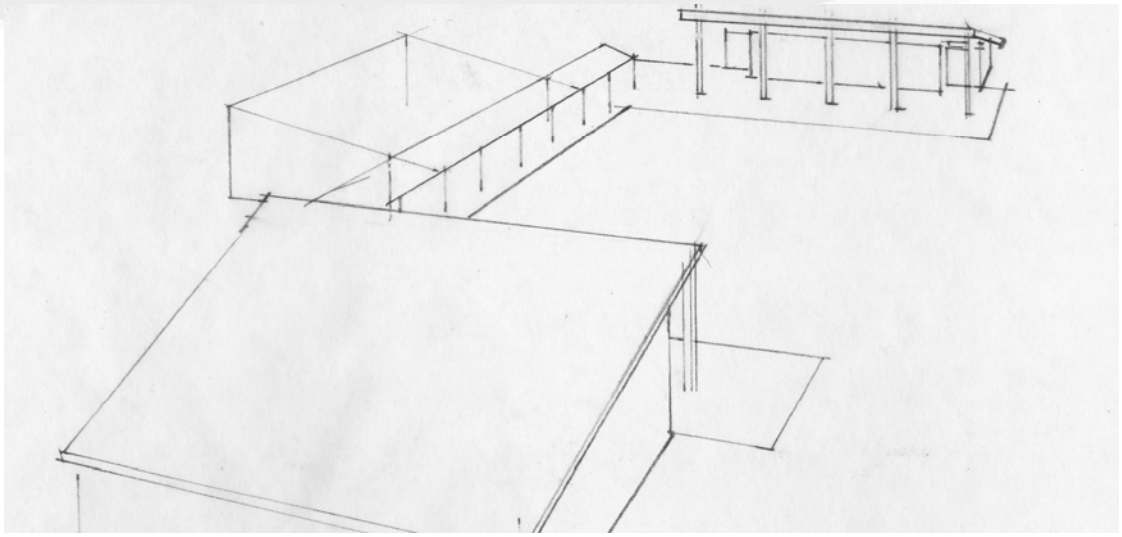
Building ensemble



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9

West Carrollton River Park

Architectural Exteriors

6/18/2024

Presented to: Client

5970 Greenwood Plaza Blvd. Greenwood Village, CO 80111

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1

Design of Commercial District

Brick/Precast Concrete

Storefront Glass/Awnings

Gable Roof/Flat Roof

Pedimented Fronts

WARREN PENINSULA

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Franklin Park Conservatory and Botanical Gardens, Columbus

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WOKA Park, Watts, Oklahoma

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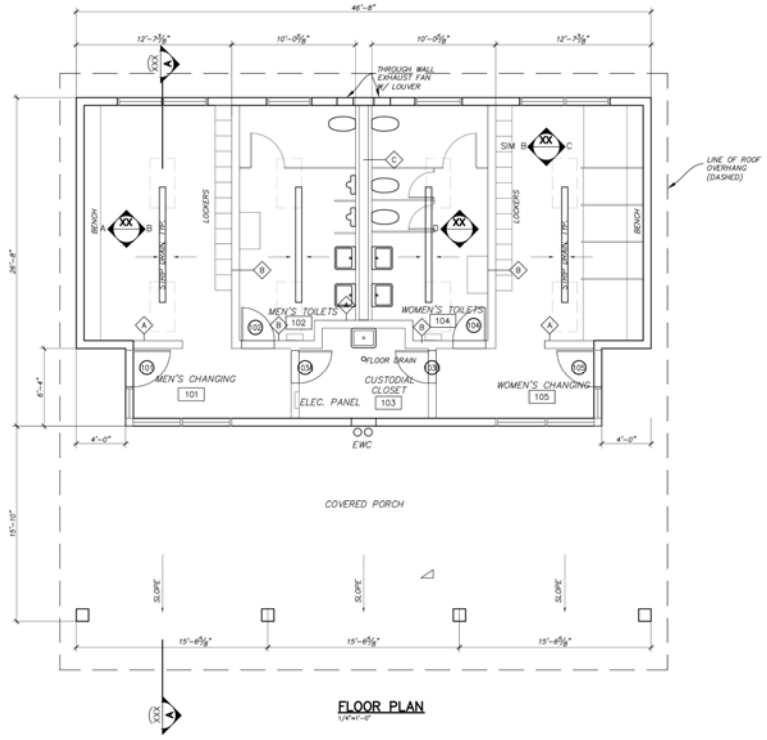
Current Plan

1102 sf enclosed

2186 sf under roof



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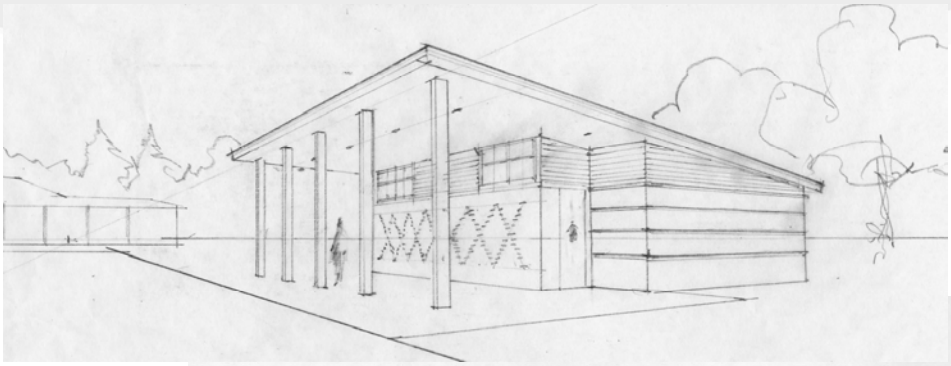
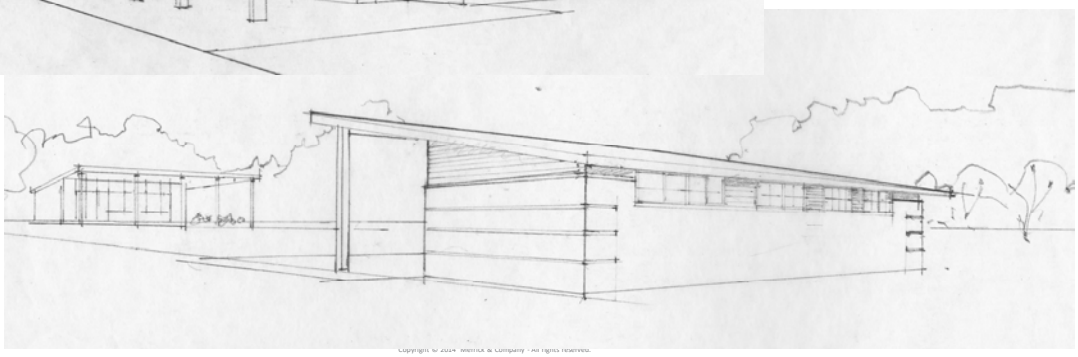
Exterior Alternative 1 is Preferred





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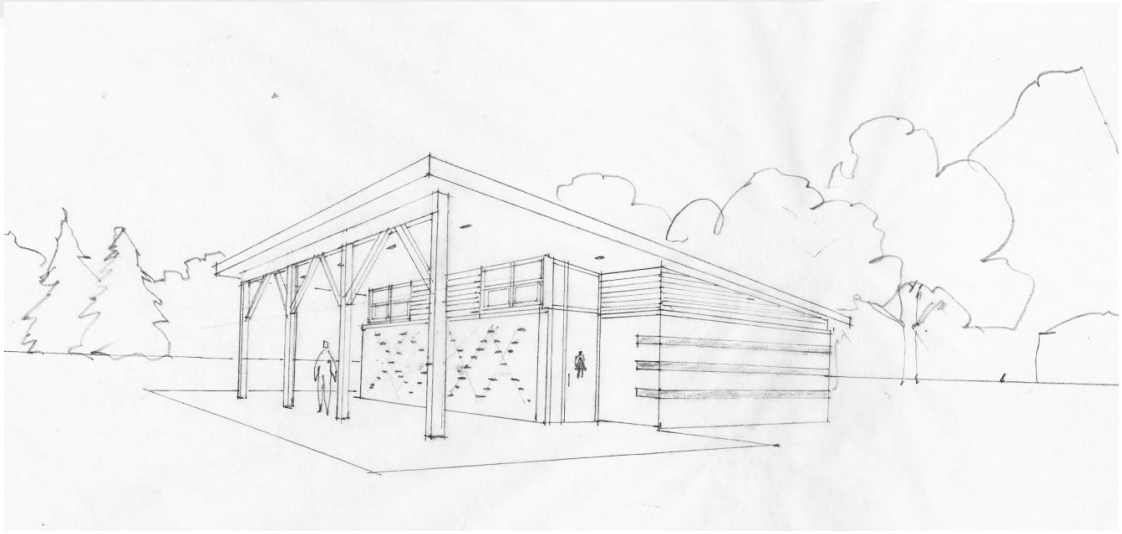
6

Proposed Exterior



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Proposed Exterior

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Attachment 4
Outline Specification for Changing / Restroom Building
West Carrollton River Park
August 2024

The scope of project is an approximate 1,100 square-foot partly conditioned building containing restrooms, changing rooms and a 1,084 square foot covered porch. The building is masonry walls on a slab on grade with a conventional wood-framed roof with glue laminated timber beams and columns. It has provisions for natural lighting and ventilation. There is seasonal space conditioning, a janitor's closet and electrical service.

Division 2 Sitework
Rough grading, grubbing and clearing, stripping and stockpile topsoil and site utilities per site work package by McLaughlin Whitewater.

Division 3 Concrete
Building slabs on grade: conc. with 6x6 ww mesh. Slabs to have light broomed finish for slip resistance and sealed with concrete sealer.

Slabs under building to have 6" gravel drainage course and 6 mil poly vapor barrier.

Concrete stem walls: Design TBD on review of geothechnical recommendations. Concept design is for formed wall with block out along slab perimeter for masonry wall.

Foundation drainage: 4" deep layer rounded river rock over French drain trench filled with gravel over filter fabric. 4" perforated PVC pipe to daylight.

Foundation damp proofing-see div. 7

Sidewalks, see Civil and Landscape Drawings

Division 4 Masonry
Exterior walls: 8" split-face concrete masonry units (CMU) running bond. Two contrasting colors and two colors of mortar.

Interior partitions: 8" standard lightweight CMU. Use 4" CMU at interior plumbing chase walls as shown on plans. Running bond, typical.

Joints: tooled, concave.

Lintels: grout-filled CMU bond beams with (2) no 5 bars

Thru-wall flashing: flexible asphalt impregnated fiberglass. Provide weep holes at 24" o.c. horizontally

Wall reinforcement:

DRAFT

1. Duro-wall ladder type reinforcement at 16” o.c. vertically
2. Double bond beam at top of exterior walls and interior bearing partitions
3. Vertical reinforcing at 48” on center with grouted cores. Align sill plate anchor bolts at grouted cores

Division 5 Metals

1. Miscellaneous Metals: Steel gussets and fasteners for timber framing.

Division 6 Carpentry

1. Rough framing:
    a. Top plates: 2x pressure treated No 2 lumber, 18” anchor bolts at 48” o.c. aligned with grouted cores of CMU bearing walls.
    b. Interior partitions: 2x4 studs at 16” o.c.
    c. Exterior siding: Western red cedar lap siding and corner trim.
    d. Alternate siding: Fiber-reinforced cement horizontal lap siding and corner trim
2. Finish carpentry:
    a. Lumber: No. 1 pine or paint grade poplar.
    b. Beaded horizontal paneling per Drawings.
    c. Inside corners. Nominal 1x1 solid wood strip
    d. Outside corners 1x1 outside corner molding.

Division 7 Thermal and Moisture Protection

1. Roofing: Single ply PVC membrane roof with all related accessories, fasteners and trim. White reflective color.
2. Foundation damp-proofing: bituminous coating applied to cured concrete.
3. Thermal Insulation: R-38 batt insulation at toilet room and custodial closet ceilings only.
4. Unit Skylights
    a. Curb mounted, self-counter flashing with standard double, heat reflective glazing.
    b. Nominal 24”x48” size by Velux or equal.

Division 8 Doors and Windows

1. Interior Doors: Hollow metal, honeycomb core, with face sheets of commercial quality hot dipped zinc coated steel that complies with ASTM A924 A60
2. Interior Door Frames: Hot dipped zinc coated steel that complies with ASTM designations A924 A60, with masonry wall anchors, primed finish.
3. Aluminum Storefront with Operable Windows:
    a. 2 inch by 4.5” nominal size framing, front glazed.
    b. Frosted, heat reflective double glazed throughout.
    c. Integral operable awning units with insect screens
    d. Clear anodized aluminum finish or as selected in final design

Division 9 Finishes

Gypsum board, ½” exterior grade, joints taped finished. Finish level 1 where concealed by paneling
Painting schedule:

1. Gypsum board: akyd primer, two coats exterior latex semi-gloss.
2. Interior masonry: masonry block sealer/filler, two coats two-part epoxy paint
3. Metal doors and misc. metals. Factory primer. Two coats alkyd exterior matt enamel.

DRAFT

4. Exterior siding, woodwork and timbers: two coats Benjamen Moore Water Lux semi-transparent oil-based stain.
5. Interior wood paneling.
    a. Fill nail holes, knots and defects with wood putty and sand smooth. Check quality after priming and refill any remaining defects.
    b. Machine sand entire surface with 120 grit paper.
    c. One coat alkyd primer
    d. Two coats interior latex paint, chalk finish.
6. Interior and exterior wood soffits and ceilings: two coats Benjamen Moore Water Lux transparent oil-based stain.
7. Concrete floors: clear concrete sealer

Division 10 Specialties

1. Toilet Partitions:
    a. Floor mounted, overhead braced with all supporting hardware for attaching to abutting walls
    b. 1-1/4" thickness phenolic resin doors, partitions and styles.
    c. Same color and manufacturer as lockers
2. Lockers
    a. Phenolic resin construction
    b. Size: 16" depth, 15" width, assorted heights per drawings
    c. Coin-operated lock with spare keys and master key
3. Toilet Accessories: see Accessory schedule on Drawings
4. Fire extinguishers and cabinets
    a. Size, mounting and location to be compliant with NFPA 10, Portable Fire Extinguishers
        i. Representative products:
            1. Dry chemical extinguisher: Larsen MP series
            2. Cabinet: Larsen SS 2409-5R
        ii. Cabinets shall not be locked but accessible to the public for emergency use
5. Signage
    a. See signage schedule on Drawings

Mechanical and Plumbing

Plumbing

The design is for a seasonal restroom with drain-down for winterizing. Ventilation is a combination of natural ventilation through windows and mechanical power ventilation to achieve satisfactory ventilation rates/requirements for toilet rooms.

a. Plumbing fixtures shown on plan of appropriate quality and function for a public restroom.
b. Flush valve type water closets and urinals. Optional hands-free operation
c. Faucets with water limits (timed) with optional hands-free operation
d. 30 gal. water heater (electric with optional solar assist), located on wall bracket or ceiling hung in custodial closet.
e. Hose bib with system drain-down at each toilet room.
f. Strip floor drains as shown on architectural plan

DRAFT

g. A mop sink
h. Electric water cooler with two spouts, ADA compliant, with water bottle filler, motion activated.

Building is not sprinklered.

Mechanical

a. Electric forced air wall heater, one each toilet room and custodial closet
b. Provide through the wall exhaust fan at each toilet room, occupant sensing with user adjustable timed shut off. Gravity type louvered wall discharge, one each toilet room fan. Door undercut or wall louver at each toilet room for air makeup.

Electrical

a. Underground power feed from main service entrance and switchgear (currently planned at the maintenance building).
b. A 100 A electric panel with key-lock access door.
c. Power distribution to electric wall heaters convenience outlets and lighting
d. Lighting is shown on architectural plans. Interior lights to be occupant activated and when natural lighting falls below set level. Exterior lighting on photo switch.
e. Artificial lighting levels
    a. Restrooms and changing rooms: 20-30 FC
    b. Custodial closet: 30-30 FC
    c. Entry: 10-15 FC
    d. Covered porch 5-10 FC

End of Outline Specification

DRAFT

§ 154.10.004 ACCESSORY USES AND STRUCTURES.

The provisions of § 154.16.01 and other regulations in this Chapter shall apply to the location and maintenance of accessory uses, buildings, and related structures.

'HISTORY: (Formerly § 154.161.1; Ord. 2909, passed 10-5-93; Am. Ord. 3063, passed 9-23-97)

§ 154.10.005 MINIMUM ZONING LOT SIZE.

Regulations concerning minimum lot size are not applicable in this district.

HISTORY: (Formerly § 154.162; Ord. 2306, passed 2-23-82)

§ 154.10.006 MINIMUM FRONTAGE.

Regulations concerning minimum frontage are not applicable in this district.

HISTORY: (Formerly § 154.163; Ord. 2306, passed 2-23-82)

§ 154.10.007 MAXIMUM HEIGHT.

Regulations concerning maximum height are not applicable in this district.

HISTORY: (Formerly § 154.164; Ord. 2306, passed 2-23-82)

§ 154.10.008 MINIMUM YARD REQUIREMENTS.

Regulations concerning minimum yard requirements are not applicable in this district.

HISTORY: (Formerly § 154.165; Ord. 2306, passed 2-23-82)

§ 154.10.009 OFF-STREET PARKING AND LOADING.

Off-street parking or loading shall be provided in accordance with the provisions specified in § 154.12.01.

HISTORY: (Formerly § 154.166; Ord. 2306, passed 2-23-82)

§ 154.10.010 SIGNS.

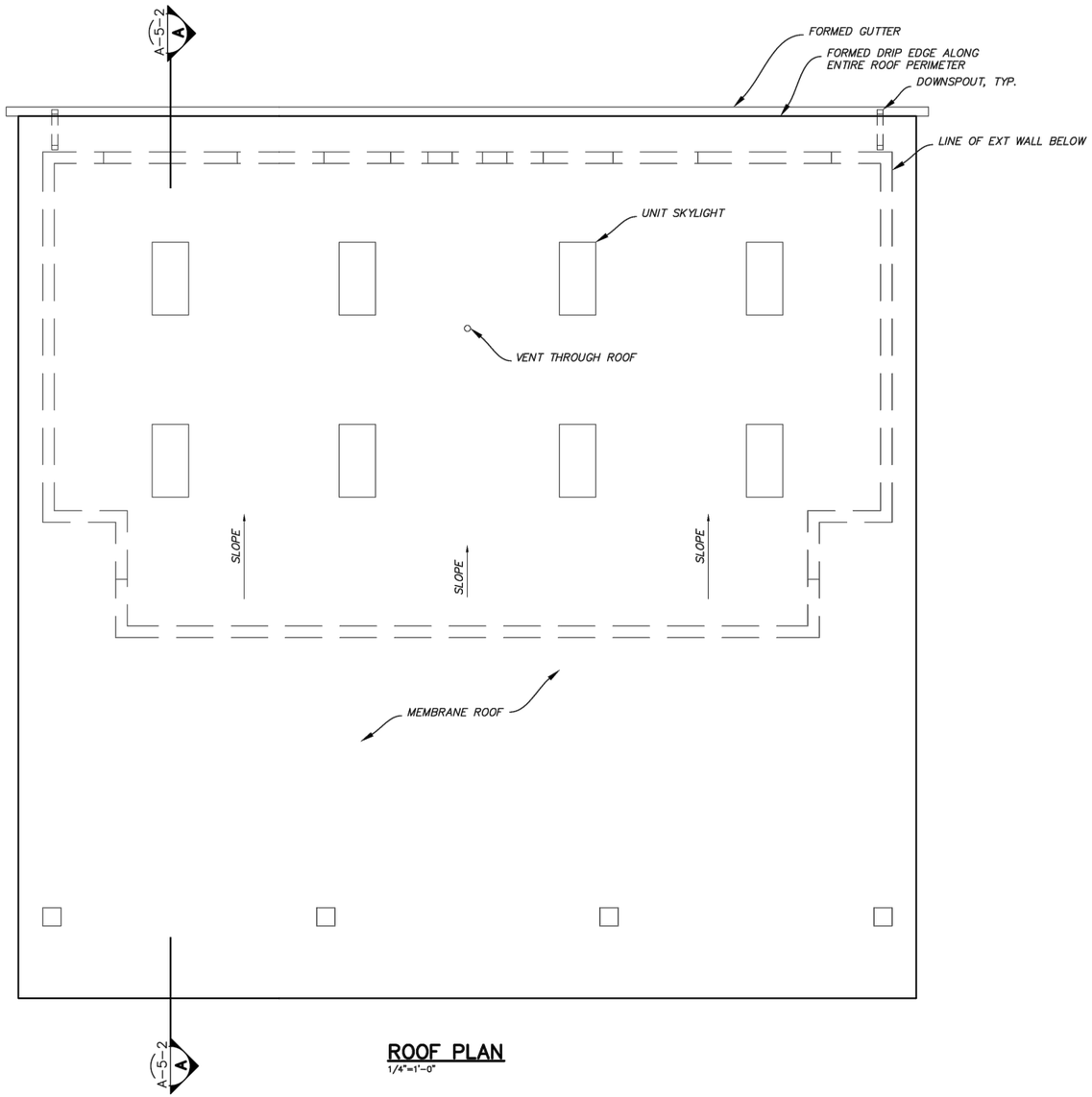
Refer to Chapter 153.

HISTORY: (Formerly § 154.167; Ord. 2306, passed 2-23-82)

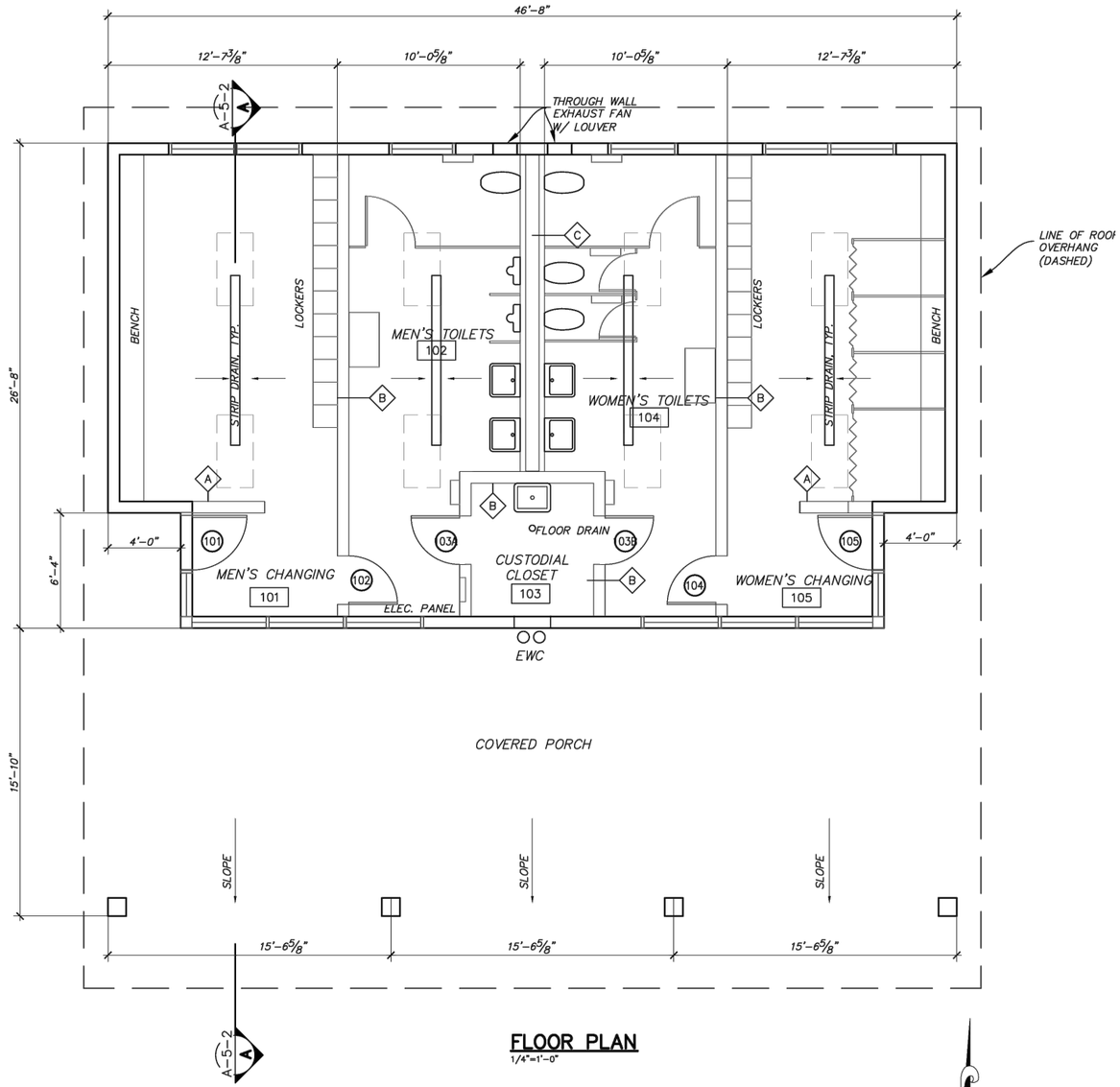
§ 154.10.011 OTHER REGULATIONS.

Refer to Sections 154.11.01 through 154.16.09.

HISTORY: (Formerly § 154.168; Ord. 2306, passed 2-23-82)



ROOF PLAN
1/4"=1'-0"



FLOOR PLAN
1/4"=1'-0"

KEY

- 034 DOOR NUMBER
- 103 ROOM NUMBER
- B PARTITION TYPE

NORTH
4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

FLOOR PLAN
ROOF PLAN

DATE 11/14/2025

DRAWING NO. CR-1

SHEET NO. 42 OF 52

PLOTTED: 11/10/2025 3:18:06 PM
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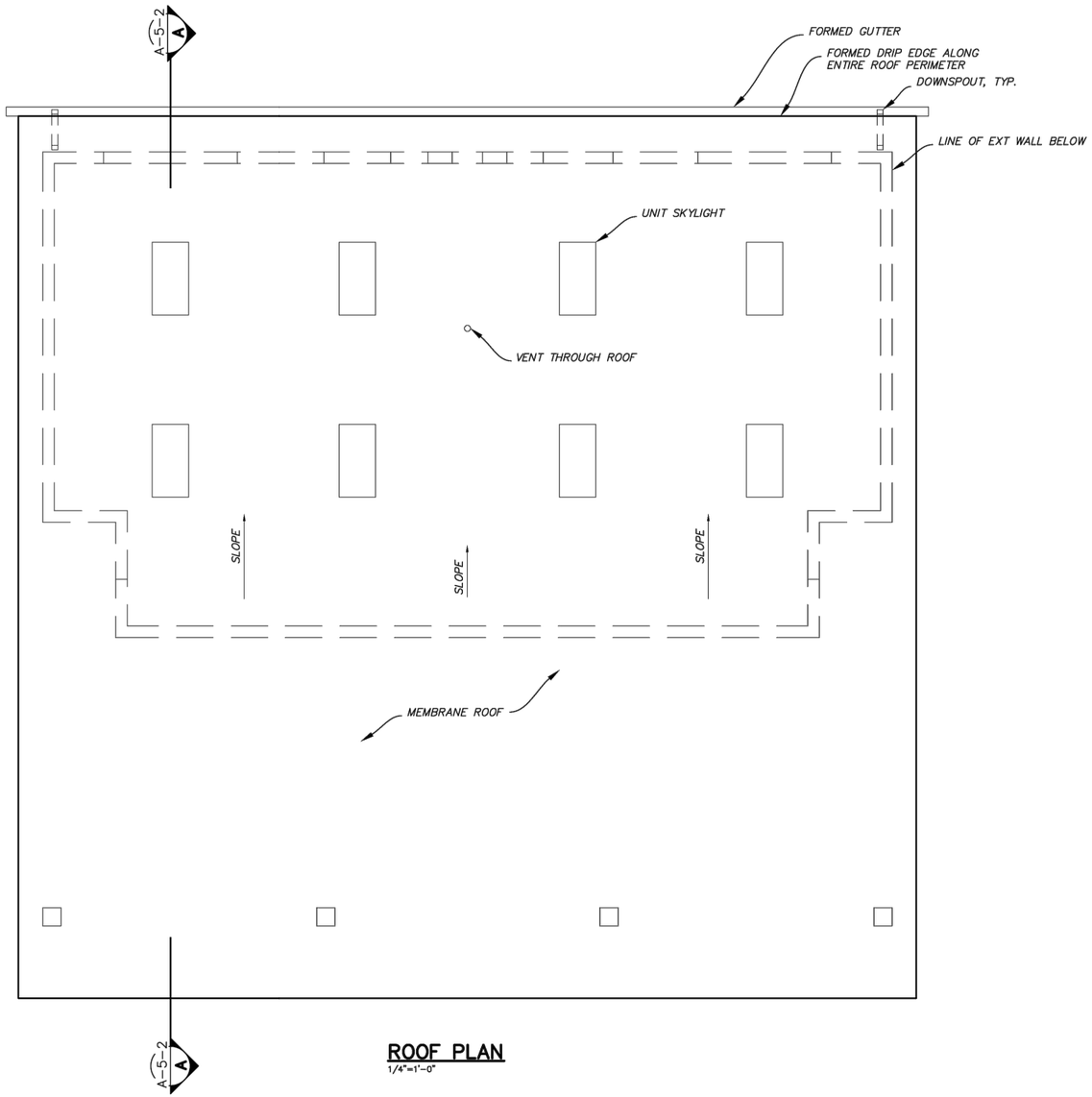
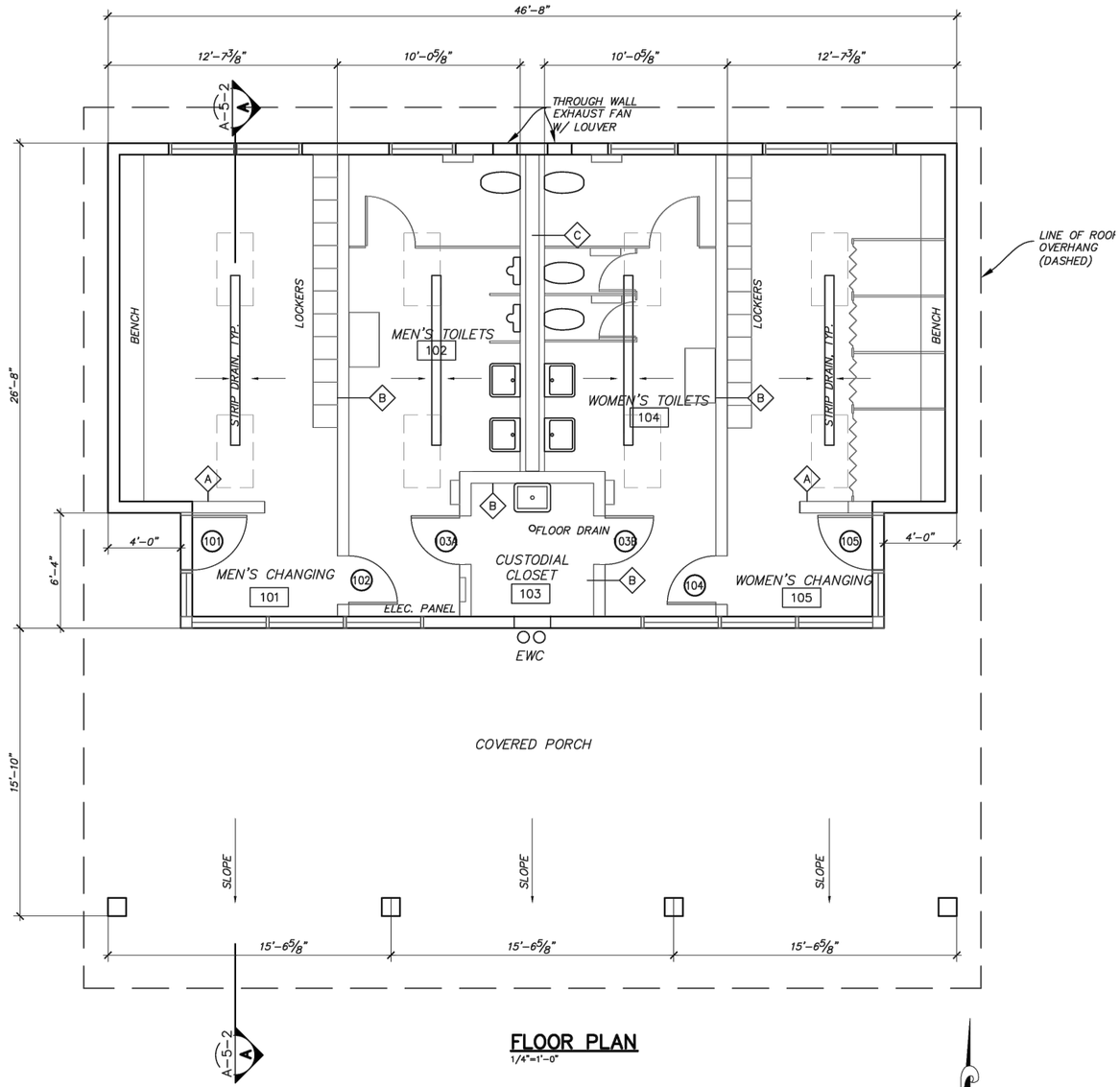


ROOF PLAN
1/4"=1'-0"



FLOOR PLAN
1/4"=1'-0"

KEY

- 034 DOOR NUMBER
- 103 ROOM NUMBER
- B PARTITION TYPE

NORTH
4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

FLOOR PLAN
ROOF PLAN

DATE 11/14/2025

DRAWING NO. CR-1

SHEET NO. 42 OF 52

PLOTTED: 11/10/2025 3:18:06 PM
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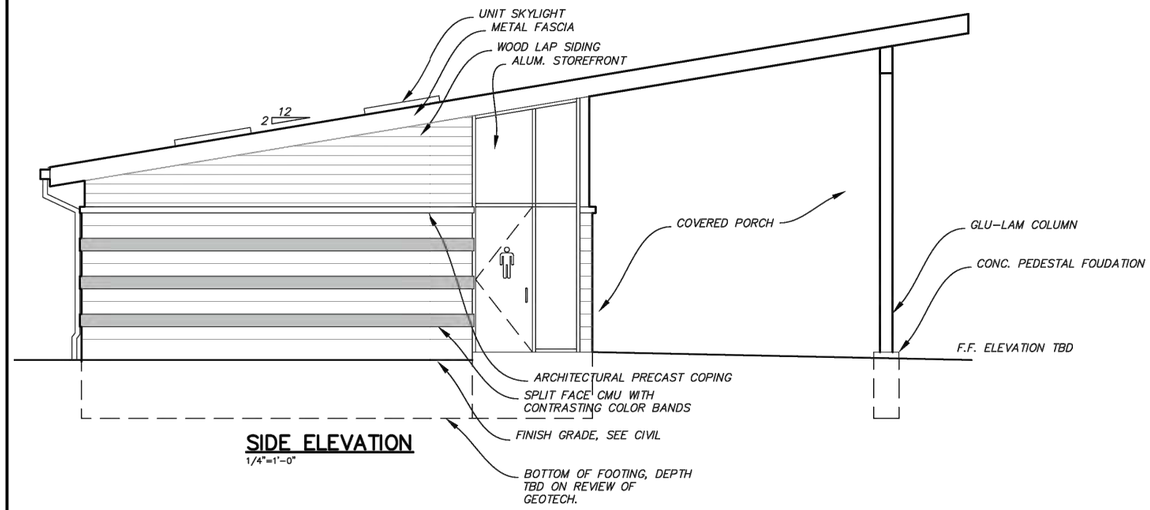
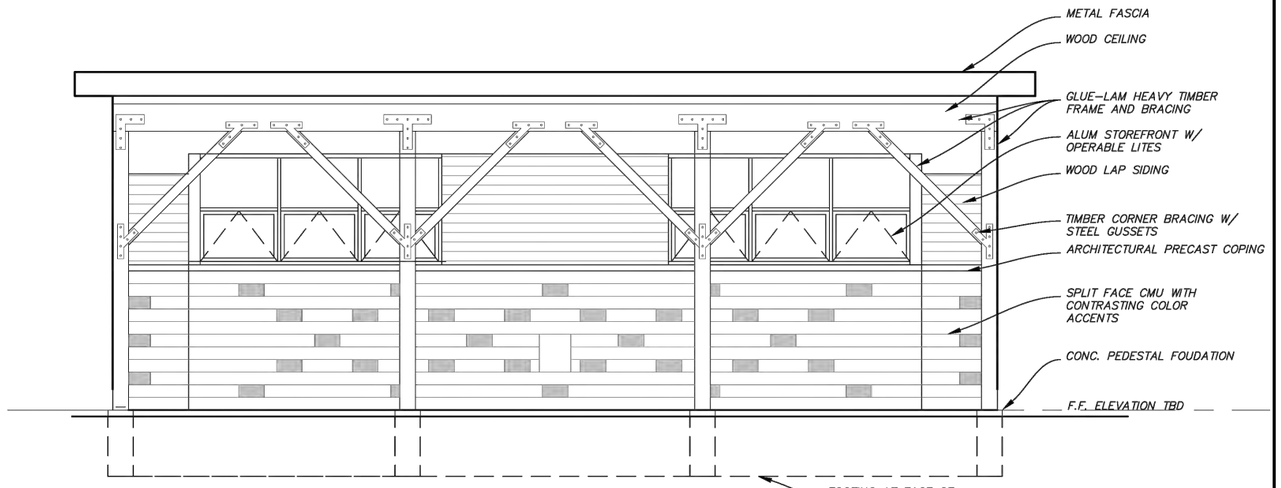
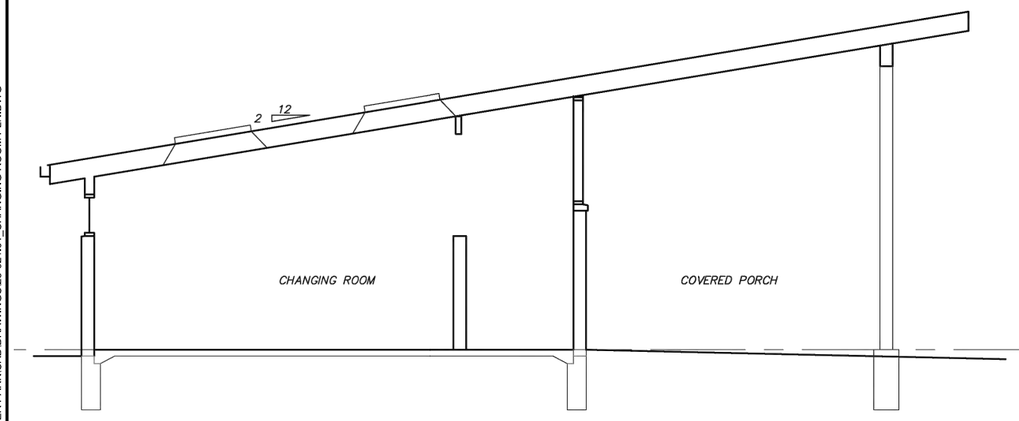


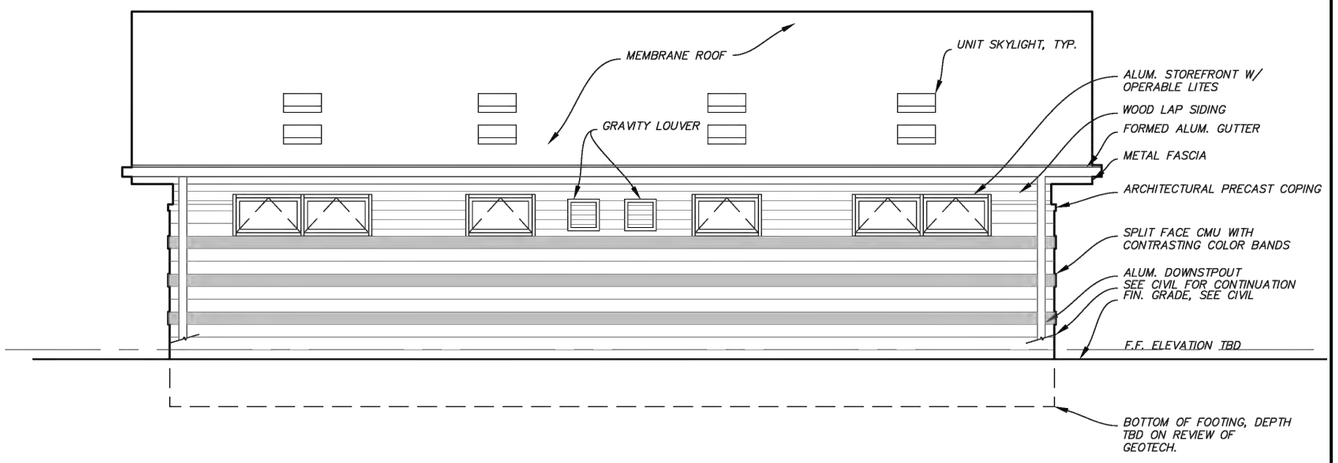
SIDE ELEVATION
1/4"=1'-0"



FRONT ELEVATION
1/4"=1'-0"



SECTION A-A
1/4"=1'-0"



REAR ELEVATION
1/4"=1'-0"

4 0 4 8
1/4 inch = 1 foot

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CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

ELEVATIONS BUILDING SECTION

DATE 11/14/2025

DRAWING NO. CR-2

SHEET NO. 43 OF 52

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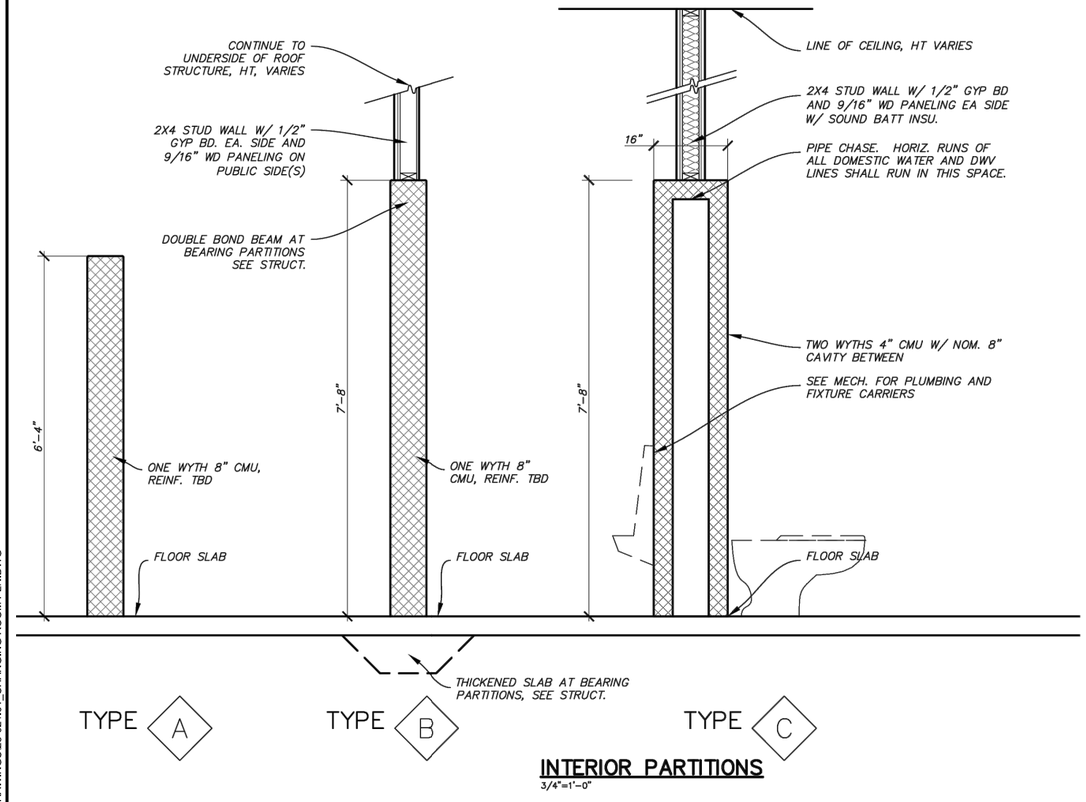


INTERIOR PARTITIONS
3/4"=1'-0"

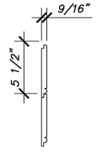
Door Schedule

			Door				Jamb			Hardware	Lock/Latch	Remarks
Mark	From	To	Type	Size	Mat'l.	Rating	Type	Mat'l.	Rating	Group	Function	
101	Exterior	Men's Changing 101	A	3-0x7-8x1-3/4"	Storefront	-		Alum	-		Restroom	Owner's time lock system
102	Men's Changing 101	Men's Toilets 102	C	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Restroom	
103a	Men's Toilet 102	Custodial Closet 103	B	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Store Rm.	
103b	Women's Toilet 105	Custodial Closet 103	B	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Store Rm.	
104	Women's Changing 105	Women's Toilet 104	C	3-0x7-0x1-3/4"	HC Metal	-		HM	-		Restroom	
105	Exterior	Women's Changing 105	A	3-0x7-8x1-3/4"	Storefront	-		Alum	-		Restroom	Owner's time lock system

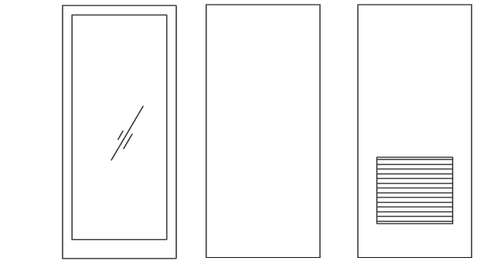
FINISH SCHEDULE

Room/ Area:	RM. No.	Walls				Floor	Ceiling		Base	Remarks:
		North	East	South	West		Ceiling Finish	Ceiling Height		
Men's Changing	101	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		
Men's Toilet	102	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		
Closet	103	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		
Women's Toilet	105	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		
Women's Changing	106	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Epoxy Paint CMU/ Paint Wd Paneling	Paint Concrete Wood, transp. Fin	varies	None		

SCHEDULES



WOOD PANELING DETAIL
3"=1'-0"



DOOR TYPES
NO SCALE

4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

DOOR, PARTITIONS SCHEDULES

DATE 11/14/2025

DRAWING NO. CR-3

SHEET NO. 44 OF 52

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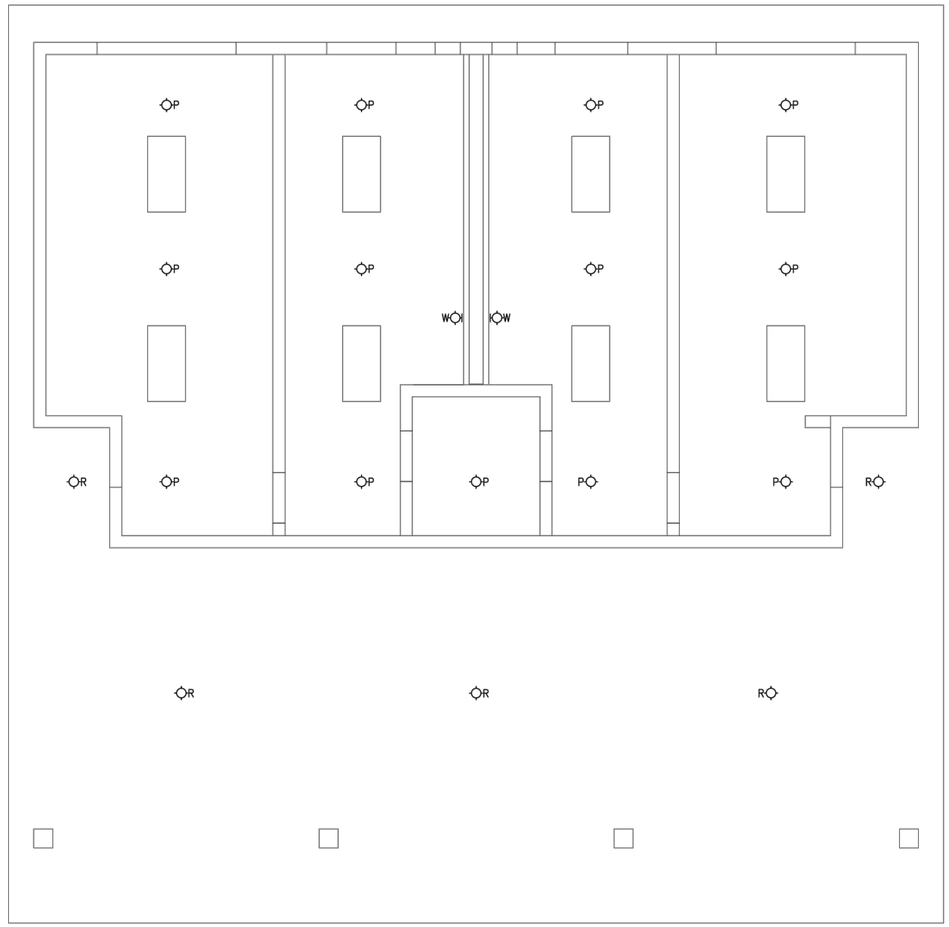
LIGHTING KEY

P PENDANT
W WALL
R RECESSED



FIRST FLOOR REFLECTED CEILING PLAN
1/4"=1'-0"

NORTH
4 0 4 8
1/4 inch = 1 foot

PREPARED UNDER THE SUPERVISION OF

CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

REFLECTED CEILING PLAN

DATE 11/14/2025

DRAWING NO. CR-4

SHEET NO. 45 OF 52

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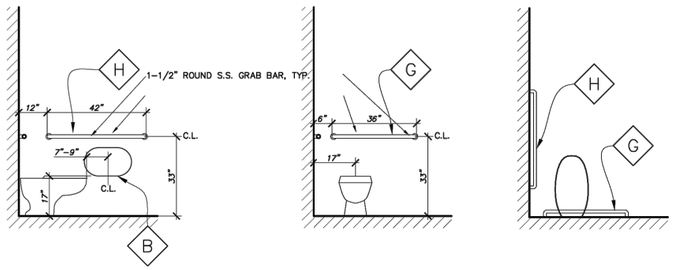
TOILET ACCESSORY SCHEDULE

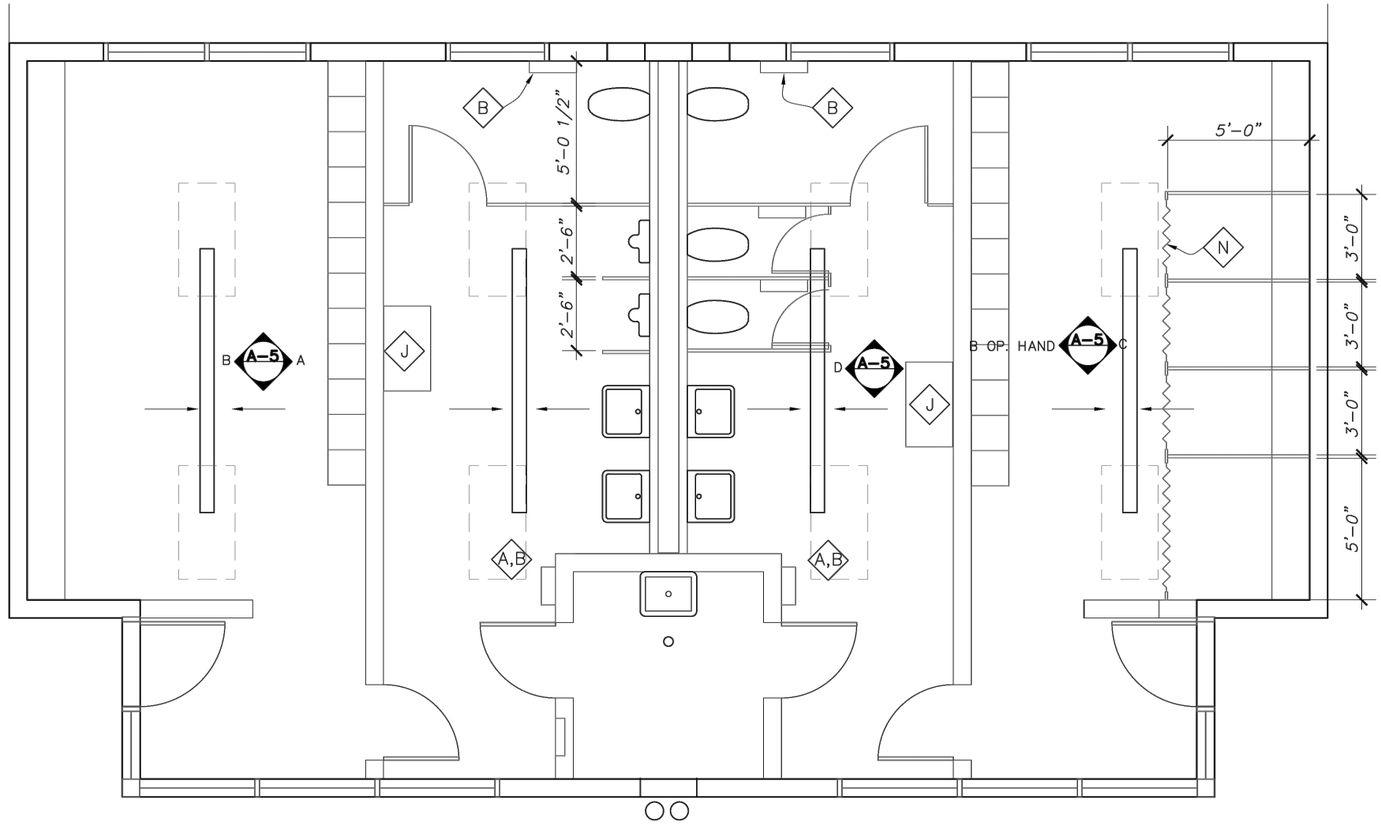
Mark	Item	Representative Manufacturer	Model No.	Mounting Height Above Floor*	Remarks
A	Waste Receptical-surface mount	Bobrick	B277	24" to 36"	to top of rim
B	Dual Toilet Paper Holder	Bradley	5425	20" to bot	Provide one per each toilet stall
C	Touchless Soap Dispenser (lavs)	Rubbermaid	Lumicel	36"	Mount between sinks, see dwgs
D	Fem. Napkin Disposal	Bradley	4781-11	36"	
E	Garment Hook	Bobrick	B 6827	40" ADA, 54" others	One per toilet compartment door
F	Channel-Framed Mirror	Bobrick	B165 2436	Per Drawings	
G	Grab Bar-36"	Bradley	812	Per Drawings	
H	Grab Bar-42"	Bradley	812	Per Drawings	
J	Baby Changing Station	Rubbermaid	FG 781888	Per Drawings	Horizontal deployment
K	Touchless Paper Towel Dispenser	Bradley	2494	Per Dawings	8" towel roll
L	Robe Hook	Bradley	9118	Per Drawings	
M	Bench support	Rakks	EH-1416	Per Drawings	48" o.c.
N	Shower Curtain	Bobrick	B-240-3		Length varies, hang on OH brace of changing compartment

KEY

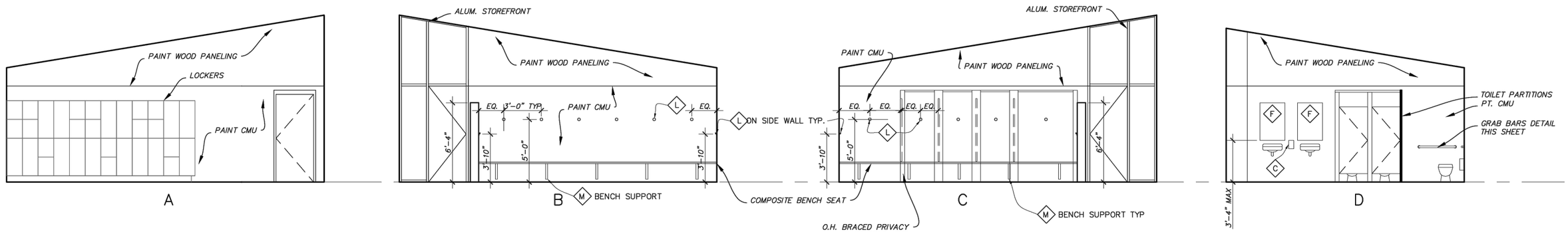
◇B TOILET ACCESSORY, SEE SCHEDULE



ACCESSIBLE TOILET STALL GRAB BARS
3/8"=1'-0"



ENLARGED PLAN
3/8"=1'-0"



INTERIOR ELEVATIONS
1/4"=1'-0"

4 0 4 8
1/4 inch = 1 foot

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SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

RESTROOM INTERIORS

DATE 11/14/2025

DRAWING NO. CR-5

SHEET NO. 46 OF 52

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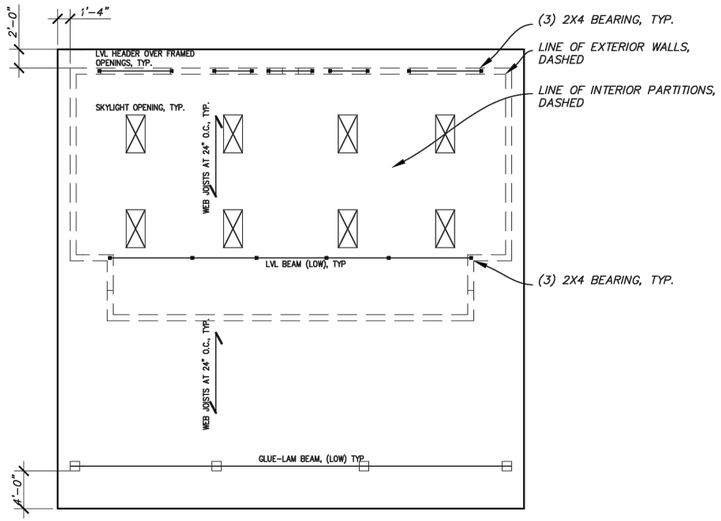
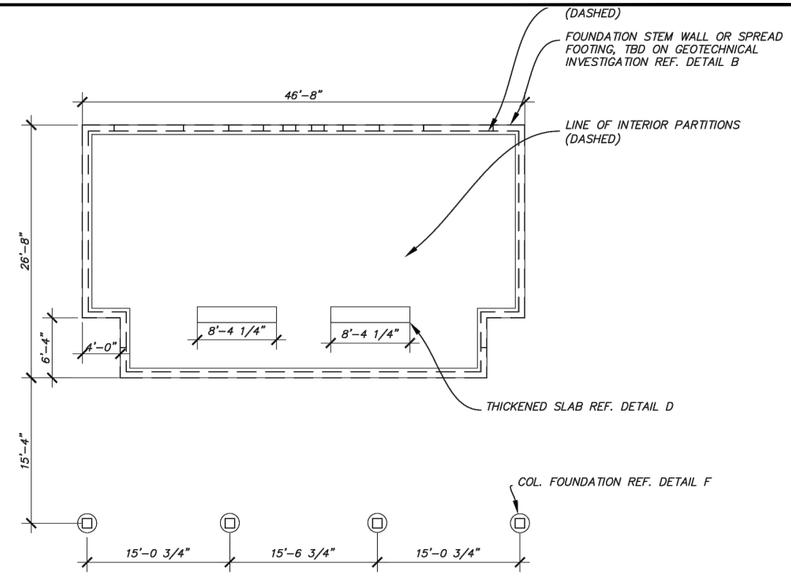
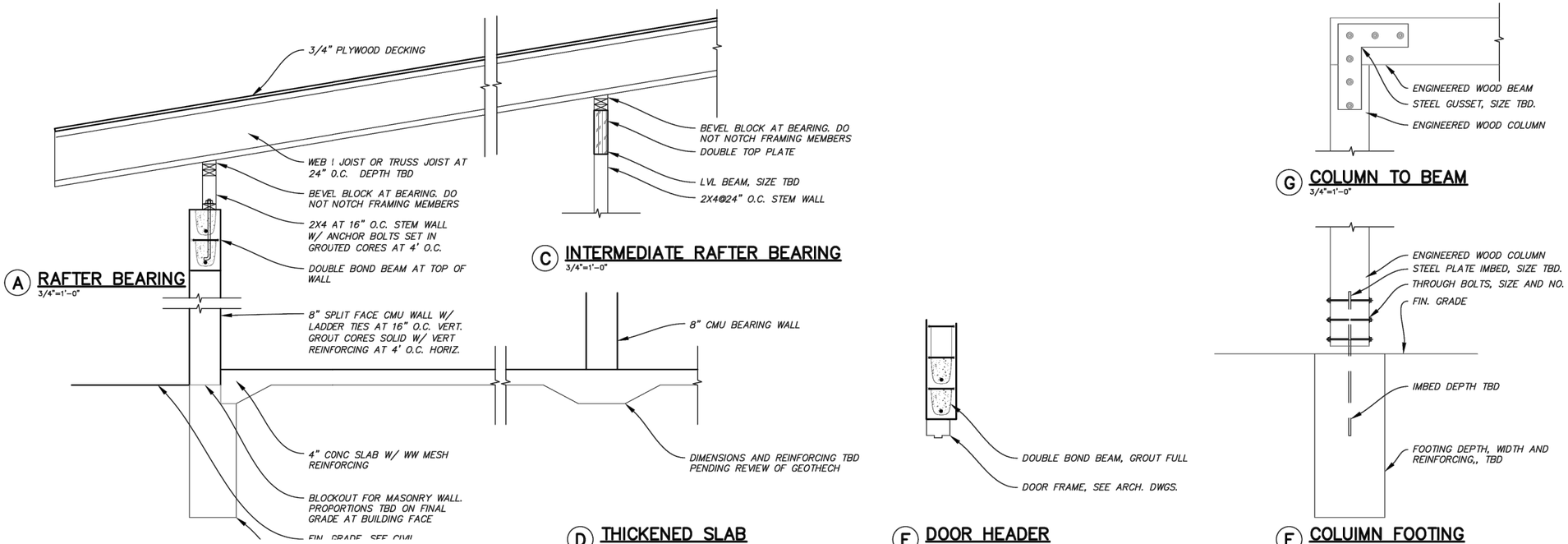


DIAGRAMATIC ROOF FRAMING PLAN
1/8"=1'-0"



DIAGRAMMATIC FOUNDATION PLAN
1/8"=1'-0"



A RAFTER BEARING
3/4"=1'-0"

B STEM WALL STRIP FOOTING
3/4"=1'-0"

C INTERMEDIATE RAFTER BEARING
3/4"=1'-0"

D THICKENED SLAB
3/4"=1'-0"

E DOOR HEADER
3/4"=1'-0"

F COLUIMN FOOTING
3/4"=1'-0"

G COLUMN TO BEAM
3/4"=1'-0"

NORTH
8 0 8 16
1/8 inch = 1 foot

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SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT
WEST CARROLLTON

WEST CARROLLTON RIVER PARK

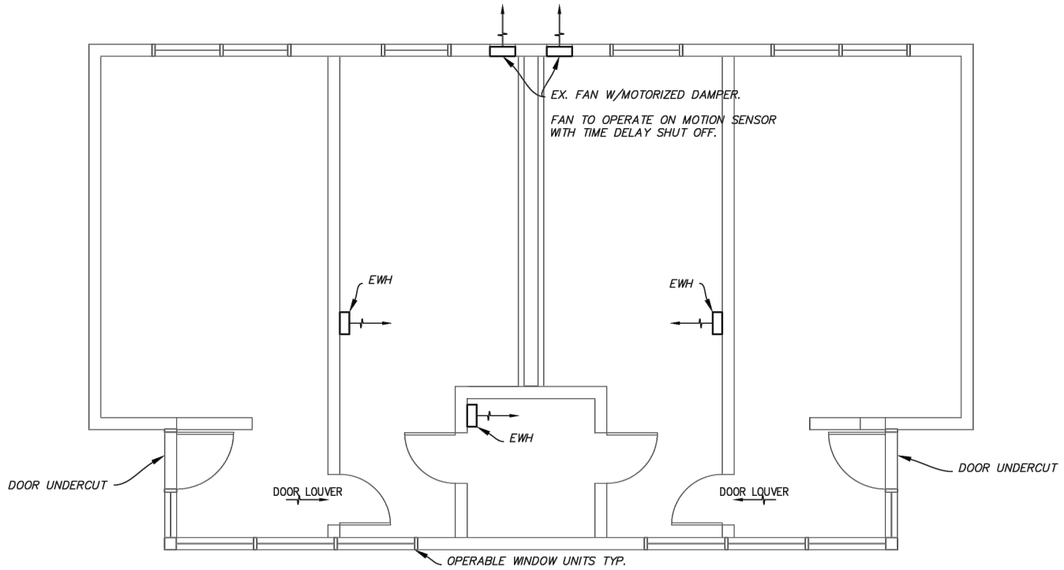
CHANGING ROOM AND RESTROOM BUILDING

FOUNDATION PLAN FRAMING SCHEMATIC DETAILS

DATE 11/14/2025

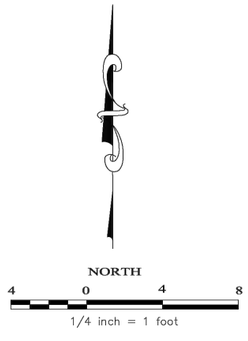
DRAWING NO. CR-6

SHEET NO. 47 OF 52



FIRST FLOOR MECHANICAL PLAN

1/4"=1'-0"



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CMAR SELECTION PLANS

SHEET REVISIONS

NO.	DATE	DESCRIPTION	

MULLER ENGINEERING COMPANY

WEST CARROLLTON

RIVER DISTRICT WEST CARROLLTON

WEST CARROLLTON RIVER PARK

CHANGING ROOM AND RESTROOM BUILDING

MECHANICAL PLAN

DATE 11/14/2025

DRAWING NO. CR-7

SHEET NO. 48 OF 52

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ATTACHMENT 4: AVAILABLE PROGRAM REQUIMENTS
Document 01 29 00 Item Quantities and Unit Cost Descriptions

PART 1 - GENERAL

1.01 DESCRIPTION

A. REQUIREMENTS: The total STATEMENT OF PROBABLE COST price shall cover all WORK required by the CONTRACT DOCUMENTS. All costs in connection with the proper and successful completion of the WORK, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction, earthwork, water control, equipment, tools; and performing all necessary labor and supervision to fully complete the WORK, shall be included in the unit and Cost of Work prices STATEMENT OF PROBABLE COST. All WORK not specifically set forth as a pay item in the Proposal shall be considered a subsidiary obligation of the CONTRACTOR and all costs in connection therewith shall be included in the prices STATEMENT OF PROBABLE COST.

B. ESTIMATED QUANTITIES FOR UNIT PRICE STATEMENT OF PROBABLE COST ITEMS: For each STATEMENT OF PROBABLE COST item, the WORK will be measured and paid for on either a unit price basis or on a Cost of Work basis. The quantities provided on the STATEMENT OF PROBABLE COST are estimates of the actual quantities of WORK only and are included solely for determining the probable cost of WORK. The actual quantities of WORK may differ from the STATEMENT OF PROBABLE COST quantities. The basis of measurement and payment for each unit price STATEMENT OF PROBABLE COST item will be the actual amount of WORK authorized, completed, and accepted. All labor, equipment, materials, and any incidentals required to complete the WORK will be considered subsidiary to that STATEMENT OF PROBABLE COST item and will not be measured or paid for separately. The CONTRACTOR agrees to make no claim for damages, loss of anticipated profits, or otherwise, due to differences between the actual WORK quantities and the estimated STATEMENT OF PROBABLE COST quantities.

C. PAYMENT: Payment will be made only for each item included in the STATEMENT OF PROBABLE COST. No WORK will be paid for that is not completed in accordance with the DRAWINGS and SPECIFICATIONS and accepted by the ENGINEER. Except as may be otherwise stipulated, no labor, equipment, materials, services including electric, water, or sewer, or any incidentals required to complete the WORK will be furnished by OWNER.

D. BASIS OR MEASUREMENT AND PAYMENT: The basis of measurement and payment for each STATEMENT OF PROBABLE COST item is described below. A general listing of STATEMENT OF PROBABLE COST items, accompanied by a brief summary of the WORK, is provided below. It is not intended to completely describe all WORK. Refer

to the DRAWINGS and SPECIFICATIONS for detailed information on each STATEMENT OF PROBABLE COST item.

E. ABBREVIATIONS:
   1. For the PAY UNITS listed below and in the STATEMENT OF PROBABLE COST, refer to the following definitions of ABBREVIATIONS (abbreviation – definition).
      a) AC: Acre
      b) ALW: Allowance
      c) COW: Cost of Work
      d) CY: Cubic Yards
      e) EA: Each
      f) LF: Linear Feet
      g) SF: Square Feet
      h) SY: Square Yards

1.02 UNIT COST DESCRIPTIONS

A. Phases 1, 2A, and 2B
   1. Item GEN.01.00: Clearing and Grubbing
      a) The measurement for payment for this item will be the actual number of acres of clearing and grubbing completed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. Measurement will be based upon scaled dimensions in acres of clearing and grubbing, as defined on the DRAWINGS and SPECIFICATIONS. No payment will be made for clearing and grubbing outside of the limits of construction shown on the DRAWINGS and SPECIFICATIONS or for WORK required to repair damage done by the CONTRACTOR's operations. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
         1) Completing the clearing and grubbing
         2) Disposing of materials off site in accordance with the DRAWINGS and SPECIFICATIONS
         3) Providing all other related and necessary labor, equipment, and materials to complete the WORK
      b) Payment will be based on the percentage of completed and accepted WORK.

Item	Pay Unit

Clearing and Grubbing	AC

2. Item GEN.02.00: Mobilization (Cost of Work)
   Item GEN.02.01 Mobilization (Periodic)
   a) No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The Cost of Work (COW) price will include all of the CONTRACTOR's costs that are lump sum items. The Periodic cost will include all of the CONTRACTOR's costs that are on a monthly or weekly basis. This item includes, but is not limited to:
      1) Bond Costs (COW). Costs of extending the Performance and Payment Bonds to 100 percent of the Contract Sum. This includes the cost of increasing the Bonds to cover the Contract Sum.
      2) Builder's Risk Insurance Premium (COW). Costs of providing the Builder's Risk insurance required by the Contract Documents.
      3) Temporary Facilities (PERIODIC). This is defined as the trailer(s), office, buildings, and any other facilities as deemed necessary by the CM that will be used on-site by the CM, for the duration of the Project. Included in this line item should be the initial set-up, monthly rental expense, removal, maintenance, and security system installation. This should also include the installation, rental, and removal of temporary sanitary facilities for the duration of the Project.
      4) Jobsite Trailer Utilities (PERIODIC). This includes any associated utilities (included, but not limited to, electricity, water, waste removal, etc.) needed for the trailer(s), for the duration of the Project.
      5) Office & Janitorial Supplies / Furnishings & Equipment / Water (PERIODIC). This is defined as the supplies needed by the CM, excluding communications equipment, to manage the operations within the jobsite trailer(s) for the duration of the Project.
      6) Office Communications Equipment / Printing & Reproduction / Postage / Photographs (PERIODIC). This is defined as any necessary computers, telephones, copy/fax machines, any

associated software/Internet packages, and/or other equipment required to perform the responsibilities of the CM, for the duration of the Project. Included in this line item should be any associated service plans, maintenance plans or monthly billings associated with these items. In addition, this should include the monthly expense for printing, postage and project photographs.

7) Office First Aid / Fire Protection / Safety / Signage (COW). This is defined as any needed first aid equipment, fire protection, signage, and safety equipment necessary for the duration of the Project.
8) Project Site Cleaning (PERIODIC). This is defined as the incremental cleaning of trailer(s) and building(s) / jobsite(s), performed weekly at a minimum, for the duration of the Project. Included in this category shall also be any required project site cleaning, road cleaning, and snow removal necessary for the duration of the Project. Additionally, this line item should include the final cleaning of the building(s)/jobsite(s) required for occupancy, at the conclusion of the project.
9) Dumpsters (COW). This is defined as the total cost of dumpster rentals for the entire project and for the duration of the Project, including general waste disposal and recycling.
10) Construction Fence / Access Points / Washout Areas (PERIODIC). This is defined as the total cost of initial set-up (furnishing and installing), monthly rental expense, removal, and maintenance of sufficient construction fencing, gates, markers, access points, concrete washout areas, and any other fencing/security items as deemed necessary by the CM for the duration of the Project.
11) Additional General Conditions (COW). Additional General Conditions items, which are typical for Projects of this type, size, and scope are listed below.
    a. Obtaining, complying with, and transferring permits
    b. Providing environmental controls for the life of the PROJECT
    c. Preparing and maintaining the PROJECT schedule

d. Delivering and removing the CONTRACTOR's equipment, supplies, and excess materials, and cleaning up the site
e. Restoring the PROJECT site to pre-project or final grades and conditions
f. Preparing and securing approvals of submittals
g. Preparing record drawings
h. Preparing and providing copies of stormwater and other required reports
i. Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on the percentage of completed and accepted WORK.

Item	Pay Unit
Mobilization (Cost of Work)	COW
Mobilization (Periodic)	PERIODIC

3. Item GEN.04.00: Surveying
   a) No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The Cost of Work price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
      1) Staking horizontal and vertical alignments
      2) Providing cut sheets to the OWNER or OWNER's representative
      3) Providing replacement stakes
      4) Locating existing utilities
      5) Staking overlot grading
      6) Setting subgrade elevations and offsets
      7) Setting temporary control points
      8) Re-establishing land monuments
      9) Finishing grades and structure elevations by a Professional Licensed Surveyor, as required, for record or as-built DRAWINGS
      10) Finishing grades and elevations by a Professional Licensed Surveyor, as required, for Pond Volume Certification

11) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on the percentage of completed and accepted WORK.

Item	Pay Unit
Surveying	COW

4. Item GEN.06.00: Water Control

a) No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The Cost of Work price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:

1) Dewatering construction area including: furnishing and installing all materials, sediment basins, diversion measures, slope drains, check dams, pumps, dewater bags, earth embankments, sheet pile, wells, stream crossings, cofferdams to provide for construction in dry conditions of all structures in areas of influence the Great Miami River.
2) Preparing and submitting water control plan for review
3) Implementing measures to control surface water and groundwater not paid for under Item, Temporary Diversion Measure. Temporary Slope Drain
4) Providing temporary power and sound proofing, as required
5) Evaluating, designing, constructing, maintaining, replacing, and monitoring dewatering measures
6) Modifying the approved and implemented water control plan as necessary
7) Obtaining all required permits
8) Monitoring, sampling and analysis, and preparing water quality reports, if required
9) Protecting WORK from groundwater, base flows, and storm events
10) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) One third of the Cost of Work price for this item will be paid after twenty-five (25) percent of the original CONTRACT amount has been earned, the second third after fifty (50) percent of the original

CONTRACT amount has been earned, and the final third will be paid upon final acceptance of the PROJECT.

Item	Pay Unit
Water Control	COW

5. Item DEM.01.00: Site Demolition
    a) The measurement for payment for this item will be a Cost of Work based on item and in accordance with the DRAWINGS and SPECIFICATIONS. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit price will include all of the CONTRACTOR's costs, which are not specifically measured and paid for under other items. This item includes, but is not limited to:
        1) Including but not limited to: Removal and modification of the portage ramp, structure on the north abutment for extension of sluice channel, and the road and sidewalk as per plan.
        2) Removing, hauling, and disposing of structures and obstructions including, but not limited to, existing pipe, culverts, inlets, concrete, asphalt, and any structures and obstructions that interfere with the WORK
        3) Backfilling and compacting after removal of structures and obstructions
        4) Moisture conditioning of suitable backfill material
        5) Restoring area, as required
        6) Providing all other related and necessary labor, equipment, and materials to complete the WORK
    b) Payment will be based on units completed and accepted.

Item	Pay Unit
Site Demolition	COW

6. Item EW.01.00: Earthwork, Cut
   Item EW.02.00: Earthwork, Fill
    a) The measurement for payment for this item will be the number of cubic yards excavated and used for fill or hauled from the site, measured and computed by the average end area method or grid method (difference between existing and finished grade) in accordance with the DRAWINGS and SPECIFICATIONS or as

otherwise directed by the ENGINEER. No measurement of this item will be made unless changes to the CONTRACT DOCUMENTS are made, in which case the ENGINEER will perform measurement of the modified volume. The quantity is based on the neat lines shown on the DRAWINGS and does not account for shrinkage or swell, and does not include structural excavation or pre-excavation required to install other items. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:

1) It is assumed that all of the Earthwork Cut and Fill will balance for this project. Any excess fill material, if not used on the site within the levees, will be stockpiled at the former treatment plant area.
2) Excavating, transporting, stockpiling with BMPs, and hauling excavated material to fill areas within PROJECT, or properly disposing off site
3) Placing, reworking, and compacting fill material
4) Cross hauling material
5) Moistening, drying, and reconditioning material, as necessary, to meet moisture-density requirements
6) Surface roughening and terracing BMPs as shown on the DRAWINGS
7) Removing and hauling deleterious materials
8) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on units completed and accepted.

Item	Pay Unit
Earthwork, Cut	CY
Earthwork, Fill	CY

7. Item RK.07.00: Feature Boulders
   a) The measurement for payment for this item will be per each feature boulder placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
      1) Excavating, backfilling, and compacting Preparing and stabilizing subgrade

2) Furnishing, handling, stockpiling, and placing boulders
3) Disposing rejected boulders Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on units completed and accepted

Item	Pay Unit
Feature Boulder	EA

8. Item RK.08.00: Surface Boulders to be Grouted
   a) The measurement for payment for this item will be the number of cubic yards of Imported boulders placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. Measurement will be based on the area of imported surface boulders, placed multiplied times the minimum depth shown on the Drawings. No separate measurement for payment will be made for any labor, excavation, handling, equipment, and materials required for this item. The unit price will include all the CONTRACTOR's costs. This item includes, but is not limited to:
      1) Excavating, backfilling, and compacting
      2) Preparing and stabilizing subgrade
      3) Furnishing, handling, stockpiling, and placing boulders
      4) Boulder preparation for grouting – washing/scrubbing surfaces of soil & debris
      5) Disposing rejected boulders
      6) Furnishing and installing weep drains
      7) Furnishing and placing steel reinforcement
      8) Providing all other related and necessary labor, equipment, and materials to complete the WORK
   b) Payment will be based on the units completed and accepted.

Item	Pay Unit
Surface Boulders to be Grouted	CY

9. Item RK.11.00: Riprap, Launchable
   Item RK.18.00: Riprap, Void-Permeated, Type L
   Item RK.19.00: Riprap, Void-Permeated, Type M
   Item RK.20.00: Riprap, Void-Permeated, Type H

a) The measurement for payment for this item will be the measured quantity as defined on the number of cubic yards of void-permeated riprap placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. No measurement of this item will be made, unless changes to the CONTRACT DOCUMENTS are made, in which case the ENGINEER will perform measurement of the modified volume. The unit price will include all of the CONTRACTOR's costs. This item includes but is not limited to:
   1) Furnishing, transporting, mixing, and placing all riprap and material for filling voids
   2) Excavating, backfilling, rodding, and compacting/plating
   3) Removing and disposing excavated material and debris
   4) Providing approved permeate material required to mix with riprap, washing with water into riprap, and burying riprap
   5) Providing all other related and necessary labor, equipment, and materials to complete the WORK.

b) Payment will be based on the percentage of completed and accepted WORK.

Item	Pay Unit
Riprap, Launchable	CY
Riprap, Void-Permeated, Type L	CY
Riprap, Void-Permeated, Type M	CY
Riprap, Void-Permeated, Type H	CY

10. Item RK.27.00: Core Rock to be Grouted

a) The measurement for payment for this item will be the number of cubic yards of Core Rock placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. Measurement will be based on the volume of imported core rock as defined by the dimensions shown and described in these CONTRACT DOCUMENTS. . No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit price will include all the CONTRACTOR's costs. This item includes, but is not limited to:
   1) Excavating, backfilling, and compacting

2) Preparing and stabilizing subgrade
3) Removing and disposing of excavated material and debris
4) Rock preparation for grouting – washing/scrubbing surfaces of soil and debris
5) Importing/furnishing, sorting, stockpiling, cross hauling, handling, and placing rock
6) Disposing rejected core rock
7) Furnishing and installing weep drains
8) Furnishing and placing steel reinforcement
9) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on the units completed and accepted

Item	Pay Unit
Core Rock to be Grouted	CY

11. Item STM.08.00: Underdrains
    a) The measurement for payment for this item will be the number of linear feet of underdrain pipe placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
        1) Trenching, backfilling and compacting as shown on DRAWINGS
        2) Placing geotextile fabric
        3) Furnishing, transporting, and placing all rock, pipe, clean-outs, and fittings
        4) Providing all other related and necessary labor, equipment, and materials to complete the WORK
    b) Payment will be based on units completed and accepted.

Item	Pay Unit
Underdrain	LF

12. Item STM.16.00: Relief Drain Extension (6" Schedule 80 PVC)
    a) The measurement for payment for this item will be the number of linear feet of pipe installed, complete in place, placed in

accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The measured length shall be along the center line of the pipe from the inside face of one manhole to the inside face of another or from one given station to another given station. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:

1) Locating and protecting all existing utilities in and along the pipe length
2) Furnishing, transporting, and installing all pipes, bends, tees, reducers, special fittings, jointing materials, valves, restraint, fasteners, concrete thrust blocks, and materials not otherwise provided for elsewhere in the DRAWINGS and SPECIFICATIONS
3) Adjusting location of existing small utilities and valves
4) Performing exploratory excavation and potholing
5) Excavating, backfilling and compacting
6) Supporting trenches, shoring, or laying slopes back if shoring is not used
7) Furnishing and compacting all materials required for a stable subbase, specific drainage material, structural backfill, and other backfill material, including imported backfill material if no suitable onsite material is available
8) Constructing the specific bedding, including the furnishing, placing, and compacting of sand, gravel, and rock
9) Furnishing, transporting, and installing all pipes, special fittings, jointing materials, and materials not otherwise provided for elsewhere in the DRAWINGS and SPECIFICATIONS
10) Tapping and/or connecting to pipes or structures
11) Furnishing, transporting, and placing flowfill material
12) Flushing and testing as required by local governing agency
13) Furnishing and installing tracer wire, location tape, and pipeline markers in accordance with the DRAWINGS, SPECIFICATIONS, or local governing agency
14) Removing and disposing of debris, pipe, excess excavated materials, and damaged materials

15) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on units completed and accepted.

Item	Pay Unit
Relief Drain Extension (6" Schedule 80 PVC)	LF

13. Item STM.19.00: Connection to Existing Utilities
    a) The measurement for payment for this item will be per a Cost of Work for all coordination pertaining to existing utilities. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
        1) Coordinating with the utility owner as necessary to complete supporting, protecting, removing and relocating of utilities
        2) Scheduling all WORK
        3) Providing all other related and necessary labor, equipment, and materials to complete the WORK
        4) Connection to water, sewer, and electric services.
        5) Linear Feet of Services is paid for under separate item.
    b) Payment will be based on the percentage of completed and accepted WORK.

Item	Pay Unit
Connection to Existing Utilities	COW

14. Item CON.04.00: Reinforced Structural Concrete
    a) The measurement for payment for this item will be the number of CUBIC yards of concrete placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit price will include all of the CONTRACTOR’s costs. This item includes, but is not limited to:
        1) All reinforcing steel
        2) Reinforced concrete for walls, abutments, including related footings.

3) Sawcutting, removing, and disposing all damaged and broken concrete, gravel, or other surface debris
4) Furnishing, forming and placing concrete, including coloring and fiber-mesh as shown on DRAWINGS
5) Furnishing and installing expansion joints
6) Furnishing and applying the curing compounds
7) Furnishing and installing steel reinforcement as shown on DRAWINGS
8) Furnishing, forming, and placing concrete thickened edge
9) Providing hot and cold protection
10) Sawcutting control joints, as required
11) Finishing and edging the concrete surface
12) Furnishing and compacting all material required for a stable subbase, including bedding, if required
13) Backfilling and compacting adjacent to trail or structure
14) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on units completed and accepted.

Item	Pay Unit
Reinforced Structural Concrete	CY

15. Item CON.05.00: Sculpted Concrete
    a) The measurement for payment for this item will be square yards measured in plan view and placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit price will include all of the CONTRACTOR's costs, which are not specifically measured and paid for under other items. This item includes, but is not limited to:
        1) Excavation
        2) Moisture control, compaction, sculpting, carving, preparing foundation/subgrade
        3) Stabilizing the subgrade
        4) Backfilling and compacting, including compaction testing as defined in the SPECIFICATIONS
        5) Furnishing and placing shotcrete for flash coat (if necessary)

6) Furnishing, handling, stockpiling, and placing steel reinforcement
7) Furnishing and installing weep drains in accordance with the DRAWINGS
8) Furnishing, placing, vibrating, curing concrete and/or shotcrete
9) Sculpting, carving, troweling, shaping, stamping (including release agent), power washing, and finishing concrete and/or shotcrete surface to provide a natural rock appearance that may include, but not limited to logs, flow splitters, boulders, etc. as approved by the OWNER and ENGINEER
10) Furnishing stamp and stamping/ concrete surface with animal prints and rock texture, where designated, as approved by the ENGINEER
11) Integral concrete color as approved by the ENGINEER and OWNER
12) Forming, pouring, and furnishing GFRC panels for incorporated walls (as necessary, if method is used)
13) Forming and pouring concrete cutoff walls
14) Furnishing and applying shotcrete (as necessary, if method is used)
15) Furnishing and applying curing compounds and sealing
16) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on the units completed and accepted.

Item	Pay Unit
Sculpted Concrete	SY

16. Item CON.07.00: Boulder Grout
    a) The measurement for payment for this item will be the number of cubic yards of Boulder Grout as provided by the quantity of concrete received as stated on the tickets collected on-site, unless:
        1) the concrete does not meet the specifications or
        2) is placed or cured in a manner that does not meet the specifications.
    b) The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:

1) Furnishing, forming, and placing material
2) Furnishing and applying curing compounds
3) Mixing and placing the boulder grout per manufacturer's specifications
4) Preparing surface and furnishing and placing reinforcing steel, as necessary
5) Furnishing and installing bonding adhesive
6) Field testing
7) Providing all other related and necessary labor, equipment, and materials to complete the WORK
8) Placing, vibrating, finishing, and curing boulder grout, including providing fibermesh and color in the boulder grout, as required
9) Providing fiber-mesh and color in the boulder grout as shown on the DRAWINGS
10) Washing excess grout from all boulders prior to the boulder grout curing Providing all other related and necessary labor, equipment, and materials to complete the WORK

c) Payment will be based on units completed and accepted.

Item	Pay Unit
Boulder Grout	CY

17. Item WAL.05.00: Sheet Pile
    a) The measurement for payment for this item will be the actual number of square feet placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. Measurements will be based upon planar square feet (length x width). No payment will be made for sheet pile installed outside the limits of construction shown on the DRAWINGS and SPECIFICATIONS, or for WORK required to repair damage done by the CONTRACTOR's operations. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
        1) Excavating and disposing of material
        2) Supplying, installing, splicing, and cutting sheet piling
        3) Driving
        4) Removing and replacing pile damaged during installation

5) Removing and disposing in an approved manner any buried obstructions in the proposed alignment of the sheet piling to allow for driving of sheet piling
6) Constructing and restoring access roads for pile driving equipment and other incidental work required to install the sheet piling
7) Cutting lifting holes in sheet piling, as necessary
8) Pre-drilling for installation into bedrock, as necessary
9) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on units completed and accepted.

Item	Pay Unit
Sheet Pile	SF

18. Item WAL.08.00: Sheet Pile Cap, All Types
    a) The measurement for payment for this item will be the number of linear feet of sheet pile cap placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. No separate measurement for payment will be made for any labor, equipment, and materials required for this item The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
        1) Excavating and disposing of the material
        2) Furnishing, forming, and placing concrete, including rebar
        3) Acquiring, placing, and compacting approved clay material as shown the DRAWINGS
        4) Installing gasket material as required
        5) Welding, extension, and splicing, as necessary, to install sheet pile cap according to the DRAWINGS and SPECIFICATIONS
        6) Providing all other related and necessary labor, equipment, and materials to complete the WORK
    b) Payment will be based on units completed and accepted.

Item	Pay Unit
Sheet Pile Cap, All Types	LF

19. Item RD.06.00: Bridge

a) No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The Cost of Work price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
   1) Furnishing, transporting, and placing deck span
   2) Furnishing, transporting, and installing bridge, not including the abutments
   3) Providing certification
   4) Providing all other related and necessary labor, equipment, and materials to complete the WORK
   5) Concrete paid for separately under Reinforced Structural Concrete Item.

b) Payment will be based on units completed and accepted.

Item	Pay Unit
Bridge	COW

20. Item TR.04.00: Concrete Sidewalk / Trail
    Item RD.07.00: Reinforced Concrete Roadway
    a) The measurement for payment for this item will be the number of square yards of concrete placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. Measurement shall be based upon the area as measured in the plan view. No separate measurement for payment will be made for any labor, equipment, and materials required for this item The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
       1) Sawcutting, removing, and disposing all damaged and broken concrete, gravel, or other surface debris
       2) Furnishing, forming and placing concrete, including coloring and fiber-mesh and materials not otherwise provided for elsewhere in the DRAWINGS and SPECIFICATIONS
       3) Furnishing and installing expansion joints
       4) Furnishing and applying the curing compounds
       5) Furnishing and placing reinforcing steel
       6) Furnishing, forming, and placing concrete thickened edge
       7) Providing hot and cold protection
       8) Sawcutting control joints, as required

9) Finishing and edging the concrete surface
10) Furnishing and compacting all material required for a stable subbase, including bedding, if required
11) Excavating, backfilling and compacting adjacent to trail or structure
12) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on units completed and accepted.

Item	Pay Unit
Concrete Sidewalk / Trail	SY
Reinforced Concrete Roadway	SY

21. Item LS.01.00: Landscaping & Site Furnishing
    a) This item is not yet defined sufficiently to evaluate the effort or materials costs. An Allowance for this Item has been included in the Item Quantities to allow for uniform comparison of costs.
    b) In general, this item will include, but is not limited to furnishing, transporting, and installing, and maintaining all materials, including:
        1) Site Furnishings such as benches, signs, and features typical to parks.
        2) Furnishing planting and maintaining trees and shrubs, and sod
        3) Fine Excavating
        4) Adding soil amendments
        5) Mulching
        6) Weeding
        7) Spray for insect and disease control, as required
        8) Maintaining trees
        9) Watering during construction warranty period
        10) Replacing dead or diseased plants during construction warranty period
        11) Excavating, backfilling, and compacting
        12) Preparing and stabilizing subgrade
        13) Removing and disposing of excavated material and debris
        14) Providing all other related and necessary labor, equipment, and materials to complete the WORK

Item	Pay Unit

Landscaping & Site Furnishing	ALW

22. Item WAV.01.00: Adjustable Wave Feature Gate and Equipment – Furnishing/Supply
    a) This item is not yet defined sufficiently to evaluate the effort or materials costs. An Allowance for this Item has been included in the Item Quantities to allow for uniform comparison of costs.

    Item WAV.02.00: Adjustable Wave Feature Gate and Equipment - Install
    b) No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The Cost of Work price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
        1) Installing Adjustable Wave Feature system components including fabricated steel gates, rubber bulbs, steel racks/grates, hinges, hydraulic system components, embedded items, Adjustable Wave Feature racks and any other system components
        2) Fabrication drawings, submittals, coordination with foundation work
        3) Installation of provided hardware and ancillary hardware for erection, attachment and hydraulic system
        4) Furnish and install hydraulic system conduits/embedded piping from controls to gates
        5) Installing permanent gate struts
        6) Testing and Startup to demonstrate a fully functioning Adjustable Wave Feature system
        7) Providing all other related and necessary labor, equipment, and materials to complete the WORK
    c) Payment will be based on units completed and accepted.

Item	Pay Unit
Adjustable Wave Feature Gate and Equipment – Furnishing/Supply	ALW
Adjustable Wave Feature Gate and Equipment - Install	COW

23. Item WAV.03.00: Obermeyer Entrance Gate & Equipment – Furnishing/Supply

a) This item is not yet defined sufficiently to evaluate the effort or materials costs. An Allowance for this Item has been included in the Item Quantities to allow for uniform comparison of costs.

Item WAV.04.00: Obermeyer Entrance Gate & Equipment - Install

b) The measurement for payment for this item will be a Cost of Work based on item and in accordance with the DRAWINGS and SPECIFICATIONS. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit price will include all of the CONTRACTOR's costs, which are not specifically measured and paid for under other items. This item includes, but is not limited to:

1) Installing the Obermeyer Entrance Gate & Equipment system components including fabricated steel gates, rubber bulbs, steel racks/grates, hinges, hydraulic system components, embedded items, and any other system components
2) Fabrication drawings, submittals, coordination with foundation work
3) Installation of provided hardware and ancillary hardware for erection, attachment and hydraulic system
4) Furnish and install hydraulic system conduits/embedded piping from controls to gates
5) Installing permanent gate struts
6) Testing and Startup to demonstrate a fully functioning Obermeyer Entrance Gate & Equipment
7) Providing all other related and necessary labor, equipment, and materials to complete the WORK

c) Payment will be based on the units completed and accepted.

Item	Pay Unit
Obermeyer Entrance Gate & Equipment	ALW
Obermeyer Entrance Gate & Equipment (Install)	COW

24. Item WAV.05.000: Sluice Gates

a) The measurement for payment for this item will be a Cost of Work based on item and in accordance with the DRAWINGS and SPECIFICATIONS. No separate measurement for payment will be made for any labor, equipment, and materials required for this item.

The unit price will include all of the CONTRACTOR's costs, which are not specifically measured and paid for under other items. This item includes, but is not limited to:

1) This item includes but is not limited to: New Sluice Gates, Sluice Gate Installation, steel rack, connections to existing concrete, abutment improvements.
2) Concrete paid for separately under Reinforced Structural Concrete Item.

b) Payment will be based on the units completed and accepted.

Item	Pay Unit
Sluice Gates	COW

25. Item WAV.06.00: Reinforced Concrete Drops and Steps

a) The measurement for payment for this item will be the number of square yards of concrete placed in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. Payment quantity shall be based upon the area as measured in the plan view. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:

1) Sawcutting, removing and disposing all damaged and broken concrete, gravel, or other surface debris
2) Furnishing, forming and placing concrete, including coloring and fiber-mesh and materials not otherwise provided for elsewhere in the DRAWINGS and SPECIFICATIONS
3) Furnishing and installing expansion joints
4) Furnishing and applying the curing compounds
5) Furnishing, forming, and placing concrete thickened edge
6) Providing hot and cold protection
7) Sawcutting control joints, as required
8) Finishing and edging the concrete surface
9) Furnishing and compacting all material required for a stable subbase, including bedding, if required
10) Excavating, backfilling and compacting adjacent to trail or structure
11) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on units completed and accepted.

Item	Pay Unit
Reinforced Concrete Drops and Steps	CY

26. Item WAV.09.00: Start Up & Tuning
    a) No separate measurement for payment will be made for any labor, equipment and materials for this item. The Cost of Work price will include all of the CONTRACTOR's costs. The Contractor shall provide Engineer documentation of costs incurred during execution of the work and payment will be made based on such invoices up to the total Cost of Work price. Contractor shall provide Engineer a table of values itemizing personnel, equipment and other costs included in this Cost of Work price. Payment for initial tuning block and tuning area installation will be paid for under other items to which they relate. Payment for additional/subsequent adjustment of tuning block and tuning areas beyond those covered in this item (if needed) and adjustments to any grouted boulders, loose boulders and bedrock (if needed) will be paid for by negotiating change orders based upon exiting contract unit prices or time and material pricing. This item includes, but is not limited to:
        1) Operations of the hydraulic system throughout the specified ranges and calibration of the inclinometers (conducted prior to rewatering).
        2) Survey/measurement support of water, structure, and gate elevations as requested by Engineer.
        3) Localized water control and dewatering needed to support tuning phase
        4) Remobilization of equipment and laborers
        5) Providing all other related and necessary material, equipment, and labor in addition to the material, equipment and labor involved in the installation of the individual material units for 10 crew days
        6) Site clean-up and restoration of disturbed areas
    b) Payment will be based on units completed and accepted.

Item	Pay Unit
Start Up and Tuning	COW

27. Item WAV.10.00: Tuning Blocks
    a) The measurement for payment for this item will be per each tuning block in accordance with the DRAWINGS and SPECIFICATIONS or as otherwise directed by the ENGINEER. The unit price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
        1) Furnishing, forming and placing concrete, including coloring and fibermesh as shown on the DRAWINGS
        2) Furnishing and applying curing compounds
        3) Embedded items
        4) Tuning block attachment hardware
        5) Finishing and edging concrete surfaces
        6) Furnishing and placing reinforcing steel as shown on DRAWINGS
        7) Providing hot and cold protection
        8) Initial installation of tuning blocks as directed by the Engineer.
        9) Providing all other related and necessary labor, equipment, and materials to complete the WORK
    b) Payment will be based on units completed and accepted.

Item	Pay Unit
Tuning Blocks	EA

28. Item WAV.18.00: Hydraulic Controls Vault
    Item WAV.19.00: Hydraulic Controls Vault Equipment
    Item WAV.20.00: Junctions Vault
    Item WAV.21.00: Junctions Vault Equipment
    a) No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The Cost of Work price will include all of the CONTRACTOR's costs. This item includes, but is not limited to:
        1) Furnishing and installing cast-in-place concrete vault enclosure, metal hatch, finishes, and appurtenances as shown on DRAWINGS.
        2) Coordination with other Adjustable Wave Feature system components to ensure a fully functioning system.
        3) Providing all other related and necessary labor, equipment, and materials to complete the WORK.

4) Vault Equipment shall include all the internal and external lines, including but not limited to: Vault/Building, Mechanical Equipment, PLC/Datalogger, Pressure Transducer, Singal Wire Cable, Hydraulic Hose, Pneumatic Hose, Trenching.

b) Payment will be based on units completed and accepted.

Item	Pay Unit
Hydraulic Controls Vault	COW
Hydraulic Controls Vault Equipment	COW
Junctions Vault	COW
Junctions Vault Equipment	COW

29. Item WAV.35.00: Anchored Guide Buoys
    a) This item is not yet defined sufficiently to evaluate the effort or materials costs. An Allowance for this Item has been included in the Item Quantities to allow for uniform comparison of costs.
    b) In general, this item will include, but is not limited to furnishing, transporting, and installing, and maintaining all materials, including:
        1) A series of individually anchored buoys stretching across the river to guide downstream river recreators to the Whitewater Course.

Item	Pay Unit
Anchored Guide Buoys	ALW

30. Item REC.13.00: Restroom/Changing Room Building
    Item REC.14.00: Operations And Maintenance Building
    a) Information provided is not to the level of details as most of the Work specified elsewhere. Therefore, the Contractor's judgement and experience (such as cost per square foot) should be utilized.
    b) No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The Cost of Work price will include all of the CONTRACTOR's costs. Costs should reflect items included in the attachments as listed in 00 73 00 Supplementary Conditions. This item includes, but is not limited to:
        1) Furnish and installation of shelter including all appurtenances provided by manufacturer, all architectural elements, and erection of structure per manufacturer recommendations

2) Coordination with manufacturer
3) Connection of all utilities,
4) Design and construction of foundation
5) Excavating, backfilling, and compacting
6) Preparing and stabilizing subgrade
7) Removing and disposing of excavated material and debris
8) Providing all other related and necessary labor, equipment, and materials to complete the WORK

c) Payment will be based on the percentage of completed and accepted WORK.

Item	Pay Unit
Restroom/Changing Room Building	COW
Operations and Maintenance Building	COW

31. Item REC.15.00: Site Lighting and Electrical

a) The measurement for payment for this item will be a Cost of Work based on item and in accordance with the DRAWINGS and SPECIFICATIONS. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit price will include all of the CONTRACTOR's costs, which are not specifically measured and paid for under other items. This item includes, but is not limited to:
   1) Design/Build of Site Lighting and Electrical throughout the entire project site
   2) Coordinating with the utility owner as necessary to complete installation and connection
   3) Scheduling all WORK
   4) Coordination with manufacturer
   5) Furnishing and installation of all materials for Site Lighting and Electrical construction
   6) Providing all other related and necessary labor, equipment, and materials to complete the WORK

b) Payment will be based on the units completed and accepted.

Item	Pay Unit
Site Lighting and Electrical	COW

32. Item REC.16.00: Camera System
    a) The measurement for payment for this item will be a Cost of Work based on item and in accordance with the DRAWINGS and SPECIFICATIONS. No separate measurement for payment will be made for any labor, equipment, and materials required for this item. The unit price will include all of the CONTRACTOR's costs, which are not specifically measured and paid for under other items. This item includes, but is not limited to:
        1) Design/Build of Camera System and associated electrical to be used for operations of wave feature and site security
        2) Coordinating with the utility owner as necessary to complete installation and connection.
        3) Scheduling all WORK
        4) Coordination with manufacturer
        5) Furnishing and installation of all materials for Camera Systems
        6) Providing all other related and necessary labor, equipment, and materials to complete the WORK
    b) Payment will be based on the units completed and accepted.

Item	Pay Unit
Camera System	COW

Table 1. Probable Construction Items – Phase 1

	ITEM ID	ITEM	PAY UNIT
GENERAL			
	GEN.01.00	Clearing and Grubbing	AC
	GEN.02.00	Mobilization (Phase 1)	AMT
	GEN.04.00	Surveying (Phase 1)	COW
	GEN.06.00	Water Control (Phase 1)	COW
	DEM.01.00	Site Demolition (Phase 1)	COW
	ERW.02.00	Earthwork, Cut	CY
	ERW.01.00	Earthwork, Fill	CY
DAM HAZARD MITIGATION			
	WAV.06.00	Reinforced Concrete Drops and Steps	CY
	RCK.08.00	Surface Boulders to be Grouted	CY
	RCK.27.00	Core Rock to be Grouted	CY
	CON.07.00	Boulder Grout	CY
	RCK.07.00	Feature Boulder	EA
	STM.16.00	Relief Drain Extension, 6" Schedule 80 PVC	LF
	RCK.18.00	Riprap, Void-Permeated, Type L	CY
SLUICE CHANNEL			
	WAV.06.00	Reinforced Concrete Drops and Steps	CY
	CON.04.00	Reinforced Structural Concrete	CY
	WAV.05.00	Sluice Gates	EA
	RCK.18.00	Riprap, Void-Permeated, Type L	CY
	WAL.05.00	Sheet Pile	SF
	WAL.08.00	Sheet Pile Cap, All Types	LF

Table 2. Probable Construction Items – Phase 2a

	ITEM ID	ITEM	PAY UNIT
GENERAL			
	GEN.01.00	Clearing and Grubbing	AC
	GEN.02.00	Mobilization (Phase 2a)	COW
	GEN.04.00	Surveying (Phase 2a)	COW
	GEN.06.00	Water Control (Phase 2a)	COW
	DEM.01.00	Site Demolition (Phase 2a)	COW
	ERW.02.00	Earthwork, Cut	CY
	ERW.01.00	Earthwork, Fill	CY
	WAV.09.00	Start Up and Tuning	COW
	STM.08.00	Underdrains	LF
DROPS			
	WAV.06.00	Reinforced Concrete Drops and Steps	CY
	CON.04.00	Reinforced Structural Concrete	CY
	CON.05.00	Sculpted Concrete	SY
	RCK.08.00	Surface Boulders to be Grouted	CY
	RCK.27.00	Core Rock to be Grouted	CY
	CON.07.00	Boulder Grout	CY
	RCK.07.00	Feature Boulder	EA
	RCK.11.00	Riprap, Launchable	CY
	WAL.05.00	Sheet Pile	SF
	WAL.08.00	Sheet Pile Cap, All Types	LF
	WAV.10.00	Tuning Blocks	EA
	WAV.04.00	Obermeyer Entrance Gate & Equipment, Install	COW
	WAV.03.00	Obermeyer Entrance Gate & Equipment	COW
	WAV.02.00	Adjustable Wave Feature Gate & Equipment, Install	COW
	WAV.01.00	Adjustable Wave Feature Gate & Equipment	COW
	WAV.20.00	Junction Vault	COW

	WAV.21.00	Junction Vault Equipment	COW
	WAV.18.00	Hydraulic Controls Vault	COW
	WAV.19.00	Hydraulic Controls Vault Equipment	COW
	WAV.35.00	Anchored Guide Buoys	COW
POOL ARMORING			
	RCK.18.00	Riprap, Void-Permeated, Type L	CY
	RCK.19.00	Riprap, Void-Permeated, Type M	CY
	RCK.20.00	Riprap, Void-Permeated, Type H	CY
ISLAND			
	CON.05.00	Sculpted Concrete	SY
	RCK.27.00	Core Rock to be Grouted	CY
	CON.07.00	Boulder Grout	CY
	RCK.19.00	Riprap, Void-Permeated, Type M	CY
	RCK.20.00	Riprap, Void-Permeated, Type H	CY
	WAL.05.00	Sheet Pile	SF
	WAL.08.00	Sheet Pile Cap, All Types	LF
BRIDGE			
	RWY.06.00	Bridge	EA
	CON.04.00	Reinforced Structural Concrete	CY

Table 3. Probable Construction Items – Phase 2b

	ITEM ID	ITEM	PAY UNIT
GENERAL			
	GEN.01.00	Clearing and Grubbing	AC
	GEN.02.00	Mobilization (Phase 2b)	COW
	GEN.04.00	Surveying (Phase 2b)	COW
	GEN.06.00	Water Control (Phase 2b)	COW
	DEM.01.00	Site Demolition (Phase 2b)	COW
	ERW.02.00	Earthwork, Cut	CY
	ERW.01.00	Earthwork, Fill	CY
SITE IMPROVEMENTS			
	TRL.03.00	Concrete Sidewalk/Trail	SY
	LDS.01.00	Landscaping & site furnishing	COW
RESTROOM/CHANGING ROOM, OPS BLDGS			
	REC.13.00	Restroom/Changing Room Building	COW
	REC.14.00	Operations and Maintenance Building	COW
	STM.19.00	Connection to Existing Utilities	COW
	RWY.07.00	Reinforced Concrete Roadway	SY

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 03 31 00

STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. CONTRACTOR shall furnish all labor, tools, and equipment for the construction of reinforced cast-in-place concrete.

B. This section includes basic finishing and curing methods, accessory control, and expansion and contraction joint devices.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 03 11 00, Concrete Forming.
2. Section 03 15 00, Construction Joints.
3. Section 03 15 13, Waterstops.
4. Section 03 21 00, Reinforcing Steel.
5. Section 03 35 00, Concrete Finishing.
6. Section 03 39 00, Concrete Curing.
7. Section 07 92 00, Sealants.
8. Section 32 16 00, Sidewalks, Curbs, and Gutters.

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing Materials (ASTM):
    a) Standard C 31, Standard Practice for Making and Curing Concrete Test Specimens in the Field
    b) Standard C 33, Standard Specification for Concrete Aggregates.
    c) Standard C 39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
    d) Standard C 94/C 94M, Standard Specification for Ready-Mixed Concrete.
    e) Standard C 109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
    f) Standard C 127, Standard Test Method for Relative Density and Absorption of Coarse Aggregate
    g) Standard C 128, Standard Test Method for Relative Density and Absorption of Fine Aggregate

h) Standard C 138, Standard Test Method for Density, Yield, and Air Content of Concrete
i) Standard C 143, Standard Test Method for Slump of Hydraulic-Cement Concrete
j) Standard C 150, Standard Specification for Portland cement.
k) Standard C 172, Standard Practice for Sampling Freshly Mixed Concrete
l) Standard C 173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
m) Standard C 192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
n) Standard C 231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
o) Standard C 260, Standard Specification for Air-entraining Admixtures for Concrete.
p) Standard C 494/C 494M, Standard Specification for Chemical Admixtures for Concrete.
q) Standard C 618, Standard Specification for Coal and Raw or Calcined Natural Pozzolan for Use in Concrete.
r) Standard C 827, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementious Mixtures
s) Standard C 900, Standard Test Method for Pullout Strength of Hardened Concrete.
t) Standard C 979, Standard Specification for Pigments for Integrally Colored Concrete.
u) Standard C 1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
v) Standard C 1059, Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.
w) Standard C 1064, Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
x) Standard C 1090, Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout
y) Standard C 1116, Standard Specification for Fiber-Reinforced Concrete and Shotcrete
z) Standard C 1399, Standard Test Method for Obtaining Average Residual- Strength of Fiber-Reinforced Concrete

aa) Standard C 1602, Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
bb) Standard C 1611, Standard Test Method for Slump Flow of Self-Consolidating Concrete
cc) Standard D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
dd) Standard D 994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
ee) Standard D 2475, Standard Specification for Felt.

2. American Concrete Institute (ACI):
    a) Standard 117, Specification for Tolerances for Concrete Construction and Materials
    b) Standard 211, Standard Practice for Selecting Proportions for Concrete.
    c) Standard 301, Specifications for Structural Concrete.
    d) 304, Guide for Measuring, Mixing, Transporting and Placing Concrete.
    e) Standard 305.1, Specification for Hot Weather Concreting.
    f) Standard 306.1, Specification for Cold Weather Concreting.
    g) Standard 308, Standard Practice for Curing Concrete.
    h) Standard 309, Standard Practice for Consolidating Concrete.
    i) Standard 318, Building Code Requirements for Structural Concrete.
    j) Standard 350, Code Requirements for Environmental Engineering Concrete Structures
    k) Standard 504, Guide to Joint Sealants.
3. International Concrete Repair Institute, Inc. (ICRI)
    a) Standard 310.2R-2013, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
4. United States Army Corps of ENGINEERs (USACE)
    a) Standard CRD-C 661-06, Specification for Anti-Washout Admixtures for Concrete.

1.04 SUBMITTALS

A. Provide product data on the following:
    1. Ready-mixed concrete mix designs.
    2. Fly ash.
    3. Admixtures (such as air-entraining and water-reducing admixtures).

4. Form release agents.
5. Bonding agents
6. Grout.

B. Concrete mix design. (Note: CONTRACTOR shall be responsible for fully informing the concrete supplier of all specification requirements regarding the concrete mix before the mix design is submitted.)
   1. The proportions of ingredients shall be selected to produce the proper workability (slump), durability (air content), strength, maximum water-cementitious materials ratio, time of set and other required properties.
   2. The proportion of ingredients shall be such as to produce a mixture with slump and durability that will WORK readily into the corners and angles of the forms and around reinforcement by the methods of placing and consolidation employed on the WORK. Do not permit the materials to segregate or excessive free water to collect on the surface.
   3. An independent testing laboratory acceptable to the ENGINEER will perform concrete trial mixtures and testing. The testing costs will be paid for by the CONTRACTOR. The costs of the mix designs shall be borne by the CONTRACTOR.

C. Prior to commencing concrete WORK, submit and obtain ENGINEER's approval of certified test reports for concrete mix design, which shall be prepared in compliance with ACI Standard 301, with concrete proportions established on the basis of previous field experience or laboratory trial batches, except as modified herein. Test reports shall also include:
   1. Fine aggregates - Source, type, gradation, deleterious substances and bulk specific gravity on basis of weight of saturated surface-dry aggregate. ASTM C 128.
   2. Coarse aggregate - Source, type, gradation, deleterious substances and bulk specific gravity on basis of weight of saturated surface-dry aggregate. ASTM C 127.
   3. Ratio of fine to total aggregates.
   4. Weight (saturated surface-dry) of each aggregate per cubic yard.
   5. Total water content in gallons per cubic yard.
   6. Slump on which design is based.
   7. Brand, type and quantity of cement.
   8. Brand, type, ASTM designation, and quantity of each admixture proposed for use.

9. Water-cementitious materials ratio (shall be not greater than specified in Part 2.02).
10. Air content (which shall be within the upper half of the allowable range).
11. For the laboratory trial batches method, the determination of the cementitious materials content necessary to attain the required strength and other properties, without exceeding the maximum water-cementitious materials ratio, shall be by preliminary tests in accordance with the following procedures:
    i. Concrete trial mixtures having proportions and consistency suitable for the WORK shall be made using at least three different cementitious materials contents which will produce a range in strengths encompassing those required for the WORK.
    ii. Proportions of ingredients shall be determined and tests conducted in accordance with the basic relationships and procedures outlined in "Recommended Practice for Selecting Proportions for Normal and Heavy- Weight Concrete (Part I):" (ACI 211.1).
    iii. For each cementitious materials content, at least three specimens for each age to be tested shall be made and cured in accordance with "Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory" (ASTM C 192) and tested for strength at 7, 14, and 28 days. Tests shall be conducted in accordance with "Standard Test Method or Compressive Strength of Cylindrical Concrete Specimens" (ASTM C 39).
    iv. From the results of these tests, a curve shall be plotted showing the relationship between cementitious materials content and the average 28-day compressive strength. The minimum cementitious materials content to be used shall be that value shown by the curve to produce a strength of at least 1500 psi in 24 hours and at least 1200 psi greater than the 28-day strength specified.
    v. If the previous field experience method is used in proportioning, the strengths shall be in compliance with ACI 301. In addition, the CONTRACTOR shall demonstrate the ability of the proposed mixture proportions to produce concrete meeting all the requirements of these Specifications. Field test records must be acceptable to the ENGINEER to use this method.
    vi. Color additive can be added to a qualified mix without separate qualification testing of the colored mix as long as the water content of

the mix is not increased as compared to the mixture without color additive. Add compatible water-reducing admixtures as needed (within recommended limits) to compensate for the increased water demand caused by the color additive. Alternatively, the cement content of the mixture to be used with color can be increased up to 50 pounds per cubic yard to maintain the original water/cement ratio of the base mix without color.

12. In addition to the test data described above, when it is expected that concrete will be placed under hot weather concrete conditions as defined in Section 03 30 00, Part 1.05.C, trial batches shall be tested at the maximum temperature that the concrete is expected to be placed. Alternatively, sufficient records may be submitted that show field concrete performance under these temperatures and which are acceptable to the ENGINEER. For provisions for concrete placed under cold weather, see Part 1.05.B

D. Cylinder compression test reports.
    1. Submit 2 copies of certified test reports to ENGINEER.
E. Ready-mix delivery tickets.
    1. Submit delivery tickets for each load at time of delivery indicating following:
        i. Quantity delivered with Mix Identification Number.
        ii. Quantity of each material in batch.
        iii. Outdoor temperature in shade.
        iv. Time at which water was added.
        v. Elapsed time between when water was added and when concrete load was in place.
        vi. Amounts of initial and supplemental water added, including any corrections for water in aggregate. Note: Total water amount shall result in a water-cementitious materials ratio not greater than the maximum permissible.
        vii. Name of individual authorizing supplemental water.
        viii. Numerical sequence of delivery by indicating cumulative yardage delivered on each ticket.
F. Integral Color Samples
    1. CONTRACTOR shall submit integral color pigment samples or colored concrete chip and appropriate technical information on color pigments, dry-shake color hardeners, stains, texture mat patterns, and sealants.
    2. Shop DRAWINGs indicating extent of each color of integrally colored concrete.

G. Miscellaneous product information.
    1. CONTRACTOR shall catalog information and shop DRAWINGs for: waterstops, admixtures, bonding agents, membrane curing compound, joint sealer, embedded items, non-shrink grout, wedge-type expansion anchors, and other concrete appurtenances.

1.05 QUALITY ASSURANCE

A. Qualifications: The ready-mixed concrete supplier to CONTRACTOR shall have the capability to produce and deliver concrete, meeting the requirements of the DRAWINGS and SPECIFICATIONS. The supplier shall have a contingency PLAN for a back-up plant in the event of a mechanical malfunction of one of the primary plant(s).
B. CONTRACTOR shall keep at least one copy of above listed ACI publications, latest edition, in PROJECT field office at all times.
C. Any material or operation specified by reference to the published specifications of a manufacturer shall be complied with unless directed otherwise by the ENGINEER.
D. In case of a conflict between the referenced specifications or standards and this Specification, the one having the more stringent requirements, as determined by the ENGINEER, shall govern.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The ready-mixed concrete truck driver shall provide the batch ticket to ENGINEER at the time of concrete delivery. The ticket shall summarize the following information legibly in an easily discernible table:
    1. Weight in pounds of all materials, excepting the water reducing and air-entraining agents which shall be in ounces.
    2. Cubic yards batched.
    3. The ratio of water to cementitious (W/C) materials ratio.
    4. Temperature of the concrete at the time it was batched.
    5. Time of batching.
    6. Free moisture in the fine and coarse aggregates in percent of weight of aggregate.
    7. Gallons of water that may be added at the site without exceeding the permissible W/C ratio.
    8. Concrete Mix Design Number.
B. Cementitious materials
    1. Store in weather-tight enclosures and protect against dampness, contamination and warehouse set.
    2. Do not use cementitious materials that have become caked or lumpy.

C. Aggregates
    1. Stockpile to prevent excessive segregation, or contamination with other materials or other sizes of aggregates.
    2. Use only one supply source for each aggregate stockpile.
    3. The bottom 6 in. of all aggregate piles in contact with ground shall not be used.
    4. Frozen or partially frozen aggregates shall not be used.
D. Admixtures
    1. Store to prevent contamination, evaporation, or damage.
    2. Protect liquid admixtures from freezing or harmful temperature ranges.
    3. Agitate emulsions prior to use.
E. Rubber and plastic materials
    1. Store in cool place away from direct sunlight.
F. Mixing and transporting ready-mixed concrete.
    1. Maximum elapsed time from time water is added to mix until concrete is in place shall not exceed 1-1/2 hours when concrete is transported in revolving drum truck bodies unless all other provisions of these specifications can be met, including maximum water-cementitious materials ratio, workability, strength and air content. Comply with ASTM C 94.
    2. Do not use concrete transported without continuous agitation if the elapsed period between the time the concrete is mixed and the time it is placed is greater than 30 minutes. With the ENGINEER's approval, an approved retarding admixture may be used at the rate prescribed in Part 2.01.D.6. Also with the ENGINEER's approval, the mixed-to-placed time period may be extended an additional 30 minutes.
    3. Do not use concrete transported with agitation when the time between start of mixing and placement is more than 90 minutes.
    4. Deliver and handle concrete in a manner that will:
        i. Prevent objectionable segregation or damage to the concrete, and
        ii. Facilitate placing with a minimum of handling.
    5. Thoroughly clean and flush the compartment in which the concrete is transported to the WORK at intervals necessary to ensure hardened concrete will not accumulate in the compartment. Discharge flushing water from the compartment before it is charged with the next batch.
    6. Obtain ENGINEER's approval for plant equipment, operation, and procedures.

1.07 JOB CONDITIONS

A. Environmental requirements:
    1. Do not place concrete during rain, sleet, or snow unless adequate protection is provided and ENGINEER's approval is obtained.
    2. Do not allow rainwater to increase mixing water or damage surface finish.
    3. For cold or hot weather concreting conditions, lab cured cylinder tests may not be an accurate indication of field achieved strengths. Under these weather conditions, the ENGINEER may require job cured cylinder breaks to determine field strength (cylinders shall be job cured in same manner as the in-place concrete.) The CONTRACTOR shall pay for testing. Refer to Section 03 30 00, part 3.10 for related items to be furnished by CONTRACTOR. If cold or hot weather concreting practices specified in Parts 1.05.B and 1.05.C are not adhered to, the ENGINEER may require CONTRACTOR, at CONTRACTOR's expense, to provide additional pullout tests in accordance with ASTM C 900, job cured cylinder tests, or 2-inch diameter cored samples from areas in question to determine field strengths achieved.
    4. Changes in temperature of the concrete shall be as uniform as possible and shall not exceed 10 Degrees F. in any 1-hour or 45 Degrees F. in any 24-hour period.

B. Cold Weather Concreting. Conform to ACI 306, "Cold Weather Concreting" in addition to this specification.
    1. Temperature of concrete when placed shall not be less than following: Minimum Concrete Temp, Degrees F

Section 03 31 00 – Table 1 – Concrete Placing Temperature		
Air Temperature Degrees Fahrenheit	Section with least dimension Under 12 inches	12 inches and over
30 to 35	60	50
0 to 30	65	55
Below 0	70	60

If water or aggregate has been heated, the water and aggregate shall be combined in the mixer before cementitious materials are added. Cementitious materials shall not be added to mixture of water and aggregate when the temperature of the mixture is greater than 95ºF.

    2. When placed, heated concrete shall not be warmer than 80ºF.
    3. Prior to placing concrete, all ice, snow, surface and subsurface frost shall be removed, and temperature of surfaces to be in contact with new concrete, including subgrade materials and massive embedments such as rock, shall

be raised to a minimum of 35ºF and a maximum of 600F. The entire mass of all massive embedments shall be raised to this temperature range.

4. Protect concrete from freezing during specified curing period. See Part 3.09, Curing, for temperature to be maintained during initial curing period.
5. When the mean daily temperature of the atmosphere is less than 40ºF., forms shall be left in place a minimum of 5 days to aid in retaining heat.
6. Heated enclosures shall be strong and windproof to insure adequate protection of corners, edges and thin sections.
7. Do not permit heating units to locally heat or dry concrete.
8. Do not use combustion heaters during first 24 hours unless concrete is protected from exposure to exhaust gases, which contain carbon dioxide.
9. If air temperatures drop below 35ºF., the CONTRACTOR shall install a high-low temperature gauge into the most exposed portion of concrete during the curing protection period. The gauge shall be equipped to register the lowest overnight temperature. If the concrete temperature drops below the specified temperature, the curing period shall be extended until the degree-days (Part 3.09) are satisfied.
10. Refer to ACI 306 for further requirements.

C. Hot Weather Concreting: Conform to ACI 305, "Hot Weather Concreting" in addition to this specification.

1. Take precautions when ambient air temperature is 90ºF or above. These measures may include installation of windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering of a light color. If daytime highs are expected to exceed 100ºF., floor and roof slab concrete shall be placed overnight, with placement commencing not prior to 3 hours before sunset.
2. Temperature of concrete when placed shall not exceed 85ºF.
3. Cool forms and reinforcing to a maximum of 90ºF by spraying with water prior to placing concrete.
4. Do not use cementitious materials that have reached a temperature of 105ºF or more at the time they enter the concrete mix.
5. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
6. Do not place concrete when evaporation rate (actual or anticipated) is 1.0 kg per square m per hour or above, as determined by Figure 2.1.5 of ACI 305.
7. Set-retarding and water-reducing admixtures may be used when the ambient air temperature is 90ºF or above to offset accelerating effects of high temperature.
8. Refer to ACI 305 for further requirements.

D. Protection from Mechanical Injury: During the curing period, the concrete shall be protected from damaging mechanical disturbances particularly load stresses, heavy shock and excessive vibration. All finished concrete surfaces shall be protected from damage caused by construction equipment, materials, or methods and by rain or running water. Self-supporting structures shall not be loaded in such a way as to over-stress the concrete.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Acquire cement and aggregate from the same source for all WORK.
B. Cement: Cement shall be Portland cement Type II, unless otherwise indicated on the DRAWINGS.
C. Aggregate:
    1. Fine Aggregate: Fine aggregate shall consist of hard, strong, durable particles complying with the provisions of ASTM C33.
    2. Coarse Aggregate: Coarse aggregate shall conform to the provisions of ASTM C33. Aggregate shall be crushed aggregate or angular screened natural aggregate. Hydraulic - cement aggregate is unacceptable.
D. Water: Water shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or steel. Mixing water for prestressed, pretensioned and prestressed post-tensioned concrete or for concrete which will contain aluminum embedments shall not contain deleterious amounts of chloride ion.
E. Admixtures: Admixtures to be used in concrete shall be subject to prior acceptance by ENGINEER. The admixture shall maintain the same composition and performance throughout the WORK as the product used in the concrete proportions established in accordance with ACI 211. Admixtures containing chloride ions shall not be used.
    1. Air Entrainment:
        i. An air-entraining agent shall be used in all concrete. The agent used shall conform to ASTM C260.
        ii. Unless otherwise shown on the DRAWINGS, the amount of air-entraining agent used in each concrete mix shall be such as will affect the entrainment of the percentage of air shown in the following tabulation in the concrete as discharged from the mixer or pumper discharge hose if applicable. Table 1 is applicable for concrete strengths less than five thousand (5,000) psi.

Section 03 31 00 – Table 2 – Concrete Strengths		
Nominal Maximum Aggregate Size (Inch)	Average Air Content (Percent)	
	Severe Exposure	Moderate Exposure
3/8	7-1/2 ± 1-1/2	6 ± 1-1/2
3/4	6 ± 1-1/2	5 ± 1-1/2
1-1/2	5-1/2 ± 1-1/2	4-1/2 ± 1-1/2

iii. The level of exposure shall be determined by ENGINEER.

iv. When a batch of concrete delivered to the PROJECT does not conform to the minimum specified air content, an air-entraining admixture may be added, one (1) time only for the batch, at CONTRACTOR's option prior to consideration for rejection. After the admixture is added, the concrete shall be remixed for a minimum of twenty (20) revolutions of the mixer drum at mixing speed. The concrete shall then be retested and if found acceptable, may be placed in accordance with the SPECIFICATIONS.

2. Water Reducing, Set-Controlling Admixture: CONTRACTOR shall use a "mid-range" water reducing, set controlling admixture, Polyheed 997, or equal. The water-reducing admixture shall be used in all concrete and shall conform to ASTM C494/C494M, specifically Types A, B, C, D, and E.
    i. Finely Divided Mineral Admixtures (Fly Ash): Mineral admixtures shall be limited to fly ash conforming to ASTM C618, Class C or Class F. Class C fly ash is not permitted where sulfate resistant cement is required.
3. Mid-Range Water-Reducing Admixture: ASTM C494. Master Polyheed 1025 by BASF (Master Builders) or equal as approved by the ENGINEER.
4. High Range Water-Reducing Admixture (Superplasticizer): "Eucon 37" by the Euclid Chemical Co., (HRWR) "Master Rheobuild 1000" by BASF (Master Builders) or "Sikament" by Sika Chemical Corp. The admixture shall conform to ASTM C494, Type F or G, and shall not contain more chloride ions than are present in municipal drinking water.
5. Anti-Washout Admixture: shall comply with USACE CRD-C 661-06 Specification for Anti-Washout Admixtures for Concrete and ASTM C 494 Type S specifications. Where concrete placement is in a submerged condition and is called out on the DRAWINGs, or in the specifications use anti-washout admixture Master Matrix UW 450 by BASF (Master Builders) or equal approved by the ENGINEER. Use anti-washout admixtures only with the ENGINEER's approval.

6. Fibrous Concrete Reinforcement: For all locations where fiber reinforcing is called out on the DRAWINGs or in the specifications, add 100 percent virgin polypropylene, fibrillated fibers to the concrete. Volume per cubic yard shall equal a minimum of 0.10% (1.5 pounds/CY). Fiber length shall be graded per manufacturer. Fiber manufacturer shall document evidence of 5-year satisfactory performance history, compliance with applicable building codes, ASTM C 1399, and ASTM C 1116/C 1116 M, Type III fiber reinforced concrete. Fibrous concrete reinforcement shall be Fibermesh 300 or Fibercast 500 manufactured by Propex Concrete Systems, Chattanooga, TN or equal approved by the ENGINEER. Product use shall be in accordance with manufacturer's instructions and recommendations.
7. Color Additives for Cast in Place Concrete: When indicated on the DRAWINGs or Specifications, Concrete Mix shall have integral color pigments added to the mix and be as manufactured by Davis Colors, or approved equal, at the rates indicated as acceptable following sample panel installation.
    i. Colored additives shall contain pure, concentrated mineral pigments specially processed for mixing into concrete and complying with ASTM C979.
    ii. Color additives containing carbon black are not acceptable. Black and Gray coloring shall be obtained using black iron oxide pigments.
    iii. Color samples shall be submitted to the ENGINEER prior to construction.
    iv. Meter and dispense colors using computer-controlled automated color weighing and dispensing systems provided by the manufacturer of the color additive. As an alternative, manual dispensing may be used and accomplished by addition of premeasured disintegrating bags. Particular attention must be given to thorough mixing of concrete after addition of the color additives. Mix until color additives are uniformly dispersed throughout the mixture and disintegrating bags, if used, have disintegrated.
    v. Do not re-temper mix by adding water in the field.
8. Tests for Chloride Ions
    i. For all concrete in which aluminum or galvanized metal is to be embedded, it shall be demonstrated by tests in accordance with AASHTO T-260 that the hardened concrete, including the aggregates, cementitious materials and any admixtures used, will not contain

more than 0.06 percent water soluble chloride ions by weight of cement.

F. Evaporative Retardant: In accordance with Section 03 29 00, Concrete Curing.
G. Bituminous Coating: Bituminous Coating for aluminum pipes will be in accordance with AASHTO M-190 Type A.
H. Grout: In accordance with Section 03 60 00, Grouting.
I. Epoxy Bonding Agent:
    1. Master Builders; Concresive Liquid (LPL).
    2. Master Builders; Concresive Standard Liquid.

2.02 COMPRESSIVE STRENGTH

A. Concrete compressive strength requirements consist of a minimum strength that must be obtained before various loads of stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of twenty eight (28) days. Unless otherwise shown on the DRAWINGS, the twenty eight (28) day compressive strength of structural concrete shall be a minimum of four thousand five hundred (4,500) psi.
B. The mix shall be designed for required strengths in accordance with ACI 301. The ratio of water to the sum of concrete plus pozzolan shall not exceed 0.45 by weight for durable, watertight, concrete. The amount of fly ash in the mix shall be between fifteen and twenty percent (15 and 20%) by weight of the total cementitious materials.
C. Unless otherwise permitted or specified in the DRAWINGS, the concrete shall be proportioned and produced to have a slump not to exceed four (4) inches or less than two and one-half (2-1/2) inches. Concrete not consolidated by internal vibration shall be proportioned to have a slump not to exceed five and one-half (5-1/2) inches or less than four (4) inches.

2.03 SOURCE QUALITY CONTROL

A. Batching:
    1. Measuring and batching of materials shall be done at a batching PLANt.
    2. Portland Cement:
        i. Either sacked or bulk cement may be used. No fraction of a sack of cement shall be used in a batch of concrete unless the cement is weighed. Bulk cement shall be weighed on scales separate and distinct from the aggregate hopper or hoppers. Batching shall be such that the accuracy of batching shall be plus or minus one percent of the required weight.
    3. Water:

i. Unless water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be filled. In lieu of the volume method, CONTRACTOR shall be permitted to use a water-metering device.

4. Aggregates:
    i. Aggregates shall be handled from stockpiles or other sources to the batching PLANt in such a manner as to secure a uniform grading of the material. Aggregates that have become segregated, or mixed with earth or foreign material, shall not be used. Batching shall be so conducted as to result in the weights of material required for each type aggregate within a tolerance of two percent (2%).
    ii. Free water contents of the coarse and fine aggregates shall be continuously tested and concrete mixture adjusted for moisture conditions of the aggregate in order to meet the designated water/cement ratio.
5. Fine Aggregate:
    i. The proportion of fine aggregate shall be between thirty six and forty four percent (36 and 44%) by volume of the total aggregates in the concrete.

B. Mixing:
1. Ready-mixed concrete shall be either “central mixed” or “shrink mixed” concrete as defined in ASTM C94/C94M. “Truck mixed” concrete as defined in ASTM C94/C94M shall not be permitted. Mixing time shall be measured from the time water is added to the mix, or cement contacts the aggregate. All concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cement. Mixers and agitators, which have an accumulation of hard concrete or mortar, shall not be used. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C94/C94M.
2. The temperature of mixed concrete, immediately before placing shall not be less than fifty degrees Fahrenheit (50°F) or more than ninety degrees Fahrenheit (90°F). Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed one hundred fifty degrees Fahrenheit (150°F).
3. The time elapsing from the time water is added to the mix (or the cement comes in contact with aggregate) until the concrete is deposited in place at

the site of the WORK shall not exceed sixty (60) minutes when the concrete is hauled in non-agitating trucks, nor more than ninety (90) minutes when hauled in truck mixers or truck agitators.

4. The batch shall be so charged into the drum that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first one-quarter (1/4) of the specified mixing time.
5. Cement shall be charged into the mixer by means that will not result in loss of cement because of the effect of wind, or in accumulation of cement on surfaces of hoppers or in other conditions which reduce or vary the required quantity of cement in the concrete mixture.

C. Transporting Mixed Concrete; Mixed Concrete or Truck Mixers:
   1. Transporting of mixed concrete shall conform to ASTM C94/C94M.
   2. Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity. They shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.
   3. No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless approved by ENGINEER. If additional water is to be incorporated into the concrete at the site, the drum shall be revolved not less than thirty (30) revolutions at mixing speed after the water is added and before discharge is commenced. One (1) addition of water at the site to adjust mix WORKability is permitted but the maximum water cement ratio shall not be exceeded.
   4. CONTRACTOR shall furnish a water-measuring device in good WORKing condition, mounted on each transit mix truck, for measuring the water added to the mix on the site. All water tanks on transit mix trucks shall be filled prior to being batched and arrive at the construction site one hundred percent (100%) full.
   5. Each load of ready mixed concrete delivered at the job shall be accompanied by the ticket in accordance with Article Delivery, Storage, and Handling.

2.04 CONCRETE PRODUCTION

A. Ready-mixed concrete
   1. Mixed and delivered, ASTM C 94.
   2. Retempering. Indiscriminate addition of water to increase slump shall be prohibited.

3. Concrete shall be mixed only in quantities required for immediate use. Concrete that has partially set shall not be retempered but shall be discarded.
4. When concrete arrives at the PROJECT with slump below that suitable for placing, first the concrete shall be remixed for at least one minute at mixing speed. If the slump is still too low, water may be added only if the maximum permissible water-cementitious materials ratio is not exceeded, the maximum slump is not exceeded, and the temperature of the concrete is less than 90ºF. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. The ENGINEER shall review such addition.

B. Batching and mixing equipment.
   1. Conform to "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete," ACI 304.

C. Proportioning
   1. Proportion ingredients to produce a well-graded mix of high density and maximum workability consistent with the accepted mix design.
   2. Entrained air, 6 percent ± 1½ percent for ASTM C 33 Size 67 or 57 coarse aggregate. Refer to ACI 301 for air entrainment required for other coarse aggregate sizes.
   3. Refer to Part 1.04.E for mixing and transporting ready-mixed concrete requirements.
   4. Strength General Requirements
      i. Design and proportion concrete to meet the following minimum compressive strengths and other criteria

Section 03 31 00 – Table 3 – Minimum Compressive Strengths						
Location	Design Strength 28-Day (psi)	ASTM C33 Aggregate Size No.	Max Slump Inches ±1.5 in.	Minimum Cement Content (lb/yd^3)	Fly Ash Content (lb/yd^3)	Maximum W-C Materials Ratio*
Structural Concrete	4500	57 or 67	4	5000	120-150	0.45
Concrete Paving**	4000	57 or 67	4	520	90	0.40
Concrete Fill Material	1500	57 or 67	2	tbd***	90	0.33

* The maximum water-cementitious materials ratio by weight, which shall be based on all water in the mix, including correction for moisture in aggregates, and shall be based on the total cementitious materials including cement and fly ash, if any.

** Concrete Paving includes walks, trails, and all exterior associated concrete flatwork areas.

*** To be determined in mix design.

Section 03 31 00 – Table 4 – Admixtures Required within this Specification				
Admixtures Required Within this Specification (May be required in other Specifications, does not include admixtures related to mix design.)				
Type	Fiberous Concrete Reinforcement	Color Additive	Anti-Washout Admixture	Other
Structural	None	None	When placed or cured in submerged conditions, See Part 2.01.	
Path	None	None	None	
Concrete Fill Material	None	None	See Part 3.03.	
Grout – for Grouted Rock and Boulder	See Rock Specification	See Rock Specification	See Rock Specification	See Rock Specification

2.05 CONCRETE ACCESORY MATERIALS

A. Curing Materials.
    1. Sheet material: ASTM C 171. Sheet material shall not be used on colored concrete.
B. Liquid Membrane-Forming Curing Compounds
    1. Liquid membrane-forming compounds for curing shall be in accordance with ASTM C 309.
    2. Membrane forming compounds shall not be used on any surface to which other concrete or stain is to be bonded.
    3. Sprayability: Use compounds of a consistency that they can be readily applied by spraying to a uniform coating at a material temperature above 40°F. Drying Time: Use liquid curing compounds that:

i. Dry to the touch in no more than 4 hours, and
ii. Do not track off the concrete when walked upon after 12 hours.

4. White Pigmented Compounds: Use compounds consisting of finely ground white pigment and vehicle, ready mixed for use without alteration.
    i. Ensure the pigment does not:
        1. Settle excessively or cake in the container, and
        2. Thicken in storage to cause a change in consistency which may result in a nonuniform spray.
    ii. Use a compound that after being sprayed on a test slab and drying has an apparent daylight reflectance no less than 60% relative to magnesium oxide. Agitate the compound just prior to it being removed from the container. Agitate it continuously during application. CONTRACTOR shall restrict the loss of water to not more than 0.20 kg/m2 in 24 hours or 0.40 kg/m2 in 72 hours, in accordance with ASTM C 156 and when using an application rate of 200 square feet per gallon.
    iii. Use Sealtight 1646 by W.R. Meadows, Inc, Thinfilm 450 by Kaufman Products Inc, DSCC White Wax Cure J9A by Dayton Superior, or an equal approved by the ENGINEER.
5. Clear Compounds: Use clear liquid membrane curing compounds complying with the requirements of ASTM C 309, Type 1-D, Class A. Use only one type of compound on a structure. Do not use different compounds on the same structure. Use Euco Rez-Seal by the Euclid Chemical Company, Sealtight 1100 by W.R. Meadows, Inc., Safe-Cure 1200 Clear by ChemMasters, or an equal approved by the ENGINEER.

C. Joint Sealers
1. Joint Sealer: Joints indicated on DRAWINGS shall be sealed with a polyurethane joint sealer material of uniform, non-sag or self-leveling consistency as indicated. The sealant shall, when installed, tenaciously adhere to primed concrete surfaces and shall remain permanently elastomeric.
2. The material shall be of a type that will, when properly installed, effectively and permanently seal joints subject to minor movements. Install with primer and cure in accordance with the manufacturer's instructions and recommendations.
3. Except as noted on the DRAWINGS, joint sealer shall be Sikaflex 2C-NS or 2C-SL Elastic Sealant/Adhesive, as manufactured by Sika Chemical

Corporation or other material acceptable to the ENGINEER. Add color as required to match adjacent surfaces where exposed to view.

4. Where applicable, match sealant to integrally colored concrete.

D. Non-Shrink Grout:
   1. Compressive Strength: shall comply with ASTM C 109 and meet or exceed 1000 psi compressive strength after 1 day tests, and 3500 psi compressive strength for a 7 day test.
   2. Height change: shall comply with ASTM C 827 for early age requirements, and ASTM C 1090 for hardened grout requirements. Expansion must be limited to 0.3% at 1, 3, 14, and 28 day test intervals.

E. Non-shrink grout shall be "Masterflow 713" or equivalent acceptable to the ENGINEER. Grouts with iron filings are not acceptable. The grout shall be compatible with the surface to be bonded.

F. Epoxy Bonding Agent: Bonding agent shall be a two-component moisture insensitive epoxy adhesive, Sikadur 32, Hi-Mod or equivalent acceptable to the ENGINEER.

G. Expansion Joint Filler Material: Joint filler material shall be closed cell neoprene or rubber conforming to ASTM D 1056, Grade 2A3. Material shall be glued securely to concrete surfaces.

H. Sand-Cement Grout: Sand-cement grout, where specified, shall be a mixture of portland cement, sand and water with a maximum water-cement ratio of 0.38 by weight. The cement used shall be of the same type and source as used in the other concrete on this PROJECT. The grout shall have a consistency similar to thick paint.

I. Wedge-Type Expansion Anchors: Wedge type anchors shall be used only where specifically shown on DRAWINGS and are prohibited under water. Expansion bolts and anchors fastened to concrete shall be stainless steel; "KWIK-BOLT" manufactured by Hilti, Inc., Phillips Red Head wedge anchors, or equivalent acceptable to ENGINEER.

J. Epoxy Anchors: Epoxy anchor bolts shall be the length and diameter indicated on the DRAWINGs and shall be similar and equal to Hilti, HIT HY 200 Stainless Steel or approved equal.

K. Epoxy Sealant: Epoxy sealant shall be a two-component, moisture insensitive, low viscosity, solvent free, epoxy resin, Sikadur 35, Hi-Mod LV or equivalent acceptable to the ENGINEER.

L. Concrete Support Blocks: Concrete support blocks for the floor reinforcement and the support of the vertical reinforcement at the base of the wall shall be a mixture of portland cement, sand and water with a maximum water-cement ratio of 0.38 by

weight. The cement used shall be of the same type and source as used in the other concrete on this PROJECT.

M. Waterstops – refer to Section 03 15 13 Waterstops for specification requirements.

N. Anti-Graffiti Coating: The coating shall be Chemprobe Series 626 Dur A Pell GS (Graffiti Shield) by Chemprobe Coating Systems, LP. Where the Anti-Graffiti Coating is to be used over stone veneers or Structural Concrete Coatings, verify compatibility of the materials prior to application. A material safety data sheet (MSDS) and a complete set of manufacturer's mixing and application instructions shall be submitted to the ENGINEER before the CONTRACTOR begins applying the coating.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to placing concrete, CONTRACTOR shall remove all debris and thoroughly dampen the surfaces that may be in contact with the concrete to be placed.

B. CONTRACTOR shall use compressed air from an air compressor to blow out construction debris and dirt at the bottom of members to be placed such as walls, beams, and columns, prior to final placement of forms that may obscure any joint. CONTRACTOR shall demonstrate to ENGINEER that all debris, such as concrete particles, saw dust, loose tie wire, bar tags, tape, trash and dirt, have been thoroughly removed.

C. All surfaces of forms and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned of all such mortar or grout before the surrounding or adjacent concrete is placed.

D. No concrete shall be placed until all formwork, reinforcement, installation of parts to be embedded, bracing of forms, and preparation of surfaces involved in the placing have been reviewed by ENGINEER.

E. Immediately before placing concrete, all surfaces upon or against which the concrete is to be placed shall be free from standing water, mud, debris, or loose materials.

F. No concrete shall be placed when form surfaces that may be in contact with the concrete, reinforcement, embedded items or sub-base is less than thirty two degrees Fahrenheit (32°F). When the mean daily outdoor temperature is less than forty degrees Fahrenheit (40°F), the temperature of the concrete shall be maintained between fifty degrees Fahrenheit (50°F) and seventy degrees Fahrenheit (70°F) for the required curing period. When necessary, arrangements for heating, covering, insulating, or housing the concrete WORK shall be made in advance of

placement and shall be adequate to maintain the required temperature without injury as a result of concentration of heat. Combustion heaters shall not be used during the first twenty four (24) hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

G. Concrete shall not be placed against forms exposed to heating unless the temperature of the forms is first cooled to less than or equal to ninety degrees Fahrenheit (≤90°F).
H. Concrete placed against gravel or crushed stone:
    1. Prevent loss of water from concrete with a minimum 2 in. layer of material having 25 percent fines passing a No. 4 sieve.
I. Concrete placed against rock:
    1. Remove all loose pieces of rock.
    2. Clean exposed rock surface in accordance with Soils ENGINEERs recommendations.
    3. Surface saturate unwetted surfaces before placing fresh concrete.
J. Concrete placed against hardened or existing concrete:
    1. Prior to placing fresh concrete against surface of hardened concrete, complete the following:
        i. Remove all laitance, foreign substances (including curing compound), wash with clean water, and thoroughly wet hardened surface before placing fresh concrete.
        ii. Apply epoxy-bonding agent at blockouts, cutouts and in locations directed by ENGINEER.
    2. Intentionally roughen all hardened surfaces to 1/4-inch diameter per ICRI 310.2R-2013 CSP 5 or above.

3.02 PLACEMENT

A. Placement shall conform to ACI 301, Chapter 8, ACI 304, ACI 306.1, ACI 305.1, and ACI 309. No concrete shall be placed in water except with the written permission of ENGINEER. The surfaces of absorptive materials against or upon which concrete is to be placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete. The concrete shall be placed by equipment that will prevent segregation or loss of ingredients. The stream of concrete shall not be allowed to separate by permitting it to fall freely over rods, spacers or other embedded materials.
B. Unless otherwise called out in these SPECIFICATIONS or shown on the DRAWINGS, the placement lift depth of concrete in walls shall be limited to two (2) feet or less to minimize surface defects such as air voids that can form on concrete surfaces. Lift

depths shall be limited to one (1) foot if, in the opinion of ENGINEER, the quality of the finish is unacceptable at the two- (2-) foot lift depth.

C. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement.
D. Concrete shall not be dropped more than five (5) feet unless confined by closed chutes or pipes. Care shall be taken to fill each part of the form by depositing the concrete as near final position as possible. The coarse aggregate shall be worked back from the forms and worked around the reinforcement without displacing the bars. After initial set of the concrete, the forms shall not be jarred and strain shall not be placed on the ends of projecting reinforcement.
E. Where steep slopes are required, the chutes shall be equipped with baffle boards or be in short lengths that reverse the direction of movement.
F. Concrete shall not be pumped through aluminum alloy pipe.
G. All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete.
H. Conveying:
    1. Convey concrete from mixer to final position as rapidly as practicable without segregation or loss of material.
    2. Use only metal or metal-lined chutes with maximum length of 20 ft, having a maximum slope of 1 vertical to 2 horizontal, and a minimum slope of 1 vertical to 3 horizontal.
    3. Provide a hopper at the end of long-belt conveyors and chutes not meeting the requirements in 2. above.
    4. Conveying by pumping methods shall conform to ACI 304, Chapter 9.
I. Depositing in Walls
    1. Deposit concrete in a continuous operation until section is completed.
    2. Concrete shall be deposited as nearly as practicable to its final position to avoid segregation due to rehandling or flowing.
    3. Place concrete in approximately horizontal layers 2 ft maximum thickness.
    4. Each layer of concrete shall be plastic when covered with following layer.
    5. Rate of vertical rise not more than 2 ft per hour.
    6. Provide placement capacity as necessary to comply with these requirements with construction and other joint locations shown on the DRAWINGs.
    7. Maximum height of concrete free fall, 4 ft.
    8. Pump concrete or use a tremie having varying lengths for placing concrete in columns and walls to prevent free fall of more than 4 ft.

9. Concrete shall not be dropped through reinforcing steel nor subjected to any other procedure that will cause segregation.
10. Place and consolidate concrete in wall or column forms at least 24 hours prior to the time concrete or any reinforcing steel is placed in the system to be supported by such walls or columns except as noted below.
11. Do not exceed 6 ft of vertical height for any portion of a wall or column placed monolithically with floor or roof slab.
12. Allow concrete to thoroughly settle before top is finished. Remove all laitance, debris, and surplus water from surfaces at tops of forms by screeding, scraping, or other effective means.
13. Overfill forms wherever top of a wall will be exposed to weathering and after concrete has settled, screed off excess.
14. See Part 3.04 C. for preparation of construction joints prior to placing wall concrete.

J. Depositing in Floor and Roof Slabs.
    1. Deposit concrete in a continuous operation until section is completed.
    2. Concrete shall be deposited as nearly as practicable to its final position to avoid segregation due to rehandling or flowing.
    3. Place concrete in strips approximately 10 ft wide approximately parallel to the wind direction at the time of placement. At least two placing crews shall be used, one working back and forth on each half of the slab, working the 10 ft wide strips continuously from one edge of the slab to the opposite edge.
    4. Each strip of concrete shall be covered with 6 mil. thick plastic 12 ft. wide or Burlene, overlapped approximately 1.5 ft, prior to the development of plastic shrinkage cracks.

K. Depositing in Flatwork (Walks, Trails, Curb & Gutter, etc.)
    1. Place concrete monolithically between expansion joints.
    2. For integrally colored concrete, minor variations in appearance of integrally colored concrete that are similar to natural variations in color and appearance of uncolored concrete are acceptable.
    3. Efflorescence: Remove efflorescence as soon as practical after it appears and as part of final cleaning.
    4. Use least aggressive cleaning techniques possible, starting with physical removal immediately following spills using a CONTRACTOR’s sponge and regularly- changed clean water.
    5. Do not use muriatic or hydrochloric acid on integrally colored concrete.

L. Submerged Depositing or Curing of Boulder Grout, Grout, and Concrete

1. Underwater placement shall be deposited only when allowed by the contract documents and approved by the ENGINEER. It shall be conducted in a manner meeting the approval of the ENGINEER for each application and the placement shall not be started until the ENGINEER's approval has been obtained. If approved by the ENGINEER, the following procedures shall be used.
2. Use Anti-Washout Admixtures as specified in Part 2.01.D.9, and in addition the concrete mix and testing guidelines within USACE CRD-C 661-06.
3. Water Content: The CONTRACTOR shall determine the quantity of water used in the concrete mix, except that the ENGINEER may direct that such quantity of water be reduced if the slump flow of the concrete exceeds the maximum limits as prescribed within USACE CRD-C 661-06. Concrete consistency shall be uniform from batch to batch. Water shall not be added to compensate for stiffening of the concrete during placement. However, the CONTRACTOR shall be permitted to add additional plasticizing admixture.
4. All underwater placement of concrete for water depths larger than 3 feet shall be placed by diver-directed pumping. The CONTRACTOR shall conduct a pre-placement meeting with his placement staff, the ENGINEER’s staff, divers (if necessary), concrete supplier, and testing technicians to review and discuss the placement PLAN.
5. Isolate areas with a floating or containment silt curtains as required to ensure calm waters, no velocities or currents, prevent migration of sediments, and as required by permitting agencies.
6. Depositing operations shall not be conducted in running water or in water with a temperature below 35 degrees F.
7. To prevent segregation, grout or concrete deposited under water shall be carefully deposited in a compact mass in its final position by means of a tremie pipe, concrete pump, or other approved method, and shall not be disturbed after being deposited. The tremie shall be watertight and sufficiently large to permit a free flow of concrete. Concrete buckets shall not be used for underwater placement of concrete except to deliver concrete to the tremie. Still water shall be maintained at the point of deposit. The water level shall be regulated so that there shall be no fluctuation of water head that may be injurious to the grout.
8. Prior to placement of concrete the CONTRACTOR shall provide acceptable facilities and made ready for accomplishment of the WORK as specified including truck access and truck cleanout facilities.

9. The discharge end shall be closed (using a “pig” or other method) at the start of the WORK in order to prevent water from entering the tube and it shall be sealed at all times when not in the deposited grout. Keep the discharge end of the pump line or tremie shaft continuously submerged in the placed material. Mixing of concrete and water shall be maintained at an absolute minimum. The tremie tube shall be kept full up to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited grout.
10. Concrete shall be supplied to the pump continuously. Concrete shall be carefully placed in a compact, monolithic mass and by a procedure that will prevent washing of the concrete. At no time shall concrete be allowed to fall through water. Should the pump line or tremie pipe come out of the fresh concrete for any reason, the line shall be cleared, and the placement re-started with the “pig” re-inserted in the line.
11. The minimum pump line inside diameter shall be 5 inches.
12. All horizontal movements of the pump line or tremie shall be conducted slowly and with care to prevent loss of the embedment of the line. If necessary, the CONTRACTOR shall provide a crane to assist in lifting and moving the end of the boom and discharge line.
13. If a bottom dump tremie bucket is used for depositing the grout, the rate of lowering and raising shall be such that the bucket shall not create undue turbulence inside the cofferdam. The bucket shall always be in the deposited grout before the bottom is opened. The CONTRACTOR shall deposit tremie grout to such elevations that after all unsound grout has been removed from the surface, the finished elevations shall be those which are shown on the PLANs.
14. The CONTRACTOR shall provide a means to determine the level of fresh concrete with respect to the required completed elevation. These means may include markings, vertical pins and alignment wires.
15. In the event of long delays in the placement during which the already deposited tremie has started to set, the CONTRACTOR shall remove the laitance, drill holes and supply and grout dowels in the already deposited portion before resuming the tremie pour; or the CONTRACTOR may be required to remove the grout or concrete already deposited and start again.
16. Submerged Concrete and Boulder Grout Placement: The concrete or Boulder Grout shall be deposited so that it enters the mass of the previously

placed material from within, displacing water with a minimum disturbance to the surface. The underwater seal at start of placing shall not produce undue turbulence in the water. Keep the tremie shaft full of concrete or Boulder Grout to a point well above the water surface. Placement shall proceed without interruption until the concrete or Boulder Grout has been brought to the required height. The tremie shall not be moved horizontally during a placing operation, and a sufficient number of tremies shall be provided so that the maximum horizontal flow of concrete or Boulder Grout shall be limited to 10 feet or less.

17. The divers shall complete a placement report detailing their WORK activities during placement.

3.03 CONSILIDATION

A. Concrete vibrators for consolidating concrete shall be two and one-half inch (2-1/2") diameter “high cycle” vibrators with a frequency under load of eight thousand (8,000) to ten thousand four hundred (10,400) vibrations per minute (vpm). Concrete vibrators of lesser capacity are unacceptable for use in any part of the construction. CONTRACTOR shall have at least one standby concrete vibrator ready for use for every two (2) concrete vibrators in use during a concrete placement.
B. All concrete shall be thoroughly consolidated with internal vibrators as recommended in ACI 309 immediately after deposition. The concrete shall be thoroughly worked around the reinforcing steel, around embedded items and into corners of forms. Vibration shall be supplemented by spading, rodding, or forking to eliminate all honeycomb and voids around embedded items.
C. The vibrator shall be inserted vertically, allowing it to penetrate rapidly to the bottom of the lift and at least six (6) inches into the previous lift. The vibrator shall be held at the bottom of lift for five to fifteen (5 - 15) seconds. The vibrator shall be pulled up at a rate of about three (3) inches per second.
D. The vibrator shall be inserted so that the fields of action overlap. The field of action is approximately eight (8) times the vibrator’s head diameter. Thus for a two and one- half (2-1/2) inch diameter vibrator, the spacing of each insertion shall be approximately twenty (20) inches.
E. Vibration shall be stopped when the concrete surface takes a sheen and large air bubbles no longer escape.
F. Do not use a vibrator to move concrete horizontally.
G. During and immediately after placement, thoroughly compact and WORK around all reinforcements, embedments, and into corners of forms, eliminating all air or stone pockets that may cause honeycombing, pitting, or planes of weakness.

H. Use mechanical vibrators that will maintain at least 9,000 cycles per minute when immersed in concrete.
I. Minimum horsepower per vibrator shall be 1-1/2.
J. Number and type of vibrators shall be as acceptable to ENGINEER. A spare vibrator will be available at all times in case of mechanical problems.
K. Over-vibrating and the use of vibrators to transport concrete laterally in forms will not be allowed.
L. Vertically insert vibrators at points approximately 2 ft apart and to a depth to penetrate 6 in. into the preceding layer.
M. Vibrate each location for a length of time to obtain adequate consolidation (generally 5 to 15 seconds).

3.04 OPENINGS AND INSERTS

A. Pipe sleeves, inserts for pipe connections, anchors, and forms for pipe holes shall be accurately placed and securely fastened to the forms in such a manner that the placing of concrete shall not alter their alignment or location. In the event that openings are inadvertently omitted or improperly placed, ENGINEER may require the concrete to be cored at the proper location. Filling of improperly placed openings shall be done with expansive grout or dry pack or mortar applied with an accepted epoxy adhesive. The surfaces of the opening shall be roughened prior to filling.

3.05 EMBEDDED ITEMS

A. At the time of concrete placement, embedded items shall be clean and free from mud, oil, and other coatings that may adversely affect bonding capacity. Aluminum embedments shall be coated with a bituminous material to prevent electrolytic action between the embedded item and reinforcing steel that results in concrete deterioration. Embedment items shall be accurately placed and securely fastened to the forms in such a manner that the placing of concrete shall not alter their alignment or location. Contact between embedded items and reinforcing steel or tendon ducts is unacceptable and is not permitted.

3.06 CONSTRUCTION JOINTS

A. The location of all construction joints shall be subject to the acceptance of ENGINEER. The surface of all construction joints shall be thoroughly cleaned and all laitance and standing water removed. Clean aggregate shall be exposed by abrasive blast cleaning. Wire brushing and air water jets may be used while concrete is fresh provided results are equal to abrasive blast cleaning. Construction joints shall be keyed at right angle to the direction of shear. Except where otherwise shown on the

DRAWINGS, keyways shall be at least one and one-half (1-1/2) inch in depth over at least twenty five percent (25%) of the area of the section.

B. Joints:

A. Watertight joints (Waterstops)
    1. Use at all locations where water is to be contained, groundwater is to be resisted and as shown on DRAWINGs. Approved waterstop is required at all such joints.

B. Expansion and contraction (control) joints
    1. At locations shown on DRAWINGs.
    2. Extend reinforcement continuously through joints, except "Expansion Joints," unless specifically shown on DRAWINGs.
    3. Form joint with felt, ASTM D 2475, where "bond breaker" is indicated.
    4. Flexible joint filler material as indicated in Part 2.03, shall be used in Expansion Joints.
    5. Expansion and contraction joints shall be caulked with a joint sealer as indicated in Part 2.03.

C. Construction joints.
    1. Provide where shown on DRAWINGs.
    2. Obtain ENGINEER's approval for proposed locations of construction joints not shown on DRAWINGs or for proposed elimination of construction joints shown on DRAWINGs.
    3. Locate joints to least impair the strength and serviceability of the structure, generally as follows:
        i. Columns and walls.
            1. At underside of beams, girders, haunches, drop panels, slabs, and at floor levels.
            2. All haunches and drop panels shall be considered as parts of supported floor or roof and shall be placed monolithically therewith.
        ii. Suspended slabs.
            1. At or near mid-span in flat slab construction.
        iii. Construction joints in walls, beams, girders, and slabs shall be perpendicular to planes of their surfaces, with expansive rubber waterstops, and shall not be keyed except as shown on DRAWINGs.
        iv. Maximum length of wall segments without construction joints shall be 500 ft or as shown on the DRAWINGs.

4. The surfaces of concrete to be cast against shall be thoroughly cleaned and all laitance removed. Concrete shall be vibrated adequately to prevent honeycombing at the joint.
5. Construction joints shall require bond. After cleaning, before new concrete is placed, vertical joints shall be wetted unless otherwise detailed on DRAWINGs or directed by ENGINEER. Prior to placement of concrete in walls, the bottom construction joint must be slushed with 2 to 3 in. of sand-cement grout. The sand-cement grout shall have a consistency similar to thick paint and shall be proportioned as specified in Part 2.03. The fresh concrete shall be placed before the grout has attained its initial set.
6. Joints where indicated on DRAWINGs or where directed by the ENGINEER to receive an epoxy bonding agent shall have been prepared and the bonding agent applied in accordance with the manufacturer's recommendations prior to placing fresh concrete.

D. Joints for Concrete Flatwork (Walks, Trails, Curb and Gutter, Pads, etc.)
1. Construct all joints true to line with faces perpendicular to surface of the sidewalk, trail, etc. Maximum variance, ¼-inch from indicated position.
2. Expansion Joints: Place joints every 100 feet, or at cold joints, or where directed by the ENGINEER. Set joint material full depth of slab, ¼-inch below the surface. Anchor in place. Finish joints with a ¼-inch radius edger.
3. Control Joints: Place joints at the same interval as the width of the trail, but not more than 10 feet. Each joint will be struck perpendicular to the trail or where designated by the ENGINEER to a depth of ¼ of the thickness of the slab. Any joints not sufficiently deep will be saw cut to the required depth from the pavement surface. All joints shall be straight.
4. Where a scoring pattern is indicated, accomplish by cutting ¼ the depth of concrete with a trowel or by placing metal strips and removing and finishing with a ¼-inch radius edger. Sawed joints of ⅓-inch width will be acceptable.
5. Where existing or proposed structures, such as light standards, fire hydrants, and poles are within the limits of the sidewalk or flatwork area, score concrete in a block 8-inches wider than the maximum dimension of structure and place a ¼-inch premolded expansion joint around structure.

3.07 EVAPORATIVE RETARDANT

A. The use of an evaporative retardant is required to assist in proper placement of concrete in accordance with Section 03 29 00, Concrete Curing. Apply two (2) times; after screeding and after the first floating operation. The retardant should be applied at a rate of one (1) gallon of sprayable solution per two hundred to four

hundred (200 - 400) square feet by spraying with an industrial type sprayer. If the nozzle of the sprayer becomes plugged, CONTRACTOR shall clean, or replace, the nozzle. Under no circumstances shall the retardant be used except by spraying a mist with a nozzle. The retardant shall be applied in strict conformance with the manufacturer's recommendations and precautions. In no case shall the retardant be used as a finishing agent. The use of an evaporative retardant requires review and approval by ENGINEER.

3.08 FIELD QUALITY CONTROL

A. CONTRACTOR shall assist OWNER or the concrete testing consultant as requested during the performance of quality control testing. When concrete is placed using a concrete pumper, concrete for testing will be taken from the pumper discharge hose.

3.09 INSPECTION

A. General
    1. Ensure that excavations and formwork are completed. Refer to Concrete Forming - Section 03 11 00 for formwork requirements.
    2. Assure that dirt, mud, encrusted concrete, debris and excess water have been removed.
    3. Check that reinforcement is properly positioned and secured in place. Refer to Reinforcement – Section 03 21 00 for steel reinforcement requirements.
    4. Verify that expansion joint material, anchors, and other embedded items are secured in proper position.

3.10 FINISHING EXPOSED SURFACES

A. Finishing unformed surfaces
    1. Slabs for aprons, slabs-on-grade, and tops of walls.
        i. Provide surface conforming to proper elevation and contour. Except as noted otherwise on the DRAWINGs, all walks and slabs shall slope 2 percent away from buildings. All other walks, exterior concrete steps, etc. shall be pitched to drain out with a slope of ¼ in. per ft. Tops of retaining walls shall be pitched back (into the backfill) 0.25 in. per ft unless designated otherwise by the ENGINEER. All aggregates shall be completely embedded in mortar by screeding.
            1. Screeded surfaces shall be free of surface irregularities.
            2. Maximum variation from a plane surface in any 10 ft section shall be ¼ in.
    2. Coordination of Finishing and Placement.

i. Mixing and placing shall be carefully coordinated with finishing. Concrete shall not be placed on the subgrade or forms more rapidly than it can be spread, straight edged, and bull floated. These operations must be performed before bleeding water has an opportunity to collect on the surface.
ii. To obtain good surfaces and avoid cold joints, the size of placing and finishing crews shall be planned with due regard for the effects of concrete temperature and atmospheric conditions on the rate of hardening of the concrete.
iii. All flatwork finishers on the PROJECT shall be ACI Certified flatwork finishers or equivalent acceptable to the ENGINEER.

3. Jointing and Edging.
    i. Joints in slabs shall be located and detailed as indicated on the DRAWINGs and in the Specifications.
    ii. Where saw-cut joints are required or permitted, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. In all cases, the saw cutting shall be completed no later than within the first 12 hours after the slab finishing operations have been completed.
    iii. Edge exposed edges of floated or troweled surfaces with a tool having a ¼ in. corner radius, unless these edges are specified to be beveled.
4. Consolidation.
    i. Concrete in slabs shall be thoroughly consolidated. Internal vibration shall be used in beams and girders of framed slabs and along the bulkheads of slabs on grade. Consolidation of slabs shall be obtained with vibrating screeds, roller pipe screeds, internal vibrators, or other acceptable means. The concrete surfaces shall not be manipulated prior to finishing operations.
5. Finishes.
    i. Unless selection of finishes is made in the Specifications or on the DRAWINGs, the following finishes shall be used, as applicable.
        1. Floated Finish - Use for tops of walls, footings, pile caps, etc.
        2. Troweled Finish - Use for floors in finished areas and where called for on DRAWINGs.

3. Broom Finish - Use for floor slabs, concrete stairs, landings, sidewalks, concrete trails, curb and gutters.
4. Raked Finish - Use for slabs to receive topping or secondary concrete.
5. Light Sandblast – As indicated on DRAWINGs and Specifications
6. Medium Sandblast – As indicated on DRAWINGs and Specifications

ii. The following finishes shall be utilized on this PROJECT unless specified or detailed otherwise.

1. Floated Finish.
    a. After the concrete has been placed, consolidated, struck- off, and leveled by bull floating, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared and/or when the mix has stiffened sufficiently to permit the proper operation of a power-driven float. The surface shall then be consolidated with power-driven floats of the impact type, except in thin sections, such as pan slabs, which shall be floated by hand. Hand floating with wood or cork-faced floats shall be used in locations inaccessible to the power-driven machine. Trueness of surface shall be rechecked at this stage with a 10-foot straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce planes checking true under the straightedge in any direction, with tolerances not exceeding ¼ in. in 10 ft. The slab shall then be refloated immediately to a uniform, smooth, granular texture.
2. Troweled Finish.
    a. Where a troweled finish is specified, the surface shall be finished first with impact power floats, as specified above where applicable, then with power trowels and finally with hand trowels. The first troweling after power floating shall be done by a power trowel and shall produce a smooth surface that is relatively free of

defects, but which may still contain some trowel marks. Additional troweling shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be free of any trowel marks and shall be uniform in texture and appearance, with tolerances not exceeding ¼ in. in 10 ft. On surfaces that support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

3. Broom Finish.
    a. Slabs shall be given a coarse transverse-scored texture by DRAWING a broom across the surface. This operation shall follow immediately after bull floating operations and hand floating as required to close the surface. Provide a uniform abrasive texture of constant color. On paths, walks and trails, broom at right angles to normal traffic direction.
4. Rake Finish.
    a. Roughened concrete surface to a ½" minimum amplitude by raking.
5. Light Sandblast.
    a. Light sandblast is defined as that which leaves an even fine-grained surface in which the cement mortar has been removed to the extent of starting to expose the small aggregate. Complete operations for a smooth form finish. If necessary, use grout rubbed finish to repair surface areas. Add color to grout mix to match color of concrete where colored concrete is specified. CONTRACTOR shall prepare a 3-foot square sample panel, including color additive, for review by the ENGINEER.
6. Medium Sandblast.
    a. Medium sandblast is defined as that which leaves an even fine-grained surface in which cement mortar has

been removed to the extent of exposing the small aggregate, and just starting to expose large aggregate. Complete operations for a smooth form finish. If necessary, use grout rubbed finish to repair surface areas. Add color to grout mix to match color of concrete where colored concrete is specified. CONTRACTOR shall prepare a 3-foot square sample panel, including color additive, for review by the ENGINEER.

3.11 REPLACEMENT, REPAIRING AND PATCHING OF DEFECTIVE CONCRETE

A. Removal and replacement of defective concrete:
    1. After forms have been removed, any concrete that is not formed as shown on the DRAWINGs, is out of alignment or level beyond the required tolerance, shows a defective surface that cannot be properly repaired or patched, or cannot be shown to prevent water migration through concrete surfaces or joints, shall be removed and replaced at the CONTRACTOR's expense.
    2. Liquid retaining concrete walls, slabs, beams, etc., cannot have any honeycombing, cold joints, cracks greater than 0.004 in. wide, or leakage of water through the concrete thickness or joints. If in the opinion of the ENGINEER the honeycombing, cold joints, cracks or leakage are excessive, the CONTRACTOR shall be required to remove the complete concrete segment and replace it. Where minor honeycombing, cold joints, cracks or leakage occurs, it shall be repaired as indicated in Part 3.07.B and C below.
B. Repair of tie holes, blockouts, cutouts and defective concrete.
    1. Immediately after form removal, repair, to the satisfaction of the ENGINEER, all repairable surface defects, including tie holes, in concrete surfaces. In all cases, repair WORK shall be completed within 24 hours of removal of the forms and prior to application of curing compound.
    2. Replace, to satisfaction of ENGINEER, within 48 hours after adjacent forms have been removed, all other honeycombed and defective concrete areas that cannot be immediately repaired as noted in item 1 above.
    3. Cut out and remove to sound concrete, with edges square-cut to avoid feathering, all honeycombed or otherwise defective concrete.
    4. Repair WORK shall conform to ACI 301 and these specifications. At all blockouts, tie-holes and cutouts, after being thoroughly cleaned, apply an epoxy-bonding agent and fill with non-shrink grout, as specified in the materials section of this specification. Color shall be added to match surrounding concrete.

5. Perform in a manner that will not interfere with thorough curing of surrounding concrete.
6. Adequately cure all repair WORK.

C. Repair of cracks and minor honeycombed areas.
1. All cracks, minor honeycombed concrete or other areas of apparent leakage, including wet spots on walls, shall be sealed with Epoxy Sealant injection or other acceptable means so that the concrete is watertight .

3.12 FINISHING FORMED SURFACES

A. Finishing.
1. Rough form finish - All surfaces not exposed to view such as surfaces in contact with earth.
    i. Chip off all fins and other surface projections greater than ¼ in. high.
    ii. Fill all tie holes and repair and patch all defects.
2. Smooth form finish - All exposed surfaces not generally exposed to view including interior surfaces of structures.
    i. Use form facing to produce a smooth, hard uniform surface.
    ii. Keep number of seams to a minimum.
    iii. Remove all fins and projections.
    iv. Clean, coat, and fill all tie holes.
    v. Repair and patch all defects.
3. Grout-Rubbed Finish – Provide a grout-rubbed finish on all non-colored concrete surfaces exposed to view. Do not begin cleaning surface until all contiguous surfaces are completed and accessible and can be completed at the same time.
    i. Complete operation for smooth form finish (see above), then wet surface and apply grout mix of 1 part of Portland Cement and 1-1/2 parts of fine sand by volume with sufficient water to produce a grout having the consistency of thick paint. Substitute white Portland Cement for a part of the gray as required in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or a spray gun.
    ii. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.

iii. While the grout is still plastic, remove all excess grout by working (rubbing) the surface with a rubber float, burlap, or other means.
iv. After the surface whitens from drying (about thirty minutes at normal temperatures), rub vigorously with clean burlap.
v. The finish shall be kept damp for at least 36 hours after final rubbing.
vi. Proper curing temperatures need to be maintained just as with other concrete WORK.

4. Sandblast finish – Exposed surfaces exposed to view, where indicated on the DRAWINGs to be sandblasted, shall include requirements of a smooth form finish followed by sandblasting to remove approximately 1/8-inch of surface concrete.
5. Anti-Graffiti Coating - All surfaces where noted on the DRAWINGs, in the Specifications and/or in the Contract to receive an Anti-Graffiti Coating.
    i. Where an Anti-Graffiti Coating is called out on the DRAWINGs, in the Specifications and/or in the Contract, the coating shall be applied to all exposed surfaces of the structure above the ground line, including all walls and headwalls, and shall also extend 6 inches below the finished ground line. This will require staged backfilling of the front face of the wall.
    ii. Sidewalks, paths, concrete wall surfaces, wall caps, bridge bearing devices, curb and barrier cover plates, steel fence, and steel rail shall be masked or otherwise protected to prevent Anti-Graffiti Coating from coming into contact with them.
    iii. The final color of the Anti-Graffiti Coating shall be clear.
    iv. The Anti-Graffiti Coating shall be applied in accordance with the manufacturer's instructions and recommendations.
    v. New mortar joints of any stonework shall be at least 28 days old, or as otherwise approved in writing by the Coating manufacturer, before the coating is applied.

3.13 CURING

A. General
    1. Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures and shall be maintained without drying at a relatively constant temperature for the period of time necessary for the hydration of the cementitious materials and proper hardening of the concrete. A list of all intended curing methods including a description of materials shall be submitted to the ENGINEER for review.

2. Initially, the concrete temperature shall be maintained at or above 70º F. for 3 days or at or above 50º F. for 5 days. Continue curing as required to achieve the specified 28-day strength. See Part 1.05 Job Conditions for additional information.
3. Keep concrete continuously moist for at least 7 days after placement by use of:
    i. Ponding or continuous sprinkling.
        1. Begin as quickly as possible after initial set.
        2. Provide complete coverage with minimum amount of runoff by re- gulating rate of water application.
        3. Interrupt application of water to walls for finishing or repair WORK only over areas being finished.
        4. Do not permit wall areas to become dry that are not being finished.
        5. Resume curing immediately after each day's finishing operations.
    ii. Polyethylene film see Item C. below.
    iii. Wet burlap, wet absorptive mats, or wet sand.
    iv. Leave forms in place for concrete walls and keep wet.
4. Use membrane-curing compound as noted below.

B. Membrane curing compound (conforming to ASTM C 309).
1. Shall be used prior to placement of plastic sheeting on concrete floor and roof slabs, walls and other miscellaneous concrete areas where acceptable to ENGINEER.
2. Spray-apply in 2 coats perpendicular to each other at coverage recommended by manufacturer. Use clear membrane curing compound, not white, on flatwork (walks, trails, paths, etc.).
3.
4. Cover unformed surfaces with curing compound within 30 minutes after final finishing.
5. Apply curing compound immediately to formed surfaces if forms are removed before end of specified curing period. Curing compound sprayed in tie holes is to be cleaned out before patching tie holes. Forms may be left in place for all or part of the curing period; wood forms shall be kept wet.
6. Protect compound against abrasion during curing period.

C. Film Curing (conforming to ASTM C 171).

1. Film curing shall not be used in lieu of water curing on tank floor and roof slabs. Use only where specifically reviewed and acceptable to ENGINEER.
2. Concrete placed early in the concrete placing operation shall not be allowed to dry out. Apply Membrane Curing Compound, or other material acceptable to the ENGINEER, as noted above prior to placing the polyethylene film or other coverings.
3. Begin as quickly as possible after initial set of concrete.
4. Cover surfaces completely with polyethylene sheeting.
5. Overlap edges for proper sealing and anchorage.
6. Cover joints between sheets with dunnage as required to prevent displacement due to wind or other factors.
7. Promptly repair all tears, holes, and other damage.
8. Anchor continuously all edges and anchor surface as necessary to prevent billowing.

3.14 QUALITY CONTROL

A. Concrete tests

1. Will be paid for by the CONTRACTOR, except where noted otherwise in these specifications, and shall be in accordance with the requirements of ACI 301, except as noted or modified in this Section. Test specimens shall be taken by an ACI Certified Concrete Field-Testing Technician - Grade 1 in accordance with the "Standard Method of Making and Curing Concrete Test Specimens in the Field," ASTM C 31.
    i. Strength test.
        1. Mold and laboratory cure seven cylinders from each sample.
        2. Test two cylinders at 7 days, and an additional two cylinders at 14 days per ASTM C 39. Test two cylinders at 28 days for acceptance. Keep the remaining one as a spare to be tested as directed by ENGINEER.
        3. The spare cylinder for each sample may be eliminated after the first several concrete placements of each type of concrete if, in the opinion of the ENGINEER, test results are consistent and within specifications.
    ii. Minimum samples.
        1. Collect the following minimum samples for each 28-day strength concrete used in the WORK for each day's placing:

Section 03 31 00 – Table 5 – Minimum Samples	
Concrete Quantity	Number of Samples

50 yd^3 or less	One
50 to 100 yd^3 or less	Two
100 yd^3 or more	Two plus on sample for each additional 100 yd^3

iii. Slump test.
   1. Conduct test for each strength test sample and whenever consistency of concrete appears to vary.
   2. Slump tests shall be made using "Standard Test Method for Slump of Hydraulic-Cement Concrete" (ASTM C 143).

iv. Air content.
   1. Conduct test from one of first three batches mixed each day and for each strength test sample.
   2. Samples indicating low air contents by the pressure method air content tests in accordance with ASTM C 231 shall be verified by the gravimetric method, ASTM C 138, and the volumetric method, ASTM C 173, before adding additional air entraining admixture in the field.

2. The CONTRACTOR shall provide the following to the OWNER and the Testing Agency at no additional cost to the OWNER:
   i. Incidental labor required to facilitate testing.
   ii. Minimum one day's advance notice when concrete is to be placed.
   iii. Storage facilities for concrete test cylinders; including, when necessary, a specially prepared box with high-low thermometer and thermostatically controlled heating devices in accordance with Section 9.2 of ASTM C 31 for storage of the cylinders for the first 24 hours after molding.
   iv. Materials, samples, and access to materials as required for testing.
   v. Reimbursement of costs for testing and inspection resulting as a consequence of the following:
      1. WORK not in compliance with the Contract Documents.
      2. Testing requested by the CONTRACTOR or Subcontractor such as field-cured cylinder tests for stripping strengths, etc.
      3. Testing to verify the adequacy of WORK done, without prior notice, without proper supervision, or contrary to standard construction practice.

vi. The use of testing services shall in no way relieve the CONTRACTOR of his responsibility to furnish materials and construction in full compliance with the DRAWINGs and Specifications.

B. Acceptance of Concrete.
   1. If the early strength tests fall below the early strengths deemed necessary to achieve the specified 28-day strength, the ENGINEER shall have the right to require conditions of temperature and moisture necessary to secure the required strength. The ENGINEER may also require pull out tests in accordance with ASTM C 900 or core tests in accordance with ASTM C 42.
   2. Strength level of concrete will be considered satisfactory so long as average of all sets of two consecutive strength test results equals or exceeds specified 28-day strength and no individual strength test result falls below the specified strength by more than 500 psi.

C. Failure of Test Cylinder Results.
   1. Upon failure of the 28-day test cylinder results, ENGINEER may require CONTRACTOR at his expense, to obtain and test at least three pullout tests or 2-in. diameter cored samples from area in question.
   2. Concrete will be considered adequate if average of three pullout or core tests is at least 85 percent of, and if no single core is less than 75 percent of the specified 28-day strength.
   3. Upon failure of the pullout or core test results, ENGINEER may require CONTRACTOR, at his expense, to perform load tests as specified in ACI 318, Chapter 20, or remove and replace as directed by the ENGINEER.
   4. In the event an area is found to be structurally unsound, the ENGINEER may order removal and replacement of concrete as required. The cost of the pullout or core tests, and the load test and the structural evaluation shall be borne by the CONTRACTOR.
   5. Fill all pullout or core holes as specified for repairing defective concrete.

3.15 SPECIAL TESTING REQUIREMENTS

A. Further concrete testing, in addition to Inspection and Materials Testing and testing for proposed mix designs, may become necessary during the PROJECT. Testing shall be provided under the conditions stated in each specification section and shall be in accordance with the requirements of ACI 301 and this specification. Refer to Parts 3.10B and 3.10C for acceptance criteria and procedures upon failure of tests.

B. In all cases, the CONTRACTOR shall provide the OWNER and the testing agency, at no additional cost to the OWNER, with the items listed in Part 3.10.A.2.

C. Sampling and Test Groups.
D. When job cured cylinders are used, samples shall be obtained as specified in Section 03 31 00, Parts 3.14A.1.a, 3.14A.1.b and 3.104.1.c, unless directed otherwise by the ENGINEER.
E. When core tests are used, samples shall be obtained in accordance with ASTM C 42 and as directed by the ENGINEER.

END OF SECTION

SECTION 03 31 01

SCULPTED CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section is supplemental to Section 03 11 00 Concrete Forming and 03 37 13 Shotcrete and includes concrete and shotcrete that is tooled, stamped, textured, colored, and finished by an experienced artisan to create Sculpted Concrete to mimic the appearance of natural rock, including furnishing materials, transporting, placing, finishing, curing and other appurtenant items of construction.

B. Work includes preparation of substrate surface, placing reinforcing steel, and placement and shaping of the top concrete or Shotcrete surface to look like natural sedimentary rock, and related items as shown or specified.

C. This section includes basic finishing and curing methods, accessory control, and expansion and contraction joint devices.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 03 11 00, Concrete Forming
2. Section 03 15 00, Construction Joints
3. Section 03 15 13, Waterstops
4. Section 03 21 00, Reinforcing Steel
5. Section 03 31 00, Structural Concrete
6. Section 03 35 00, Concrete Finishing
7. Section 03 37 13, Shotcrete
8. Section 03 39 00, Concrete Curing
9. Section 07 92 00, Sealants
10. Section 31 38 00, Rock

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing Materials (ASTM)
    a) Standard C33, Standard Specification for Concrete Aggregate
    b) Standard C94/C94M, Standard Specification for Ready-Mixed Concrete
    c) Standard C150, Standard Specification for Portland cement
    d) Standard C260, Standard Specification for Air-entraining Admixtures for Concrete

e) Standard C494/C494M, Standard Specification for Chemical Admixtures for Concrete
f) Standard C618, Standard Specification for Coal and Raw or Calcined Natural Pozzolan for Use in Concrete
g) Standard C979, Standard Specification for Pigments for Integrally Colored Concrete
h) Standard C1059, Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete
i) Standard D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)

2. AMERICAN CONCRETE INSTITUTE (ACI)
a) Standard 211, Standard Practice for Selecting Proportions for Concrete
b) Standard 301, SPECIFICATIONS for Structural Concrete
c) Standard 304, Guide for Measuring, Mixing, Transporting and Placing Concrete
d) Standard 305.1, Specification for Hot Weather Concreting
e) Standard 306.1, Specification for Cold Weather Concreting
f) Standard 309, Standard Practice for Consolidating Concrete
g) Standard 318, Building Code Requirements for Structural Concrete
h) Standard 504, Guide to Joint Sealants
i) 506, Recommended Practice for Shotcreteing

1.04 SUBMITTALS

A. See Section 03 31 00 – Structural Concrete for submittal requirements for concrete.
B. Provide product data on the following:
1. Ready-mixed concrete or Shotcrete mix designs.
2. Fly ash.
3. Admixtures (such as air-entraining and water-reducing admixtures).
4. Form release agents.
5. Bonding agents.
6. Grout.
7. Concrete coloring pigment.
8. Data for proprietary materials and items including patching compounds, curing compounds, and other requested by the ENGINEER.
9. Contractor statement detailing previous sculpted concrete experience.
10. A sculpted concrete construction plan is to be submitted in writing to the ENGINEER for review 7 days prior to construction. The plan shall describe

methods and equipment proposed for hauling, placing, curing, and protecting sculpted concrete as well as placement schedules indicating anticipated daily progress.

11. Shop drawings for sculpted concrete feature indicating sizes, spacing, locations, and quantities of reinforcing steel, bending and cutting schedules, splicing, supporting and spacing devices, and other accessories.
12. The CONTRACTOR shall construct a sample sculpted concrete panel measuring not less than 50 square feet. The sample panel shall represent the finished surface texturing, coloring, and etching of the sculpted concrete feature. The ENGINEER or other representatives of the OWNER shall observe and approve the sample panel prior to the construction of any sculpted concrete features.
13. The CONTRACTOR shall submit to the ENGINEER for review and approval, all proposed texture mats to be utilized by the CONTRACTOR to achieve the most natural rock appearance and texture possible. If other methods of texturing will be performed, the contractor shall submit detailed descriptions of such methods for review.

C. The following documents shall be submitted in accordance with PROJECT SPECIFICATIONS:
    1. Submit integral color pigment samples or colored concrete chip and appropriate technical information on color pigments, dry-shake color hardeners, stains, texture mat patterns, and sealants.
    2. Other appropriate technical information for placing and finishing Sculpted Concrete.
    3. Three (3) samples of colored, stained, textured, or stamped concrete for each Sculpted Concrete finish type on the PROJECT measuring at least 48 inches by 48 inches shall be submitted to the ENGINEER for the purpose of approving the aesthetic concept of Sculpted Concrete before construction of the large sample area including selected colors, shades, hues, and surface texture. The ENGINEER will have 15 calendar days to either approve or reject the submittal. Production Sculpted Concrete shall use the same materials, colorants, finishes and mix proportion as the approved concept samples or as revised during construction and approval of the larger sample area.

1.05 QUALITY ASSURANCE

A. Sculpted Concrete CONTRACTOR Qualifications: In order to be considered the Sculpted Concrete CONTRACTOR for placement of Sculpted Concrete surfaces,

the Sculpted Concrete CONTRACTOR shall meet the requirements of this Specification. Documentation must be provided to the ENGINEER, prior to any WORK onsite, supporting the following requirements.

1. The subcontractor must have successfully completed at least three demonstrated PROJECTs, totaling at least 5,000 square feet within the last 5 years, utilizing the methods proposed for this PROJECT to replicate natural rock surfaces with textured or stamped and colored concrete. Demonstrated PROJECTs shall include PROJECTs such as zoos, golf courses, waterways, and other high-end rock simulations. Portions of demonstrated PROJECTs submitted (or area accounted in these qualification requirements) shall not include any WORK related to residential construction, driveways, paths, curbs, etc. Subcontractor shall submit a statement detailing related experience and in meeting stated requirements.
2. The subcontractor shall submit a list of these three demonstrated PROJECTs as specified above including photographs as noted below. The list shall include PROJECT name, location and the name, address and phone number of an OWNER's representative who can be contacted as a reference. Also included shall be the name of the PROJECT's manager and other key individuals.
3. The subcontractor shall submit the name of the crew chief of the WORK to be performed and their experience must include at least one of the demonstrated PROJECTs acting in the same role. The crew chief shall be onsite during placement of Sculpted Concrete and shall direct all finishing and sculpting efforts.
4. The subcontractor shall submit at least three 8-inch by 10-inch color photographs of each of the demonstrated PROJECTs listed in item (A.2) above to demonstrate the subcontractor's ability to replicate natural surfaces.

B. The ENGINEER will review the submittals described above and will either approve or reject the subcontractor's qualifications for performing the WORK on this PROJECT.

C. The Sculpted Concrete CONTRACTOR shall construct larger sample areas for each type of sculpted concrete used on the PROJECT based on the approved 48-inch by 48-inch samples described above. Each area shall measure not less than 100 square feet. The sample area shall represent the finished surface texturing, coloring, and etching of the sculpted concrete features. The ENGINEER and other representatives of the OWNER shall observe and approve the sample panel prior to the construction of any sculpted concrete features. The location of each sample

area will be determined with the ENGINEER, if acceptable, the sample area may remain in place, if not the sample area will be removed and a second sample area be constructed. Additional sample areas shall be constructed until approved by ENGINEER. Approved sample areas are not to be repeated exactly in the PROJECT or pre- cast. Variation of the texture, coloring, and surface relief of sculpted concrete throughout the PROJECT is required and shall meet the aesthetic concept approved by the ENGINEER.

D. At least 10 Working days prior to beginning the WORK, the CONTRACTORs shall submit to the ENGINEER for review and approval all Working DRAWINGS and calculations required to complete the WORK. The Working DRAWINGS shall clearly show all Sculpted Concrete features, embedded rocks, and all visible elements of the WORK. The Working DRAWINGS shall also show reinforcing details and details of connections to any previously completed WORK.
E. During installation, small (4-inch to 6-inch square) areas of Sculpted Concrete will be removed and sampled after initial placement for visual testing purposes by the ENGINEER during installation. Verification of surface treatment mixing and penetration will be made. CONTRACTOR shall replace and repair these areas immediately so that no cold joints or color variations occur. Approximate tests may be one per 3 square yards to 10 square yards.
F. Structural Concrete as specified in Section 03 31 00, Structural Concrete, shall be used in the construction of the sculpted concrete feature unless Shotcrete is previously approved.
G. Prior to placement of structural concrete for the sculpted concrete feature, the ENGINEER or other representatives of the OWNER must observe all reinforcing bar, forms, and surfaces receiving concrete. Prior to placing concrete CONTRACTOR must repair all discrepancies identified by ENGINEER or other representatives of the OWNER.
H. OWNER's Direction:
    1. It is intended that the finished sculpted concrete feature simulate natural rock as shown on the DRAWINGS. OWNER’s direction and aesthetic intentions are specified herein.
    2. To achieve the natural rock simulation, the CONTRACTOR shall coordinate fully with ENGINEER or other representatives of the OWNER. The ENGINEER or OWNER explicitly reserves the right to continuously monitor the WORK for aesthetic quality until the desired effects are achieved.

3. All WORK in this section shall be observed by the ENGINEER or other representatives of the OWNER. The CONTRACTOR shall ensure a representative of the OWNER is onsite prior to placement of concrete.
4. For sculpted concrete work, visits to other project sites (to view examples) may be required. Adequate notification of the intent to begin WORK on this item (minimum 24 hours) is required to ensure inspection and oversight by the ENGINEER and/or OWNER.

I. The fabrication of artificial rockwork and placement, installation, and/or adjustment of finish details and sculptures shall be accomplished in such a manner as to appear as realistic as possible and “read right” to the trained eye. This element is artistic in nature and may require field adjustments to completed work to obtain the desired effect. The ENGINEER will decide questions of aesthetic effect. Minor changes or adjustments to in-place work shall be made at the CONTRACTOR’s expense.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Structural concrete delivery, storage, and handling shall be performed in accordance with Section 03 31 00, Structural Concrete.
B. Ready-mixed Shotcrete shall comply with ASTM C94 except that it may be delivered to the Shotcrete equipment in the dry state if that equipment is capable of adding the water and mixing satisfactorily with the dry ingredients, or with ASTM C685, in which case the ingredients are delivered dry and proportioned and mixed at the site.
C. Structural reinforcing steel delivery, storage, and handling shall be performed in accordance with Section 03 21 00, Reinforcing Steel.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Concrete, admixtures, surface treatments, and finishes for Sculpted Concrete shall meet the requirements of Section 03 31 00 – Structural Concrete as modified below.
    1. Fibrous Concrete Reinforcement: Per Section 03 31 00.
    2. Color Additives for Sculpted Concrete: When indicated on the DRAWINGS or SPECIFICATIONS, Sculpted Concrete shall have integral color pigments added to the mix and be as manufactured by Davis Colors, or approved equal, at the rates indicated as acceptable following sample panel and larger sample area installation.
        i. Colored additives shall contain pure, concentrated mineral pigments specially processed for mixing into concrete and complying with ASTM C979.

ii. Color additives containing carbon black are not acceptable. Black and Gray coloring shall be obtained using black iron oxide pigments.
iii. The CONTRACTOR shall determine exact color or combination of colors to be added to mimic the natural rock of the PROJECT and construct sample panel for approval by the ENGINEER. Color samples shall be submitted to the ENGINEER prior to sample panel construction.
iv. CONTRACTOR shall determine the exact dosage required to produce grout/concrete to mimic the natural rock of the PROJECT as per manufacturer recommendations and ENGINEER approval.
v. Meter and dispense colors using computer-controlled automated color weighing and dispensing systems provided by the manufacturer of the color additive. As an alternative manual dispensing may be used and accomplished by addition of premeasured disintegrating bags. Particular attention must be given to thorough mixing of concrete after addition of the color additives.
vi. Do not re-temper mix by adding water in the field.

B. Surface Treatment and Finishes:
1. Dry Shake Color Hardeners: Color hardeners, where indicated on the DRAWINGS or in the SPECIFICATIONS shall be as manufactured by Brickform or approved equal at the manufacturer recommended application rates or as approved following sample panel(s) installation.
i. The CONTRACTOR shall determine exact color or combination of colors to be applied to mimic the natural rock of the PROJECT and construct sample panel for approval by the ENGINEER. Color samples shall be submitted to the ENGINEER prior to sample panel construction.
2. Stain and Sealant: Concrete stain, where required by the DRAWINGS or SPECIFICATIONS, shall be as recommended by the CONTRACTOR to meet the following requirements.
i. Create base colors, and color variations that are deemed acceptable following sample panel and larger sample area production.
ii. Accurately simulate hues, streaking and coloration matching onsite bedrock and boulders.
iii. Must maintain color (little to no fading) in submerged conditions or direct sunlight.

iv. Following staining, the finish shall be sealed with sealant recommended by the CONTRACTOR and stain manufacturer, and shall meet the following requirements:
    1. No discoloration with exposure to sunlight.
    2. Increase durability by limiting water penetration.
    3. Preserve color of original stain.
v. Stain and sealants shall be applied per manufacturer's recommendations.

3. Copper Shake: Areas where required by the DRAWINGS or SPECIFICATIONS shall have powdered copper evenly worked within the upper 1/2-inch of the finished surface of the Sculpted Concrete Finish. The copper shall be from 98 percent to 99.999 percent pure electrolytic copper powder -325 Mesh. The application shall be at no less than 3 pounds per square yard.
4. Coloring and Finishes Summary: See the information in the following table for a summary of the coloring and finishes requirements for this PROJECT.

C. Sculpted Concrete Color Admixtures and Finishing Requirements. PROJECT requirements for Sculpted Concrete coloring and finishing per table below:

Section 03 31 01 – Table 1 – Sculpted Concrete Color Admixtures And Finishing Requirements				
Finish	Integral Concrete Color	Dry-Shake Surface Color Hardeners	Surface Stain	Copper Shake
Sculpted Concrete-All Types	Yes – In a minimum of the top 5 inches (Care will be taken to ensure that there are no cold joints). Minimum of 5% color additive. Color to be selected by client.	As recommended by Sculpted Concrete CONTRACTOR.	As recommended by Sculpted Concrete CONTRACTOR.	Include on 10% of total area of the Sculpted Concrete – Areas are generally located within and adjacent to the Drops as directed by ENGINEER. Apply in addition to other finish treatments but do not paint over.

D. Concrete Class:
    1. Concrete
        i. Concrete shall have the following characteristics:
            1. Required field compression strength of 4,500 psi at 28 days.
            2. Air Content Range of 5% - 8%

3. Maximum water | cementitious ratio of 0.45
4. For all concrete mix designs with ASTM C150 cements, up to a maximum of 20% Class C fly ash, 30% Class F fly ash, or 30% high-reactivity Pozzolan by weight of total cementitious material may be substituted for cement

ii. The concrete mix shall be made with AASHTO M 43 size No. 8 coarse aggregate.

03 31 01 – Table 2 – Concrete Mix	
Sieve size U.S. Standard Square Mesh Sieves	AASHTO M 43 size No. 8 coarse aggregate Percent by Weight Passing
3/4”	-
1/2”	100
3/8”	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

2. Shotcrete
   i. Shotcrete shall be placed as a wet mixture of aggregate and Portland cement.
   ii. The minimum 28-day compressive strength shall be 4500 psi.
   iii. Coarse aggregates

03 31 01 – Table 3 – Shotcrete	
Sieve size U.S. Standard Square Mesh Sieves	AASHTO M 43 size No. 8 coarse aggregate Percent by Weight Passing
3/4”	-
1/2”	100
3/8”	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

3. Fine Aggregates
   i. AASHTO M6
   ii. ASTM C33

03 31 01 – Table 4 – Fine Aggregates	
Sieve size U.S. Standard Square Mesh Sieves	AASHTO M 43 size No. 8 coarse aggregate Percent by Weight Passing
3/4”	-
1/2”	-
3/8”	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

E. Use cement conforming to one of the following:
    1. Portland Cement conforming to ASTM C-150. Use only one brand of cement throughout the project.
    2. Blended hydraulic cement conforming to ASTM C-595 type IS, IS-A, IP, or IP-.
F. Water shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances. For finished Shotcrete, use curing water that is free from elements that could cause staining.
G. Submit for acceptance proportioning and test data from prior experience. If data from prior experience are not available or accepted, make and have tested specimens from three or more different mix proportions. Submit mix design containing recommended mix proportions and test results for acceptance of ready-mixed Shotcrete. Air entrainment shall be 5-8% prior to pumping.
H. General: Structural concrete shall conform to Section 03 31 00, Structural Concrete. Structural reinforcing steel shall conform to Section 03 21 00, Reinforcing Steel.
I. Concrete Pigment: Concrete coloring shall conform to ASTM C979.
J. Reinforcing Steel: reinforcing steel shall meet the requirements of section 03 21 00 Reinforcing Steel.

2.02 CONCRETE ACCESSORY MATERIALS

A. Concrete Accessory Materials for Sculpted Concrete shall be in accordance with Section 03 31 00 – Structural Concrete, as modified below.
B. Colored powder release agent shall be Antique Release as manufactured by Brickform or approved equal by ENGINEER.

C. Liquid Membrane: Membrane-curing compound shall be in accordance with ASTM C 309. Membrane curing compound shall be sprayable, 18 percent minimum solids content, as manufactured by L&M Construction Chemicals, Inc or equivalent acceptable to the ENGINEER. Membrane curing compound used on colored concrete shall be in accordance with ASTM C1315 and shall be as manufactured by L&M Construction Chemicals, Inc or equivalent acceptable to the ENGINEER. Curing compound shall be non-toxic. When used on colored or stained concrete, curing compound shall be approved by color additive/stain manufacturer and compatible with the color additives, stains, and any surface treatments/finishes used.

2.03 REINFORCEMENT

A. Reinforcement for Sculpted Concrete shall be in accordance with Section 03 21 00 – Reinforcing Steel.

B. Dowels or rock anchors shall be embedded in the grouted core rock or bedrock and attached to Sculpted Concrete reinforcement as per lap length and embedment requirements as shown on DRAWINGS. Dowels or rock anchors shall be installed at a rate of 1 dowel/anchor per 5 square feet unless shown otherwise on the DRAWINGS.

2.04 COMPRESSIVE STRENGTH

A. Concrete compressive strength shall conform to Section 03 31 00, Structural Concrete.

2.05 SOURCE QUALITY CONTROL

A. Batching, Mixing, Transporting Mixed Concrete; Mixed Concrete or Truck Mixers: Shall comply with Section 03 31 00, Structural Concrete.

2.06 ADMIXTURES

A. Use of admixtures shall be permitted upon approval by the ENGINEER.

2.07 STAINING

A. See section 09 91 00 of these specifications for information related to staining sculpted concrete.

PART 3 – EXECUTION

3.01 GENERAL

A. Concrete placement, conveyance, and consolidation shall meet the requirements of Section 03 31 00 – Structural Concrete.

B. CONTRACTOR shall have all subgrade and surface preparations, reinforcement, and form installation completed 48 hours prior to the pour to allow inspection and approval by ENGINEER.

C. Location and type of Sculpted Concrete shall be as shown on the DRAWINGS and as specified herein. The general location and limits of the sculpted concrete are as defined on the DRAWINGS. However, the final location shall be adjusted as determined by the ENGINEER. Where grouted or loose Boulders are adjacent to limits of Sculpted Concrete, place at least two rows of boulders prior to placement of Sculpted Concrete and steel reinforcement for Sculpted Concrete.
D. Sculpted Concrete Areas to Receive Tuning Blocks: Location of Reinforcement to not interfere with drop-in anchors for all tuning blocks. Flat areas to accept tuning blocks shall be of sufficient size and finish to accept tuning blocks. Where spot elevations are shown on the plan views in the DRAWINGS, the elevations are on the surface of the Sculpted Concrete and not the top of a tuning block.
E. “Sculpted concrete” shall be constructed with a single layer of concrete or Shotcrete. The CONTRACTOR is responsible for reviewing the DRAWINGS and deciding which application method will maintain the intended shape and grades. Any other application approach must be reviewed and approved by the ENGINEER.
F. The “Test Section” shall be constructed first. This section will be inspected by the ENGINEER and OWNER. Once deemed acceptable and any necessary modifications to future work are discussed and agreed upon, the CONTRACTOR shall commence construction on other sculpted concrete. There is no specified sequence for the other areas.

3.02 SURFACE PREPARATION

A. General
    1. Moisten subgrade prior to placement, but do not cause water to pond, nor muddy or soft spots to appear.
    2. Designate limits of each placement and obtain ENGINEER's review of entire installation area prior to proceeding.
    3. ENGINEER shall inspect and approve all subgrade prior to installation.
B. Concrete Placed Against Rock
    1. ENGINEER shall be notified of installation area prior to surface preparation of bedrock or installation of reinforcement.
    2. ENGINEER shall approve bedrock subgrade surface prior to installation.
    3. Remove all loose pieces of rock.
    4. Thoroughly clean all rock surfaces in accordance with Section 31 38 00, Rock.
    5. Surface saturate rock surfaces prior to concrete placement.
C. Concrete Placed Against Hardened or Existing Concrete.

1. Prior to placing fresh concrete against surface of hardened concrete, complete the following:
    i. Remove all laitance, foreign substances (including curing compound), wash with clean water, and thoroughly wet hardened surface before placing fresh concrete.
    ii. Apply epoxy-bonding agent at blockouts, cutouts and in locations directed by ENGINEER.

D. Excavation to subgrade shall be carefully considered by the CONTRACTOR. Subgrade may be sloped uniformly, or stepped in accordance with the grading shown on the DRAWINGS as a means of reducing the concrete/Shotcrete quantity required. No adjustment in quantity shall be made for concrete/Shotcrete placed at thicknesses greater than the uniform layer shown on the DRAWINGS. The building of earthen steps on top of a sloping subgrade plane that has been compacted and approved is strictly prohibited. All concrete/Shotcrete necessary to achieve the layout shown on the DRAWINGS shall be included in the unit cost of the sculpted concrete.

E. Prior to placing concrete, the CONTRACTOR shall remove all debris and thoroughly dampen the surfaces that may be in contact with the concrete to be placed.

F. The CONTACTOR shall examine the subgrade, and the conditions under which concrete reinforcement is to be placed, and correct conditions that would prevent the proper and timely completion of the work. The subgrade shall be free of water, unfrozen, mud, debris, or loose materials and have met compaction requirements as specific in section 31 23 00. The CONTRACTOR shall not proceed with the work until unsatisfactory conditions have been corrected. A Shotcrete flash coat may be applied over the top of the completed subgrade. The flash coat shall consist of a 1-inch layer of Shotcrete that will cap and protect the subgrade material during placement of reinforcing steel and prior to placement of sculpted concrete. The flash coat thickness can be counted towards the total required thickness of sculpted concrete if the following conditions are met: This requirement may be waived by OWNER or ENGINEER if CONTRACTOR can demonstrate it is not required and will not compromise the quality of the structure.
    1. The thickness of the flash coat does not exceed 1.5 inches
    2. The flash coat is power washed clean after steel placement is complete.
    3. The flash coat Shotcrete does not excessively crack, break apart, and/or separate from the subgrade prior to placement of sculpted concrete. Determination of acceptance shall be performed by the ENGINEER.

G. CONTRACTOR shall use compressed air from an air compressor to blow out construction debris and dirt at the bottom of members to be placed such as walls, beams, and columns, prior to final placement of forms that may obscure any joint. CONTRACTOR shall demonstrate to ENGINEER that all debris, such as concrete particles, saw dust, loose tie wire, bar tags, tape, trash, and dirt, have been thoroughly removed.
H. All surfaces of forms and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned of all such mortar or grout before the surrounding or adjacent concrete is placed.
I. No concrete shall be placed until all formwork, reinforcement, installation of parts to be embedded, bracing of forms, and preparation of surfaces involved in the placing have been reviewed by ENGINEER.
J. Concrete shall be placed when form surfaces that may be in contact with the concrete, reinforcement, embedded items or sub-base are greater than thirty-two degrees Fahrenheit (32°F). When the mean daily outdoor temperature is less than forty degrees Fahrenheit (40°F), the temperature of the concrete shall be maintained between fifty degrees Fahrenheit (50°F) and seventy degrees Fahrenheit (70°F) for the required curing period. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury as a result of concentration of heat. Combustion heaters shall not be used during the first twenty four (24) hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
K. Concrete shall not be placed against forms exposed to heating unless the temperature of the forms is first cooled to less than or equal to ninety degrees Fahrenheit (<90°F).

3.03 CONCRETE PLACEMENT

A. Concrete shall be placed directly on approved subgrade in accordance with the requirements set for in Section 03 31 00.
B. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement.
C. Concrete shall not be dropped more than five (5) feet unless confined by closed chutes or pipes. Care shall be taken to fill each part of the form by depositing the concrete as near final position as possible. The coarse aggregate shall be worked back from the forms and worked around the reinforcement without displacing the bars. After initial set of the concrete, the forms shall not be jarred and strain shall not be placed on the ends of projecting reinforcement.

D. Where steep slopes are required, the chutes shall be equipped with baffle boards or be in short lengths that reverse the direction of movement.
E. Concrete shall not be pumped through aluminum alloy pipe.
F. All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete.

3.04 SHOTECRETE PLACEMENT

A. Place Shotcrete using suitable delivery equipment and procedures that will meet the requirements of this specification. Refer to ACI Standard 506-66, Recommended Practice for Shotcreteing.
B. Do not place Shotcrete if drying or stiffening of the mix takes place at any time prior to delivery to the nozzle. Do not use rebound or previously expended material in the Shotcrete mix.
C. Remove over-spray or rebound prior to final set and before placement of Shotcrete material on such adjacent surfaces.
D. Placement Techniques:
    1. Control thickness, method of support, air pressure, and/or water content of Shotcrete to preclude sagging or sloughing off. Discontinue Shotcreteing or provide suitable means to screen the nozzle stream if wind or air currents cause separation of the nozzle stream during placement.
    2. Dampen absorptive substrate surfaces prior to placement of Shotcrete to facilitate bond and to reduce the possibility of shrinkage cracking developing from premature loss of the mixing water.
    3. Broom or scarify the surface of freshly placed Shotcrete to which, after hardening, additional layers of Shotcrete are to be bonded. Dampen surface just prior to application of succeeding layers.
    4. Provide a supply of clean dry air adequate for maintaining sufficient nozzle velocity for all parts of the Work, and if required, for simultaneous operation of a suitable blow pipe for clearing away rebound.
E. Placement Around Reinforcement:
    1. Hold the nozzle at such a distance and angle to place material behind reinforcement before any material is allowed to accumulate on its face. In the dry-mix process additional waste may be added to the mix when encasing reinforcement to facilitate a smooth flow of material behind the bars.
    2. Do not place Shotcrete through more than one layer of reinforcing steel rods or mesh in one application unless demonstrated by pre-construction tests that steel is properly encased. Test to ascertain if any voids or sand pockets

have developed around or behind reinforcement by probing with an awl or other pointed tool; by removal of randomly selected bars; or by coring or other suitable means.

3.05 COVER OF REINFORCEMENT

A. Place concrete and/or Shotcrete to provide the 1 ½” (minimum) cover over all reinforcement.

3.06 LINE AND THICKNESS CONTROL

A. Use adequate ground wires or other accepted means to establish the thickness, surface planes, and finish lines of the concrete/Shotcrete.
B. No additional payment will be made for concrete volume or steel reinforcement placed in excess of amounts shown on the DRAWINGS, unless the ENGINEER agrees that conditions warrant such a change that go beyond the requirements set forth in Section 3.03(A) of this SPECIFICATION. If the CONTRACTOR prepares the subgrade in such a manner requiring additional concrete to meet design lines and grades without ENGINEER approval, the ENGINEER may require additional reinforcement steel at no additional charge to the OWNER.

3.07 CONSOLIDATION

A. Concrete vibrators for consolidating concrete shall be two and one-half inch (2-1/2") diameter “high cycle” vibrators with a frequency under load of eight thousand (8,000) to ten thousand four hundred (10,400) vibrations per minute (vpm). Concrete vibrators of lesser capacity are unacceptable for use in any part of the construction. CONTRACTOR shall have at least one standby concrete vibrator ready for use for every two (2) concrete vibrators in use during a concrete placement.
B. All concrete shall be thoroughly consolidated with internal vibrators as recommended in ACI 309 immediately after deposition. The concrete shall be thoroughly worked around the reinforcing steel, around embedded items, and into corners of forms. Vibration shall be supplemented by spading, rodding, or forking to eliminate all honeycomb and voids around embedded items.
C. The vibrator shall be inserted vertically, allowing it to penetrate rapidly to the bottom of the lift and at least six (6) inches into the previous lift. The vibrator shall be held at the bottom of lift for five to fifteen (5 - 15) seconds. The vibrator shall be pulled up at a rate of about three (3) inches per second.
D. The vibrator shall be inserted so that the fields of action overlap. The field of action is approximately eight (8) times the vibrator’s head diameter. Thus for a two and one- half (2-1/2) inch diameter vibrator, the spacing of each insertion shall be approximately twenty (20) inches.

E. Vibration shall be stopped when the concrete surface takes a sheen and large air bubbles no longer escape.
F. Do not use a vibrator to move concrete horizontally.

3.08 OPENINGS AND INSERTS

A. Pipe sleeves, inserts for pipe connections, anchors, and forms for pipe holes shall be accurately placed and securely fastened to the forms in such a manner that the placing of concrete shall not alter their alignment or location. In the event that openings are inadvertently omitted or improperly placed, ENGINEER may require the concrete to be cored at the proper location. Filling of improperly placed openings shall be done with expansive grout or dry pack or mortar applied with an accepted epoxy adhesive. The surfaces of the opening shall be roughened prior to filling.

3.09 EMBEDDED ITEMS

A. At the time of concrete placement, embedded items shall be clean and free from mud, oil, and other coatings that may adversely affect bonding capacity. Aluminum embedments shall be coated with a bituminous material to prevent electrolytic action between the embedded item and reinforcing steel that results in concrete deterioration. Embedment items shall be accurately placed and securely fastened to the forms in such a manner that the placing of concrete shall not alter their alignment or location. Contact between embedded items and reinforcing steel or tendon ducts is unacceptable and is not permitted.

3.10 JOINTS

A. Concrete construction joints for Sculpted Concrete shall meet the requirements of Section 03 31 00 – Structural Concrete.
B. Construction joints (i.e. expansion and contraction/control joints) shall be at locations shown on the DRAWINGS and as required between placements. ENGINEER shall approve the location of all construction joints not shown on the DRAWINGS.
C. The location of all construction joints shall be subject to the acceptance of ENGINEER. The surface of all construction joints shall be thoroughly cleaned and all laitance and standing water removed. Clean aggregate shall be exposed by abrasive blast cleaning. Wire brushing and air water jets may be used while concrete is fresh provided results are equal to abrasive blast cleaning. Construction joints shall be keyed at right angle to the direction of shear. Except where otherwise shown on the DRAWINGS, keyways shall be at least one and one-half (1-1/2) inch in depth over at least twenty five percent (25%) of the area of the section.

D. Construction joints shall not be allowed within a location where water is expected to flow over in the final constructed condition.
E. Taper construction joints to a shallow edge form, about 1 inch thick, except where the joint will be subjected to compressive stress. In this case, use non-tapered joints and take special care to avoid or remove trapped rebound at the joint.
F. The entire joint shall be thoroughly cleaned and wetted prior to the application of additional concrete/Shotcrete.
G. Make joints perpendicular to the main reinforcement. Continue reinforcement across joints.
H. Position construction and control joints to conform to the locations of natural occurring cracks and joints in the simulated rock and earth forms.

3.11 SCULPTED CONCRETE FINISHES

A. Sculpted Concrete shall have a combination of surface stain, dry-shake color hardener and integral concrete color to simulate onsite rock outcrops, bedrock, or individual boulders as designated by the ENGINEER. The surface shall have a character similar to surrounding surfaces and blend harmoniously with other portions of the WORK. Sculpted Concrete WORK shall be performed to match the approved larger sample area and use the Same construction procedures and techniques employed to assemble the approved larger sample areas. Photos of expected Sculpted Concrete finish quality are as follows

Photo #1 - Example During Construction Sculpted Concrete: Core rock and reinforcement prior to concrete placement

Photo #2 - Example During Construction Sculpted Concrete: Placement of Concrete

Photo #3. Example During Construction Finishing of Type I Sculpted Concrete

Photo #4 - Type I Sculpted Concrete

Photo #5 - Type II Sculpted Concrete Olympic Venue, Ocoee River after 20 Years

B. General

1. Concrete for Sculpted Concrete shall be placed at a slump appropriate to the slope of the slab being placed but generally have a slump between ½ to 2 inches. Slopes steeper than 3 to 1 (horizontal to vertical) shall be placed using irregular step forms or as shown on the DRAWINGS. Sculpted Concrete may also be shotcrete applied using a wet mix process per Section 03 37 13 Shotcrete.
2. All Sculpted Concrete shall be Type II unless otherwise noted on the DRAWINGS.
3. During and immediately after placement, thoroughly compact and WORK around all reinforcements, embedments, and into corners of forms, eliminating all air or stone pockets that may cause honeycombing, pitting, or planes of weakness. Mechanical vibrators shall be used to consolidate concrete.
4. The CONTRACTOR shall use trowels, floats, brushes/brooms, and other concrete finishing tools to consolidate, buildup, sculpt, and texture the slab.
5. Finished surfaces must be slip resistant.
6. Do not dampen finishing tools when integral colored concrete is used.
7. Do not over-trowel or start troweling late when integral colored concrete is used.
8. Use dry shake Color Hardeners and/or stains to create color accents. Apply per manufacturer recommendations.
9. Stain shall be applied once the concrete has cured 28 days or as recommended by stain manufacturer. A sealant shall be applied per manufacturer recommendations that is compatible with the stain used. Curing compounds that combine sealants and curing compounds shall be avoided if stains are to be applied to an area of sculpted concrete.
10. Texture mats or stamps may be used when approved by the ENGINEER. Final Sculpted Concrete surface finishes shall not be uniform or repeatable. Colored powdered releasing agents may be used to enhance the finish.
11. CONTRACTOR will provide an expert(s) to perform texturing and shaping of the concrete/Shotcrete that is left exposed above ground.
12. Finished product shall simulate natural rock as described in the SPECIFICATIONS and DRAWINGS. The CONTRACTOR shall achieve the desired appearance by 1) troweling the concrete/Shotcrete smooth, 2) cutting rock formation scars into the surface, and 3) texturing the entire

surface using both texture mats and power washing to achieve a natural rock finish. Alternative methods must be approved by ENGINEER.

13. Extend texture layer a minimum of 3 feet below finished grade.
14. If a trail section is included in the sculpted concrete a broom finish shall be applied to the trail surfaces shown on the DRAWINGS. Broom marks shall be perpendicular to the traveled direction. The broomed surface shall be smooth and void of sculpted concrete carvings.

C. Appearance and Types

1. Sculpted Concrete finishes shall be the result of hand carving, texturing, stamping, and smoothing of concrete by experts provided by the subcontractor and approved by the ENGINEER, based on previous WORK examples and approved test panels for this PROJECT.
2. Appearance of the sculpted concrete shall be like that shown in Photo #4 and Photo #5, above and in the DRAWINGS. Colors and shading shall be determined in the submittal process.
3. Sculpted Concrete Type I: Finish shall consist of variable surface relief of up to 4 inches above and 4 inches below design grade or as shown on the DRAWINGS, with variable sculpted surface joints (fissures) of ½-inch to 1-1/2-inch deep in an irregular pattern. Joint edges shall be smoothed and rounded. All edges and corners shall have a minimum radius of 6 inches unless otherwise approved by the ENGINEER. Supplemental reinforcing of surface variability, relief, or features is not required, see DRAWINGS. Finish shall also consist of placing foil or “rubber skin” over the surface to create minor (1/8-inch deep) irregular lines in the surface. Texture mats/stamps may be used to create surface texture. Concrete shall be integrally colored. Stains and/or dry-shake color hardener may be applied to match appearance as described above. Apply copper shake when required by the PROJECT. The finish will be partially submerged and in direct contact by people. Final sealing, as recommended by the subcontractor and coloring product manufacturers, shall not allow effervescence unless deemed by the ENGINEER to enhance the quality of the WORK.
4. Sculpted Concrete Type II: Finish shall consist of variable surface relief of 12” above and 9” below design grade or as shown on the DRAWINGS, with variable sculpted surface joints (fissures) of 1-1/2-inch to 3-inch deep in an irregular pattern. Joint edges shall be smoothed and rounded. All edges and corners shall have a minimum radius of 6 inches unless otherwise approved by the ENGINEER. Supplemental reinforcing of surface variability, relief, and

features is required, see DRAWINGS. Finish shall also consist of placing foil over the surface to create minor (1/8-inch deep) irregular lines in the surface. Texture mats/stamps may be used to create surface texture. Concrete shall be integrally colored. Stains and/or apply dry-shake color hardener may be applied to match appearance as described above. Apply copper shake when required by the PROJECT. The finish will be partially submerged and in direct contact by people. Final sealing, as recommended by the subcontractor, shall not allow effervescence unless deemed by the ENGINEER to enhance the quality of the WORK.

5. Areas where powdered copper shall be WORKed into the surface shall be as directed by the ENGINEER. Powdered copper shall be WORKed in evenly within the upper 1/2 inch of the Sculpted Concrete finish. The application shall be at no less than 3 pounds per square yard.
6. If not identified on the DRAWINGS or in these SPECIFICATIONS, a Type I Finish is to be used.
7. Finishes of sculpted concrete that do not meet the requirements of the SPECIFICATIONS or DRAWINGS shall be removed and replaced at the CONTRACTOR's sole expense.

3.12 WHITEWATER USERS SAFETY:

A. Sculpted Concrete shall be installed to meet PROJECT safety requirements for recreational whitewater use as directed by the ENGINEER including, but not limited to, no sharp edges or protrusions oriented in the upstream direction or in areas of fast moving water, large gaps or holes that could entrap persons or persons extremities, and slopes or features of the sculpted concrete that impair access to or from the water.
B. Should the ENGINEER deem any Sculpted Concrete areas unsafe for recreational whitewater use, the areas shall be modified or removed and replaced at the CONTRACTOR's sole expense.

3.13 CURING

A. Per requirements of Section 03 31 00 – Structural Concrete
B. Curing requirements specified in 03 39 00 Concrete Curing, shall be followed at all times.
C. Curing method shall be compatible with and not cause any discoloration or damage to surface finishes and color treatments.
D. The use of an evaporative retardant is required to assist in proper placement of concrete in accordance with Section 03 29 00, Concrete Curing. Apply two (2) times; after screeding and after the first floating operation. The retardant should be

applied at a rate of one (1) gallon of sprayable solution per two hundred to four hundred (200 - 400) square feet by spraying with an industrial type sprayer. If the nozzle of the sprayer becomes plugged, CONTRACTOR shall clean or replace the nozzle. Under no circumstances shall the retardant be used except by spraying a mist with a nozzle. The retardant shall be applied in strict conformance with the manufacturer's recommendations and precautions. In no case shall the retardant be used as a finishing agent. The use of an evaporative retardant requires review and approval by ENGINEER.

E. Shotcrete
    1. Initial Curing
        i. Following curing procedures of ACI Standard 308. Immediately after finishing, keep Shotcrete continuously moist for at least 24 hours. The methods and materials used for curing shall be approved by ENGINEER prior to placing Shotcrete.
    2. Final Curing
        i. Provide additional curing immediately following the initial curing and before the Shotcrete has dried. Use one of the following materials or methods:
            1. Continue the method used in initial curing.
            2. Materials conforming to "Specifications for Sheet Materials for Curing Concrete," (ASTM C171).
            3. Other moisture retaining coverings accepted upon approval by ENGINEER.

F. Duration and Temperature of Curing
    1. Continue curing for the first 7 days after installation or for the first 3 days if high early strength is obtained. During the curing period, maintain Shotcrete or concrete above 40□F and in a moist condition as specified above. Prevent rapid drying at the end of the curing period

3.14 TOLERANCES

A. Thicknesses of Sculpted Concrete as indicated on the DRAWINGS shall be a minimum. Concrete cover over reinforcement shall meet requirements of Section 03 31 00 – Structural Concrete, Section 03 21 00 – Reinforcing Steel, and as shown on the DRAWINGS

B. Control Areas: Overall finished surface elevations of sculpted concrete in Control Areas shall be within +/- 1-inch of design grade and design elevations shown on the DRAWINGS. Evaluation shall be completed by averaging the finished surface elevations of sculpted concrete above and below the design surface elevations for

any area selected by the ENGINEER. The ENGINEER shall use visual inspection, survey or other measurement techniques for evaluation of tolerances of Control Areas. Control Areas include, but are not limited to, any areas identified on the DRAWINGS as Control Areas, crests of drop structures, water control structures, tuning areas, wall caps, boat chutes, and areas adjacent to boat chutes and areas adjacent to whitewater features.

C. Non-Control Areas: Non-Control Areas of sculpted concrete are any area not defined as a Control Area by the SPECIFICATIONS or DRAWINGS. Overall finished surface elevation of sculpted concrete in Non-Control Areas shall be within +/- 3 inches of design grade and design elevations on average as shown on the DRAWINGS. Evaluation shall be completed by averaging the finished surface elevations of sculpted concrete above and below the design surface elevations for the cross-section (cut nominally perpendicular to flow or centerline) of any bank or feature over a width of approximately 6-ft. The ENGINEER shall use visual inspection, survey or other measurement techniques for evaluation of tolerances of Non-Control Areas.
D. Sculpted concrete that does not meet the specified tolerances shall be removed and replaced at the CONTRACTOR's sole expenses.

3.15 EQUIPMENT

A. All Shotcrete shall be applied to the substrate surface via pneumatic-feed or positive displacement guns. All guns, air compressors, delivery hoses, and nozzles shall work together to provide the appropriate Shotcrete product as determined acceptable by the ENGINEER. Failure to meet the desired product and strengths may result in rejection of equipment and/or methods employed by the CONTRACTOR at the discretion of the ENGINEER.

3.16 REPAIR OF SURFACE DEFECITS

A. Remove and replace concrete or Shotcrete, which lacks uniformity, exhibits segregation, honeycombing, or lamination, or which, contains any dry patches, slugs, voids or sand pockets. Remove and replace damaged in-place concrete or Shotcrete.
B. Replace any concrete or Shotcrete which subsides after placement.

3.17 FIELD QUALITY CONTROL

A. CONTRACTOR shall assist OWNER or the concrete testing consultant as requested during the performance of quality control testing. Testing will be taken from the concrete truck.
B. Test panels shall be shot for the Shotcrete. The panels should be 18" by 18" by 3" and shot at the same orientation as the majority of the structure. Panels shall be

shot for every day of placement and every 25 CY of Shotcrete placed. All panels should be cured at the project site. Cores should be taken from the panel in accordance with ASTM C 42. Cores will be used to verify compressive strength. CONTRACTOR is to provide the panels for use in Shotcrete testing and have them available in the field prior to the start of Shotcrete. CONTRACTOR is to notify the ENGINEER 48 hours in advance of the start of Shotcrete operations.

END OF SECTION

SECTION 03 35 00

CONCRETE FINISHING

PART 1 - GENERAL

1.01 DESCRIPTION

A. CONTRACTOR shall supply all labor, tools, equipment, and materials to finish properly placed concrete for structures.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:
   1. Section 03 11 00, Concrete Forming.
   2. Section 03 31 00, Structural Concrete.
   3. Section 03 60 00, Grouting.
   4. Section 32 16 00, Sidewalks, Curbs, and Gutters.

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI):
      a) Standard 116, Cement and Concrete Terminology.
      b) Standard 121, Quality Assurance Systems for Concrete Construction.
      c) Standard SP-15, ACI 301 Field Reference Manual.
      d) Standard 309, Identification and Control of Consolidation-Related Surface Defects in Formed Concrete.
      e) Standard 311, Guide for Inspection of Concrete.
   2. American Society for Testing Materials (ASTM):
      a) Standard C 33, Standard Specification for Concrete Aggregates.
      b) Standard C150, Standard Specification for Portland Cement.
   3. U.S. Department of Interior—Bureau of Reclamation (USBR):
      a) M-47, Standard Specifications for Repair of Concrete.

1.04 SUBMITTALS

A. Provide product data on the following:
   1. Grout.
   2. Bonding agent.
   3. Method of repairing defects, unless otherwise called out herein.

1.05 NOT USED IN THIS SPECIFICATION

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver the materials to the PROJECT site in the manufacturer's containers with all labels intact and legible at the time of use. Materials shall be stored in a secure, indoor, dry area. Maintain grouts and aggregates in a dry condition during delivery, storage, and handling.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Premixed Pre-Packaged Grout:
    1. Master Builders; EMACO R320.
    2. Master Builders; EMACO S66-CR.
B. Epoxy Bonding Agent:
    1. Master Builders; Concresive Liquid (LPL).
    2. Master Builders; Concresive Standard Liquid.
C. Cement:
    1. ASTM C150, Type to match original concrete surface.
D. Aggregate:
    1. ASTM C33, one hundred percent (100%) passing the No. 30 mesh sieve.
E. Bond Coat Mortar:
    1. Mortar used to bond patching mortar shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of one (1) part cement to not more than one (1) part sand by damp loose volume.
F. Patching Mortar:
    1. Patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of one (1) part cement to not more than two and one-half (2-1/2) parts sand by damp loose volume. White Portland cement shall be substituted for a part of the gray Portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that shall permit placing.
G. Water:

1. Only clean potable water shall be used. A calibrated measuring device is required for measuring the proper amount of water to be added to pre-packaged grouts and mortars.

PART 3 – EXECUTION

3.01 PREPARATION

A. The means and methods of repair of improperly placed or finished concrete shall be reviewed by ENGINEER prior to performing the WORK. Regardless of prior approval of the means and methods of concrete finish repair, no concrete finish shall be repaired until ENGINEER has reviewed the existing finish. This includes defects caused by ineffective and improper vibration such as honeycomb, excessive air voids on formed surfaces, placement "pour" lines (cold joints), and sand streaking. It also includes defects caused by excessive form deflections, form damage, or form failure.

B. Repair of Surface Defects:
   1. Surface defects, unless otherwise specified by the CONTRACT DOCUMENTS, shall be repaired immediately after form removal, but not before review by ENGINEER. The surface temperature of the concrete shall be fifty degrees Fahrenheit (50°F) and rising. CONTRACTOR shall measure surface temperatures when requested by ENGINEER. If necessary, CONTRACTOR shall enclose and heat the area to be repaired to bring the surface temperature of the concrete and air temperature to acceptable levels, and to permit proper curing.
   2. All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut. Feathered edges shall not be permitted. The area to be patched and an area at least six (6) inches wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared, mixed to the consistency of thick cream, and after surface water has evaporated from the area to be patched, well brushed into the surface.
   3. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least one (1) hour before being finally finished. The patched area shall

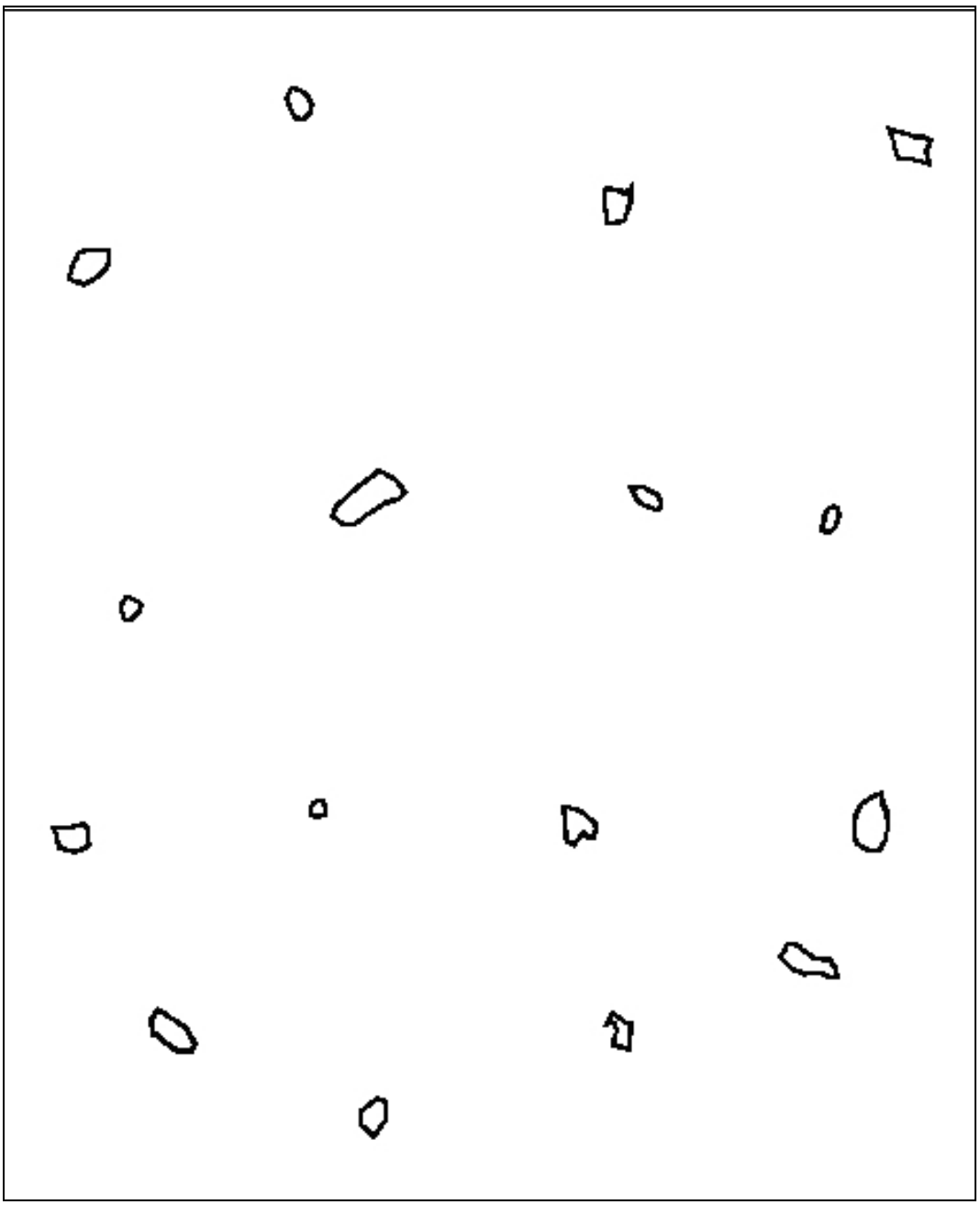
be kept damp for seven (7) days. Metal tools shall not be used in finishing a patch in a formed wall that shall be exposed.

C. Alternative Surface Defect Repairs:
    1. Certain types of defects may require the use proprietary compounds for adhesion or as patching ingredients. ENGINEER shall review these defects and request means and methods for these repairs from CONTRACTOR.
    2. In lieu of, or in addition to, the foregoing patching procedures using bond coat and patching mortars, epoxy bonding agents and premixed pre-packaged grouts may be used for repair of defective areas. Such compounds shall be used in accordance with the manufacturer's written recommendations and directions. ENGINEER shall review and provide written acceptance of these procedures.

3.02 APPLICATION

A. Tie Holes:
    1. Unless otherwise called out in the DRAWINGS tie holes shall be finished as specified herein.
    2. Water Retaining Structures and Below grade Vaults with Breakback Cone Ties: Fill tie holes solid as specified in Section 03 60 00, Grouting.
    3. Other Structures: After being cleaned and thoroughly dampened, fill tie holes solid as specified in Section 03 60 00, Grouting.

B. Finishing of Formed Surfaces:
    1. Finishes shall be performed as called out on the DRAWINGS and in referenced SPECIFICATIONS.
    2. Smooth Form Finish: The form facing material shall produce a smooth, hard, uniform texture on the concrete. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. Surface textures that result from forms with raised grain, torn surfaces, worn edges, patches, dents, or other defects shall be ground smooth or otherwise repaired.
        i. Air Voids on Formed Surfaces: Air voids on formed surfaces deeper than one-quarter (¼) inch shall be filled with patching mortar. The frequency and size of air voids shall be equal to or better than shown in Figure 1. The total void area is one percent (1%) of the surface area, or thirty-six hundredths (0.36) square inches. This six-inch (6") by six-inch (6") figure shall be the visual standard for acceptance of the finish that does not require filling of air voids.



ii. Tie Holes: Tie holes shall be filled as specified in Section 03 60 00, Grouting.
iii. Form Fins: Chip or rub off form fins exceeding one-sixteenth (1/16) inch in height.
iv. Rock Pockets: Poorly consolidated concrete shall be removed to sound concrete and the defect repaired. ENGINEER shall outline the area to be repaired.

3. As-Cast Finish: For as-cast concrete finish form materials shall produced a sound surface.
    i. Air Voids: Fill air voids deeper than one-quarter (1/4) inch and larger than one-half (1/2) square inch. The total area of acceptable air voids is seventy-two hundredths (0.72) square inch in a six-inch (6") by six-inch (6") square.
    ii. Tie Holes: Tie holes shall be filled as specified in Section 03 60 00, Grouting.
    iii. Form Fins: Chip or rub off form fins exceeding one-eighth (1/8) inch in height.
4. Rubbed Finish: Immediately after removing the forms, form ties shall be broken back a minimum of three-quarters (¾) inch from the surface, honeycomb, voids, and other surface defects grouted. The surfaces shall then be thoroughly dampened and rubbed with a No. 16 carborundum stone or equal abrasive to create a uniform surface paste. The rubbing shall be continued to remove all form marks and surface irregularities producing a smooth, dense surface. After setting, the surface shall then be rubbed with a No. 30 carborundum stone until the surface is smooth in texture and uniform in color. Unless otherwise shown in the DRAWINGS only exposed surfaces shall have a rubbed finish.
5. Grout Finish: Prepare surface as described in "Rubbed Finishes" above. Mix one (1) part Portland cement and one-half (½) part fine sand with sufficient water to produce a grout with the consistency of thick paint. Wet surface of concrete to prevent absorption of water from grout, and apply grout uniformly with brushes. Immediately after applying grout mix, scrub the surface with a cork float or stone to coat surface and fill remaining air voids and other remaining surface defects. Remove excess grout by working the surface with rubber float. After the surface whitens from drying, rub with clean burlap. Cure surface for a period of seventy two (72) hours.

C. Finishing of Unformed Surfaces: Unless otherwise shown on the DRAWINGS unformed surfaces shall be finished as follows:
    1. Slabs: Screed with straightedge to remove low and high spots bringing the surface to the required finish elevation of slope and float with a steel float at least three (3) feet in width. When the concrete has reached its initial set, finish with a steel trowel. Use a steel power trowel for large areas. Leave finish essentially free of trowel marks, uniform in texture and appearance

and plane to the correct tolerance. Dusting the surface with dry cement, sand, or sprinkling with water is prohibited.

2. No wetting of concrete surfaces during slab finishing operations shall be permitted. Further, no concrete finishing operation shall be permitted while there is water on the surface of slabs and other flatwork.
3. Finishes that are exposed and subject to foot traffic shall receive a broom finish with a texture of plus or minus one-sixteenth (±1/16) inch or as designated on the DRAWINGS.
4. Tops of Walls with Bearings: Strike smooth tops of walls and similar unformed surfaces that shall have bearings or bearing pads, and finish with a steel trowel.
5. Stairways and Sidewalks: Strike smooth tops of stairs and sidewalks and finish with a light broom providing a texture of plus or minus one-sixteenth (±1/16) inch.
6. Slabs with Waterproofing Membranes: Strike smooth and float finish.
7. Construction Joint Surfaces: Surface shall be broom or raked finished. Surface shall be water or grit blasted prior to placing additional concrete, such as columns on column footings and column footings on reservoir slabs.

END OF SECTION

SECTION 03 37 13

SHOTCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This WORK consists of constructing pneumatically applied concrete (both shotcrete and plaster) onto designated surfaces at locations and thicknesses with the lines and dimensions shown on the PLANS or as designated by the ENGINEER.

B. Inform ENGINEER at least 2 weeks in advance of time and places at which CONTRACTOR intends to place pneumatically applied concrete. All preparation WORK for concrete placements shall be substantially completed at least 2 workdays prior to the scheduled start of concrete placement to allow for the ENGINEER's review and any necessary corrections.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 03 31 00, Structural Concrete
2. Section 03 31 01, Sculpted Concrete
3. Section 31 38 00, Rock

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute Standards (ACI)
    a) Standard 301, Specification for Structural Concrete for Buildings
2. Society for Protective Coatings (SSPC)
    a) Standard SSPC-SP6, Commercial Blast Cleaning
3. American Society for Testing Materials (ASTM)
    a) Standard A 185, Specification for Wire Fabric, Plain, Welded Steel for Concrete Reinforcement
    b) Standard A 615, Specification for Bars, Deformed and Plain, Billet-Steel, for Concrete Reinforcement
    c) Standard A 820, SPECIFICATIONS for Steel Fibers for Fiber Reinforced Concrete
    d) Standard C 31, Practice for Making and Curing Concrete Test Specimens in the field
    e) Standard C 33, Specification for Concrete Aggregates
    f) Standard C 94, Specification for Ready-Mixed Concrete

g) Standard C 109, Test Method for Compressive Strength of Hydraulic Cement Mortars
h) Standard C 150, Specification for Portland Cement
i) Standard C 171, Specification for Sheet Materials for Curing Concrete
j) Standard C 309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete
k) Standard C 330, Specification for Lightweight Aggregates for Structural Concrete
l) Standard C 595, Specification for Blended Hydraulic Cements
m) Standard C 618, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete
n) Standard C 642, Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete
o) Standard C 685, Specification for Concrete made by Volumetric Batching and Continuous Mixing
p) Standard C 856, Standard Practice for Petrographic Examination of Hardened Concrete
q) Standard C 989, Specification for Ground Granulated Blast-Furnace Slag for use in Concrete and Mortars
r) Standard C 1116, Specification for Fiber-Reinforced Concrete and Shotcrete
s) Standard C 1140, Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels
t) Standard C 1141, Standard Specification for Admixtures for Shotcrete
u) Standard C 1480, Standard Specification for Packaged, Pre-Blended, Dry, Combined Materials for Use in Wet or Dry Shotcrete Application
v) Standard C 1604, Standard Test Method for Obtaining and Testing Drilled Cores of Shotcrete

1.04 SUBMITTALS

A. Mix Design: A shotcrete mix design meeting the requirements of Section 03 31 00 - Structural Concrete.
B. Shotcrete Application Method Statement: The Shotcrete Application Method Statement shall be a wet-mix process and shall include DRAWINGS and notes

describing equipment, procedures and sequences for shotcrete production, application, curing plan, and applicable manufacturer's literature and recommendations. The Shotcrete Application Method Statement shall also include written documentation that verifies the qualifications of the nozzlemen that will be performing the WORK. All nozzlemen shall have had at least 1 year of experience in the application of shotcrete and hold a current certification for ACI Shotcrete Nozzleman for the methods and orientations to be used.

C. Sculpted Concrete Applications: Where Sculpted Concrete is specified or shown on the DRAWINGS, the CONTRACTOR shall submit in accordance with Section 03 31 01 - Sculpted Concrete.

1.05 QUALITY ASSURANCE

A. Preconstruction Testing (Shotcrete Quality): Onsite preconstruction testing shall be completed by the OWNER. The CONTRACTOR shall provide all materials, labor and equipment to produce test panels in accordance with this specification.
    1. Prepare preconstruction test panels for examination by ENGINEER prior to job shotcrete placement. Preparation and testing shall comply with ASTM C 1140.
    2. Produce test panels for each proposed mix proportion, each anticipated shooting orientation, and each proposed nozzleman. Mixes shall meet requirements of Section 2.01 of these SPECIFICATIONS. In half of the test panels provide reinforcement of the same size and spacing required for PROJECT construction. Obtain six test specimens from each panel, three nonreinforced specimens and three with reinforcing steel.
    3. Test the nonreinforced specimens for compliance with the specified physical properties in accordance with ASTM C 1604.
    4. Visually grade the reinforced specimens for compliance with specified core grade (Section 1.6 – Shotcrete Core Grades).
    5. Test admixtures for compatibility with cement in accordance with ASTM C 1141.
    6. Unless otherwise specified, only nozzlemen with a test panel mean core grade less than or equal to 2.5 (Section 1.05) shall be allowed to place job shotcrete. When the prequalification test panel is rejected, a second panel may be shot. If the nozzleman's second mean core grade is greater than 2.5, the nozzleman shall not be permitted to shoot on the PROJECT.

B. Construction Testing (Shotcrete Quality): Construction testing will be completed by the OWNER. The OWNER reserves the right to test all panels or a reduced number (i.e. every other) based on results of previous tests.

1. Produce a material test panel for each mix and each workday or every 50 cubic yards placed, whichever is less. Test panels shall be produced in accordance with ASTM C 1140 with a minimum size of 18 inches x 18 inches. Test panels shall be constructed in the same manner as that being used on the PROJECT, including distance from nozzle, angle and orientation. Test panels shall be cured in similar conditions to what is anticipated in the field and shall be field cured until test specimens are taken. Test specimens from test panels in compliance with ASTM C 1140.
2. The field compressive strength shall be determined from at least three test specimens from each test panel in accordance with ASTM C 1140 and tested at 28 days. The mean compressive strength of a set of three cores shall equal or exceed the required compressive strength with no individual core less than 0.85 of the required compressive strength.
3. The CONTRACTOR shall remove and replace shotcrete that exhibits segregation, honeycombing, de-lamination, voids, sand pockets, excessive cracking, or does not meet the specified material properties, at the CONTRACTOR's expense. If there is a dispute between the CONTRACTOR and ENGINEER in regard to the quality of in- place shotcrete, the following procedure shall be applied:
    i. Three cores shall be taken for each 100 square feet of shotcrete identified with defects in accordance with ASTM C 1604 at locations designated by the ENGINEER. The shotcrete shall be at least 28 days old. Cores containing reinforcing steel shall not be tested.
    ii. Cores will be immediately tested for compressive strength. A core break during coring operations such that it cannot be tested in accordance with ASTM C 1604 will be assigned a compressive strength of 0 psi.
    iii. If a set of cores does not produce an average compressive strength equal or in excess of the required compressive strength (28 day), the shotcrete represented by the cores shall be removed and replaced at the CONTRACTOR's expense.
    iv. All costs associated with coring and testing shall be at the CONTRACTOR's expense, regardless of the outcome.
    v. The CONTRACTOR shall patch areas used for sampling and testing immediately after samples have been removed in accordance to Chapter 9 of ACI 301. Do not fill holes by shooting.

1.06 SHOTCRETE CORE GRADES

A. Grade 1: Shotcrete specimens are solid; there are no laminations, sandy areas or voids. Small air voids with a maximum diameter of 1/8 inch and maximum length of ¼ inch are normal and acceptable. Sand pockets, or voids behind continuous reinforcing steel are unacceptable. The surface against the form or bond plane shall be sound, without a sandy texture or voids.
B. Grade 2: The core shall have no more than two laminations or sandy areas with dimensions not to exceed 1/8-inch-thick by 1 inch long. The height, width and depth of void shall not exceed 3/8 inch. Porous areas behind reinforcing steel shall not exceed ½-inch in any direction except along the length of the reinforcing steel. The surface against the form or bond plane shall be sound, without a sandy texture or voids.
C. Grade 3: The core shall have no more than two laminations or sandy areas with dimensions exceeding 3/16-inch-thick by 1¼ inch long, or one major void, sand pocket, or lamination containing loosely bonded sand not to exceed 5/8 inch thick and 1¼ inch in width. The surface against the form or bond plane may be sandy with voids containing overspray to a depth of 1/16 inch.
D. Grade 4 The core shall meet, in general, the requirements of Grade 3 cores, but may have two major flaws such as described for Grade 3 or may have on flaw with a maximum dimension of 1 inch perpendicular to the face of the core with a maximum width of 1½ inch. The end of the core that was shot against the form may be sandy and with voids containing overspray to a depth of 1/8 inch.
E. Grade 5: A core that does not meet the criteria of core Grade 1 through Grade 4, by being of poorer quality, shall be classified as Grade 5.
F. Determination of grade shall be by computing the mean of a minimum of three test specimens.
G. A mean grade of 2.5 or less is acceptable unless otherwise specified. Individual shotcrete cores with a grade greater than 3 are unacceptable.
H. The above core grades are based on cores with a surface area of 50 square inches. For cores with greater or lesser area than 50 square inches, adjust allowable flaws relative to 50 square inches.

1.07 ACCEPTANCE

A. Acceptable shotcrete shall consist of a dense and uniform mixture without rebound, inclusions, segregations, or discernible weakness of bond between the rock or structure and the shotcrete. Acceptance will be based on the requirements of this section and the visual inspection and sounding of the shotcrete.
B. Shotcrete that exhibits movement or settlement after placement while still in the plastic state shall be repaired or replaced at the CONTRACTOR’s expense.

C. Shotcrete WORK that meets applicable requirements will be accepted by the ENGINEER.
D. Shotcrete WORK that has previously failed to meet one or more requirements, but which has been repaired to bring it into compliance, will be accepted by the ENGINEER.
E. Shotcrete WORK that fails to meet one or more requirement and which cannot be brought into compliance may be accepted or rejected by the ENGINEER. Modifications may be required to assure that remaining WORK complies with the requirements.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Shotcrete and plaster materials, proportioning and placement shall comply with the requirements of ACI 506.2, "SPECIFICATIONS for Materials, Proportioning and Application of Shotcrete", the requirements of Section 03 31 00 – Structural Concrete, and as modified below in this Section.
B. Prepackaged material shall meet the requirements of ASTM C1480 and meet the sulfate resistance requirements indicated in Section 03 31 00.
C. Strength and General Requirements
    1. Design and proportion Shotcrete and plaster materials shall meet the following minimum compressive strengths and other criteria:

Section 03 37 13 – Table 1 – Shotcrete Compressive Strengths							
Location	Aggregate Size (Inch)	Design Strength 28-Day (psi)	Required Strength 7-Day (psi)	Minimum Cement Content* (lbs/yd)	Flyash Content %	Air Content % Range (Total)	Maximum Water Cement Ratio*
Shotcrete**	1/2	4,500	3,000	N/A	20 max.	7-10***	0.38
Plaster**	3/8 max.	4,500	3,000	N/A	20 max.	7-10***	0.38

* The maximum water-cementitious materials ratio by weight, which shall be based on all water in the mix, including correction for moisture in aggregates, and shall be based on the total cementitious materials including cement and fly ash.

** Add fibrous reinforcement. See Admixtures Section 03 31 00.

******Prior to pumping.

D. Admixtures shall meet the requirements of Section 03 31 00 – Structural Concrete.
    1. Admixtures for use in shotcrete shall meet the requirements of ASTM C 1141.

2.02 REINFORCEMENT

A. Reinforcement for shotcrete shall be in accordance with Section 03 20 00 - Concrete Reinforcement. Plaster shall not be reinforced.

2.03 CONCRETE ACCESSORY MATERIALS

A. Accessory materials for shotcrete shall be in accordance with Section 03 31 00 – Structural Concrete.

2.04 SEALANTS AND CURING MATERIALS

A. Sealants and curing materials for shotcrete shall be in accordance with Section 03 31 00 – Structural Concrete.

PART 3 – EXECUTION

3.01 GENERAL

A. Shotcrete shall be applied at the locations and to the thicknesses shown on the DRAWINGS. The thickness of shotcrete shall not be less than the dimensions shown on the DRAWINGS

B. For rock and soil cuts, surfaces shall be prepared to the line and grade shown on the DRAWINGS. The CONTRACTOR shall provide documentation, including survey data, to show that the excavated face conforms to the DRAWINGS so that the minimum thickness is achieved. If the ENGINEER determines that irregularities are excessive, additional reinforcing may be required. All costs associated with additional shotcrete required to bring an over excavated cut to the proper line and grade shall be borne by the CONTRACTOR. The CONTRACTOR shall fill all voids, holes, and pits created during the excavation process. Where additional shotcrete in excess of the plan thickness is required to make the final shotcrete face conform to the DRAWINGS, the CONTRACTOR shall provide a plan and method statement for applying the additional shotcrete. The WORK shall not proceed until the proposed plan and methods have been reviewed and approved by the ENGINEER.

3.02 BATCHING AND MIXING

A. Per Section 03 31 00 Structural Concrete.

B. Shoot shotcrete materials within 90 minutes after batching.

3.03 SURFACE PREPARATION

A. General: Do not apply shotcrete to frozen surfaces. De-icing compounds shall not be used to thaw ice, snow, or frost.

B. Earth: Prepare surfaces to line and grade. Dampen surface immediately prior to shooting.

C. Concrete, Masonry, and Shotcrete: When bonding to existing concrete, masonry or shotcrete is required, remove all deteriorated, loose, unsound material or contaminants that may inhibit bonding. Chip areas to be repaired to remove offsets

causing abrupt changes in thickness. Taper edges to eliminate square shoulders at the perimeter of a cavity. Surfaces shall be a saturated surface dry condition immediately prior to shooting. When multiple layers of shotcrete are to be applied, each layer of shotcrete shall be cleaned. If curing compound is used, the curing compound shall be removed by sandblasting or a method approved by the ENGINEER.

D. Structural/Reinforcement: The surface shall be free of deleterious materials that inhibit bonding. For new construction, reinforcement laps shall be separated with a clearance of at least three times the diameter of largest aggregate. Reinforcement shall be secured to prevent movement. Existing rebar and metals shall be sandblasted clean prior to shotcrete placement.
E. Rock: Remove loose material, mud, or other foreign material that will prevent bonding. Clean surface. Pre-wet surface and apply epoxy immediately prior to shooting.
F. Forms: Use form-release coating material on removable forms. Secure forms to minimize the effects of vibration. Construct forms to allow escape of placement air and rebound.

3.04 JOINTS

A. Construction Joints: Taper construction joints at a 1 to 1 slope where joint is not subject to compression loads. Surface preparation of joints shall comply with Section 3.3.C. Continue reinforcement through construction joint.

3.05 ALIGNMENT CONTROL

A. Install taut ground wires or other means to establish thickness and plane of required surface. Install taut ground wires or other means at corners of offsets not established by forms.

3.06 APPLICATION

A. Placement Techniques: Provide a platform that permits nozzleman unobstructed access to the receiving surface. Place shotcrete first in corners, recesses, and other areas where rebound and overspray cannot escape easily. Remove rebound and overspray from previously prepared surfaces prior to shotcrete placement. Place shotcrete with nozzle held approximately perpendicular to the receiving surface. In corners, direct nozzle at approximately 45-degree angle or bisect the corner angle. Apply shotcrete so sags or sloughing do not occur. Discontinue shooting or shield the nozzle stream if wind causes separation of ingredients during shooting. Do to reuse rebound or overspray. Remove laitance from shotcrete surfaces to receive additional shotcrete layers. Surface preparation after final set shall comply with

Section 3.3.C. Do not apply shotcrete on surfaces with standing water from adjacent surfaces, including exposed reinforcement.

B. Encasement of Reinforcement: Place shotcrete to completely encase reinforcing steel. Encase reinforcement by shooting with enough velocity and plasticity so material flows around and behind the reinforcement. Front face of reinforcement shall remain clean during encasement. Place shotcrete to provide the cover over reinforcement required by ACI 301. Minimum slump of shotcrete is 1 inch.
C. When reinforcing fibers are required, the fibers shall be uniformly dispersed in the shotcrete. Production shall be suspended when visible fiber clumps are observed.

3.07 FINISHES

A. Surface finishes for shotcrete shall be as indicated on the DRAWINGS and shall meet the following requirements:
    1. Unfinished (Gunned Finish): Finished surface created from the shotcrete process with no additional finishing WORK.
    2. Shotcrete Type I: Type I finish shall consist of floating and smooth troweling to a uniform surface, followed by staining/dry-shake coloring and sealing. Portions of this surface will be under water at all times.
    3. Shotcrete Type II: Type II finish consist of floating and placing foil over the surface to create minor (1/8-inch deep) irregular lines in the surface. Texture mats or stamps to create irregular lines will also be allowed. Surface shall be colored using staining/dry-shake coloring and sealed.
    4. Sculpted Concrete Finishes per Section 03 37 01 Sculpted Concrete.

3.08 CURING

A. Per requirements of Section 03 31 00 – Structural Concrete.
B. Natural curing shall be permitted if ambient relative humidity is maintained above 95 percent.
C. Curing method shall be compatible with and not cause any discoloration or damage to surface finishes and color treatments.
D. The following procedures shall be followed if the temperature of the shotcrete structure falls below 32 degrees F before the minimum curing period is complete:
    1. Cores shall be taken following the procedures of ASTM C 1604 at locations designated by the ENGINEER.
    2. The ENGINEER will take immediate possession of the cores and submit the cores for a petrographic examination in accordance with ASTM C 856.
    3. All costs associated with coring, transmittal of cores, and petrographic examination shall be borne by the CONTRACTOR regardless of the outcome of the petrographic examination.

4. Shotcrete damaged by frost as determined from petrographic examination shall be removed and replaced at the CONTRACTOR's expense.
5. The CONTRACTOR shall patch areas used for sampling and testing immediately after samples have been removed.

3.09 COLD/HOT WEATHER SHOTCRETING

A. Cold and hot weather shotcreting shall be performed per requirements of Section 03 31 00 – Structural Concrete.
B. Do not place shotcrete when material temperature is above 90 degrees F.
C. Shooting may proceed when ambient temperature is 40 degrees F and rising. 50 degrees F for latex modified shotcrete. Shooting shall be discontinued when ambient temperature is 40 degrees F and falling unless protective measures are taken to protect shotcrete. Shotcrete shall not be placed against frozen surfaces.

3.10 PROTECTION

A. Protect surfaces not intended for shotcrete placement against deposit of rebound and overspray or impact from nozzle stream.
B. Remove rebound and hardened overspray from final shotcrete surfaces and from areas not intended for shotcrete placement.

3.11 TOLERANCES

A. Thickness of shotcrete as indicated on the DRAWINGS shall be a minimum.

END OF SECTION

SECTION 05 50 00

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work to be performed in accordance with this SPECIFICATION consists of furnishing all materials, equipment, supplies, and accessories and of performing all operations required in connection with the fabrication and installation of all miscellaneous metalwork shown on the DRAWINGS and as specified herein.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:
   1. Section 03 31 00, Structural Concrete
   2. Section 09 90 00, Painting
   3. Section 35 22 70, Adjustable Wave Feature and Gates
   4. Section 35 23 00, Start-Up & Tuning of Whitewater Facilities

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Society for Testing and Materials (ASTM)
      a) Standard A 36, Standard Specification for Carbon Structural Steel
      b) Standard A 123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      c) Standard A 153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
      d) Standard B 308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
      e) Standard C 881, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
      f) Standard F 593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
   2. American Iron and Steel Institute (AISI):
      a) Standard 304, Stainless Steel
   3. American Institute of Steel Construction (AISC)
      a) Specification for the Design, Fabrication and Erection of Steel for Buildings
   4. American Welding Society (AWS)
      a) Standard D1.1, Structural Welding Code

1.04 SUBMITTALS

A. Prior to fabrication or delivery, obtain ENGINEER's approvals. Provide a materials and SPECIFICATIONS list, construction and fabrication details, layout and erection diagrams, and method of anchorage to adjacent construction. Give location, type, size and extent of welding and bolted connections and clearly distinguish between shop and field connections. Prior to submittal, coordinate shop DRAWINGS with related trades to insure proper mating of assemblies. Catalog work sheets showing illustrated cuts of item to be furnished, scale, details, and dimensions may be submitted for standard manufactured items.

B. Submit ICC-ES Evaluation Reports for each type of anchor proposed for use.

C. Where items must fit and coordinate with finished surfaces or constructed spaces, take measurements at site and not from DRAWINGS. Where concrete, masonry or other materials must be set to exact locations to receive work, furnish assistance and direction necessary to permit other trades to properly locate their work. Where welded connectors, concrete, or masonry inserts are required to receive work, shop DRAWINGS shall show exact locations required, and all such DRAWINGS shall be furnished to the trades responsible for installing the connectors or inserts.

1.05 QUALITY ASSURANCE

A. Unless otherwise specified all work shall conform to the applicable requirements of the following SPECIFICATIONS and codes:

1. Steel: Fabrication and erection of structural steel and miscellaneous steel shall be in accordance with the latest edition of the AISC "Specification for the Design, Fabrication and Erection of Steel for Buildings", and "Code of Standard Practice for Steel Buildings and Bridges". Rolled shapes, plates, and bars shall conform to the latest edition of the AISC "Manual of Steel Construction" and shall also conform to current ASTM Designation A-36.
2. Aluminum: Fabrication of aluminum shall be in accordance with ASCE "Specification for Structures of Aluminum Allow 6061-T6, Second Progress Report of the Committee of the Structural Division on Design in Lightweight Structural Alloys".
3. Weld Quality: All field and shop welding shall be performed by welders qualified and certified in accordance with AWS D1.0 "Welding in Building Construction". Welding shall conform to AWS D1.1 Structural Welding Code. CONTRACTOR shall provide copies of welding and other postproduction fabrication Quality Control (QC) report upon delivery of fabricated items to site.

4. Welding Inspection: All field and shop welds will be inspected and tested by the OWNER or Designee. 100% of welds will be inspected at their option. CONTRACTOR shall facilitate such inspections and coordinate inspections with ENGINEER and provide at least 5 working days' notice prior to requested inspection. Welds may be visually inspected by an AWS CWI and some (assume approximately 25%) of the welds will be radiographed for the full length/circumference. If a weld fails to meet acceptance standards, then all welds completed by the welder performing the failed weld will be 100% radiographed. Defective welds shall be repaired and tested at the expense of the CONTRACTOR.

1.06 GENERAL REQUIREMENTS

A. Fabrication. All miscellaneous metalwork shall be manufactured using the best practices of modern sheet metal, structural steel and foundry shops. Welding shall be performed by qualified welders with all exposed welds being ground smooth.
B. Steel structural built-up members shall have full-length continuous welded joints to seal inaccessible surfaces.
C. Painting. Painting shall generally be done at the shop and in conformance with these SPECIFICATIONS. Where metalwork is required to be painted in the field, the prime coat of paint shall be shop applied on all.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCTS AND REQUIREMENTS

A. Structural Steel. Structural steel and miscellaneous metalwork not otherwise specified shall meet the requirements of ASTM Designation A36. Items covered by this requirement include lintel beams, angles, channels, plates, anchor bolts, trolley hoist beams, support angles, baffle supports, metal stairs and beams, walkways, weirs, troughs, etc.
B. Aluminum: Fabrication of aluminum shall be in accordance with ASCE "Specification for Structures of Aluminum Alloy 6061-T6, Second Progress Report of the Committee of the Structural Division on Design in Lightweight Structural Alloys".
C. Galvanizing.
    1. Steel items which are specified or shown to be galvanized shall be coated with zinc by the hot-dip process. Individual items shall be welded or assembled as a complete assembly prior to galvanizing in one piece – DO NOT cut or weld after galvanizing.
    2. Both the inside and the outside of open hollow members shall be coated.

3. The zinc used for the coating shall conform to ASTM Specification B-6. The weight of zinc coating shall be an average of 2.0 ounces per square foot and not less than 1.8 ounce per square foot. The zinc coating process shall conform with the requirements of ASTM Specification A123 and A153.
4. Galvanized coatings marred or damaged during erection or fabrication shall be repaired by use of DRYGALV as manufactured by the American Solder and Flux Company, Galvalloy, Galvion, or equal, applied in accordance with the manufacturer's instructions.

D. Bolts and Connectors. All steel bolts and washers shall conform to ASTM Standard A-307, Grade A. Where called for on DRAWINGS, SPECIFICATIONS, or where submerged, normally or occasionally, bolts shall be fabricated from stainless steel, Type 304, (B8M, B8MA) in accordance with ASTM Standard A-193. When fastening to galvanized steel, galvanized or cadmium plated bolts shall be used. Hoisting eyes shall be galvanized.

E. Expansion Bolts. Expansion bolts and anchors shall be stainless steel and used only where specifically noted or detailed. Expansion bolts shall not be acceptable for anchorage of any vibrating machinery or equipment. Where expansion bolts are used in Interior Dry Locations provide snap-off or flush shell concrete anchors produced by Phillips Self-Drilling Concrete Anchors, Star Selfdril Shields, or equal. For exterior or wet locations to fasten to concrete, they shall be similar and equal to Molly Parabolt or Phillips Redhead. Where expansion bolts are used to fasten to concrete block, they shall be similar and equal to Rawl anchors.

F. Anchor Bolts. Anchor bolts Epoxy Anchors.
    1. Adhesive: Two-component epoxy base resin and hardener meeting the requirements of ASTM C881 Types I, II, IV, and V, Grade 3, Classes B and C. Adhesive shall be supplied in manufacturer's standard side-by-side cartridge and dispensed through a static-mixing nozzle supplied by the manufacturer.
    2. Anchor rod or insert: Stainless steel, AISI 316L or AISI 304 meeting the requirements of ASTM F593 (Condition CW). Chamfered threaded end for ease of starting the nut, and 45-degree chisel or cut point on the opposite end. Furnish nuts and washers to meet the requirements of the rod or insert.
    3. Manufacturer: Hilti HIT RE 500, Simpson Strong Tie Epoxy-Tie ET or ETF (fast cure), Power Fastening Power-Fast Plus, or equal. For fastening to materials with voids, such as hollow-block masonry, provide Simpson Strong-Tie ETS for Epoxy- Tie, or equal.

2.02 METALS IN WHITEWATER COURSE

A. Bolts and hardware for Tuning Blocks: Bolts, anchor bolts, nuts, washers, all fasteners and other mounting hardware, and other hardware shall be 304 stainless steel with threads to match fastener system. Washers shall be of similar material and coatings compatible for use with bolts. Drop-In fastening anchors for connection of tuning and pool blocks to foundations shall be SSRM 304 stainless steel, female type manufactured by Red Head or approved equal.
B. The prime coat of paint required by the Painting 09 90 00 Specification shall be shop applied on all metalwork to be painted.
C. Items which are specified or shown to be galvanized shall be coated with zinc by the hot-dip process. All steel in the whitewater course shall be finished with coatings rated for immersion in non-potable water see Painting Specification.
D. Junction Vault Door. The Junction Vault Door shall be Bilco J-4ALH20, or approved equal.
E. Controls Vault Hatch. The Controls Vault access hatch shall be a Halliday Locking Unit aluminum access hatch with features as indicated on the DRAWINGS, or approved equal.

2.03 MISCELLANEOUS METAL PRODUCTS

A. Beams and Columns: Wide flange cold-rolled steel members, size and lengths as shown on DRAWINGS conforming to ASTM A 992/A 992M, Grade 50 (345).
B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M, Grade 50 (345).
C. Plate and Bar: ASTM A 36/A 36M, Grade 50 (345).
D. Pipe: ASTM A 36/A 36M, Grade 50 (345)

PART 3 – EXECUTION

3.01 GENERAL

A. All fabrication shall be equal to the best practice in modern sheet metal and structural shops. Welding shall be performed by qualified welders, and welds exposed to view shall be ground smooth. Bolt hole templates shall be furnished or obtained where required, to or from other Subcontractors and equipment suppliers to insure accurate locations for connections.

3.02 HANDLING

A. Care shall be exercised in the handling and shipping of all miscellaneous metalwork to prevent bending and distortion, scratching, and exposure to the elements.

3.03 ASSEMBLY

A. Set structural members to the lines and elevations shown on the DRAWINGS with all parts aligned and properly adjusted before permanently fastening. Unaligned bolt holes shall be re-drilled or reamed to permit bolting. Gas cutting torches shall

not be used for correcting fabrication errors or discrepancies. Field welding is not permitted except where specifically allowed or called out on the DRAWINGS.

B. Where connections are required between weirs, troughs, and walls, and structural elements are required to have no leakage, the bolted connections shall be sealed with neoprene sheet. Weirs shall be set exactly level. No leakage shall be permitted around plates, weirs, connections or through bolt holes where indicated on DRAWINGS.

3.04 HANDRAIL AND GUARDRAIL

A. Install in accordance with the manufacturer's instructions. Sleeves shall be manufactured from larger diameter pipe of the same material as the posts. All flanges shall be fastened to concrete with expansion anchors. Mounting sleeves for side wall locations shall be welded to a flat plat extending a minimum of 3 inches into the sleeve. All sleeves shall be 6 inches in length. When in place, all railing shall be straight and level without kinks. Rail height shall be 42 inches above the floor level. Provide 4-inch toeboard along the perimeter of all elevated floors, installed with 1/2-inch gap above the floor. After alignment is accepted, posts shall be caulked in place.

3.05 ALUMINUM EMBEDS

A. All aluminum in contact with or embedded in concrete, masonry, or grout shall be coated with asphalt bituminous coating on the mating face to prevent direct contact.

3.06 ANCHORING SYSTEMS

A. Install in accordance with ICBO ES Evaluation Report for the specific anchor provided. Immediately notify the ENGINEER of any discrepancies between the ICBO report and the requirements shown on the DRAWINGS for resolution prior to proceeding.

B. Mechanical Anchors: Install per manufacturer recommendations for the specific application and material to be anchored into.

C. Epoxy Anchors:

1. Drill hole to the specified depth and diameter.
2. Clean hole with a wire brush. Remove dust from the hole with compressed air. Jetting holes with water is not permitted.
3. Install in clean holes free of standing water.
4. Dispense a bead of adhesive off to the side to check for proper mixture before injecting in the hole.
5. Fill hole halfway to 2/3 of the way, starting from the bottom of the hole to prevent air pockets. Withdrawal the nozzle as the hole fills.

6. Insert the anchor, turning slowly until the anchor contacts the bottom of the hole. Do not disturb the anchor during the specified cure time.

3.07 DROP-IN ANCHORS

A. Install anchors per manufacturer recommendations for the specific application and material to be anchored into.
B. CONTRACTOR to coordinate rebar placement in concrete foundations and anchor locations to avoid drilling through rebar during anchor placement.
C. Once concrete is sufficiently cured, drill holes to accept anchor plumb to vertical and at locations shown on the DRAWINGS or directed by the ENGINEER.
D. Hole shall be cleaned of all debris, dust and cuttings using a brush and compressed air prior to anchor placement.
E. All anchors shall be flush or up to 1/8” below adjacent concrete surfaces once installed.

3.08 ACCESS HATCHES

A. Deliver hatches to job site in time for installation with the concrete pour. Ensure all surfaces to be in contact with concrete are coated with asphaltic isolation coating; touch up or recoat as necessary. Bare aluminum shall not be in contact with concrete. Prior to the concrete pour, install the PVC drain line, with p-trap, within the concrete formwork from the frame drain coupling to a free discharge opening flush with the ceiling of the wet well structure. Install in conformance with the manufacturer’s installation instructions. Set frame level and true to plane at all four corners, and flush with adjacent finished surfaces. Doors, when closed, shall be flush with frames and flush with each other.

3.09 FINISHES

A. Shop paint all structural steel work, except members or portions of members to be embedded in concrete or mortar, or to be galvanized. Paint embedded steel on exposed portions and the initial two inches of embedded areas only. Do not paint contact surfaces which are to be welded, high-strength bolted or riveted. See 09 90 00 - Painting specification for requirements on surface preparations and coatings.
B. Hidden surfaces caused by bolted connections shall have finished painting completed prior to assembly.
C. Do not paint aluminum surfaces unless specifically required by the DRAWINGS or SPECIFICATIONS; EXCEPT that ALL aluminum to be embedded or in contact with concrete or masonry shall be coated with an 8 mil dry film thickness of zinc chromate paint or bituminous coating.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This WORK shall consist of furnishing and applying two (2) coats of a semi-opaque pure acrylic water repellent and colored coating to all designated concrete surfaces in accordance with the DRAWINGS and SPECIFICATIONS.

B. The WORK to be performed in accordance with the requirements of this Specification consists of furnishing all materials, equipment, supplies, and accessories required and of performing all operations needed in connection with the painting of the various parts of the WORK.

C. No paint shall be applied to permanently finished equipment which is acceptable by the ENGINEER such as factory-finished motor control centers, control consoles, and factory finished equipment. Equipment and their appurtenant parts such as guards and bases which arrive on the job site only primed, shall be painted in accordance with the appropriate painting system described following. All shop prime coats by equipment manufacturers shall be applied to surfaces as specified herein with paint that is approved and compatible with accepted topcoat paint.

D. A “Summary of the Items to be Painted or Stained” under this contract is given in Part 4 herein.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 03 35 00, Concrete Finishing.

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Society for Protective Coatings (SSPC)
    a) Standard SSPC-PA 1, Shop, Field, and Maintenance Painting of Steel
    b) Standard SSPC-PA 2, Determining Compliance to required DFT
    c) Standard SSPC-PA 4, Maintenance Repainting with Oil-based
    d) Standard SSPC-PA 5, Maintenance Coating of Steel
    e) Standard SSPC-PA 6, FRP Linings for Steel Tank Bottoms
    f) Standard SSPC-PA 7, Applying Thin-Film Coatings to Concrete
    g) Standard SSPC-PA 8, Thin-Film Linings in New Steel Vessels
    h) Standard SSPC-PA 9, Measurement of DFT on Concrete

i) Standard SSPC-PA 10, CONTRACTOR ESH Requirements
j) Standard SSPC-PA 11, Edge Protection 2020
k) Standard SSPC-PA 12, Method for Preparation of Uncontaminated Rusted
l) Standard SSPC-PA 14, Applying Plural Component Polyurea
m) Standard SSPC-PA 15, Preparing Contaminated Steel Test Panels
n) Standard SSPC-PA 16, Evaluating Scribe Undercutting Data
o) Standard SSPC-PA 17, Determining Profile Compliance
p) Standard SSPC-PA 18, Thermal Spray Coatings to Steel Bridges
q) Standard SSPC-PA 19, Visual Evaluation of Pinholes in a Concrete or Masonry Coating

2. National Association of Corrosion Engineers (NACE)
    a) Standard NACE 1, White Metal Blast
    b) Standard NACE 2, Near-White Metal Blast
    c) Standard NACE 3, Commercial Blast
    d) Standard NACE 4, Brush-off Blast
    e) Standard NACE 6, Surface Preparation of Concrete
    f) Standard RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
    g) Standard TM-01-70, Visual Standard for Surfaces of New Steel Air Blast Cleaned with Sand Abrasive
    h) Standard TM-01-75, Standard for Materials Resistant to Sulphide Stress Cracking (SSC) in Oil and Gas Fields
3. American Water WORKs Association (AWWA):
4. National Association of Pipe Fabricators (NAPF)
    a) Standard NAPF 500-03/500-03-04, Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings
5. International Concrete Repair Institute (ICRI)

1.04 SUBMITTALS

A. Submit color mixture to be used in a color block for approval by OWNER.
B. The paints to be used on the various substrate materials shall be of the best quality commercial and industrial grades and shall be manufactured by nationally known and approved paint manufacturers with local representation. The CONTRACTOR shall submit to the ENGINEER, in time to allow the ENGINEER reasonable review time, a minimum of three copies of a Painting Schedule. This Schedule shall give

the information listed below for all the paints and stains the CONTRACTOR intends to use on all the items requiring paint.

C. Product Data: Submit manufacturer's product data sheets fully describing each product, including:
    1. Name of the manufacturer of the paint or coating system.
    2. Generic name of paint (chemical composition type such as alkyd, epoxy, vinyl, etc.);
    3. Trade name and number of each specific paint.
    4. Number of coats to be applied for each paint.
    5. Dry film thickness to be achieved for each coat.
    6. Spreading rate at which each coat will be applied.
    7. Color name and number accompanied by color chart.
    8. Results of accepted tests (ASTM, Fed. Std.) for hardness, abrasion, impact, humidity, etc.
D. Material Safety Data Sheets (MSDS): Submit manufacturer's material safety data sheets for each product.
E. Volatile Organic Compound (VOC) Compliance: Submit VOC data for each product.
F. NSF Certification: Submit certifications showing NSF Standard 61 approval for any
G. painting systems in contact with potable water.
H. Submit Manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
I. Schedule of products to be used and mil thickness to be applied.
J. Manufacturer's standard color selection chart.

1.05 QUALITY ASSURANCE

A. Mock-ups:
    1. Three (3) two-foot by two-foot (2' x 2') samples showing the designated colors and texture shall be prepared for initial approval. The coating shall be applied by the same method to be used in the final field application to a surface similar in pattern and texture to the surfaces to be coated on the PROJECT.
    2. A final sample for the chosen color and texture measuring at least four feet by four feet (4' x 4') shall be prepared as specified above and shall be set at the PROJECT site for a period of three (3) days for review by ENGINEER. The final samples shall receive ENGINEER's written approval before the coating can be incorporated into the WORK.
B. The manufacturer shall have 10 years of successful experience and shall be able to demonstrate successful performance on comparable projects.

C. The applicator shall be able to demonstrate a minimum of 5 years application experience on projects of similar size and complexity to this PROJECT. All applying personnel must be trained and experienced in the application of each product.

1.06 MANUFACTURER'S RECOMMENDATIONS

A. All paint shall be mixed and applied with strict conformance to the paint manufacturer's directions, which will take precedence over this Specification. The paint manufacturer shall verify and approve the selection of paints to be applied to each specific substrate material.

1.07 DELIVERY STORAGE AND HANDLING

A. The materials shall be delivered to the site in the manufacturer's original, unopened containers and packaging and with labels clearly identifying:
    1. Coating or material name
    2. Manufacturer
    3. Color name and number
    4. Batch or lot number
    5. Date of manufacture
    6. Mixing and thinning instructions

B. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions. Keep the containers sealed until they are ready for use. Do not use materials beyond manufacturer's shelf life limits. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of any materials that show evidence of contact with moisture. Protect materials during handling and application to prevent damage or contamination.

1.08 COLORS

A. The exact colors to be used on the various substrate materials will be confirmed by the OWNER from color charts submitted by the CONTRACTOR as a portion of the Painting Schedule. General colors to be submitted for use on the various materials are listed with the "Summary of the Items to be Painted and Stained" in Part 4 herein.

PART 2 – PRODUCTS

2.01 MATERIALS

A. The coating shall be self-priming, semi-opaque colored toner containing only methyl methacrylate ethyl acrylate copolymer resins. The toning pigments shall be suspended in solution at all times by a chemical suspension agent and solvent. The toning pigments shall be laminar silicates, titanium dioxide, and inorganic oxides. There shall be no settling or color variation. Use of vegetable or marine oils, paraffin

materials, stearates, or organic pigments in any part of the coating formulation shall not be permitted.

B. Physical Properties:
   1. Weight by Gallon: 8.3 lbs, min.
   2. Solids by Weight: 30% min.
   3. Sand (Silicone): 3.2 to 3.8 lbs/gallon (exclude at retaining walls form liner finish)

2.02 GENERAL

A. Surfaces to receive paint protective coating materials as specified in this Section shall be coated in conformance with the applicable coating systems specified. So far as possible, all paint and coating materials shall be provided by a single source supplier.
B. Products shall be standard for recognized manufacturer engaged in production of such materials for essentially identical or similar applications in the water and wastewater treatment industry.
C. Only compatible materials shall be used in the WORK. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to approval of the OWNER, a compatible barrier coat shall be applied between all existing prime coat and subsequent field coats to ensure compatibility.
D. With the approval of the ENGINEER, the field applied primer coat may be omitted when the equipment or material installed has a satisfactory primer coat that is compatible with topcoats. Some paint systems require no primer coat, only one or more coats of the paint used as the topcoat. In these cases, primers will not be required, but only when omitting the primer is in accordance with the paint manufacturer's directions.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. All concrete finishing shall be completed in accordance with the SPECIFICATIONS. The concrete shall be at least fourteen (14) days old before the bonding agent and coating may be applied.
B. Prior to application of the coating material, all voids and irregularities shall be pointed and trued with a mortar consisting of cement and fine sand aggregate. Only minor voids, which can be completely filled with the coating material, may remain.
C. Within twenty-four (24) hours before the coating is applied, the concrete surfaces to be coated shall be hot water blasted at a minimum of three thousand (3,000) psi followed by a cold-water rinse to remove dirt, curing agents, form release agents, or

other foreign substances that would be detrimental to the coating penetration or color.

D. All surfaces to be coated shall be clean, dry, and free of frost or other foreign substances at the time of application.
E. Surface preparation of each substrate material shall be as described in the painting system breakdown and completed prior to beginning the painting operation.
F. All structural steel, metalwork, piping, and other metal surfaces to be painted shall be thoroughly cleaned of grease, oil, and contaminants by the use of solvents recommended by the paint manufacturer. When blasting is required in the surface preparation of a painting system, the blasting shall be performed within conformance of the “Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive” as written by the National Association of Corrosion Engineers, Houston, Texas, hereinafter referred to as NACE. Blasting shall be accomplished in a manner and with the appropriate grit to limit the depth of finished surface profile to a of the dry mil thickness of the paint. Any dust permits required for field blasting shall be obtained by the CONTRACTOR.
G. Acceptance of the final blasted steel surfaces will be made by the ENGINEER utilizing the visual standards test method NACE TM-01-70 or an illuminated magnifier comparator (Keane-Tator) to visually compare the specified NACE surface with the steel actually being blasted. SSPC and NACE standards of quality are called out for each painting system where blasting is required as a portion of the surface preparation. The standards referred to are:
    1. SSPC-SP5 / NACE 1: White Metal Blast
    2. SSPC-SP10 / NACE 2: Near-White Blast
    3. SSPC-SP6 / NACE 3: Commercial Blast
    4. SSPC-SP7 / NACE 4: Brush-Off Blast
H. The CONTRACTOR shall continue to blast the surface of the steel until such time as the ENGINEER is satisfied that the steel being blasted is of a quality equal to the specified SSPC/NACE grade.
I. All dust created by the blasting operation must be removed immediately after the blasting operation by vacuuming. The first coat of paint should be applied to the steel as soon as possible and always the same day that the blasting is done.

3.02 APPLICATION METHODS

A. The coatings shall be applied to all exposed concrete elements above the ground line and shall extend a minimum of one (1) foot below the ground line or as shown on the DRAWINGS.

B. The coating shall be applied only when the ambient temperature is between forty degrees Fahrenheit (40°F) and ninety degrees Fahrenheit (90°F).
C. The coating shall be mixed by a mechanical mixer and shall be applied by spraying. A roller shall be used immediately after the spray application to obtain texture and fill minor voids as approved by ENGINEER. A brush may be used to apply coating to form liner finishes as approved by ENGINEER.
D. The process shall be applied uniformly in the following sequences:
    1. Application of the first coat applied at a rate of forty-five (45) square feet per gallon, and eighty (80) square feet per gallon for the second coat.
    2. The second coat shall not be applied until at least twelve (12) hours after application of the first coat, but not to exceed ninety six (96) hours, or as recommended by the manufacturer.
    3. Workmanship shall be such that the final coated surface is colored uniformly and presents a pleasing appearance.
E. Exterior painting shall not be done during damp weather when ambient temperature is below 50°F. Paint manufacturer's directions for cold weather applications shall be followed explicitly. All fresh WORK shall be protected from damage. For interior WORK, the temperature shall not be allowed to fall below 50°F while paint is being applied or while it is drying.
F. All paint shall be evenly applied in a uniform coat. The finished painting shall show no drops, runs, or sagging of materials.
G. In addition to preparatory sanding, each coat, except the last, shall be fine-sanded. Avoid cross scratches and swirls.
H. Each coat of paint shall be given at least 48 hours to dry before the next coat is applied, unless otherwise directed by the manufacturer's instructions. Any walls that are to have dampproofing applied thereto, will be marked with chalk lines to the approval of the ENGINEER to establish a clean-cut line at which the dampproofing stops.
I. All metalwork which has been shop-painted with rust-inhibitive prime coat shall be handled with care to preserve such coating. Before painting, the CONTRACTOR shall repaint all defective or damaged areas with an approved prime coat after cleaning and removing dust.
J. On metal surfaces, each coat of paint shall be applied at the rate specified to achieve the minimum dry mil thickness required. On concrete and/or masonry, application rates will vary according to surface texture. However, in no case shall the stated spreading rate be exceeded. On porous surfaces, a protective and decorative finish shall be achieved. Deficiencies in the film thickness shall be

corrected by the application of an additional coat(s) of paint. Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times will be necessary. Additional coats of paint shall not be applied, nor shall be returned to service until existing paints are thoroughly dry.

K. Special care shall be taken when painting surfaces in contact with potable water or water in the treatment process so that adequate curing is accomplished. No paint or curing agents shall be used that could impart a taste, odor or discoloration to the water in the process. Manufacturer's instructions shall be strictly followed.

L. Where thinning is necessary, only the products of the manufacturer furnishing the paint or for the particular purpose, shall be allowed; all such thinning shall be done strictly in accordance with the manufacturer's instructions, as well as with the full knowledge and approval of the ENGINEER. Where two or more coats are specified, the first coat shall be tinted a shade lighter than the following coat, and progressively to the color specified for the final coat, and subject to approval.

M. Paint both faces and all edges of doors which require painting. Doors between rooms having different finishes shall have edges finished to match the room the door opens into.

N. Knife-putty nail holes upon the priming coat with putty tinted to color of finished WORK. Putty full and flush with surrounding surfaces; thumb-puttying will not be permitted. Permit to dry and harden before applying next coat.

3.03 ENVIRONMENTAL REQUIREMENTS FOR COATING WORK AND PERFORMANCE STANDARDS FOR CURING

A. Protect all surfaces and surrounding areas that are not to be coated. CONTRACTOR shall be fully responsible for containing airborne paint spray and for repairing any surfaces that are inadvertently painted that are not supposed to be painted.

B. Schedule coating WORK to avoid excessive dust and airborne contaminants. Protect WORK areas from excessive dust and airborne contaminants during coating application and curing.

C. Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D 102. Provide sufficient ventilation airflows and heating to assure that the coating will properly cure. If oil or gas-fired heaters are used, then these heaters shall be of the indirect-fired design in which no combustion products or flue gases are discharged inside the tank. The use of “salamander” style heaters for this purpose is excluded by this Specification.

D. For this PROJECT, a performance standard of 0.1 mg/L for Volatile Organic Compounds (VOC) in water left standing in the tank has been established to

determine if the coating was properly cured after it was applied. Following tank disinfection, the OWNER's representative will draw samples of water at 24 hours and again at 72 hours and then analyze these samples for bacteria and VOC's. The tank coating will be considered to have been properly cured if the VOC level in both of these water samples measures less than 0.1 mg/L.

E. At no additional cost to OWNER, provide whatever corrective actions are needed to achieve compliance with the 0.1 mg/L standard for VOC's as described. These corrective actions may include but are not limited to re-filling and re-testing for VOC's, obtaining competent technical advice from the coating manufacturer, and removing improperly cured coatings and then re-coating the tank interior.

3.04 CLEAN-UP/TOUCH-UP WORK

A. Upon completion, carefully remove all spatterings of paint material from adjoining WORK, glass, plumbing fixtures, trim and concrete surfaces. A detailed inspection of paint WORK shall be made and disfigured portions thereof shall be satisfactorily touched up or refinished to produce an acceptable job. All disused implements of service, rubbish and debris, resulting from the WORK shall be removed from the premises and the entire PROJECT left in a neat, clean, and acceptable condition.

3.05 WRITTEN APPROVAL OF COATINGS MANUFACTURER

A. For all coatings to be applied to new and existing concrete, concrete block, plaster and asbestos cement paneling, written approval shall be obtained from the coatings manufacturer for the items listed below. Three copies of this written approval shall be submitted to the ENGINEER after the coatings manufacturer has personally inspected each of the following conditions:
    1. Final surface preparation of all surfaces prior to coating application.
    2. Sequencing of application of coatings as to when each surface of each wall and ceiling shall be coated.

B. Keep the coatings manufacturer informed of the status of the job at all times so that he can govern the application process to be assured that all coatings are applied within his recommendations.

3.06 TESTING EQUIPMENT & PROCEDURES TO BE EMPLOYED BY THE CONTRACTOR

A. The CONTRACTOR shall have on the PROJECT site the following testing equipment. Equipment shall be in calibration and proper WORKing order. Equipment shall be used in accordance with the manufacturer's instructions or as directed by the ENGINEER. The ENGINEER shall be notified of time of testing so that he might be present to witness testing. The CONTRACTOR shall keep a daily log of environmental conditions, WORK schedule, and any other pertinent information.

The log shall be turned over to the OWNER at the end of the PROJECT to be included in the permanent record.

B. Sling Psychrometer: Relative humidity and dew point readings shall be taken at intervals throughout the day's WORK. Readings shall be taken at the start of the morning's WORK, mid day and afternoon. Should environmental conditions change, additional readings shall be taken to assure that coatings are being applied under the conditions as outlined by the coating's manufacturer.
C. Surface Temperature Thermometer: Surface temperatures shall be taken in areas where WORK is being performed. Surface temperature shall be as specified by the coating's manufacturer.
D. Dry Film Thickness Measurements: Dry film thickness reading shall be taken with a properly calibrated (per the manufacturer's instructions) ultrasonic coating thickness gage instrument. Dry film thickness reading will be taken and recorded in a frequency and manner as dictated by the ENGINEER.

3.07 INSPECTION BY OWNER

A. As implied in previous section, the OWNER will also provide quality control checks, using staff of the ENGINEER and/or a NACE-certified inspector. These activities will include:
    1. Testing of Coating Application WORK: The OWNER will employ the services of a coating inspector to verify that specified paint film thickness has been achieved and that the finished coating is absolutely continuous, for all coated elements, particularly at or below the tank's overflow water level. This Section describes the nominal procedures that will be used by the OWNER's coating inspector.
    2. Paint film thickness shall be verified by measuring the wet film thickness of each coat as it is applied and the dry film thickness of the entire system. The wet film thickness shall be measured with a gage that will measure wet film thickness within an accuracy of ±0.5 mil. A wet film thickness measurement shall be made for each 100 sq. ft. of surface painted.
    3. The dry film thickness shall be measured in accordance with SSPC-PA9 with an ultrasonic coating thickness gage for concrete applications, and SSPC-PA2 for all other dry film thickness measurements. As many dry film thickness measurements as feasible shall be made so there is at least three readings for the first 100 sq ft of surface painted and approximately one measurement for each 100 sq. ft. thereafter. Any deficiencies in required film thickness shall be corrected by the CONTRACTOR per the recommendations of the coating manufacturer.

i. Standard SSPC-PA 1, Shop, Field, and Maintenance Painting of Steel
ii. Standard SSPC-PA 2, Determining Compliance to required DFT
iii. Standard SSPC-PA 4, Maintenance Repainting with Oil-based
iv. Standard SSPC-PA 5, Maintenance Coating of Steel
v. Standard SSPC-PA 6, FRP Linings for Steel Tank Bottoms
vi. Standard SSPC-PA 7, Applying Thin-Film Coatings to Concrete
vii. Standard SSPC-PA 8, Thin-Film Linings in New Steel Vessels
viii. Standard SSPC-PA 9, Measurement of DFT on Concrete
ix. Standard SSPC-PA 10, CONTRACTOR ESH Requirements
x. Standard SSPC-PA 11, Edge Protection 2020
xi. Standard SSPC-PA 12, Method for Preparation of Uncontaminated Rusted
xii. Standard SSPC-PA 14, Applying Plural Component Polyurea
xiii. Standard SSPC-PA 15, Preparing Contaminated Steel Test Panels
xiv. Standard SSPC-PA 16, Evaluating Scribe Undercutting Data
xv. Standard SSPC-PA 17, Determining Profile Compliance
xvi. Standard SSPC-PA 18, Thermal Spray Coatings to Steel Bridges
xvii. Standard SSPC-PA 19, Visual Evaluation of Pinholes in a Concrete or Masonry Coating

3.08 FIELD QUALITY CONTROL

A. Inspector's Services:
    1. Verify coatings and other materials are as specified.
    2. Verify surface preparation and application is as specified.
    3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
    4. Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
        i. Check for holidays on interior steel immersion surfaces using holiday detector.
    5. Report:
        i. Submit written reports describing inspections made and actions taken to correct nonconforming WORK.
        ii. Report nonconforming WORK not corrected.
        iii. Submit copies of report to ENGINEER and CONTRACTOR.
B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

PART 4 – PAINTING SCHEDULE

4.01 SUMMARY OF ITEMS TO BE PAINTED AND STAINED

A. A summary of the items to be painted and stained under this contract is listed below. A description of acceptable painting systems follows this summary. Where colors are listed as "TBD" they shall be selected by the OWNER during the submittal procedure.

Section 0 90 00 – Table 1 – Items to be Painted and Stained		
Misc. ferrous items not listed elsewhere, shipped uncoated or prime coated	Match adjacent surface	B (2)
Misc. ferrous items not listed elsewhere, galvanized	Match adjacent surface	B (4)
Interior wet well and inlet forebay concrete surfaces (including floor, walls and ceiling)	Manufacturer's standard	G (1)
Structural Steel – Gates	Dark Blue	D (1)
Structural Steel Canopy	Columns and Beam – Tan Roof and edge angels – Green	B (4.a)
All other Steel including railings, racks, frames, and misc. steel	TBD	D (1)
Waveshaper Hydraulics/Control Vault (Exterior Only)	Brown	A (1)
Junction Vault Lid	Match adjacent surface	B (6)
Exposed Concrete Bridge Piers and Bents	Shall be agreed upon by bridge OWNER	A (6)
Exposed Steel-Cased Bridge Piers and Bents	Shall be agreed upon by bridge OWNER	B (5)
Stamped and Colored Concrete (Sculpted Rock)	Variations	A (5)
Landscape Blocks	Clear	A (7)

4.02 PAINTING SYSTEMS BREAKDOWN

A. Paint only those items listed in the above "Summary". Painting schedule is to be submitted for each of the systems which will be utilized.

B. Concrete and Masonry Surfaces. Paint shall be similar and equal to that manufactured by the Tnemec Co. unless noted otherwise.

1. Exterior Concrete-Exposed

i. Surface Preparation: Concrete surfaces must be clean and free of excess dirt, mortar, paint, films, protective coatings, efflorescence, etc. in accordance with SSPC-SP 13/NACE 6. Allow masonry surfaces to cure a minimum of 14 days under normal weather conditions. All tie holes, honeycomb and other surface flaws shall be patched in accordance with the Specification, Concrete WORK.

Section 09 90 00 – Table 2 - Exterior Concrete Exposed		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 156 Enviro-Crete	8.0 mils	98 sq.ft./gal.
Coat No. 2 156 Enviro-Crete	16.0 mils	98 sq.ft./gal.

2. Exterior Concrete Block
   i. Surface Preparation: Concrete surfaces must be clean and free of excess dirt, mortar, paint, films, protective coatings, efflorescence, etc. in accordance with SSPC-SP 13/NACE 6.Allow masonry surface to cure a minimum or 14 days under normal weather conditions. Clean all surfaces with solution of 1 part muriatic acid and 2 to 4 parts clean water. Rinse with water under pressure while scrubbing with stiff brushes or brooms. Continue to rinse until pH of 7 or higher is obtained. Allow masonry surface to dry completely. Masonry surfaces must be clean and free of excess dirt, dust, mortar, paint, films, protective coatings, efflorescence, etc.

Section 09 90 00 – Table 3 - Exterior Concrete Block		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 156 Enviro-Crete	8.0 mils	98 sq.ft./gal.
Coat No. 2 156 Enviro-Crete	8.0 mils	98 sq.ft./gal.

3. Exterior Concrete Block – Split-Face Concrete Masonry Units
   i. Surface Preparation: Concrete surfaces must be clean and free of excess dirt, mortar, paint, films, protective coatings, efflorescence, etc. in accordance with SSPC-SP 13/NACE 6. Allow concrete and mortar to cure for a minimum of 14 days before coating. Substrate surface is to be sound, clean and free of dirt, loose mortar, paint, insulation, insulation glue and mastic films, protective coating, efflorescence, etc. Patch any other defects as directed.

Section 09 90 00 – Table 4 - Exterior Concrete Block Split-Face		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series 130 Envirofill	N/A	60-80 sq.ft./gal.
Coat No. 2 Series 156 Enviro-Crete	8.0 mils	98 sq.ft./gal.
Coat No. 3 Series 156 Enviro-Crete	8.0 mils	98 sq.ft./gal.

4. Interior Concrete Block - (Semi-Gloss Polyamide Epoxy)
    i. Surface Preparation: Concrete surfaces must be clean and free of excess dirt, mortar, paint, films, protective coatings, efflorescence, etc. in accordance with SSPC-SP 13/NACE 6. Substrate surface is to be sound, clean and free of dirt, loose mortar, paint, insulation, insulation glue and mastic films, protective coating, efflorescence, etc. Allow concrete and mortar to cure for a minimum of 14 days before coating. Patch any other defects as directed. If cleaning is necessary, prepare surfaces by etching with solution containing 1 part muriatic acid to 2 to 4 parts fresh water. Rinse with clean water under pressure while scrubbing with stiff brushes or brooms. Test with pH paper and continue rinsing until pH of 7 or higher is obtained.

Section 09 90 00 – Table 5 – Interior Concrete Block		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Block Filler: Series 130 Envirofill	N/A	80-100 sq.ft./gal.
Coat No. 1 Series V69-Color H.B. Epoxoline	4.0 mils	277 sq.ft./gal.
Coat No. 2 Series V69-Color H.B. Epoxoline	4.0 mils	277 sq.ft./gal.

5. Grout and Concrete – Stained
    i. Surface Preparation: Grout and concrete surfaces must be clean and free of excess dirt, mortar, paint, films, protective coatings, efflorescence, etc. in accordance with SSPC-SP 13/NACE 6. Allow concrete and mortar to cure for a minimum of 14 days before coating. Surface is to be sound, clean and free of dirt, loose mortar, paint, insulation, insulation glue and mastic films, protective coating,

efflorescence, etc. Patch any other defects as directed. Remove excess water by brooms or squeegees and allow to dry thoroughly before coating.

ii. As an alternate for Grout, a membrane curing compound that leaves the grout with a durable color and meets the requirements of Cast-In-Place Concrete - Section 03 30 00 can be used if specifically approved by the ENGINEER.

iii. Rock and Boulder Cleanup. Take caution to minimize over spray on rock, riprap and boulders.

Section 09 90 00 – Table 6 – Grout and Concrete		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series 636 Dur A Pell 20	N/A	50-75 sq.ft./gal.

6. Exposed Concrete Bridge Piers and Bents Surface Preparation:
   i. In the event that excavation activities expose surface voids or cavities more than 6 inches measured in any direction along the surface of the pier, and/or more than 1.5 inches deep measured normal to the surface, follow the concrete pier protection procedures in the notes below.
   ii. Repair damaged concrete at piers by removal and replacement, using hand-applied method of concrete or mortar placement.
   iii. Chip the concrete faces 1/4-inch deep around the limits of damaged concrete, making straight cuts square to the face of the pier.
   iv. Care shall be taken in removing existing concrete to prevent damage to the existing structure, removal of excessive portions of the structure, and removal of unintended portions of the structure. The CONTRACTOR shall be responsible at no cost to Railroads for repairing any such damage and removal.
   v. If concrete removal exposes any existing reinforcing steel, remove concrete 1” past the inside face of the rebar using equipment no larger than a 15 lb. chipping hammer to prevent damage to the substrate and reinforcement.
   vi. Replace any damaged reinforcing steel with new grade 60 reinforcing steel of the same bar size, or as directed by bridge OWNER. Provide 1” minimum clear and 1” minimum cover at new reinforcing bars.

vii. Follow all manufacturer's recommendations for roughening the concrete contact surfaces (method and resulting aggregate surface profile), and for preparing and cleaning the concrete substrate and any exposed reinforcing steel.
viii. Provide epoxy bonding agent/primer at exposed reinforcing steel and concrete contact surfaces. Bonding agent/primer shall be Sika Armatec110 Epo Cem or approved equal. Mix and apply bonding agent in accordance with manufacturer's directions.
ix. Where alternate types of materials or methods of construction are proposed, they are to be listed by name and manufacturer and submitted with SPECIFICATIONS and calculations where required.
x. Build to original faces of concrete with Sika Sikatop 123 plus mortar or approved equal. Prepare surfaces, mix, apply, and cure mortar in accordance with manufacturer's recommendations.
xi. Place mortar in multiple lifts where repair depth exceeds the recommended maximum layer thickness. Follow all manufacturer's recommendations for applying product in multiple lifts.
xii. Mortar shall be moist cured in accordance with manufacturer's recommendations.
xiii. Provide a class 1 ordinary surface finish conforming to the requirements of CDOT 601.14(b)(1), followed by a structural concrete coating conforming to the requirements of CDOT 708.08. the color shall be as agreed upon by bridge OWNER and Adams County.

7. Landscape Block
    i. Surface Preparation. Per manufacturer's instructions.

Section 09 90 00 – Table 7 – Landscape Block		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Sherwin Williams Anti-Graffiti Coating B97C00150	6.0-9.0 mils	128-192 sq.ft./gal.

C. Miscellaneous Metal Surfaces
1. Paint shall be similar and equal to that manufactured by Tnemec Co.
2. Interior/Exterior – Submerged or adjacent to water (polyamide epoxy)
    i. Surface Preparation: Remove all grease, oils and contaminants. Remove all weld spatters and grind rough and sharp welds to smooth,

rounded contour and blast clean to near-white blast finish (NACE No. 2). Surface to be dry.

Section 09 90 00 – Table 8 – Miscellaneous Metal Surfaces		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Pota-pox Primer V140-1255	4 ± 1 mils	220 sq. ft./gal.
Coat No. 2 Hi-Build Epoxoline V69*	4 ± 1 mils	220 sq. ft./gal.
Coat No. 3 Hi-Build Epoxoline V69*	4 ± 1 mils	220 sq. ft./gal.

* Where in contact with potable water use Series V140, Pota-Pox Plus.

3. Interior/Exterior Railings, Metal Windows, Doors and Frames, Miscellaneous Metalwork (Not submerged, but exposed to moist atmosphere and/or sunlight and weather). (Aliphatic Polyurethane Semi-Gloss Enamel over Polyamide Epoxy)
    i. Surface Preparation: Remove all grease, oils and contaminants. Remove all weld splatters and grind rough and sharp welds to smooth, rounded contour and blast clean to near-white blast finish (NACE No. 2). Surface to be dry.

Section 09 90 00 – Table 9 – Miscellaneous Metalwork		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 High-Build Epoxoline V69	5.0 ± 1.0 mils	175 sq. ft./gal.
Coat No. 2 Endura Shield 1095	2.5 min. + 1.0 mils	372 sq. ft./gal.

4. Interior/Exterior - Submerged in Sewage (Coal Tar Epoxy)
    i. Surface Preparation: Remove all grease, oils, and contaminants. Remove all weld splatters and grind rough and sharp welds to smooth rounded contour and blast clean to near-white metal finish (NACE No. 2). Surface to be dry.

Section 09 90 00 – Table 10 – Submerged in Sewage		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 V69 High Build Epoxoline II	4.0 mils	277 sq.ft./gal.

Coat No. 2 46H-413 Tneme-Tar	18.0 mils	70 sq.ft./gal.

Note: Coat No. 1, primer coat, to be shop applied only. Coat No. 1 is eliminated for material to have surface prepared at job-site.

5. Galvanized Steel and Nonferrous Metal Pipes and Surfaces.
    i. Paint shall be similar and equal to that manufactured by Tnemec Co.
        1. Exterior Exposed
            a. Surface Preparation: Remove all grease, oils and contaminants. Remove all rust from galvanized steel. Remove white rust from galvanized steel by hand or power brushing. Remove rust from old galvanized steel in accordance with SSPC-SP 2 or SP3. Do not damage or remove galvanizing. Lightly sand galvanizing to provide surface roughness as recommended by the manufacturer to achieve suitable bond.

Section 09 90 00 – Table 11 – Exterior Exposed Galvanized and Nonferrous Metal		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series V69 Hi-Build Epoxoline	4.0 mils	225 sq.ft./gal.
Coat No. 2 Series 1095 Endura-Shield	3.0 mils	N/A

        2. Interior Exposed
            a. Surface Preparation: Removal all grease, oils and contaminants. Remove all rust from galvanized steel. Remove white rust from galvanized steel by hand or power brushing. Remove rust from old galvanized steel in accordance with SSPC-SP 2 or SP3. Do not damage or remove galvanizing. Lightly sand galvanizing to provide surface roughness as recommended by the manufacturer to achieve suitable bond.

Section 09 90 00 – Table 12 – Interior Exposed Galvanized and Nonferrous Metal		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series V69 High-Build Epoxoline	4.0 mils	225 sq.ft./gal.

Coat No. 2 Series V69 High-Build Epoxoline	4.0 mils	225 sq.ft./gal.

3. Immersion
    a. Surface Preparation. Remove all grease, oils and contaminants. Remove all rust from galvanized steel. Remove white rust from galvanized steel by hand or power brushing. Remove rust from old galvanized steel in accordance with SSPC-SP 2 or SP3. Do not damage or remove galvanizing.

Section 09 90 00 – Table 13 – Immersion Wastewater/Non-Potable Water		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series V69 High-Build Epoxoline	5.0 mils	225 sq.ft./gal.
Coat No. 2 Series V69 High-Build Epoxoline	6.0 mils	225 sq.ft./gal.

Section 09 90 00 – Table 14 – Immersion Potable Water		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series V140 PotaPox Plus	6.0 mils	225 sq.ft./gal.
Coat No. 2 Series V140 PotaPox Plus	6.0 mils	225 sq.ft./gal.

6. Exposed Steel-Cased Bridge Piers and Bents
    i. Surface Preparation: Prepare the exposed surfaces of the casing to standard SSPC-SP 2 (Hand Tool Cleaning). Exposed surfaces shall receive a primer coat of Tnemec Series 90-97 Tnemec-Zinc, an intermediate coat of Tnemec Series 73 Endura-Shield, and a finish coat of Tnemec Series 1071 Flouronar. The color shall be as agreed upon by bridge OWNER and Adams County.
7. Junction Vault Lid
    i. Surface Preparation: Surfaces must be clean and free of excess dirt, loose paint, rust, oil, grease, wax, soap, etc. Do not use ammonia to remove existing mildew. Sand surface with 80 grit sandpaper. Solvent clean with thinner to remove residue.

Section 09 90 00 – Table 15 – Junction Vault Lid		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 TuffCoat UT-95	2 mils	Per manufacturers SPECIFICATIONS
Coat No. 2 TuffCoat UT-200	15-18 mils	Per manufacturers SPECIFICATIONS
Coat No. 3 TuffCoat UT-200	15-18 mils	Per manufacturers SPECIFICATIONS

D. Ductile or Cast Iron – Pipe, Equipment, and Valves
    1. Paint shall be similar and equal to that manufactured by Tnemec Co.
    2. Exterior Exposed
        i. Surface Preparation: Ensure surfaces are clean, dry and free of oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter in accordance with SSPC-SP 6/NACE 3.

Section 09 90 00 – Table 16 – Ductile or Cast Iron Exterior Exposed		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series V69 Hi-Build Epoxoline	5.0 mils	225 sq.ft./gal.
Coat No. 2 Series V69 Hi-Build Epoxoline	6.0 mils	225 sq.ft./gal.
Coat No. 3 Series 1095 Endura-Shield	3.0 mils	225 sq.ft./gal.

    3. Interior Exposed
        i. Surface Preparation: Ensure surfaces are clean, dry and free of oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter in accordance with SSPC-SP 6/NACE 3.

Section 09 90 00 – Table 17 – Ductile or Cast Iron Interior Exposed		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series V69 High-Build Epoxoline	5.0 mils	225 sq.ft./gal.
Coat No. 2 Series V69 Hi-Build Epoxoline	6.0 mils	225 sq.ft./gal.

    4. Immersion

i. Surface Preparation: Ensure surfaces are clean, dry and free of oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter in accordance with SSPC-SP 10/NACE 2.

E. Section 09 90 00 – Table 18 – Immersion Wastewater/Non-Potable Water		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series V69 High-Build Epoxoline	5.0 mils	225 sq.ft./gal.
Coat No. 2 Series 46H-413 High-Build Tneme-Tar	20.0 mils	70 sq.ft./gal.

Section 09 90 00 – Table 19 – Immersion Potable Water		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series V140 PotaPox	6.0 mils	225 sq.ft./gal.
Coat No. 2 Series V140 PotaPox	6.0 mils	225 sq.ft./gal.

Note: Coat No. 1, primer coat, to be shop applied only. Prepare shop primer to receive field coat in accordance with manufacturer's instructions.

F. Steel – Gates.
   1. Paint shall be similar and equal to that manufactured by CeRam-Kote Products.
   2. Exterior Exposed
      i. Surface Preparation: Ensure surfaces are clean, dry and free of oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter in accordance with SSPC-SP 10/NACE 1.

Section 09 90 00 – Table 20 – Immersion Potable Water		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 CeRam-Kote 54	5.0 mils	N/A
Coat No. 2 CeRam-Kote 54	5.0 mils	N/A
Coat No. 3 CeRam-Kote 54	5.0 mils	N/A
Coat No. 4 CeRam-Kote 54	5.0 mils	N/A

Note: All steel outside the Vane (see E (1 & 2) below) shall receive this coating including but not limited to: framing, plates, pipes, torque tube, flanges, bearing covers, and shims.

G. Steel – Vane.
   1. Paint shall be similar and equal to that manufactured by TNEMEC Products (primer) and Rhino Liner (Coating).
   2. Top Surface – Immersion

i. Surface Preparation: Ensure surfaces are clean, dry and free of oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter in accordance with SSPC- SP 10/NACE 2.

Section 09 90 00 – Table 21 – Top Surface Immersion		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series N69 High Build Epoxoline II	3.0 mils	N/A
Coat No. 2 Series N69 High Build Epoxoline II	3.0 mils	N/A
Coat No. 3 Rhino Liner Tough Grip	1/4 inch	N/A

Note: Rhino Liner Tough Grip shall be applied to achieve a very smooth finish of similar characteristic to a smooth troweled concrete finish (garage floor). No surface irregularities, fins, sharp or rough edges will be acceptable. Applicator to provide a 12" x 12" sample of the finish prior to application on Vane.

3. Sides and Bottom Surface – Immersion
    i. Surface Preparation: Ensure surfaces are clean, dry and free of oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter in accordance with SSPC- SP 10/NACE 2.

Section 09 90 00 – Table 22 – Sides and Bottom Surface Immersion		
Paint Name and Number	Thickness	Dry Mil. Spreading Rate
Coat No. 1 Series N69 High Build Epoxoline II	3.0 mils	N/A
Coat No. 2 Series N69 High Build Epoxoline II	3.0 mils	N/A
Coat No. 3 Rhino Liner Tough Grip	1/16 inch	N/A

Note: Rhino Liner Tough Grip shall be applied to achieve a very smooth finish of similar characteristic to a smooth troweled concrete finish (garage floor). No surface irregularities, fins, sharp or rough edges will be acceptable.

H. Wet Well Protective Coatings
    1. Blended Amine Cured Epoxy – spray applied. Designed specifically for immersed, non-immersed, corrosive environments, especially for headspace environments that are corrosive due to biogenic sulfide corrosion. Non-potable specifically designed for long term use in wastewater environments. Coating is suitable for application on concrete and ferrous surfaces.

i. Concrete Surfaces
    1. Surface Preparation: Surface preparation shall not begin until at least 30 days after the concrete has been placed and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content may be tested by the ENGINEER or coating manufacturer.
    2. Oil, grease, and form release and curing compounds shall be removed by abrasive blasting and chipping.
    3. All coating termination and transition details shall be prepared in accordance with the coating manufacturer's standard detail DRAWINGS. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedment's in the concrete substrate, and other details. The coating manufacturer's standard detail DRAWINGS shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the coating manufacturer shall be required to produce one at no additional cost to the OWNER.
    4. Concrete surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete. Surface Preparation must open up all shelled over airvoids or bugholes to fully expose the void's depth, width, and length. Concrete shall be abraded to achieve a uniform concrete surface profile of CSP-5 in accordance with ICRI 310.2.
    5. Paint Name: Carboline Plasite 4500S; Sauereisen Sewergard 210S; Raven 400; Tnemec Series 435; or equal.
    6. Thickness: For Concrete: 60 mils DFT minimum, applied in one or more coats as recommended by the manufacturer.
    7. Field Inspection and Testing: The CONTRACTOR shall give the ENGINEER a minimum of 3 Days advance notice of the start of any field surface preparation or coating application, and a minimum of 7 Days advance notice of the start of any surface preparation activity.

8. Such WORK shall be performed only in the presence of the ENGINEER, unless the ENGINEER has granted prior approval in writing to perform such WORK in its absence. If the CONTRACTOR proceeds with preparation or coating without ENGINEER inspection or waiver of inspection, the ENGINEER may require removal and reapplication of the coating, which will be at the CONTRACTOR's sole expense.
9. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the WORK, shall not relieve the CONTRACTOR of its responsibility to perform the WORK in accordance with these SPECIFICATIONS.
10. Scaffolding shall be erected and moved to locations where requested by the ENGINEER to facilitate inspection. Additional illumination shall be furnished on areas to be inspected.
11. Inspection Devices: The CONTRACTOR shall furnish inspection devices in good working condition for the detection of holidays and measurement of dry film thicknesses of coatings. Dry-film thickness gauges shall be made available for the ENGINEER's use while coating is being done, until final acceptance of such coatings.
12. The CONTRACTOR shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the ENGINEER.
13. Holiday Testing: The CONTRACTOR shall test for continuity all coated surfaces. Areas that contain discontinuities shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then be retested. The ENGINEER reserves the right to test a representative sample of surface area for both holidays and coating thickness at its discretion.
14. Holiday detection shall be performed in accordance with NACE RP0188. Pulse- type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the required coating thickness.

15. Film Thickness Testing: On non-ferrous substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.
16. Holiday Repair: Using a pencil grinder or other suitable power tool, remove the coating system at all pinholes or holidays in an area at least 2 inches in diameter or in both dimensions around the defect back to the concrete substrate.
17. Chip out and remove the concrete to expose the full dimensions in all three directions of the air void responsible for the defect.
18. Aggressively abrade or sand the intact coating system surface at least 3 inches beyond the removal area in all directions to produce a uniform 6 to 8 mil profile in the intact coating system.
19. Vacuum clean the prepared area to remove all dust, dirt, etc. leaving clean sound surfaces.
20. Tape to mask the periphery of the prepared intact coating area to prevent coating repair application onto the prepared area.
21. Using a putty knife or other suitable tool, fill the opened void with the approved filler/surfacer material completely and strike-off. Allow to cure per coating manufacturer's recommendations.
22. Apply the coating system in the number of coats necessary to achieve the specified 60 mils DFT over the defect and coating removal area and feather the coating onto the abraded coated surfaces around the removal area to avoid a lip and to achieve a neat repair outline. Allow to cure properly.

ii. Ferrous Surfaces

1. Surface Preparation: Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast-cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70 - Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive and TM-01-75 - Visual Standard for Surfaces of New Steel Centrifugally Blast Cleaned with Steel Grit.

2. Oil, grease, welding fluxes, and other surface contaminants shall be removed by solvent cleaning per SSPC SP1 - Solvent Cleaning prior to blast cleaning.
3. Sharp edges shall be rounded or chamfered, and burrs and surface defects and weld splatter shall be ground smooth prior to blast cleaning.
4. Shop-applied coatings shall not be incorporated in the coating system. Shop- applied coatings shall be completely removed during the surface preparation process.
5. General ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 3.0 to 3.5 mils. Blast Cleaning shall produce a minimum surface profile of 3.0 mils.
6. Cast or ductile-iron piping surfaces including fittings shall be prepared in accordance with NAPF 500-03, NAPF 500-03-04, and NAPF 50. Cast or ductile iron surfaces shall be abrasive blast cleaned to a clean, gray uniform metal appearance free of variations in color and loose materials.
7. Remove traces of grit, dust, dirt, rust scale, friable material, loose corrosion products or embedded abrasive from substrate by vacuum cleaning prior to coating application.
8. Care must be taken to prevent contamination of the surface after blasting from Workers fingerprints, deleterious substances on Workers clothing, or from atmospheric conditions.
9. Paint Name: Carboline Plasite 4500S; Sauereisen Sewergard 210S; Raven 400; Tnemec Series 435; or equal.
10. Thickness: For Ferrous Items: 30 to 40 mils DFT, applied in one or more coats as recommended by the manufacturer.
11. Field Inspection and Testing: Same as specified for System F1, and:
    a. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC Paint Application Specification No. 2 using a magnetic type dry film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, or equal. Each coat shall be tested for the correct

thickness. No measurements shall be made until at least 8 hours after application of the coating.

12. Holiday Repair: As specified for System F1, modified as recommended by the manufacturer for ferrous surfaces.

END OF SECTION

SECTION 31 14 13

TOPSOIL AND WETLAND TOPSOIL STRIPPING AND STOCKPILING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This WORK consists of salvaging and stockpiling topsoil and wetland topsoil and excavating suitable topsoil or wetland topsoil from stockpiles, CONTRACTOR sources, available sources, or from the approved natural ground cover to place on designated areas.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:
   1. Section 31 11 00, Clearing and Grubbing.
   2. Section 31 23 00, Excavation and Fill.
   3. Section 31 25 00, Erosion and Sedimentation Control.
   4. Section 32 91 13, Topsoil and Wetland Topsoil.

1.03 NOT USED IN THIS SPECIFICATION

1.04 NOT USED IN THIS SEPCIFICATION

1.05 NOT USED IN THIS SPECIFICATION

PART 2 – PRODUCTS

2.01 MATERIALS

A. Topsoil shall meet the requirements of Section 32 19 13 Topsoil and Wetland Topsoil. Topsoil and Wetland Topsoil shall consist of natural onsite ground cover or hauled material from offsite sources.

B. Erosion and Sedimentation Control for Stockpiles shall meet the requirements of Section 31 25 00, Erosion and Sedimentation Control.

C. Wetland topsoil material shall consist of moist organic soil, including any existing wetland vegetation and seeds. Material shall be excavated from areas as shown on the DRAWINGS, hauled material from offsite sources, or as directed by ENGINEER. All wetland topsoil materials shall meet the requirements of Section 32 19 13, Topsoil and Wetland Topsoil.

PART 3 – EXECUTION

3.01 TOPSOIL

A. Topsoil within the limits of the PROJECT shall be salvaged prior to beginning excavating, fill or hauling, operations by excavating topsoil and stockpiling the material at designated locations on DRAWINGS or as designated by OWNER in a manner that will facilitate measurement, minimize sediment damage, and not obstruct natural drainage.
B. Imported topsoil shall be hauled to the site and stockpiled in locations designated by OWNER.
C. Salvaged topsoil exceeding the quantity required under the CONTRACT shall be disposed of at CONTRACTOR's expense.

3.02 STOCKPILE

A. No soil stockpile shall exceed ten (10) feet in height.
B. All topsoil stockpiles shall be protected from sediment transport by surface roughening, watering, and perimeter silt fencing.
C. Any topsoil stockpile remaining longer than 30 days shall be seeded with a sterile temporary cover (such as REGREEN or approved equivalent) or the approved specified final seed mixture.
D. Upon completion of PROJECT or as approved by OWNER or OWNERS REPRESENTATIVE, remove surplus subsoil and topsoil from site. Grade stockpile area as necessary for planting or seeding.

3.03 WETLAND TOPSOIL

A. Wetland topsoil material shall be excavated from areas designated on the DRAWINGS or as approved by ENGINEER to a minimum depth of eighteen (18) inches, or as otherwise designated, and placed within twenty four (24) hours in the wetland relocation site.
B. CONTRACTOR shall prepare the wetland relocation site to elevations specified in the DRAWINGS or as approved by ENGINEER prior to excavating the wetlands topsoil. If ENGINEER determines that this is not possible, then CONTRACTOR shall stockpile wetland topsoil material in an approved area, to remain undisturbed until the relocation site has been prepared.
C. All wetland topsoil stockpiles shall be protected from sediment transport by surface roughening, watering, and perimeter silt fencing.
D. Storage time within the stockpile shall be as short as possible.
E. If deemed necessary by ENGINEER, the stockpile shall be protected in such a manner to preserve the wetland seed bank.
F. Wetland topsoil material shall be placed over the prepared relocation areas to a depth of eighteen (18) inches, or as otherwise designated.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 - GENERAL

1.01 DESCRIPTION

A. This WORK shall consist of excavation, embankment fill, disposal of excess material, shaping, and compaction of all material encountered within the limits of WORK, including excavation and fill for structures. The excavation shall include, but is not limited to, the native soils which shall be excavated for the PROJECT WORK. All WORK shall be completed in accordance with these SPECIFICATIONS, the lines and grades, and typical cross-sections shown on the DRAWINGS.

B. All excavation shall be classified, “unclassified excavation,” or “muck excavation” or “rock excavation,” as hereafter described. All embankment shall be classified “embankment material” as hereafter described.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 31 11 00, Clearing and Grubbing.
2. Section 31 23 19, Dewatering.
3. Section 31 25 00, Erosion and Sedimentation Control.

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
    a) D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).
    b) D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.04 NOT USED IN THIS SPECIFICATION

1.05 QUALITY ASSURANCE

A. Final topography and/or cross-sections shall be surveyed of areas that are to finished grade and compared to the design section for accuracy.

B. Final grade shall match design grades within the tolerances discussed in PART 3 EXECUTION.

1.06 DEFINITIONS

A. Embankment Material shall consist of approved material acquired from excavation or from outside sources, hauled and placed in embankments.

B. Muck Excavation shall consist of the removal of mixtures of soils and organic matter not suitable for foundation material and replacement with approved material.
C. Rock Excavation shall consist of igneous, metamorphic and sedimentary rock which cannot be excavated without the use of rippers, and all boulders or other detached stones each having a volume of one-half (1/2) cubic yard or more, as determined by physical or visual measurement. It shall also include replacement with approved material as required.
D. Unclassified Excavation shall consist of the excavation of all materials of whatever character required of the WORK, obtained within the PROJECT limits.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Embankment Material may consist of approved material acquired from excavations or material hauled from outside the PROJECT limits.
B. Suitable material identified onsite shall be used first for embankments and backfill.
C. Excess excavated native soils which are not used as embankment or backfill shall become the property of CONTRACTOR and shall be disposed of offsite by CONTRACTOR, in a location acceptable to ENGINEER.
D. Muck Excavation shall also include the replacement of excavated muck with uniformly graded rock, riprap, onsite or imported soils, or other material, whichever is most suitable for the specific situation encountered.
E. ENGINEER will determine which type of aggregate or other material which shall be used after observing the specific site conditions.
F. Structural Backfill:
    1. When specified on the DRAWINGS or as required by ENGINEER, Class I structural backfill shall meet the following gradation requirements:

Section 31 23 00 – Table 1 – Structural Backfill	
Sieve Size	% By Weight Passing Square Mesh Sieves
2-inch	100
No. 4	30 - 100
No. 5	10 – 60
No. 200	5 - 20

    2. In addition, this material shall have a liquid limit not exceeding thirty five (35) and a plasticity index of not over six (6).

3. Impervious structural backfill, where shown or specified, shall consist of material having one hundred percent (100%) finer than two (2) inches in diameter and a minimum of thirty-five percent (35%) passing a No. 200 U.S. Standard Sieve.

PART 3 – EXECUTION

3.01 GENERAL EXCAVATION/EMBANKMENT

A. General:
   1. The excavation and embankment shall be finished to reasonably smooth and uniform surfaces.
   2. Variation from the subgrade plane shall not be more than eight-tenths (0.08) foot in soil or more than eight-tenths (0.08) foot above or one-half (0.50) foot below in rock.
   3. Where bituminous or concrete surfacing materials are to be placed directly on the subgrade, the subgrade plane shall not vary more than four-tenths (0.04) foot.
   4. Materials shall not be wasted without permission of ENGINEER.
   5. Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed.
   6. Prior to beginning grading operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with Section 31 11 00, Clearing and Grubbing, of these SPECIFICATIONS.
   7. CONTRACTOR shall notify ENGINEER in sufficient time before beginning excavation or embankment such that the necessary topography and/or crosssections may be taken. CONTRACTOR shall not excavate beyond the dimensions and elevations established, and material shall not be removed prior to surveying the site.
   8. When CONTRACTOR's excavating operations encounter remains of prehistoric people's dwelling sites or artifacts of historical or archaeological significance, the operations shall be temporarily discontinued.
      i. ENGINEER will contact archaeological authorities to determine the disposition thereof.
      ii. When directed, CONTRACTOR shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper state authorities.
      iii. Such excavation will be considered and paid for as extra WORK.

B. Excavation:

1. Unclassified:
    i. All excess suitable material excavated from the PROJECT site and not used for embankment shall be removed from the PROJECT site and become the property of CONTRACTOR.
    ii. Where material encountered within the limits of the WORK is considered unsuitable for embankment (fills) on any portion of this PROJECT WORK, such material shall be excavated as directed by ENGINEER and replaced with suitable fill material.
    iii. All unsuitable excavated material from excavation consisting of any type of debris (surface or buried), excavated rock, bedrock or rocks larger than six (6) inches in diameter, and boulders shall be hauled from the PROJECT site and disposed of by CONTRACTOR at CONTRACTOR's expense.
    iv. Debris is defined as "anything that is not earth which exists at the job site."
2. Muck:
    i. Where excavation to the finished grade section results in a subgrade or slopes of unsuitable soil, ENGINEER may require CONTRACTOR to remove the unsuitable materials and backfill to the finished graded section with approved material.
    ii. Disposal of the unsuitable material and replacement with suitable material shall be at CONTRACTOR's expense.
3. Good surface drainage shall be provided around all permanent cuts to direct surface runoff away from the cut face.
4. Rock:
    i. Unless otherwise specified, rock shall be excavated to a minimum depth of 0.5 foot below subgrade within the limits of the channel area, and the excavation shall be backfilled with material shown on the DRAWINGS or as designated by ENGINEER.
    ii. Disposal of material and replacement with suitable approved material shall be at CONTRACTOR's expense.
5. Embankment Construction:
    i. Embankment construction shall consist of constructing all fill areas, including preparation of the areas upon which they are to be placed, the placing and compacting of approved material within areas where unsuitable materials have been removed, and the placing and

compacting of Embankment Material in holes, pits and other depressions within the PROJECT area.

ii. Only approved materials shall be used in the construction of embankments and backfills.

iii. Approved materials shall consist of clean onsite cohesive soils or approved imported soils.

iv. Onsite cohesive soils or imported soils shall be placed and compacted in horizontal lifts, using equipment and procedures that produce recommended moisture contents and densities throughout the lift and embankment height. Onsite or imported cohesive soils shall be compacted within a moisture content range of two percent (2%) below, to two percent (2%) above optimum moisture content and compacted to ninety-five percent (95%) of the Maximum Standard Proctor Density (ASTM D698).

v. When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built one-half (1/2) width at a time, the slopes that are steeper than four-to-one (4:1) when measured longitudinally or at right angles to the adjacent ground shall be continuously benched over those areas where it is required as the WORK is brought up in layers.

    1. Benching shall be well “keyed” and where practical a minimum of eight (8) feet. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts.
    2. Material thus cut out shall be recompacted along with the new Embankment Material at CONTRACTOR’s expense.

6. The ground surface underlying all fills shall be carefully prepared by removing all organic matter, scarification to a depth of eight (8) inches and recompacting to ninety-five percent (95%) of the Maximum Standard Proctor Density (ASTM D698) at optimum moisture content + or - two percent (2%) prior to fill placement.
7. Embankment Material shall be placed in horizontal layers not exceeding 8 inches (loose measurement) and shall be compacted to ninety five percent (95%) of the Maximum Standard Proctor Density (ASTM D698) at optimum moisture content + or - two percent (2%).

i. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting.
ii. As the compaction of each layer progresses, continuous leveling and manipulating required to ensure uniform density.

8. For embankments which serve as berms, the downstream portion shall be keyed into the subsurface soils a minimum of three (3) feet to enhance the stability of the slope.
9. Materials which are removed from excavations beneath the water table may be over the optimum moisture content and shall be required to be dried out prior to reusing them.
10. Cross hauling or other action as appropriate will be ordered when necessary to ensure that the best available material is placed in critical areas of embankments, including the top two (2) feet of all embankments. No additional payment will be made for cross hauling ordered by ENGINEER.
11. Frozen materials shall not be used in construction of embankments.
12. During the construction of the channels, the channel bottom shall be maintained in such condition that it will be well drained at all times.
13. Excavation or embankment (fill), and structural backfill WORK either completed or in a stage of completion that is either eroded or washed away or becomes unstable as a result of either rains, snow, snow melt, channel flows, or lack of proper water control shall be either removed and replaced, recompacted, or reshaped as directed by ENGINEER and in accordance with the DRAWINGS and SPECIFICATIONS at CONTRACTOR's sole expense.
14. Removed unsuitable materials shall be hauled away and disposed of at CONTRACTOR's expense. Placing of replacement materials for removed unsuitable materials shall be purchased, placed, and compacted at CONTRACTOR's expense.

C. Proof Rolling:
1. Proof rolling with a heavy rubber tired roller shall be required, if designated on the DRAWINGS or when ordered by ENGINEER.
2. Proof rolling shall be done after specified compaction has been obtained. Areas found to be weak and those areas which failed shall be ripped, scarified, wetted if necessary, and recompacted to the requirements for density and moisture at CONTRACTOR's expense.
3. Proof rolling shall be done with equipment and in a manner acceptable to ENGINEER. Proof rolling as shown on the DRAWINGS or as ordered by

ENGINEER shall not be measured and paid for separately, but shall be included in the unit prices bid for the WORK.

3.02 EXCAVATION AND BACKFILL FOR STRUCTURES

A. Poor foundation material for any of the WORK shall be removed, by CONTRACTOR, as directed by ENGINEER.
    1. CONTRACTOR will be compensated for removal and replacement of such materials in accordance with Muck Excavation.
B. CONTRACTOR is cautioned that construction equipment may cause the natural soils to pump or deform while performing excavation WORK inside and on footings, structural floor slabs, or other structure foundation areas.
C. CONTRACTOR shall remove and replace at CONTRACTOR's expense any foundation materials which are:
    1. Saturated by either surface or subsurface flows because of the lack of adequate water control or dewatering work by CONTRACTOR;
    2. Frozen for any reason; or
    3. Disturbed by CONTRACTOR's WORK or caused to become unacceptable for foundation material purposes by means of CONTRACTOR's equipment, manpower, or methods of WORK.
D. Dewatering shall not be conducted by pumping from inside footings, structural floor slabs, or other structure foundation limits. This may decrease the supporting capacity of the soils.
E. Care shall be taken when excavating the foundations to avoid disturbing the supporting materials. Excavation by either hand or careful backhoe soil removal, may be required in excavating the last few inches of material to obtain the subgrade of any item of the concrete WORK.
F. Any over-excavated subgrades that are due to CONTRACTOR's actions, shall be brought back to subgrade elevations, as indicated on the DRAWINGS, by CONTRACTOR and at CONTRACTOR's expense in the following manner:
G. For over-excavations of two (2) inches or less, either backfill and compact with approved granular materials; backfill with one-half (1/2) inch crushed rock; or fill with concrete at the time of the appurtenant structure concrete pour.
H. For over-excavations greater than two (2) inches, backfill and compact with an approved granular material.
    1. All granular footings, structural floor slabs, or other structure areas shall be compacted with a vibratory plate compactor prior to placement of concrete, reinforcing, or bedding materials.

2. Backfill, and fill within three (3) feet adjacent to all structures and for the full height of walls, shall be selected non-swelling material.
    i. It shall be granular, well graded, and free from stones larger than two (2) inches.
    ii. Material may be job excavated, but shall selectivity be required as determined by ENGINEER.
    iii. Stockpiled material, other than topsoil from the excavation, shall be used for backfilling unless an impervious structural backfill is specified.
    iv. The backfill material shall consist of either clean onsite granular material free of stones larger than two (2) inches in diameter with no more than twenty percent (20%) passing the No. 200 sieve, or equivalent imported materials.
    v. All backfill around the structures shall be consolidated by mechanical tamping.
    vi. The material shall be placed in six-inch (6") loose lifts within a range of two percent (2%) above to two percent (2%) below the optimum moisture content and compacted to ninety-five percent (95%) of Maximum Standard Proctor Density (ASTM D698) for cohesive soils, or to seventyfive percent (75%) relative density for pervious material as determined by the relative density of cohesionless soils test, ASTM D4253.
3. Impervious structural backfill shall be placed in six-inch (6") loose lifts within a range of two percent (2%) above to two percent (2%) below the optimum moisture content and compacted to ninety-five percent (95%) of Maximum Standard Proctor Density for cohesive soils as determined by ASTM D698.

END OF SECTION

SECTION 31 23 13

SUBGRADE PREPARATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Definitions

1. Optimum Moisture Content: As defined in Section 31 23 00 Excavation and Fill.
2. Prepared Ground Surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.
3. Prepared Grouted Core Rock Subgrade: Ground surface after completion of clearing and grubbing, demolition of existing structures, removal of sediment and debris, dewatering, and excavation to grade.
4. Prepared Surface of Existing Riprap: Surface of existing riprap after removal of sediment and debris, vegetative growth, and other interfering or objectionable material.
5. Maximum Dry Density: As defined in Section 31 23 00 Excavation and Fill.
6. Relative Density: As defined in 31 23 00 Excavation and Fill..
7. Subgrade: Layer of existing soil after completion of clearing, grubbing, scalping of topsoil prior to placement of fill, roadway structure or base for floor slab.
8. Proof-Rolling: Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement.

1.02 NOT USED FOR THIS SPECIFICATION

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   I. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3 (600 kN-m/m3)).
   II. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

1.04 NOT USED FOR THIS SPECIFICATION

1.05 QUALITY ASSURANCE

A. Notify ENGINEER when subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

1.06 SQUENCING AND SCHEDULING

A. Complete applicable WORK specified in 31 14 13 Earthwork - Topsoil Stripping and Stockpiling and Section 31 23 00 Excavation and Fill, prior to subgrade preparation.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Prepare subgrade when unfrozen and free of ice and snow.

PART 2 – NOT USED FOR THIS SPECIFICATION

PART 3 – EXECUTION

3.01 GENERAL

A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.
B. Bring subgrade to proper grade and cross-section and uniformly compact surface.
C. Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.
D. Maintain prepared ground surface in finished condition until next course is placed.

3.02 COMPACTION

A. Under Earthfill: Compact upper 8 inches of subgrade to the maximum dry density in accordance with ASTM D698.
B. Under Pavement Structures, Floor Slabs On Grade, or Granular Fill Under Structures: Compact the upper 8 inches of subgrade to minimum of 95 percent maximum dry density as determined in accordance with ASTM D698 within percentage points of the material's optimum moisture content.
C. Bedrock Subgrade: Compaction not required.

3.03 MOISTURE CONDITIONING

A. Dry Subgrade: Add water, then mix to make moisture content uniform throughout.
B. Wet Subgrade: Aerate material by blading, discing, harrowing, or other methods, to hasten drying process.
C. Bedrock Subgrade: Keep bedrock surface moist at all times.

3.04 TESTING

A. Proof-roll subgrade with equipment specified in Geotechnical engineering Report (See Special Conditions) to detect soft or loose subgrade or unsuitable material, as determined by ENGINEER.

B. Bedrock subgrade shall be inspected and sounded by a Geotechnical ENGINEER.

3.05 CORRECTION

A. Soft or Loose Subgrade:
    1. Adjust moisture content and recompact, or
    2. Over-excavate as specified in Section 31 00 00 - Earthwork, and replace with suitable material from the excavation, as specified in Section 31 23 00 Excavation and Fill.
B. Unsuitable Material: Over-excavate as specified in Section 31 23 00 Excavation and Fill, and replace with suitable material from the excavation, as specified in Section 31 23 00 Excavation and Fill.

3.06 GROUTED CORE ROCK SUBGRADE PREPARATION

A. No materials shall be placed in any portion of the grouted core rock foundation until the foundation for each section has been dewatered, stripped, excavated to grade, and suitably prepared, and has been approved by the ENGINEER.
B. All cavities, depressions, and irregularities, either existing or resulting from removal of loose or weathered rock fragments found within the area to be covered by grouted core rock and which extend below or beyond the established lines of excavation shall be filled with concrete fill.
C. The suitability of each section of the foundation for placing grouted core rock materials thereon will be determined by the ENGINEER. No concrete materials shall be placed when the subgrade is frozen.
D. The bottom and side slopes of excavation upon or against which grouted core rock is to be placed shall be excavated intact sandstone bedrock as approved by the ENGINEER.
E. If, at any point in rock or foundation materials, the natural foundation material is disturbed or loosened, it shall be removed and replaced with concrete fill.
F. Immediately prior to placing the first layer of grouted core rock, all bedrock surfaces upon or against which the grouted core rock is to be placed shall be cleaned of all loose and objectionable materials in an approved manner by handwork, barring, picking, brooming, air jetting, or other effective means. Such surfaces shall be properly moistened and sufficiently cleaned so that the grouted core rock will bond intimately to the surfaces. Standing water shall be removed from depressions prior to placement of grouted core rock.

3.07 RIPRAP SUBGRADE PREPARATION

A. Prior to placing riprap against existing riprap, prepare existing riprap surface. Remove and dispose of debris, interfering or objectionable material, silt, vegetative matter, wood, standing water, and damaged riprap. Modify riprap surface to stable

configuration by working into a stable position. Obtain ENGINEER's approval of final subgrade prior to placing riprap on riprap subgrade.

END OF SECTION

SECTION 31 23 19

WATER CONROL AND DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The WORK of this section consists of controlling groundwater, site drainage, and storm flows during construction. CONTRACTOR is cautioned that the WORK involves construction in and around drainage channels, local rivers, and areas of local drainage. These areas are subject to frequent periodic inundation.

1.02 RELATED SECTIONS

A. The following is a list of specifications which may be related to this section:
   1. Section 31 23 00, Excavation and Fill
   2. Section 31 23 33, Trenching and Backfilling
   3. Section 31 35 00, Erosion and Sedimentation Control

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      i. Standard D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

1.04 SUBMITTALS

A. CONTRACTOR shall submit to the ENGINEER a Water Control Plan 2 weeks prior to execution of the PROJECT. At a minimum, the Water Control Plan shall include:
   1. Descriptions of proposed groundwater and surface water control facilities including, but not limited to, equipment, methods, standby equipment and power supply, means of measuring inflow to excavations, pollution control facilities, discharge locations to be utilized, and provisions for immediate temporary water supply as required by this section.
   2. Drawings showing locations, dimensions, and relationships of elements of each system.
   3. Design calculations demonstrating adequacy of proposed dewatering systems and components.
   4. If system is modified during installation or operation, revise or amend and resubmit Water Control Plan.

1.05 NOT USED FOR THIS SPECIFICATION

PART 2 – PRODUCTS

2.01 MATERIALS

A. Onsite materials may be used within the limits of construction to construct temporary dams and berms. Materials such as plastic sheeting, sand bags, and storm sewer pipe may also be used if desired by CONTRACTOR.

PART 3 – EXECUTION

3.01 GENERAL

A. For all excavation, CONTRACTOR shall provide suitable equipment and labor to remove water, and keep the excavation dewatered so that construction can be carried on under dewatered conditions.
    1. Water control shall be accomplished such that no damage is done to adjacent channel banks or structures.
    2. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.
B. CONTRACTOR is responsible for investigating and becoming familiar with all site conditions that may affect the WORK including surface water, potential flooding conditions, level of groundwater and the time of year the work is to be done.
C. CONTRACTOR shall conduct operations in such a manner that storm or other waters may proceed uninterrupted along their existing drainage courses.
    1. By submitting a BID, CONTRACTOR acknowledges that CONTRACTOR has investigated the risk arising from such waters and has prepared BID accordingly, and assumes all of said risk.
D. At no time during construction shall CONTRACTOR affect existing surface or subsurface drainage patterns of adjacent property.
    1. Any damage to adjacent property resulting from CONTRACTOR's alteration of surface or subsurface drainage patterns shall be repaired by CONTRACTOR at no additional cost to OWNER.
E. Pumps and generators used for dewatering and water control shall be quiet equipment enclosed in sound deadening devices.
F. CONTRACTOR shall remove all temporary water control facilities when they are no longer needed or at the completion of the PROJECT.
G. All excavations made as part of dewatering operations shall be backfilled with the same type material as was removed and compacted to ninety-five percent (95%) of Maximum Standard Proctor Density (ASTM D698) except where replacement by other materials and/or methods are required.

3.02 CONSTRUCTION

A. Surface Water Control:
    1. Surface water control generally falls into the following categories:
        i. Normal low flows along the channel.
        ii. Storm/flood flows along the channel.
        iii. Flows from existing storm drain pipelines.
        iv. Local surface inflows not conveyed by pipelines.
    2. CONTRACTOR shall coordinate, evaluate, design, construct, and maintain temporary water conveyance systems.
        i. These systems shall not worsen flooding, alter major flow paths, or worsen flow characteristics during construction. CONTRACTOR is responsible to ensure that any such worsening of flooding does not occur.
        ii. CONTRACTOR is solely responsible for determining the methods and adequacy of water control measures.
    3. At a minimum, CONTRACTOR shall be responsible for diverting the quantity of surface flow around the construction area so that the excavations will remain free of surface water for the time it takes to install these materials, and the time required for curing of any concrete or grout. CONTRACTOR is cautioned that the minimum quantity of water to be diverted is for erosion control and construction purposes and not for general protection of the construction site.
        i. It shall be CONTRACTOR's responsibility to determine the quantity of water which shall be diverted to protect the WORK from damage caused by stormwater.
    4. CONTRACTOR shall, at all times, maintain a flow path for all channels.
        i. Temporary structures such as berms, sandbags, pipeline diversions, etc., may be permitted for the control of channel flow, as long as such measures are not a major obstruction to flood flows, do not worsen flooding, or alter historic flow routes.

B. Groundwater Control:
    1. CONTRACTOR shall install adequate measures to maintain the level of groundwater below the foundation subgrade elevation and maintain sufficient bearing capacity for all structures, pipelines, earthwork, and rockwork.
        i. Such measures may include, but are not limited to, installation of perimeter subdrains, pumping from drilled holes or by pumping from sumps excavated below the subgrade elevation.

   ii. Dewatering from within the foundation excavations shall not be allowed.
2. The foundation bearing surfaces are to be kept dewatered and stable until the structures or other types of work are complete and backfilled.
   i. Disturbance of foundation subgrade by CONTRACTOR operations shall not be considered as originally unsuitable foundation subgrade and shall be repaired at CONTRACTOR's expense.
3. Contractor shall dispose of groundwater as follows:
   i. Obtain discharge permit for water disposal from authorities having jurisdiction.
   ii. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge.
   iii. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.
   iv. Remove solids from treatment facilities and perform other maintenance of treatment facilities as necessary to maintain their efficiency.
4. Any temporary dewatering trenches or well points shall be restored following dewatering operations to reduce permeability in those areas as approved by ENGINEER.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENT CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This WORK shall consist of temporary measures needed to control erosion and water pollution. These temporary measures shall include, but not be limited to, berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. These temporary measures shall be installed at the locations where needed to control erosion and water pollution during the construction of the PROJECT, and as directed by ENGINEER, and as shown on the DRAWINGS.

B. The Erosion Control Plan presented in the DRAWINGS serves as a minimum for the requirements of erosion control during construction. CONTRACTOR has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the PROJECT. Therefore, if the provided plan is not working sufficiently to protect the PROJECT areas, then CONTRACTOR shall provide additional measures as required to obtain the required protection. CONTRACTOR shall include in the BID price for erosion control a minimum of all items shown on the Erosion Control Plan and any additional items that may be needed to control erosion and water pollution.

C. The WORK of this section consists of temporary measures for the control of erosion, sedimentation and other pollutants during construction. WORK includes installation of such measures in accordance with the DRAWINGS and any permits for the PROJECT, maintenance during the contract period to assure proper function, and removal of temporary measures in coordination with installation of permanent erosion control measures.

D. The CONTRACTOR shall provide and maintain adequate erosion control measures during all phases of construction to protect surface waters from run-off transporting eroded materials. The erosion control measures shall be inspected during and after each run-off event, with repairs being made and excess sediment removed as needed. The CONTRACTOR is responsible for preventing sediment from traveling off-site or to nearby water sources.

E. The CONTRACTOR shall be responsible for developing the necessary sedimentation and erosion control PLANS and securing associated permits necessary to execute the WORK from the agencies having jurisdiction. Provide all needed coordination

and payment of fees associated therewith. CONTRACTOR has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the PROJECT. Therefore, if the provided plan is not working sufficiently to protect the PROJECT areas, then CONTRACTOR shall provide additional measures as required to obtain the required protection.

F. In the event of conflict between these requirements and erosion and pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations shall apply.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:
    1. Section 31 23 19, Dewatering
    2. Section 31 11 00, Clearing and Grubbing
    3. Section 31 14 13, Topsoil and Wetland Stripping and Stockpiling

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:
    1. Ohio Environmental Protection Agency - Ohio's Standards for Stormwater Management, Land Development and Urban Stream Protection.
B. Erosion control details and practices may be obtained from the Rainwater and Land Development Chapters.
C. In addition, the CONTRACTOR may submit details, sketches and descriptions of other soil erosion and sediment control measures he wishes to utilize during construction (or modifications to the specified practices).

1.04 SUBMITTALS

A. Submit the following information:
    1. Erosion Control Plan.
    2. Construction schedule for Erosion Control per Article Scheduling.
    3. Sequencing Plan per Article Scheduling.
    4. Plan for disposal of waste material per Article Scheduling.
    5. Product data for materials proposed for use.
    6. All applicable permits for Erosion Control.

1.05 NOT USED FOR THIS SPECIFICATION

1.06 REGULATORY REQUIREMENTS

A. 401 Construction Dewatering Industrial Wastewater Permit (Construction Dewatering Permit 401):
    1. CONTRACTOR shall apply for and obtain a Construction Dewatering Permit 401.
    2. All costs for this permit shall be the responsibility of CONTRACTOR.

3. This permit requires that specific actions be performed at designated times.
4. CONTRACTOR is legally obligated to comply with all terms and conditions of the permit including testing for effluent limitations.
5. CONTRACTOR shall allow the Ohio Environmental Protection Agency or other representatives to enter the site to test for compliance with the permit.
6. Non-compliance with the permit can result in stoppage of all WORK.

B. In the event of conflict between these requirements and erosion and pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations shall apply.

1.07 SCHEDULING

A. Sequencing Plan:
   1. CONTRACTOR shall submit a sequencing plan for approval for erosion control in conformance with CONTRACTOR's overall Construction Plan for approval by OWNER.
   2. Changes to the Erosion Control Sequencing Plan may be considered by OWNER only if presented in writing by the CONTRACTOR.

B. Temporary Erosion Control:
   1. When so indicated in the CONTRACT DOCUMENTS, or when directed by ENGINEER, CONTRACTOR shall prepare construction schedules for accomplishing temporary erosion control WORK including all maintenance procedures.
   2. These schedules shall be applicable to clearing and grubbing, grading, structural WORK, construction, etc.

C. CONTRACTOR shall submit for acceptance the proposed method of erosion control on haul roads and borrow pits and a plan for disposal of waste material.

D. CONTRACTOR shall be required to incorporate all permanent erosion control features into the PROJECT at the earliest practicable time as outlined in the accepted schedule. Temporary erosion control measures shall then be used to correct conditions that develop during construction.

E. WORK shall not be started until the erosion control schedules and methods of operations have been accepted.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All materials shall be submitted for approval prior to installation.

B. Materials may include hay bales, straw, fiber mats, fiber netting, wood cellulose, fiber fabric, gravel, and other suitable materials, and shall be reasonably clean, free of deleterious materials, and certified weed free.
C. Grass Seed:
    1. Temporary grass cover (if required) shall be a quick growing species, suitable to the area, in accordance with local criteria and permit requirements, which will provide temporary cover, and not compete with the grasses sown for permanent cover.
    2. All grass seed shall be approved by ENGINEER and in accordance with local regulations prior to installation.
D. Fertilizer and soil conditioners shall be approved by ENGINEER and in accordance with local regulations prior to installation.

2.02 CHANNEL SLOPES AND OTHER DISTURBED AREAS

A. Materials for use as temporary measures include straw bales, loose mulch, mulch blankets, silt fence, sod buffer strips and other stabilization materials. Temporary grass cover (if required) shall be a quick growing species, suitable to the area, in accordance with local criteria and permit requirements, which will provide temporary cover, and not compete with the grasses sown for permanent cover. The grass seed and any fertilizer and soil conditioners shall be approved by ENGINEER and shall be in accordance with local regulations prior to installation. Floating turbidity curtains or other approved material shall be used as temporary sediment control in areas with approved submerged construction.

2.03 ACTIVE FLOWING STREAM OR DIVERSION

A. Material for use as temporary measures to stabilize the invert or toe of slope zone of a live stream or diversion channel include pipe, concrete rubble, riprap, plastic sheeting, synthetic erosion control matting or other functional material that is not hazardous to water quality.

2.04 STORM SEWER OUTFALLS/POINT DISCHARGES

A. Materials for temporary erosion control on slopes downstream of storm sewer or swale outfalls may be pipe, concrete rubble, riprap, cast-in-place concrete, plastic sheeting, synthetic erosion control matting or other functional material that is not hazardous to water quality.

PART 3 – EXECUTION

3.01 GENERAL

A. All temporary and permanent erosion and sediment control practices shall be maintained and repaired as needed to ensure continued performance of their intended function.
B. OWNER will monitor CONTRACTOR's erosion control and WORK methods.
    1. If the overall function and intent of erosion control is not being met, OWNER will require CONTRACTOR to provide additional measures as required to obtain the desired results.
    2. Costs for any additional erosion control measures shall be paid for at contract unit prices.
C. The erosion control features installed by CONTRACTOR shall be adequately maintained by CONTRACTOR until the PROJECT is accepted.
D. Working In or Crossing Watercourses and Wetlands:
    1. Construction vehicles shall be kept out of watercourses to the extent possible.
    2. Where in-channel WORK is necessary, precautions shall be taken to stabilize the WORK area during construction to minimize erosion.
        i. The channel (including bed and banks) shall always be restabilized immediately after in-channel WORK is completed.
    3. Where a live (wet) watercourse must be crossed by construction vehicles during construction, a Temporary Stream Crossing shall be provided for this purpose.
E. Procedures for installation, maintenance and removal of temporary erosion control measures shall generally conform to the guidelines contained in the criteria manuals referenced in Part 1 herein. The specific practices and measures to be implemented depend on the CONTRACTOR's construction procedures, sequencing, and general approach to the PROJECT.

3.02 PROTECTION OF ADJACENT PROPERTIES

A. Properties adjacent to the site of a land disturbance shall be protected from sediment deposition.
B. In addition to the erosion control measures required on the DRAWINGS, perimeter controls may be required if damage to adjacent properties is likely, and may include, but is not limited to:
    1. Vegetated buffer strip around the lower perimeter of the land disturbance
        i. Vegetated buffer strips may be used only where runoff in sheet flow is expected and should be at least twenty (20) feet in width.
    2. Sediment barriers such as straw bales, erosion logs, and silt fences.
    3. Sediment basins and porous landscape detention ponds.

4. Combination of above measures.

3.03 CONSTRUCTION

A. Stabilization of Disturbed Areas:
    1. Temporary sediment control measures shall be established within five (5) days from time of exposure/disturbance.
    2. Permanent erosion protection measures shall be established within five (5) days after final grading of areas.
B. Stabilization of Sediment and Erosion Control Measures:
    1. Sediment barriers, perimeter dikes, and other measures intended to either trap sediment or prevent runoff from flowing over disturbed areas shall be constructed as a first step in grading and be made functional before land disturbance takes place.
    2. Earthen structures such as dams, dikes, and diversions shall be stabilized within five (5) days of installation.
    3. Stormwater outlets shall also be stabilized prior to any upstream land disturbing activities.
C. Stabilization of Waterways and Outlets:
    1. All onsite stormwater conveyance channels used by CONTRACTOR for temporary erosion control purposes shall be designed and constructed with adequate capacity and protection to prevent erosion during storm and runoff events.
    2. Stabilization adequate to prevent erosion shall also be provided at the outlets of all pipes and channels.
D. Storm Sewer Inlet Protection: All storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site shall be protected from sediment deposition by the use of filters.
E. Construction Access Routes:
    1. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required.
    2. Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day.
    3. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area.
    4. Street washing shall be allowed only after sediment is removed in this manner.

3.04 DISPOSITION OF TEMPORARY MEASURES

A. All temporary erosion and sediment control measures shall be disposed of within thirty (30) days after final site stabilization is achieved or after the temporary measures are no longer needed as determined by OWNER.
B. Trapped sediment and other disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion.
C. Substantial Completion of Erosion Control Measures:
    1. At the time specified in the CONTRACT DOCUMENTS, and subject to compliance with specified materials and installation requirements, CONTRACTOR shall receive a Substantial Completion Certificate for temporary erosion control measures.
    2. Maintenance of Erosion Control Measures after Substantial Completion: CONTRACTOR shall be responsible for maintaining temporary erosion control measures as specified in the DRAWINGS and CONTRACT DOCUMENTS until such time as WORK has been accepted by OWNER.
D. Final Completion and Acceptance of Erosion Control Measures:
    1. After ENGINEER and OWNER have determined that the drainage area has stabilized, CONTRACTOR shall remove all remaining temporary erosion control measures.
    2. Any damage to the site shall be repaired to the satisfaction of ENGINEER and at no cost to OWNER.
E. All temporary erosion and sediment control measures shall be removed and disposed of after permanent measures are installed and established. Permanent erosion protection measures shall be installed within five (5) days after final grading of areas. Both operations shall be coordinated to prevent erosion or other damage to the channel or finished grading. Trapped sediment or other disturbed soil areas shall be permanently stabilized to prevent further erosion and sedimentation.

3.05 CONSTRUCTION IN WATERWAYS

A. To the extent possible, movement of construction equipment within the flowing portion of channels or waterways shall be minimized. When a live (wet) watercourse must be crossed by construction vehicles during construction, a Temporary Stream Crossing shall be provided for this purpose. Isolate or divert stream flows so construction equipment, materials and Earthwork are not exposed (vulnerable) to flow.

3.06 TEMPORARY CONTROLS DURING SITE WORK

A. All dewatering flows that carry sediment or other deleterious material shall not be directly introduced to the stream. Such flows shall be routed to a sediment basin(s) or trap(s) for treatment prior to discharge to the stream. The intent is to trap

material disturbed by construction activities and prevent the discharge of this material into the stream. Sediment basins or traps shall be monitored and maintained no less than weekly (including removal of sediment and/or repair of basin dike or filter material) or whenever the basin fills with sediment to 50 percent of capacity.

B. Properties and roadways adjacent to the site shall be protected from sediment deposition. This may be accomplished by leaving a sod buffer strip around the lower perimeter of the land disturbance, by installing perimeter controls such as sediment barriers, filters or dikes, or by a combination of such measures. Construction ingress and egress routes shall be stabilized by gravel or other means to prevent tracking sediment, mud or debris onto adjacent thoroughfares. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required. At the end of each day, and more frequently if needed, remove soil, sediment, or debris from paved roadways and keep them clean throughout the construction period. Sediment shall be removed from roads by shoveling or sweeping. Street washing shall be allowed only after sediment is removed in this manner.
C. Sediment basins and traps, perimeter dikes, sediment barriers (such as straw bale barriers or silt fencing), and other measures intended to trap sediment on-site, must be constructed as a first step in grading and be made functional before upslope land disturbance takes place. Temporary sediment control measures shall be established within five (5) days from time of exposure/disturbance.
D. Diversion channels must be stabilized against erosion by use of riprap, or other measures.
E. Roughened soil surfaces shall be used on slopes during initial grading operations. Surface roughening creates horizontal grooves along the contour of the slope. Roughening may be accomplished by furrowing, scarifying, ripping, or disking the soil surface to create a 2 to 4- inch minimum variation in soil surface. Diversion dikes or ditches shall be constructed at the top of long or steep slopes which have significant drainage areas above the slope. Diversions or terraces may also be used to reduce slope length.
F. Concentrated storm water shall not be allowed to flow down cut or fill slopes unless contained within a stabilized temporary or permanent channel, flume or slope drain structure.
G. Wherever a slope face crosses a water seepage plane which endangers the stability of the slope, adequate drainage or other protection shall be provided.

H. All storm drain inlets within or near the site that are operable during construction shall be protected with filter fabric or a similar approach to remove sediment from stormwater runoff prior to entering the storm drain system.
I. Floating turbidity curtains shall be installed prior to any activity within areas with approved submerged construction.

3.07 DUST ABATEMENT

A. During the performance of the WORK required by these SPECIFICATIONS or of any operation appurtenant thereto, the CONTRACTOR shall furnish all the labor, equipment, materials and means required, and shall carry out proper and efficient measures whenever and as often as necessary to reduce the dust nuisance and to prevent dust which has originated from their operations from damaging dwellings or causing a nuisance to persons. The CONTRACTOR shall be liable for any damage resulting from dust originating from their operations under these SPECIFICATIONS. The cost of sprinkling or of other methods for dust control shall be included in the cost for erosion and sediment control.

END OF SECTION

SECTION 31 38 00

ROCK

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section consists of installation of water control measures, subgrade preparation, riprap, boulders, boulders to be grouted, grout, weep/underdrains (if included), and miscellaneous appurtenant items as indicated herein and on the DRAWINGS.

B. The terms “Boulder Grout” or “grout” – when referenced related to grouting rock, boulders, core rock, etc., as used in these SPECIFICATIONS, refers to a type of concrete to be used as a filler and cementing agent between boulders. The grout, and all related Boulder Grout work, shall meet the requirements of this Section and Section 03 31 00 – Structural Concrete, including, but not limited to: mix design, quality assurance and control, submittals, materials, job conditions, placement, curing and testing.

C. The term “Rock” includes all types of rock defined in Part 2 of this specification including Boulders, Riprap, Core Rock, River Cobble, and others. The term “Boulders” includes Surface Boulders, Rounded Surface Boulders, and Feature Boulders as defined in Part 2 of this specification.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 03 31 00, Structural Concrete
2. Section 03 31 01, Sculpted Concrete
3. Section 31 23 00, Excavation and Fill
4. Section 31 23 19, Dewatering

1.03 NOT USED FOR THIS SPECIFICATION

1.04 SUBMITTALS

A. In advance of delivery of imported rock to the work site an inspection of the quarry or source of any imported rock shall be arranged by the CONTRACTOR and shall include the CONTRACTOR, ENGINEER, and Quarry Representative.

B. Rock Work Plan: The CONTRACTOR shall prepare a Rock Work Plan for the PROJECT and is solely responsible to source and provide all rock required for the PROJECT. The plan shall provide the CONTRACTOR’s methods and procedures for managing the sourcing, supply, stockpiling, delivery, and installation of rock work for the PROJECT including the following:

1. Rock shall be imported from a quarry or other source or harvested from sources and deposits located and described within the PLANS and SPECIFICATIONS. Identify material sources and expected quantities for each type of Rock. Estimated quantities will be made at the earliest time practicable for each area to be harvested, and the Rock Work Plan will be updated or amended to reflect quantities.
   For each type of imported Rock, include certificates stating the source of the Rock and that the Rock will meet the requirements of this section. Include test results for specific gravity, abrasion, gradation and freeze thaw on samples of rock to be supplied on this PROJECT.
2. For Rock that is harvested or from a source other than a quarry, methods for identifying and testing suitable rock that meets the requirements defined for each type of specified Rock shall be identified and described. The ENGINEER can provide guidance, based on visual inspection, for identifying Rock that is of sufficient quality. Sorting methods that are to be performed on such harvested or imported Rock (other than from a quarry) and testing methodology shall be identified in the Rock Work Plan and shall be shown to produce reliable results.
3. The CONTRACTOR and quarry or Rock supplier shall identify procedures that will be used to stockpile, mix, and grade the types of Riprap and Boulders specified.
4. Provide sketches or exhibits indicating material stockpile and staging areas.
5. Describe methodologies and techniques for installation of each Rock type. Include the coordination of Sculpted Concrete installations with Rock work where applicable.

C. Submit design mix for Boulder Grout per requirements of Section 03 31 00 - Structural Concrete.
D. Visual Checking: Boulders shall be visually checked by the CONTRACTOR at the quarry or source of imported rock, onsite harvesting areas, or at the work site as required for size, elongation, cracks, deterioration, and other defects visible on the entire surface area of the stone. If cracks are observed, the CONTRACTOR shall notify the ENGINEER to make a determination as to acceptability of Rock. Rocks with cracks or defects that are detrimental to a long-lasting product shall not be shipped to the work site. If deficient Rocks are found on the work site these shall be set aside and not used on the PROJECT unless approved by the ENGINEER.
E. Sample Installation of Grouted and Ungrouted Boulders: The CONTRACTOR will be required to construct a sample installation of grouted and/or ungrouted Boulders a

minimum of 20 feet by 20 feet for each type and detail (as shown in the SPECIFICATIONS and/or DRAWINGS) of Rock used at locations to be designated by the ENGINEER. The sample installation shall incorporate all aspects of grouted and ungrouted Boulder construction and shall be approved by the ENGINEER before any permanent placement of grouted or ungrouted Boulders on the job. The sample areas will serve as a guide for all subsequent Boulder installations and remain undisturbed for the entirety of the PROJECT. The ENGINEER shall be given a minimum of 10 working days' notice by the CONTRACTOR of their intent to construct this sample installation. After completion of the sample installation, the ENGINEER will have 5 working days to approve or reject the sample installation. The sample Boulder installation may constitute a portion of the final PROJECT at a location approved by the ENGINEER and shall be constructed only in the presence of the ENGINEER or their Representative.

1.05 NOT USED FOR THIS SPECIFICATION

PART 2 – PRODUCTS

2.01 ROCK

A. General: Rock shall be imported or harvested. The CONTRACTOR shall harvest Rock from the site at locations and to the extent approved by the ENGINEER. Sources of harvested Rock includes loose boulders and rock from areas identified within the PLANS and as described in the SPECIFICATIONS, excavated rock, blasted rock, or demolition of rock structures, where applicable and approved by the ENGINEER. Imported rock shall be derived from offsite sources such as quarries, pits excavations, or surface sources. Harvested and imported rock must meet all the requirements of this section including testing for Apparent Specific Gravity, Abrasion Loss and Freeze Thaw Loss, as described below. All imported or harvested Rock must be screened and/or sorted and stockpiled into the various Rock types to be used on the PROJECT. Graded materials shall be stockpiled in a manner to avoid segregation.

All Rock and Boulders are to be sound and durable against disintegration under conditions to be met in handling and placing. Rock and Boulders shall be hard and tenacious and otherwise of a suitable quality to ensure permanency in the specified kind of work. Rocks and Boulders shall be free of calcite intrusions, cracks, joints, and other defects that promote accelerated weathering and deterioration of the rock. Rhyolite rock shall not be allowed.

The color of imported Boulders and Riprap (other than Core Rock) shall match closely with existing rock in the PROJECT site as approved by the ENGINEER. Color

schemes shall be consistent on the entire PROJECT and shall match the color schemes of Rock to be used for all other portions of the WORK.
All Rock shall conform to the following test requirements of the American Society for Testing Materials (ASTM) and American Association of State Highway and Transportation Officials (AASHTO) Standards:

Section 31 38 00 – Table 1 – Rock Material Testing Requirements		
Property / Test	Requirement	Testing Standard
Apparent Specific Gravity	2.60 Minimum	ASTM C127
Abrasion Loss	40% Maximum	ASTM C535
Freeze-Thaw Loss	10% Maximum after 12 Cycles	AASHTO T103, Procedure A

All Rock (including Boulders) to be used on the PROJECT must be approved by the ENGINEER. Once approved, the Rock shall be kept consistent through the PROJECT. No change may be made to any Rock source unless specifically approved by the ENGINEER.

B. TYPES: The following types of Rock shall be imported or harvested for this PROJECT.
   1. Surface Boulders. To be used for grouted Boulder or ungrouted Boulder installations in areas where smoothness of each Boulder is not required. The minimum size of Surface Boulders to be used on this PROJECT is shown on the DRAWINGS or details, but shall be at least 24-inches in each dimension, so that the boulder volume exceeds 8 cubic feet. Where Toe Boulders or Grouted Boulder Toe is identified, the minimum size of the boulders is shown on the DRAWINGS and shall be at least 36-inches in all directions. Boulder sizes and exposed surface areas shall vary. Surface Boulders shall have no exposed sharp edges facing upstream. Sharp edges on Surface Boulders must be mechanically rounded before or after placement. Any remaining sharp edges on exposed surfaces of Surface Boulders facing upstream shall be mechanically rounded to 3 inches or greater radius unless otherwise directed by the ENGINEER.
   2. Harvested Boulders. Shall meet the requirements of Surface Boulders. Generally, Harvested Boulders with non-rounded edges are used in areas where contact with people is minimal. ENGINEER will identify areas in the field where Harvested Boulders are to be used. 24-inches is the minimum dimension of Harvested Boulders to be used on this PROJECT.
   3. Feature Boulders. To be used in grouted Boulder and ungrouted Boulder installations. Feature Boulders shall be 4 feet to 10 feet in at least one

dimension and no less than 36-inches in any dimension as shown on the DRAWINGS. The exact locations, orientation, and type of Feature Boulders are generally shown on the Drawing but shall be placed and oriented as directed by the ENGINEER. Rounded Feature Boulders shall also meet the requirements specified in 2.01.B.4 below. The estimated distribution (by percentage) of Feature Boulders and Rounded Feature Boulders (i.e. type) to be installed on the PROJECT is shown in the table following.

4. Rounded Surface and Rounded Feature Boulders. Where Rounded Surface or Rounded Feature Boulders are specified, they shall meet the requirements of Surface Boulders and the following conditions related to roundness and smoothness. Rounded shall be defined as having rounded surfaces with no sharp edges on at least three sides or 75 percent of continuous surface area. All Rounded Surface and Rounded Feature Boulders shall be rounded naturally by prolonged exposure to weather, glaciation, or moving water. Large boulders collected from harvesting efforts that do not meet this criterion, but otherwise meet all requirements for Surface or Feature Boulders, shall be used (and paid for as Surface or Feature Boulders, harvested as applicable) at locations identified by the ENGINEER. Rounded Surface and Rounded Feature Boulders shall be natural appearing material and shall be subject to acceptance by the ENGINEER. Any remaining sharp edges on exposed surfaces of Rounded Surface Boulders and Rounded Feature Boulders shall be mechanically rounded to 3 inches or greater radius unless otherwise directed by the ENGINEER.
    i. Unless otherwise shown on the DRAWINGS or included in the table below, Boulders shall not be considered Rounded or meet this requirement.
    ii. Location where Rounded Surface and Feature Boulders are used on this PROJECT:
5. Core Rock: is rock obtained from sources listed above to be used in grouted Boulder installations that are buried, beneath a layer of Surface Boulders, or exposed where shown on the PLANS. Core Rock shall be angular rock or broken onsite concrete (where allowed by permits) meeting size requirements. Sharp edges are not a concern for buried/nonexposed Core Rock. Exposed Core Rock shall have no sharp edges on at least three sides or 75% of continuous surface area. Unless otherwise stated or shown in the DRAWINGS, the minimum size of Core Rock to be used on this PROJECT is

12-inches in any and all dimensions. Core Rock shall have its greatest dimensions not greater than 3 times its least dimension.

6. Riprap: Imported rock meeting the following requirements:
    i. Each load of riprap shall be reasonably well graded from the smallest to the largest size specified in Table 4.
    ii. Stones smaller than the two to ten percent (2 - 10%) size will not be permitted in an amount exceeding ten percent (10%) by weight of each load.
    iii. Control of gradation shall be by visual inspection. However, in the event ENGINEER determines the riprap to be unacceptable, ENGINEER shall pick two (2) random truckloads to be dumped and checked for gradation.
        1. Mechanical equipment and labor needed to assist in checking gradation shall be provided by CONTRACTOR at no additional cost.
    iv. Rirap shall be angular and rough-hewn.
    v. Riprap shall be free from cracks, joints and other defects conducive to accelerated weathering.
    vi. Riprap shall have its greatest dimensions not greater than 3 times its least dimension.
    vii. Riprap shall meet the following gradation:

Section 31 38 00 – Table 2 – Classification Of Gradation Of Ordinary Riprap (Imported)			
Riprap Designation	% Smaller than Given Size by Weight	Intermediate Rock Dimensions (inches)	d 50 (inches)*
Type VL	70 – 100 50 – 70 35 – 50 2 – 10	12 9 6 2	6
Type L	70 – 100 50 – 70 35 – 50 2 – 10	15 12 9 3	9
Type M	70 – 100 50 – 70 35 – 50 2 – 10	21 18 12 4	12
Type H	70 – 100	30	18

	50 – 70 35 – 50 2 – 10	24 18 6	
Type VH	70 – 100 50 – 70 35 – 50 2 – 10	42 33 24 9	24

*d 50 = Mean Particle Size

7. Harvested Riprap. Shall meet the same requirements for specific gravity, abrasion, and freeze thaw as required of Riprap and be approved by the ENGINEER based on visual inspection.
8. Granular Bedding Material: Granular Bedding designation and total thickness of bedding shall be as shown on the DRAWINGS. Granular Bedding shall meet the same requirements for specific gravity, abrasion, and freeze thaw as specified above.
   Gradation for Granular Bedding:

Section 31 38 00 – Table 3 – Gradation For Granular Bedding		
	Percent by Weight Passing Square-Mesh Sieves	
U. S. Standard Sieve Size	Type I	Type II
3 – inch	-	100
1-1/2 inch	-	-
3/4 inch	-	20 – 90
3/8 inch	100	-
No. 4	95 - 100	0 - 20
No. 16	45 – 80	-
No. 50	10 – 30	-
No. 100	2 – 10	-
No. 200	0 – 2	0 - 3

9. River Cobble: The River Cobble shall have rounded edges and shall be screened, washed, or otherwise cleaned to be free of organics, trash, foreign matter, fine sediments and sharp rock. The size of River Cobble to be used in this PROJECT is 4 to 12 inches in the largest dimension. Void-Permeated Riprap Type VL may be used in place of cobble as approved by ENGINEER.
10. Gravel Level Spreader: The gravel used in the level spreader shall be ODOT No. 4 Coarse Aggregate (AASHTO M43) or approved equivalent.

11. Harvested Landscape Block: Landscape Block without noticeable signs of cracking or damage shall be harvested from the existing site parking lot for reuse. The available Landscape Block is 21-inch by 18-inch by 45-inch and will be placed according to the DRAWINGS.

C. QUALITY CONTROL: The CONTRACTOR shall manage the delivery and stockpiling of Rock at the site to assure that adequate supply of Rock meeting the SPECIFICATIONS is available for installation when required. Stockpile locations shall be arranged to avoid interference with other PROJECT operations. Rock which does not meet SPECIFICATIONS or is not installed shall be removed from the site.

D. HARVESTING: The CONTRACTOR shall harvest Rock from the site at locations and extent shown on the DRAWINGS or described in the SPECIFICATIONS. Harvesting includes accessing the areas to be harvested, collecting, transporting to a staging area or other approved area, sorting by size and quality, cleaning (if necessary) including removal of organics and fine sediments, testing rock and restoring harvest areas. Sorting methods that are to be performed on such harvested or imported Rock (other than from a quarry) shall be identified in the Rock Work Plan and shall be shown to produce reliable results. Methods such as sorting through an adjustable sorting rack (“rock grizzly”) with appropriate bar spacing shall be employed resulting in consistently produced materials that meet the specified minimum and/or maximum size specified. Materials will be routinely tested by the CONTRACTOR to ensure the material is meeting the specified minimum and/or maximum sizing. The Rock Work Plan shall also detail methods and PLANS for testing all harvested Rock for Apparent Specific Gravity, Abrasion Loss and Freeze Thaw Loss. Sources of harvested Rock include loose boulders, rock, and river cobble from surface areas of the site (where shown or described), and from all excavated areas (up to the Quantities specified below), including that from blasting, or demolition of rock structures, that can meet the requirements of this specification after screening, sorting and cleaning. Rock to be harvested includes Surface Boulders, Rounded Surface Boulders, Feature Boulders, Rounded Feature Boulders, Core Rock, Riprap, River Cobble, Landscape Block and other Types defined above that meet all the requirements of this section.

   Surface Areas to be harvested include:

   1. All areas identified in the Overall Demolition & Harvesting Plan.
   2. Rock must be screened and/or sorted and stockpiled into the various rock types to be used on the PROJECT. Graded materials shall be stockpiled in a manner to avoid segregation.

2.02 RIPRAP SOIL MATERIAL

A. The Riprap Soil material shall be suitable native soils from the site or topsoil and have a minimum fines content of 15%. The Riprap Soil material shall be approved by the ENGINEER prior to use.
B. Prior to amendments, the Riprap Soil material shall be free of trash and organic materials.
C. Unless otherwise determined as not needed, an Organic Compost Soil Amendment shall be well mixed with the Riprap Soil material. Use a well decomposed, stable, weed free organic matter source, derived from agricultural food, or industrial residuals' biosolids (treated sewage sludge); yard trimmings, or source-separated or mixed solid waste as a component for seed establishment. The product shall contain no substances toxic to plants and shall be reasonably free (less than 1 percent by dry weight) of man-made foreign matter. Organic Compost Soil Amendment shall possess no objectionable odors and shall not resemble the raw material from which it was derived.
D. Organic Compost Soil Amendment shall have the following characteristics:

Section 31 38 00 – Table 4 – Organic Compost Soil Amendment Requirements	
Parameter	Requirement
pH Range	5.5 – 8.0
Moisture Content	35% - 55%
Particle Size	Pass through 1-inch screen or smaller
Stability	Stable to highly stable, providing nutrients for plant growth
Maturity/Growth Screening	Demonstrate ability to enhance plant growth
Soluble Slat Concentrations	2.5 dS (mmhos/cm) or less preferred
Organic Matter Content	30% - 70%
Suggested Source	A-1 Organic, Eaton, Colorado (970) 454-3492 or an approved equal. Submit Sample for approval.

E. Organic Compost Soil Amendment shall be well mixed with on-site native soil at an applied rate of 1 cubic yard per 5 cubic yards.
F. The soil fill material shall be well mixed and free of trash.
G. Unless specified elsewhere, seed for buried riprap shall consist of a mix of native grasses as proposed by a local, well qualified supplier. Rates and application will be as recommended by the supplier. Seed mixes must be free of invasive species

and/or noxious weeds including reproductive and propagative material such as seeds, roots, stems, flowers and leaves.

2.03 SOIL RIPRAP

A. Soil Riprap shall be comprised of riprap that meets all requirement of Riprap as specified in Part 2.01 Rock.
B. Soil Riprap shall be placed in the minimum thicknesses as noted on the Drawing PLANS, details, and sections.
C. The soil material shall be native or imported topsoil and mixed with sixty-five percent (65%) riprap and thirty five percent (35%) soil by volume and meet the requirements of Part 2.02 Riprap Soil Material.
D. Unless specified elsewhere, seed for buried Riprap shall consist of a mix of native grasses as proposed by a local, well qualified supplier. Rates and application will be as recommended by the supplier. Seed mixes must meet all requirements of Part 2.02.G.

2.04 VOID-PERMEATED RIPRAP

A. Void-Permeated Riprap differs from Soil Riprap and Void-Filled Riprap in that most of the voids are filled after placement of the Riprap layer. The material to be washed into the voids shall be referred to as Permeate Material.
    1. Rock requirements are to comply with Riprap material SPECIFICATIONS in Part 2.01 Rock.
    2. Samples of Riprap and Permeate Materials shall be submitted for the review and approval of the ENGINEER prior to construction.
    3. Where “Void-Permeated Riprap” is designated on the DRAWINGS, the Riprap material shall be mixed with the Permeate Materials prior to placing the initial layer of Riprap.
    4. Permeate Material shall consist of sands, rounded gravels and rounded River Cobbles. Permeate Material shall meet the gradation requirements specified in the following table. If Permeate Materials are harvested on-site, the material shall be well mixed in a ratio of bucket loads according to the table below and stockpiled on site with the gradation of the Permeate Material visually approximated and agreed upon with the ENGINEER. If AGREEMENT cannot be reached, a sample shall be taken and the gradation shall be established.
    5. Void-Permeated Riprap shall be placed in the minimum thicknesses as noted on the Drawing PLANS, details, and sections. The materials required for each step in the placement procedure include:

Section 31 38 00 – Table 5 – Void-Permeated Riprap Material Composition And Placement Requirements		
Approximate Proportions	Material Type	Material Description
Initially Placed Riprap		
75-90%* of Initially Place Riprap	Riprap	Type VL, VH, L, M or H as Indicated on DRAWINGS
10-25%* - of Initially Placed Riprap	Permeate Materials: Pit Run well missed and placed with riprap or: VTC (Vehicle Tracking Control Rock)	4-inch minus pit run surge (round river rock and sand, well graded, 90-100% passing 4-inch sieve, 70-80% passing 1.5-inch sieve, 0 -60% passing 3/8-inch sieve, 10-30% passing #16 sieve). or: VTC (Vehicle Tracking Control) rock (crushed rock with 100% passing 4-inch sieve, 50-70% passing 3-inch sieve, 0-10% passing 2-inch sieve)
Permeate Material (To be Washed into Voids after Initial Placement)		
25%	Permeate Material	2 to 4-inch cobble (round washed river rock that is well-graded, 100% passing 6-inch sieve, 35-50% passing 3-inch sieve, 5-20% passing 2-inch sieve) Harvested onsite channel/river bottom material or: 4-inch minus pit run surge (round river rock and sand, well graded, 90-100% passing 4-inch sieve, 70-80% passing 1.5-inch sieve, 40-60%passing 3/8- inch sieve, 10-30% passing #16 sieve) or:

		VTC (Vehicle Tracking Control) rock (crushed rock with 100% passing 4-inch sieve, 50-70% passing 3-inch sieve, 0-10% passing 2-inch sieve)
50%	Permeate Material	Harvested sands and gravels collected from locations identified on site.
Material Placed on top of Riprap Layer after Plating		
Top layer	Top dressing	Same as the Permeate Material

* Percentage used shall be based upon mixing samples made prior to placement of riprap as determined by the ENGINEER. The CONTRACTOR shall prepare four samples of at least two cubic yards each. The ENGINEER shall inspect each sample and determine new mix percentages for next trial sample.

**Initial layer thickness shall meet the requirements shown on the DRAWINGS with tolerance at plus or minus 2-inches.

2.05 BOULDER GROUT

A. Concrete used for grouted Rocks and Boulders – “Boulder Grout” or “Grout” shall be an approved batch and meet all the requirements for ready-mixed concrete as specified in Section 03 31 00 - Structural Concrete, except as modified below.
B. Strength and General Requirements.
    1. Design and proportion Boulder Grout to meet the following minimum compressive strengths and other criteria.

Section 31 38 00 – Table 6 – Boulder Grout Mix Design Requirements							
Location	Aggregate Size inch– (ASTM C33 size)	Design Strength 28-day (psi)	Required Strength 7-day (psi)	Slump + 1-inch†	Minimum Cement Content* (lbs/yd)	Flyash Content	Maximum Water Cement Ratio*
Boulder Grout **	#67	4,500	3,000	2-10	611	20% max.	0.38

* The maximum water-cementitious materials ratio by weight, which shall be based on all water in the mix, including correction for moisture in aggregates, and shall be based on the total cementitious materials including cement and fly ash, if any.
** Add synthetic fiber reinforcement. See Boulder Grout Admixtures.

† Slump is defined for Single Boulder Layer and Multiple Boulder Layer applications in the Table provided in Part 2.05.B.3.

2. Entrained Air for Boulder Grout.
    i. Entrained air, 6 ± 1½ percent for ASTM C33 Size 67 coarse aggregate. Refer to ACI 301 for air entrainment required for other coarse aggregate sizes.
3. The slump of the Boulder Grout will be adjusted depending on the number of Rock or Boulder layers grouted in a single pour. All Boulder Grout shall meet the specified requirements for slump, durability, strength, water-cement ratio and other properties. Boulder Grout slump shall vary per the following table:

Section 31 38 00 – Table 7 – Grout Slump Requirements By Layer Application	
Boulder Grout Location	Slump
Single Boulder Layer	2” to 5”
Multiple Boulder Layer	6” to 10” Note: When grouting on steeper slopes, and at the direction or approval of the ENGINEER, the CONTRACTOR shall use a slump in the range specified for Single Boulder Grouting, but only in those portions along the surface of the slope.

4. When Boulder Grout arrives at the PROJECT with slump below 2-inches, first the Boulder Grout shall be remixed for at least one minute at mixing speed; if the slump is still too low, water may be added only if the maximum permissible water-cement ratio is not exceeded. The water-cement ratio must be verified by truck batch tickets and corrections for moisture in the aggregates. The water must be incorporated by additional mixing equal to at least half of the total mixing required. Any water addition must be reviewed and approved by the ENGINEER.
5. When grouting multiple Rock layers, Boulder Grout shall arrive at the job site at a slump of less than 2-inches or be adjusted to less than 2 inches with water, be verified, then the high-range water-reducing admixture (super-plasticizer) added to increase the slump to the approved level for placement. Water shall not be added for this purpose. CONTRACTOR shall review recommendations of the admixture supplier and ready-mix producer with

ENGINEER. Batch plant additions of part or the entire high-range water-reducing admixture may be considered if found acceptable by the ENGINEER and if shown to produce equal or better results.

6. Slump shall be adjusted by the CONTRACTOR within the ranges given above to assure complete penetration of the Boulder Grout through each rock layer, into the layer below, and to the underlying subgrade.
7. Do not re-temper mix by adding water once slump is attained in each truck load.

C. Boulder Grout Admixtures:
   1. Fibrous Concrete Reinforcement: Per Section 03 31 00.
   2. Color Additives for Boulder Grout: When indicated on the DRAWINGS or SPECIFICATIONS, Boulder Grout shall have integral color pigments added to the mix and be as manufactured by Davis Colors, or approved equivalent, at the rates indicated as acceptable following sample panel installation.
      i. Colored additives shall contain pure, concentrated mineral pigments specially processed for mixing into concrete and complying with ASTM C979.
      ii. Color additives containing carbon black are not acceptable. Black and Gray coloring shall be obtained using black iron oxide pigments.
      iii. The CONTRACTOR shall determine exact color or combination of colors to be added to mimic the natural rock of the PROJECT and construct sample panel for approval by the ENGINEER. Color samples shall be submitted to the ENGINEER prior to sample panel construction.
      iv. Dosage rates shall typically be between 3 percent and 5 percent and shall not exceed 10 percent of weight of cementitious materials mix. CONTRACTOR shall determine the exact dosage required to produce Boulder Grout to mimic the natural rock of the PROJECT as per manufacturer recommendations and ENGINEER approval.
      v. Meter and dispense colors using computer-controlled automated color weighing and dispensing systems provided by the manufacturer of the color additive. As an alternative, manual dispensing may be used and accomplished by addition of premeasured disintegrating bags. Particular attention must be given to thorough mixing of concrete after addition of the color additives.

D. Surface Treatment and Finishes:

1. Boulder Grout shall be finished using dry shake color hardeners, stain, and sealant where shown on the DRAWINGS or as specified below.
2. Dry Shake Color Hardeners: Color hardeners, where indicated on the DRAWINGS or in the SPECIFICATIONS, shall be as manufactured by Brickform or approved equivalent at the manufacturer recommended application rates or as approved following sample panel(s) installation.
    i. The CONTRACTOR shall determine exact color or combination of colors to be applied to mimic the natural rock of the PROJECT and construct sample panel for approval by the ENGINEER. Color samples shall be submitted to the ENGINEER prior to sample panel construction.
    ii. Boulder Grout Color: Dry shake color hardener shall be applied to 75 percent of the Boulder Grout surface area above “Low Water Level” as defined by the lowest invert elevation of the next drop structure downstream as shown on DRAWINGS. Coloring shall be applied randomly to create variegation of colors, hues, and shades similar to natural rock. Apply per manufacturer’s recommendations and approved sample panel installation.
3. Stain and Sealant: Concrete stain, where required by the DRAWINGS or SPECIFICATIONS, shall be as recommended by the CONTRACTOR to meet the following requirements.
    i. Create base colors, and color variations that are deemed acceptable following test panel production.
    ii. Accurately simulate hues, streaking and coloration matching onsite bedrock boulders.
    iii. Must maintain color (little to no fading) in submerged conditions or direct sunlight.
    iv. Following staining, the finish shall be sealed with sealant recommended by the CONTRACTOR and stain manufacturer, and shall meet the following requirements:
        1. No discoloration with exposure to sunlight.
        2. Increase durability by limiting water penetration.
        3. Preserve color of original stain.
    v. Stain and sealants shall be applied per manufacturer recommendation.

E. Coloring and Finishes Summary: See the information in the following table for a summary of the coloring and finishes requirements for this PROJECT.

Section 31 38 00 – Table 8 – Boulder Grout Coloring And Finishes Requirements			
Finish	Integral Concrete Color	Dry-Shake Surface Color Hardeners	Surface Stain
All Boulder Grout	Yes	Yes	Yes

2.06 FILTER FABRIC

A. Use Mirafi 140 N non-woven filter fabric, or ENGINEER approved equivalent, where shown on the DRAWINGS.

2.07 CURING COMPOUND

A. Membrane-curing compound shall be in accordance with ASTM C309. Membrane curing compound shall be sprayable, 18 percent minimum solids content, as manufactured by L&M Construction Chemicals, Inc or equivalent acceptable to ENGINEER. Membrane curing compound used on colored concrete shall be as manufactured by L&M Construction Chemicals, Inc or equivalent acceptable to ENGINEER. Curing compound shall be non-toxic and must not cause discoloration of the Boulder Grout and boulders. When used on integrally colored, dry shake, or stained Boulder Grout, curing compound shall be approved by color additive/stain manufacturer and compatible with the color additives, stains, and any surface treatments/finishes used.

2.08 PLANTERS

A. If included in this PROJECT, planters shall be per details shown on the DRAWINGS. Local placement of rock and grading shall be oriented so that runoff is directed to the planter. Planters shall be HDPE pipe, reinforced concrete pipe, or pre-cast concrete manhole sections. HDPE pipe shall be N-12 ST IB as manufactured by Advanced Drainage Systems, Inc, or approved equal, have smooth interior walls and annular exterior corrugations, and meet the requirements of ASTM F2648. Reinforced concrete pipe shall be Class II per ASTM C76 with joints meeting requirements of ASTM C443. Pre-cast concrete manholes shall meet the requirements of ASTM C-478. The bottom of the planter shall be covered to eliminate seepage of Boulder Grout upward into the planter during Boulder Grout placement. Erosion control mat shall be Enkamat 7020 or approved equal at locations shown on the DRAWINGS. Metal fasteners, bolts, and washers shall be fabricated from stainless steel, Type 316, (B8M, B8MA) in accordance with ASTM Standard A193.

PART 3 – NOT USED FOR THIS SPECIFICATION

END OF SECTION

SECTION 31 62 16

STEEL SHEET PILES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers all members to be used in the construction of steel sheet pile. This SPECIFICATION also covers the installation of steel sheet piling and trimming of the sheet pile to the lines and grades shown on the DRAWINGS or as required. This WORK also includes pre-drilling to facilitate driving sheet pile to the designated elevations.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:
   1. Section 31 23 00, Excavation and Fill.
   2. Section 31 23 19, Dewatering.
   3. Section 31 23 33, Trenching and Backfilling.
   4. Section 31 25 00, Erosion and Sedimentation Controls
   5. Site Soils Investigation (Geotechnical Soils Report)

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI): 318/318R, Building Code Requirements for Structural Concrete and Commentary.
   2. American Petroleum Institute (API): Spec 5L, Specification for Line Pipe.
   3. American Society for Testing and Materials (ASTM):
      i. Standard A 36, Standard Specification for Carbon Structural Steel.
      ii. Standard A 53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, ZincCoated, Welded and Seamless.
      iii. Standard A 139, Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over).
      iv. Standard A 252, Standard Specification for Welded and Seamless Steel Pipe Piles.
      v. Standard A 328, Standard Specification for Steel Sheet Piling.
      vi. Standard A 572, Standard Specification for High-Strength Low-Alloy Columbium Vanadium Structural Steel.
      vii. Standard A 690, Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments.

viii. Standard A 1011/A 1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength LowAlloy with Improved Formability.

4. American Water Works Association (AWWA):
    i. Standard C200, Steel Water Pipe—6 in. (50 mm) and Larger.
5. American Welding Society (AWS):
    i. Standard D1.1, Structural Welding Code—Steel.

1.04 SUBMITTALS

A. Provide qualifications of proposed sheet pile installer.
B. CONTRACTOR shall provide information from the manufacturer that indicates the sheet piling meets or exceeds the SPECIFICATIONS listed in this section.
C. CONTRACTOR shall submit verification from the manufacturer that the hammer can deliver the required energy.
D. Splice locations, if necessary, shall be reviewed and accepted by ENGINEER prior to installation.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Sheet piling installer shall have, as a minimum, three (3) successful past installations of sheet piling of comparable overall heights and sections and comparable penetration into soils similar to those found on the PROJECT.

PART 2 – PRODUCTS

2.01 GENERAL

A. All steel sheet piling shall be new and unspliced material throughout, unless otherwise reviewed and accepted by ENGINEER.
B. Steel sheet piles and special fabricated shapes shall be of a design that ensures continuous interlock throughout the entire length when in place.

2.02 MATERIALS

A. Steel sheet piling shall meet the requirements of ASTM A328, (Grade 50).
B. Steel corners, tees, wyes, and crosses shall meet the requirements of ASTM A328 or ASTM A690.
C. Steel sheet piles required for the PROJECT shall be the type and weight shown on the DRAWINGS. Sheet piling shall be constructed with a weathering finish.
    1. Additional length beyond those indicated on the DRAWINGS may be required to provide for trimming of tops of sheet piling.

D. The interlocks between steel sheet pile sections shall be configured such that the average width of the annular space between all contact points of the interlocks shall be a maximum of one-eighth (1/8) inch, as determined by ENGINEER.
E. Steel sheet piles and interlocks shall not have excessive kinks, camber or twist that would prevent the pile from reasonably free sliding to grade.
F. All fabricated connections shall be made with the use of angles or bent plates, as necessary, and shall be adequately welded or connected with high strength bolts as accepted by ENGINEER.
G. Handling Holes:
    1. If handling holes are provided, they shall be two (2) standard two and nine-sixteenth (2-9/16) inch diameter handling holes located six (6) inches from one end.
    2. The holes shall be plugged by welding a piece of steel over the hole prior to installing any riprap, backfill or drop structure cap.
    3. The plated hole shall be watertight.
H. All steel sheet piling shall be new and un-spliced material throughout unless otherwise reviewed and accepted by the ENGINEER.
I. Sheet Pile Cap: Shall be 12-inches by 12-inches by 1/2-inch thick ASTM A36 Steel with a continuous weld on both sides to the top of sheet pile with a spacing of no more than 48-inches on-center, unless shown otherwise on the DRAWINGS.

2.03 STORAGE AND HANDLING

A. Do not subject piles to damage by impact bending stresses in transporting to and storing piles onsite.
B. Store and handle piles such that corrosion protection coating will not be damaged.

2.04 SHAPES

A. Steel sheet piles and special fabricated shapes shall be of a design that assures continuous interlock throughout the entire length when in place.
B. Additional length beyond those indicated on the DRAWINGS may be required to provide for trimming of tops of sheet piling.
C. Steel sheet piles and interlocks shall not have excessive kinks, camber or twist that would prevent the pile from reasonably free sliding to grade.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Do not begin sheet pile installation until the earthwork in the area where the piles are to be driven has been completed to the extent that the grade elevation is at no

more than twelve (12) inches above or below the top of the piling elevation as indicated on the DRAWINGS.

3.02 PREPARATION

A. Any fill along the alignment of the sheet pile must be in place to sub-grade elevations and compacted prior to driving the sheet pile.
B. Fill material (except riprap, boulders, bedding and grout) is not to be placed around the sheet pile after the sheet pile is in place.

3.03 INSTALLATION

A. General:
    1. All welding or gas cutting shall be in accordance with the current standards of the American Welding Society.
    2. Virtual Refusal:
        i. Steel sheet piling shall be driven to the depths shown on the DRAWINGS or to virtual refusal.
        ii. Virtual refusal is defined as ten (10) blows per inch with an approved pile hammer.
        iii. A pile hammer shall be used to determine virtual refusal.
        iv. The hammer shall be operating at the manufacturer's recommended stroke and speed when virtual refusal is measured.
B. Sheet Piling Driving:
    1. Steel sheet piling shall be assembled before driving and then driven as a continuous wall, progressively in stages to keep the piles aligned correctly and minimize the danger of breaking the interlock between the sheets.
    2. Steel sheet piling shall be driven to form a tight bulkhead.
    3. A driving head shall be used and any piling which is damaged in driving or which has broken interlocks between sections shall be pulled and replaced at CONTRACTOR's expense.
    4. The piling shall be driven within the following tolerances:
        i. Alignment:
            1. Sheet pile shall be driven to form a relatively straight line between the termini points shown on the DRAWINGS.
            2. Horizontal deviation of any point from a straight line connecting the two ends of the wall section shall be a maximum of six (6) inches.
        ii. Plumbness: Each individual sheet pile section shall be driven vertical, within a horizontal tolerance of two percent (2%) of any vertical length measured along the pile.

iii. Elevation:
1. Tops of sheet pile sections shall be within a tolerance of one (1) inch from plan elevations.
2. CONTRACTOR shall not be paid for excess sheet pile trimmed off the end of the pile to meet final grade.

C. CONTRACTOR shall brace and/or provide soil grading as necessary during construction operations in order to provide lateral stability for the sheet pile wall. The sheet pile wall has been designed for the soil grades of the final configuration denoted on the DRAWINGS only. Other temporary configurations during the construction period shall not be allowed.

D. Care shall be taken during driving to keep from causing deformations of the top of the piles, splitting of section, or breaking of the interlock between sections. Care shall also be taken during driving to prevent and correct any tendency of steel sheet piles to twist or get out of plumb.

E. Steel Z piling shall be driven with the ball-end leading. Proper care and planning shall be used to allow for this construction procedure in both immediate and possible future walls.

F. Alternate Z piles shall be reversed end for end for proper interlocking in the “normal” position. Piles shall also be aligned properly to maintain a “normal” driving width.

G. For sheet piles driven into the native soils, pre-drilled soils, or excavated soils a vibratory driver may be used as long as the required depth is obtained.

H. For sheet piles being driven into bedrock, an approved hammer utilizing a minimum hammer energy of 19,000 foot-pounds per square inch of steel section shall be used to obtain the required depth or virtual refusal. The hammer shall be clearly marked so that it can be identified at the job site.

I. Steel sheet pile that is full length as shown on the DRAWINGS and is required to be driven below the specified cutoff elevation shall be spliced with additional steel sheet piling with a full penetration butt weld.

3.04 CONSTRUCTION REQUIREMENTS

A. Sheet piling installer must have, as a minimum, three successful past installations of sheet piling of comparable overall heights and sections and comparable penetration into soils similar to those found on the PROJECT.

B. Steel sheet piling shall be driven to the depths shown on the DRAWINGS or to virtual refusal. Virtual refusal is defined as 10 blows per inch with an approved pile hammer. A pile hammer shall be used to determine virtual refusal. The hammer shall be operating at the manufacturer's recommended stroke and

speed when virtual refusal is measured.

C. Care shall be taken during driving to keep from causing deformations of the top of the piles, splitting of section, or breaking of the interlock between sections. Care shall also be taken during driving to prevent and correct any tendency of steel sheet piles to twist or get out of plumb. Steel sheet piling shall be driven to form a tight bulkhead. A driving head shall be used and any piling which is damaged in driving or which has broken interlocks between sections shall be pulled and replaced at CONTRACTOR's expense.
D. Splice locations, if necessary, must be reviewed and accepted by the ENGINEER prior to installation.
E. CONTRACTOR shall brace and/or provide soil grading as necessary during construction operations in order to provide lateral stability for the sheet pile wall. The sheet pile wall has been designed for the soils grades of the final configuration denoted on the DRAWINGS only. Other temporary configurations during the construction period shall not be allowed.
   Any fill along the alignment of the sheet pile must be in place to sub-grade elevations and compacted prior to driving the sheet pile. Fill material (except riprap, boulders, bedding and grout) is not to be placed around the sheet pile after the sheet pile is in place.
F. All welding or gas cutting shall be in accordance with the current standards of the American Welding Society.
G. Reinforcing bars shall be welded to the sheet pile at locations shown on the DRAWINGS.

END OF SECTION

SECTION 32 34 00

PEDESTRIAN AND LIGHT VEHICLE BRIDGES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section contains requirements for a fully engineered clear span bridge and shall be the minimum standards for design and construction. Clear span length and width of the bridge shall be as shown on the DRAWINGS.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:
   1. Section 31 23 00, Excavation and Fill.
   2. Section 31 23 19, Dewatering.
   3. Section 31 23 33, Trenching and Backfilling.
   4. Section 31 25 00, Erosion and Sedimentation Controls

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Institute of Steel Construction (AISC).
   2. American Society for Testing Materials (ASTM):
      a) Standard A36/A36M, Standard Specification for Carbon Structural Steel.
      b) Standard A 242, Standard Specification for High-Strength Low-Alloy Structural Steel
      c) Standard A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
      d) Standard A 325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
      e) Standard A 490, Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
      f) Standard A 500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
      g) Standard A 525, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
      h) Standard A 588, Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance

i) Standard A 606, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
j) Standard A 847, Standard Specification for Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
k) Standard G 101, Standard Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

3. American Wood Preservers' Association (AWPA):
    a) Standard P5, Standard for Waterborne Preservatives.
4. American Welding Society (AWS):
    a) Standard D1.1/D1.1M, Structural Welding Code – Steel.
5. The Society for Protective Coatings (SSPC):
    a) Standard SP6, Commercial Blast Cleaning.
6. Uniform Building Code (UBC).
7. West Coast Lumber Inspection Bureau (WCLIB).
8. American Association of State Highway and Transportation Officials (AASHTO):
    a) LRFD Bridge Design SPECIFICATIONS
9. American National Standards Institute (ANSI)
10. Steel Deck Institute (SDI)
    a) Standard C-2017, Standard for Composite Steel Floor Deck-Slabs

1.04 SUBMITTALS

A. Submit complete SHOP DRAWINGS to ENGINEER for review.
B. Submit manufacturer's certification of compliance with referenced standards.
C. Submittal DRAWINGs
    1. Schematic DRAWINGs and diagrams shall be submitted to the customer for their review after receipt of order. Submittal DRAWINGs shall be unique DRAWINGs, prepared to illustrate the specific portion of the WORK to be done. All relative design information such as member sizes, bridge reactions, and general notes shall be clearly specified on the DRAWINGs. DRAWINGs shall have cross referenced details and sheet numbers. All DRAWINGs shall be signed and sealed by a licensed Professional ENGINEER.
D. Structural Calculations
    1. Structural calculations for the bridge superstructure shall be submitted by the bridge manufacturer and reviewed by the OWNER or OWNER's designated ENGINEER. All calculations shall be signed and sealed by a

licensed Professional ENGINEER registered in the State of Colorado. The calculations shall include all design information necessary to determine the structural adequacy of the bridge. The calculations shall include the following:

i. All AISC allowable stress checks for axial, bending and shear forces in the critical member of each truss member type (i.e. top chord, bottom chord, floor beam, vertical, etc.).
ii. Checks for the critical connection failure modes for each truss member type (i.e. vertical, diagonal, floor beam, etc.). Special attention shall be given to all welded tube connections (see AWS D1.1, section 3.3.2 for design check requirements).
iii. Main truss deflection checks.

1.05 QUALITY ASSURANCE

A. Bridge design shall be signed and sealed by a Registered Ohio Professional Engineer.
B. Qualified bidders
    1. Each bidder is required to identify their intended bridge supplier as part of the BID submittal. Qualified suppliers must have at least 5 years of experience fabricating these types of structures.
C. Certifications
    1. Welder Certifications
        i. Welder certifications in compliance with AWS standard qualification tests.
D. Procedures
    1. Welding procedures in compliance with Welding Section 3.01

1.06 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery requirements with manufacturer.
B. Comply with manufacturer’s requirements for unloading, lifting, and placement.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:
    1. Continental Bridges; 1-800-328-2047.
    2. Big ‘R’ Manufacturing; 1-800-234-0734.
    3. Excel Bridges; 1-800-548-0054.
    4. Bridge America; 1-320-763-5600.

5. Steadfast Bridges; 1-800-749-7515.

2.02 DESIGN REQUIREMENTS

A. General:
   1. Bridge shall meet the referenced standards as called for in the following paragraphs.
   2. All allowable design stresses shall be in compliance with the SPECIFICATIONS of the design, fabrication, and erection of structural steel for buildings by the American Institute of Steel Construction (AISC) and Uniform Building Code (UBC).
   3. Minimum height of fifty four (54) inches (top of truss top chord), or as shown on the DRAWINGS.
   4. Maximum horizontal opening in railing of nine inches or as shown on the DRAWINGS.
   5. Unless otherwise shown on the DRAWINGS, the minimum loading shall be as follows:
      i. Uniform live load of sixty pounds per square foot (60 psf).
      ii. Concentrated live load of ten thousand (10,000) pounds vehicle weight on bridge plus thirty percent (30%) impact.
      iii. Minimum wind load of twenty-five (25) pounds per square foot (psf).
      iv. Horizontal pressure as if enclosed surface.
      v. Railing load of fifty pounds per linear foot (50 lbs/lf) of horizontal load.
   6. Mounting plates shall allow for thermal expansion.

B. Dimensions and Requirements:
   1. Length: As shown on DRAWINGS.
   2. Width: Clear unobstructed inside width as shown on DRAWINGS.
   3. Railings: Install for full length of bridge.
   4. Camber: Five percent (5%) of one-half (1/2) of span (if required) or as shown on the DRAWINGS.
   5. Abutments: Bridge to accommodate abutment elevations noted on the DRAWINGS.
   6. Decking: All decking shall be secured to the bridge members along the centerline of the bridge with a minimum of two (2) screws per board or as shown on the DRAWINGS.
   7. Rub Rails: Nominal two-inch by six-inch (2" x 6") wood rub rails on inside of bridge shall be placed thirty two (32) inches above the top of the bridge deck or as shown on the DRAWINGS.

C. Materials:

1. Metal Fabrication:
    i. Material thickness and design of member shall be fully engineered for the length and style of each bridge requirement specified.
    ii. Bridge shall be fabricated from high strength low-alloy atmospheric corrosion-resistance ASTM A606 Type 4 steel, self-weathering, (U.S.S. Cor Ten) ASTM A242, or ASTM A588/A588M structural steel shapes and tubing (FY = fifty thousand pounds per square inch [50,000 psi]).
    iii. Bolts and nuts shall be in accordance with SPECIFICATIONS for structural joints using ASTM A325 or ASTM A490 bolts. Anchor bolts shall be ASTM A307 or ASTM A36/A36M.
    iv. E8018 Series electrodes or equivalent shall be used for welding.
2. Wood Decking: All standard bridges shall have nominal three-inch by twelve-inch (3" x 12") planks of west coast region Douglas Fir or No. 1 Southern Yellow Pine, selected structural planks graded according to WCLIB standard grading or equal. Decking shall be treated to AWPA P5 or equal. Preservatives utilized shall be Chromated Copper Arsenate (CCA) or Ammoniacal Copper Arsenate (ACA) or equal.
3. Concrete Decking: As shown on the DRAWINGS.
4. Steel:
    i. Unpainted Weathering Steel: Bridge shall be fabricated from high strength, low alloy, atmospheric corrosion resistant ASTM A847 cold-formed welded square and rectangular tubing and/or ASTM A588, or ASTM A242, ASTM A606 plate and structural steel shapes. The minimum corrosion index of atmospheric corrosion resistant steel, as determined in accordance with ASTM G101, shall be 5.8.
5. Decking:
    i. Bridge decking shall be designed and sized for the specified design loads but shall be a minimum nominal 5” thick.
        1. Concrete Deck: Decking shall be galvanized steel form deck suitable for pouring a reinforced concrete slab. The form deck shall be designed to carry the dead load of the wet concrete, weight of form decking, plus a construction load of 20 psf or a 150-pound concentrated load on a 1’-0” wide section of deck.
            a. The form deck shall be either smooth or composite. Composite decking shall not be used as reinforcing when designing for concentrated loads (wheel loads). The decking shall be galvanized in accordance with

ASTM A525 (G60). Concrete deck design shall be performed by the bridge manufacturer.

b. Concrete decks shall be designed for concentrated load as specified in Section 3.1. The wheel loads used for deck design shall be distributed per AASHTO LRFD Bridge Design SPECIFICATIONS and using Steel Deck Institute C-2017 Standard for Composite Steel Floor Deck-Slabs.

2.03 FABRICATION

A. Workmanship, fabrication, and shop connections shall be in accordance with AWS and AISC specifications.
B. All welding shall be done by welders certified for AWS D1.1/D1.1M structural welding requirements.
C. Welding electrodes for self-weathering, corrosion-resistant steel shall have the same weathering characteristics as E5018 or equivalent.
D. All boldly exposed members shall have mill scale removed according to SSPC SP6.

2.04 GENERAL FEATURES OF DESGIN

A. Bridge System Type
    1. Bridge shall be designed as a Half Through “Pratt” truss that has one (1) diagonal per panel and plumb end vertical members. Interior vertical members shall be perpendicular to the chord faces.
        i. Bridge may be designed utilizing an underhung floor beam (top of floor beam welded to the bottom of the bottom chord) or in an H-section configuration where the floor beams and floor system are placed up inside the trusses. The bridge manufacturer shall determine the floor beam location.
        ii. The bridge manufacturer shall determine the distance from the top of the deck to the top and bottom of the truss members based upon structural and/or shipping requirements. The distance from the top of the deck to the bottom of the truss shall be no greater than 2’-0”.
        iii. The top of the top chord shall not be less than 48 inches above the deck (measured from the high point of the deck).
B. Member Components
    1. All members of the vertical trusses (top and bottom chords, verticals, and diagonals) shall be fabricated from square and/or rectangular structural steel tubing. Other structural members and bracing shall be fabricated from structural steel shapes or square and rectangular structural steel tubing.

C. Attachments
    1. Safety Rails: Horizontal angle safety rails shall be provided on the structure spaced so as to prevent a 4” sphere from passing through the truss rails. Safety rails shall be welded to the outside of the structure. The safety rail system shall be designed for an infill loading of 200 pounds, applied horizontally at right angles, to a one square foot area at any point in the system.
    2. Rubrails: Manufacturer will install 5/4” x 6” wood rubrails to the inside face of the bridge truss verticals. Rubrails shall be naturally durable hardwood Ipe (Tabebuia Sp.) Lapacho Group or Cumaru (Dipteryx odorta). The top of the rubrail shall be 3’-0” above the top of the deck.

D. Camber
    1. The bridge shall be cambered to offset the dead load and appear flat.

E. Elevation Difference
    1. The bridge abutments shall be designed and constructed at the same elevation on both ends of the bridge.

F. Approach Handrails
    1. Railing at each abutment shall be provided by bridge manufacturer to match safety rails on bridge. Extents of railing shall be as shown on DRAWINGs.

2.05 ENGINEERING

A. General: Structural design of the bridge structure shall be performed by or under the direct supervision of a Professional ENGINEER and done in accordance with recognized Engineering practices and principles.

B. Design Loads:
    1. Dead Load: The bridge structure shall be designed considering its own dead load (superstructure and decking) only. No additional dead loading need be considered.
    2. Uniform Live Load: The bridge structure shall be designed for a pedestrian live load of 90 pounds per square foot.
    3. Concentrated Loads: The bridge superstructure, floor system and decking shall be designed for a concentrated load of 1000 pounds placed on any area 2.5 ft x 2.5 ft square, and H-5 vehicle loading per AASHTO.
    4. Wind Load: The bridge shall be designed for a wind load of 25 pounds per square foot on the full vertical Projected area of the bridge as if enclosed. The wind load shall be applied horizontally at right angles to the longitudinal axis of the structure. The wind loading shall be considered both in the design

of the lateral load bracing system and in the design of the truss vertical members, floor beams and their connections.

5. Overturning Forces: The effect of forces tending to overturn structures shall be calculated assuming that the wind direction is at right angles to the longitudinal axis of the structure. In addition, an upward force shall be applied at the windward quarter point of the transverse superstructure width. This force shall be 20 pounds per square foot of deck.
6. Top Chord/Railing Loads: The top chord, truss verticals, and floor beams shall be designed for lateral wind loads (per Item D, above). However, in no case shall the load be less than 50 pounds per lineal foot or a 200-pound point load, whichever produces greater stresses, applied in any direction at any point along the top chord or at the top of the safety system if higher than the top chord.

C. Design Limitations:
   1. Deflection
      i. Vertical Deflection: The vertical deflection of the main trusses due to service pedestrian live load shall not exceed 1/400 of the span. The deflection of the floor system members (floor beams and stringers) due to service pedestrian live load shall not exceed 1/360 of their respective spans.
      ii. Horizontal Deflection: The horizontal deflection of the structure due to lateral wind loads shall not exceed 1/500 of the span under an 115 MPH ultimate (25 PSF) wind load.
   2. Minimum Thickness of Metal: The minimum thickness of all structural steel members shall be 1/4” nominal and be in accordance with the AISC Manual of Steel Constructions’ “Standard Mill Practice Guidelines.” For ASTM A500 and ASTM A847 tubing, the section properties used for design shall be per the Steel Tube Institute of North America’s Hollow Structural Sections “Dimensions and Section Properties.”

D. Governing Design Codes/References:
   1. Structural members shall be designed in accordance with recognized Engineering practices and principles as follows:
      i. Structural Steel Design:
         1. American Institute of Steel Construction (AISC).
         2. Structural steel design shall be in accordance with applicable sections of the “Manual of Steel Construction: Load and Resistance Factor Design.”

ii. Welded Tubular Connections:
    1. American National Standards Institute / American Welding Society (ANSI/AWS).
    2. All welded tubular connections shall be checked, when within applicable limits, for the limiting failure modes outlined in the ANSI/AWS D1.1 Structural Welding Code or in accordance with the "Hollow Structural Section Connections Manual" as published by the American Institute of Steel Construction (AISC).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install bridge and decking per manufacturer's recommendations. Wood decking shall be "rattle proof" and installed to the greatest extent possible to prevent warping. Confirm that concrete abutments have obtained sufficient strength before placement of steel structure.

3.02 WELDING

A. Welding
    1. Welding and weld procedure qualification tests shall conform to the provisions of ANSI/AWS D1.1 "Structural Welding Code," latest edition. Filler metal shall be in accordance with the applicable AWS Filler Metal Specification (i.e. AWS A5.28 for the GMAW Process). For exposed, bare, unpainted applications of corrosion resistant steels (i.e. ASTM A588 and ASTM A847), the filler metal shall be in accordance with AWS D1.1, Section 3.7.3.

B. Welders
    1. Welders shall be properly accredited operators, each of whom shall submit certification of satisfactorily passing AWS standard qualification tests for all positions with unlimited thickness of base metal, have a minimum of 6 months experience in welding tubular structures, and have demonstrated the ability to make uniform sound welds of the type required.

3.03 FABRICATION

A. General
    1. Fabrication, workmanship, and shop connections shall be in accordance with the American Association of State Highway and Transportation Officials SPECIFICATIONS (AASHTO).

B. Drain Holes

1. When the collection of water inside a structural tube is a possibility, either during construction or during service, the tube shall be provided with a drain hole at its lowest point to let water out.

C. Welds

1. Special attention shall be given to developing sufficient weld throats on tubular members. Fillet weld details shall be in accordance with AWS D1.1, Section 3.9 (See AWS Figure 3.2). Unless determined otherwise by testing, the loss factor "Z" for heel welds shall be in accordance with AWS Table 2.8. Fillet welds, which run onto the radius of a tube, shall be built up to obtain the full throat thickness. The maximum root openings of fillet welds shall not exceed 3/16" in conformance with AWS D1.1, Section 5.22. Weld size or effective throat dimensions shall be increased in accordance with this same section when applicable (i.e. fit-up gaps > 1/16"). Full- penetration welds will not be allowed (top and bottom chords to be full-length bars).

3.04 FINISHING

A. Blast Cleaning

1. To aid in providing a uniformly "weathered" appearance, all exposed surfaces of steel shall be blast cleaned in accordance with Steel Structures Painting Council Surface Preparation SPECIFICATIONS No. 6 Commercial Blast Cleaning, SSPC-SP6 latest edition.
2. Exposed surfaces of steel shall be defined as those surfaces seen from the deck and from outside of the structure. Stringers, floor beams, lower brace diagonals and the inside face of the truss below deck and bottom face of the bottom chord shall not be blasted.

3.05 DELIVERY AND ERECTION

A. Delivery shall be made to a location nearest the site that is easily accessible to normal over-the- road tractor/trailer equipment. The county shall be responsible for unloading the bridge at the time of arrival. The Manufacturer shall coordinate with the OWNER for the desired delivery date of the bridge 30 days in advance.

END OF SECTION

SECTION 35 22 70

ADJUSTABLE WAVE FEATURE AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

A. There shall be designed, furnished, and installed Adjustable Wave Feature within the waterway or river to create, adjust, and control specific wave formations. These shall collectively be referred to as Gates. Gates are shown and dimensioned on DRAWINGs and requirements including loadings are specified within this SECTION. The equipment shall include gate panels, kicker assembly, hinges, racks, hydraulic cylinders (actuators), valves, seals and instrumentation control devices to move the gates as schematically shown on the DRAWINGs. The hydraulic system including cylinders, valves, reservoir, controls, and hydraulic pump to move the gate is included.

B. Definitions:

A. Gate System Supplier: The fabricator of the Adjustable Wave Feature or their authorized representative. As defined above, also may be referred to as Manufacturer.

B. CONTRACTOR: The CONTRACTOR is the person or organization identified in the AGREEMENT as being responsible for the WORK under this Section. The term CONTRACTOR shall also refer to an authorized representative of the CONTRACTOR.

C. Actuators: Hydraulic cylinders to move the various panels of the gates.

D. Lip: Downstream end of the most downstream panels.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONs which may be related to this section:

1. Section 03 31 00, Structural Concrete
2. Section 05 50 00, Miscellaneous Metals
3. Section 09 90 00, Painting
4. Section 11 00 00, General Equipment
5. Section 35 23 00, Startup and Tuning of Whitewater Facilities

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing Materials (ASTM)

a) Standard A 29/A 29M: Steel Bars, Carbon and Alloy, Hot-Wrought and Cold- Finished, General Requirements
b) Standard A 36/A 36M: Structural Steel
c) Standard A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
d) Standard A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
e) Standard A 153: Zinc Coating (Hot-Dip) on Iron and Steel Hardware
f) Standard A 181/A 181M: Forgings, Carbon Steel for General Purpose Piping
g) Standard F 593: Stainless Steel Bolts, Hex Cap Screws, and Studs
h) Standard A 536: Ductile Iron Castings
i) Standard D 751: Coated Fabrics, Test Method
j) Standard D 1149: Rubber Deterioration – Surface Ozone Cracking in a Chamber (Flat Specimens), Test Method
k) Standard D 3350: Polyethylene Plastics Pipe and Fittings Materials
l) Standard D 4801: Polyethylene Sheeting in Thickness of 0.25 mm (0.010 in.) and Greater

2. American Institute of Steel Construction (AISC)
    a) “Manual of Steel Construction.”
3. American Welding Society (AWS)
    a) D11 “Structural Welding Code.”
4. The Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    a) Standard C6 2.41, IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
5. International Society of Automation (ISA)
    a) Standard S 50.1, Compatibility of Analog Signals for Electronic Process Instruments.
6. National Electrical Manufacturers Association (NEMA)
    a) Standard 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
7. AB 1, Molded Case Circuit Breakers and Molded Case Switches.
8. ICS 2, Industrial Control Devices, Controllers and Assemblies.
9. National Fire Protection Association (NFPA)
    a) Standard 70, National Electrical Code (NEC).
10. Underwriters Laboratories Inc. (UL)

a) Standard 508A, Standards for Safety, Industrial Control Panels.

11. Gates and Gate Controls shall meet the requirements of this section and DRAWINGs and be designed by, and meet the requirements specified by the Gate System Supplier.

1.04 SUBMITTALS

A. Submit the following:

1. Gate System Supplier qualifications and experience demonstrating compliance with requirements.
2. Final design DRAWINGs, computations, and engineering analysis of Gates prior to commencement of Shop DRAWINGs, fabrication submittals and fabrication of Gates. Design Loads including dead loads, safety factors, etc. are to be included. DRAWINGs, computations, and engineering analysis are to be sealed by a licensed Professional ENGINEER in the state of the installation. Shop DRAWINGs shall detail all connections, fabrication details, all final dimensions, clearances, tolerances, finishes, etc. An anchor bolt template shall also be shown on the Shop DRAWINGs and shall be furnished unless waived in writing by the ENGINEER.
3. Product Compliance Certificate, Material Testing Records, and Installation Instructions prior to commencement of installation.
4. Handling and storage PLAN and requirements, prior to delivery of Gates, and any components to the PROJECT site. Written instructions from Gate System Supplier will be provided.
5. The CONTRACTOR shall be responsible for following the manufacturer's installation and storage instructions, as approved by the ENGINEER, until final acceptance after Startup and Tuning. No equipment shall be delivered unless such instructions have been approved by the ENGINEER.
6. WORK PLAN and schedule for construction including foundation WORK, anchors, concrete forming and steel placement, placement of embeds and anchors, hydraulic lines and hoses, and sensing/controls piping, special concrete WORK to fill areas of difficult placement, concrete finishing and placement, testing of anchor bolts, WORK area PLAN for placement, detailed sequential steps of placement, equipment for placement, controls and sensing line installation, and all testing procedures.
7. Specific minimum tolerances required by Gate System Supplier for construction of reinforced concrete, painting, torque for anchor bolts and fasteners, pressures, deadbands, dimensions and related construction.

Supplier's requirements do not supersede other stricter requirements elsewhere in these SPECIFICATIONs and as shown on DRAWINGs.

8. Written instructions regarding concrete embedded anchor system hardware, to include tolerances, thirty (30) days prior to anticipated delivery of the concrete embedded anchor system hardware.
9. Installation and Operation Inspection Report by Gate System Supplier. Supplier shall submit a written report with respect to the equipment certifying that: (1) the equipment has been properly installed and lubricated under their supervision, (2) the equipment is in accurate alignment, (3) they were present when the equipment was placed in operation, (4) the equipment has been operated and inspected under full load conditions and operated satisfactorily, (5) they are fully covered under the terms of the guarantee. Report(s) shall include report from on-site inspection by Gate System Supplier. Inspections will be periodic as required for installation of critical components or at critical times. At least one inspection report approving installation of each Gate prior to running water over the Gate during the construction dewatering phase. The ENGINEER shall be informed of the date for each inspection at least two weeks prior to all onsite inspections by the Gate System Supplier. Refer to Article Installation for additional details.
10. Hydraulic System Leakage Test Records prior to final inspection by ENGINEER.
11. Installation Acceptance Certificate with copies of test reports attached, and Warranty Certificate immediately following final inspection by ENGINEER.
12. Bill of material, catalog information, descriptive literature, wiring diagrams, and Shop DRAWINGs for components of control system.
13. Catalog information on electrical devices furnished with system.
14. Shop DRAWINGs, catalog material, and dimensional layout DRAWINGs for control panels and enclosures.
15. Panel elementary diagrams of prewired panels. Include in diagrams control devices and auxiliary devices, for example, relays, alarms, fuses, lights, fans, and heaters.
16. Complete set of user manuals.
17. Submit manufacturer's standard warranty certificate. Manufacturer's standard warranties for specified products shall be transferred to the City of West Carrollton upon acceptance of the PROJECT.

18. Operation and Maintenance Manual, Installation Acceptance Certificate with copies of test reports attached, and Warranty Certificate immediately following final inspection by ENGINEER.

1.05 QUALITY ASSURANCE

A. Warranty:
    1. The Gate System Supplier shall provide a 5- year warranty on the Gates commencing at final acceptance of the WORK. The warranty shall cover all manufactured and supplied components and parts and include on-site assessment, removal, and replacement.
    2. In addition to the general warranty requirements, the equipment warranty shall cover (1) faulty or inadequate design by the Gate System Supplier; (2) improper assembly or fabrication; (3) defective workmanship or materials, and (4) leakage, breakage or other failure. It shall be the Gate System Supplier's responsibility to ascertain the conditions and service under which the equipment will operate and to warrant that operation under those conditions shall be successful. The supplier shall furnish a copy of the warranty to OWNER named as beneficiary. Any defects or failure within the warranty period shall immediately be repaired or replaced by the Gate System Supplier.

1.06 GATE SYSTEM SUPPLIER

A. The Gate System Supplier shall complete the final design of all Gates and appurtenances including but not limited to Adjustable Wave Feature hydraulic system and associated components for operation, hinges, and kicker assembly, supply all components, and supervise installation of Gates Systems. The Gate System Supplier shall have previously designed, manufactured, and supplied equipment similar in function and size and have at least 15 years of experience. Substitute equipment, if allowed, must be modified as necessary to provide the specified Gates and to meet the specified operating conditions. The Gate System Supplier shall have expertise in the hydraulics of flow that impacts the Gates. The term Gate System Supplier shall also include an authorized representative of the Supplier.

1.07 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT AND MATERIALS

A. Insofar as is practical, the equipment specified herein shall be factory assembled. The parts and assemblies that are, of necessity, shipped unassembled shall be packaged and tagged in a manner that will protect the equipment from damage and facilitate the final assembly in the field. Generally, machined, and unpainted parts

shall be protected from damage by the elements of weather with the application of a strippable protective coating.

B. Box, crate, or otherwise enclose and protect equipment during shipment, handling, storage, and following installation so as to ensure the preservation of the required quality and fitness of all materials and equipment until final acceptance of the PROJECT. Keep equipment dry and covered from exposure to weather. Store pumps, motors, electrical equipment, controls, insulation, and equipment having anti-friction or sleeve bearings in weather-tight storage facilities. Lift large equipment items only at the points designated by the manufacturer. Protect factory painted surfaces against impact, abrasion, discoloration, and other damage. Repair damage as directed and approved.

1.08 DESIGN

A. General: Rotation of the gate of the Adjustable Wave Feature(s) allows the desired hydraulic jump formation over a wide range of flows. To reliably provide this ability, the Adjustable Wave Feature shall be designed for long-term low-maintenance operations. The shape, dimensions, some details, range of motions of Gates, and various criteria are as specified on the PLANs and within this SPECIFICATION. A hydraulic pump and control system like that on various equipment with 3-way hydraulic valves operates the gate of the Adjustable Wave Feature. Adjustments can be made during normal operations, however once the tuning phase is completed, steel bars will be fabricated by the CONTRACTOR and supplied to the OWNER to allow the Adjustable Wave Feature to be locked into place in the future if desired.

B. Gate Description: Gates shall consist of stainless steel panels with hinges anchored to concrete and hinges between composite panels where shown on DRAWINGs. Hinges and attachment hardware shall be flush or slightly recessed below the concrete foundation upstream of the hinge unless otherwise approved by ENGINEER. Actuators for all Adjustable Wave Feature gates shall include hydraulic cylinders mounted between the hinged gate panels and the concrete foundations. Mounting bracket shall allow for adjustment of hinge elevations as shown on DRAWINGs. The hinges and actuators shall allow the gates to operate through a range from fully raised to fully lowered and as otherwise shown on DRAWINGs. If needed, mechanical limits, including conditions during maintenance, shall be provided to prevent damage to hinges.

C. Drop Assembly: Kicker Assembly shall consist of a stainless steel panel with hinge attached to Adjustable Wave Feature Gate as shown on DRAWINGs. Stainless steel

turnbuckles shall meet requirements shown on DRAWINGs. The Gate System Supplier shall determine location and number of required turnbuckles. However, at minimum, turnbuckle attachments shall align with the stiffening ribs on the front face of the Adjustable Wave Feature.

D. Member Sizes and Dimensions: The moveable panels that make up the Adjustable Wave Feature and Gates shall be designed to move within the limits shown on the PLANs with water flowing in the waterway. The shape and dimensions of the Adjustable Wave Feature gates are as shown on the PLANs and the overall dimensions and shape shall not be changed significantly. Members, connections, and details are shown schematically. Minimum sizes of members and connections are shown on the PLANs. The Gate System Supplier shall determine if larger members or additional members and connections are required. Dimensions for the components and various members shown on the PLANs are illustrative only and final dimensions of all members shall be determined by the Gate System Supplier based upon actual member sizes, required clearances, welding, painting, and assembly needs, objectives, and details, etc.
E. Design Rationale: The Adjustable Wave Feature design shall be based both on thorough stress analysis and on long term experience with comparable components under similar conditions. Design efforts by the Gate System Supplier shall include structural analysis. Any hydraulic modeling completed by the Gate System Supplier as part of the final design shall be provided to the ENGINEER for review. A detailed, working solid 3D model of the Gates in a 3D computer application program shall be provided. This shall be fully moveable and readily able to demonstrate the gates range of motion and verify the absence of interference of the various components and structural members. This model shall be viewable with rotatable gate(s) in at least one common program/application.
F. Hydraulic Loading: The Gates including attachments hinges, bearings, and connectors shall be analyzed and designed using the loadings and considerations shown in the table below and as described herein. The movable panels that make up the Adjustable Wave Feature Gates shall be designed to move within the limits shown on DRAWINGs with water flowing in the waterway.
G. The Adjustable Wave Feature Gates will be in a rapidly varying flow regime (transition from super critical to sub critical flow) at a hydraulic jump. Depending on the hydraulic jump formation the gate will experience downward or upward (uplift) loading. The Adjustable Wave Feature gate(s) and system components (including actuators) shall be designed to withstand the loads shown in the table below. The

surrounding waters will be very turbulent and all lines, hoses, and other equipment will be designed to accommodate severe turbulent conditions. Loads shown do not include dead loads and do not include a safety factor. Gate System Supplier shall assign an appropriate safety factor based on their experience with similar systems.

Section 35 22 70 – Table 1 – Adjustable Wave Feature Gates			
Gate Panel	Gate Loading Type	Live Load (lbf/ft^2)	Notes
Adjustable Wave Feature Panels	Upward Hydraulic Loading (Uplift)	350	No Safety Factor Applied
Adjustable Wave Feature Panels	Downward Hydraulic Loading	300	No Safety Factor Applied

H. Other Loading: Gate System Supplier shall also consider operational loadings of potential sediment buildup or debris accumulation under the gate. The gate shall be designed so that if obstructed from downward movement by debris or sediment buildup, the gate will not be damaged when the maximum working pressure is applied in the hydraulic system (see below).

I. Hydraulic System Loading: Gate system supplier shall size and select hydraulic cylinders and all components including but not limited to hydraulic fittings, hoses, and lines, that meet the load requirements provided above including structural analysis of connections and buckling of extended cylinder/rod. The normal working system hydraulic pressure shall be no more than 2,500 psi and the cylinders shall provide the forces required to overcome the live and dead load forces at the normal working hydraulic pressure. The maximum working system hydraulic pressure shall be 3,000 psi. Unless specifically stated, the system and all components shall have a rated working pressure of at least the maximum working system hydraulic pressure plus safety factor.

J. Loading Due to Restricted Movement: Loading due to the force exerted by the cylinders at maximum operating pressure shall be accounted for if conditions are encountered where the gate is prevented from movement due to reaching the limits of the range of movement.

K. Unequal Cylinder Loading: The Gates including the frame, panels, cylinders, connections, pivots, and attachments shall be designed so as to accommodate an unequal loading of any individual cylinder of 50% of its maximum design loading without excessive deflection or stresses of the Gate including the frame, connections, supports, pivots, clevises, etc.

L. Engineering Analysis: Engineering analysis shall be carried out on the Adjustable Wave Feature(s) to calculate the maximum stresses and deformations and to verify the safety of the features. In the analysis of Adjustable Wave Feature(s), all loading conditions needed for design including, but not limited to, the two load cases as described below shall be made and presented:
    1. Downward load case: Adjustable Wave Feature(s) gate in the fully raised position with specified hydrostatic head pushing down on the exposed horizontal surfaces of the Adjustable Wave Feature(s) gate and no uplift hydrostatic pressure.
    2. Uplift load case: Adjustable Wave Feature(s) gate in the fully lowered position with the uniform hydrostatic up-lift pressure pushing up on the exposed horizontal desk surfaces of the Adjustable Wave Feature(s) gate and no hydrostatic downward pressure.

PART 2 – PRODUCTS

2.01 GATE CONTRACTOR SUPPLIED COMPONENTS

A. The Gates and all necessary ancillary components required to allow successful operation of the Gates shall be provided by the Gate System Supplier. Design documentation and equipment to be so provided includes, but is not limited to the following:
    1. Final design DRAWINGs and calculations, shop DRAWINGs, computer modeling (if required) results and engineering analysis of gate system forces prior to commencement of fabrication of the gates.
    2. Stainless steel gate panels and associated piping attachments.
    3. Hinges.
    4. Seals with attachment hardware.
    5. Gate attachment hardware with anchor bolts, nuts, and washers.
    6. Reinforced rubber cover and J-bulbs.
    7. Hydraulic system controls including electrical hydraulic pump and reservoir, hydraulic fluid, associated valves and control components.
    8. Hydraulic hand pump including manifold and associated bypass valving.
    9. The hydraulic cylinders including all bearings, attachments, pivots, flexible hydraulic hoses that attach from the cylinders to the stainless-steel hydraulic lines, attachment fittings, clevises etc.

10. Inclinometers and cables communicating with a 4-20 mA signal to an LCD output display located in a NEMA 4X enclosure located in hydraulic controls vault.
11. Adjustable Wave Feature Racks.
12. Drop Assembly
13. All other appurtenances as required to provide a complete and functioning system.

2.02 STEEL COMPONENTS

A. Structural components, hinge retainers, splitters, and restraining strap clamps shall be manufactured from ASTM A572 Grade 50 Steel or approved equal.
B. Other non-structural components to be manufactured from ASTM A36 steel or approved equal.
C. All threaded fasteners including anchor bolts and attachment hardware shall be 304 stainless steel or approved equal. Anchor bolt allowable shear and tension stresses for attachment to concrete shall not exceed that recommended by the anchor bolt manufacturer.
D. Stainless steel panels and other stainless items shall be from Type 304 stainless steel, 3CR12 stainless steel, or approved equal. All embedded steel, connectors, attachment hardware, mounting plates and all other members and items shown on the PLANs as stainless steel (SS) shall be stainless steel.
E. All steel and stainless-steel components shall be designed so that the maximum stress level in each component is less than 40 percent of yield strength and less than 25 percent of ultimate strength.
F. All bolts on exposed faces of steel gates shall be countersunk flush to surface, or round head bolt when approved by ENGINEER. Any protruding attachment hardware for fasteners that are not countersunk or round head, shall be covered with reinforced rubber as approved by ENGINEER.
G. All welds and edges shall be ground smooth.

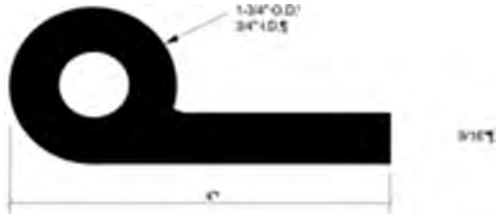
2.03 J BULB SEALS

A. All panels including the crest panels and all panels that make up each Adjustable Wave Feature shall have adjustable J bulb seals (or reinforced rubber spacers) along all outside edges that abut to the abutment walls.
B. J Bulb seals shall have 1 3/4-inch diameter hollow bulb and be 4 inches wide and made of Hi Tensile Neoprene meeting the following property values requirements.

Section 35 22 70 – Table 2 – J Bulb Seals

Property	Values
Tensile Strength	2250 min. PSI
Ultimate Elongation	400 % min.
Shore A Durometer	60 / 70
Specific Gravity	1.4
Compression Set	30% max
Tensile Strength after Oxygen Bomb Aging	80% min.
Ozone Resistance	Good

C. The cross-section shall be as shown on the following figure (Figure 1)

1. 

   i. Figure 1

D. The J Bulbs shall be installed with a continuous stainless steel support bar that is securely anchored ‘to resist deflection or warping.

2.04 EDGES AND GAPS

A. Exposed edges on gates shall have a minimum radius of 2-inches or as shown on the DRAWINGs. All other exposed edges on all panels, hinge attachments, steel, etc., shall be rounded to no less than 1/4 inch. Edges of panels and hinges shall have no gaps between gate panels/frames and concrete walls greater than 1/4 inch and any gap shall not taper from wider to small in the upstream to downstream direction to prevent fingers or lose articles of clothes from becoming entrapped/tangled. All gaps between gate panels and concrete walls shall be filled with rubber securely attached to the frame to prevent fingers or lose articles of clothes from becoming entrapped.

2.05 INCLINOMETERS/TILT GAUGES

A. Inclinometers shall be accurate to at least 0.5 degrees, be reliable and suitable for river conditions and have an IP68 rating with a specified pressures based on anticipated immersion depth. Connector output shall be rated and supplied with IP69K connector cable.
B. Inclinometers shall be supplied by the Gate System Supplier.
C. All mounting hardware shall be stainless.

D. Output shall integrate with the display located in the hydraulic controls vault and be suitable for the distance required.
E. Shock: Shall meet EN60068-2-27:1993, 100 g/11 ms, 100 shocks.
F. Vibration: Shall meet EN60068-2-6:1995, 20 g/10 Hz-2 kHz, 10 cycles.
G. All tilt gauges and wiring shall be protected from debris, severe turbulence, and abrasion and long enough to avoid splicing.
H. Gauges shall be mounted to facilitate maintenance and replacement.
I. Two inclinometers shall be provided for each Adjustable Adjustable Wave Feature.
J. Display: The Inclinometer shall communicate with a digital display located in a panel within the control vault.

2.06 HYDRAULIC CYLINDERS AND ATTACHMENTS

A. Cylinders shall be double acting and designed to support the entire design hydraulic loads, dead loads, and other loads. Cylinder shall meet the operating ranges including required stroke length as shown on the PLANs. The cylinders and all hardware shall be designed for submerged conditions and for vegetable oil based hydraulic fluid. Unless designated on the DRAWINGs as temporary, the Cylinders shall have a stainless-steel body and a rubber bellow cover to protect the rod seals. The cylinders shall have working pressures as specified above. All bolts, rods, clevises, rod eyes, pivoting hardware, and all other hardware shall be Type 304 stainless steel. Seals shall be designed for vegetable oil operation and submerged conditions. Cylinder supports, pivots, clevises, etc. shall be designed to allow for inaccuracies in construction, unequal loadings, etc. so as to not put any non-axial loading or moment on the hydraulic cylinders. All cylinder mounts shall be spherical connections. Cylinders shall be provided with a 5-year manufacturer's warranty.

2.07 ADJUSTABLE WAVE FEATURE HYDRAULIC SYSTEM

A. The hydraulic system supplying the pressure and controlling the hydraulic cylinders of the Adjustable Wave Feature Gates shall provide smooth, reliable and efficient operations of the Gates. The hydraulic system shall be designed so that there is not a loss of hydraulic pressure over time and that the cylinder and the gate panels stay in-place when the system is turned off or un-attended. All systems components shall be suitable for water immersion or damp environments without corrosion. Controls, valves, pumps, motors, piping shall be securely attached to the vault a minimum of 24 inches above the floor.
    1. The hydraulic system will be designed to provide the specified design forces with a working pressure of the normal working hydraulic pressure specified above.

2. The hydraulic system will be supplied, and all components designed to operate with vegetable base hydraulic fluid of the supplied viscosity.
3. Hydraulic Fluid: The grade shall be as determined for the application. Hydraulic fluid shall be readily and totally biodegradable, maintain low viscosity at -20°F, and be stable for a period longer than 25 years. Base fluid shall be canola (rapeseed) oil approved by the ENGINEER and the product shall have been produced and marketed for at least 10 years by major companies and government organizations. Ten gallons of additional fluid for future use shall be supplied. The hydraulic fluid shall meet or exceed the following requirements:
    i. Anti-wear performance: Exceed the requirements for US Steel 126, 136 and 127, load stage 10 in the FZG (DIN 51354), and GM (LS-2).
    ii. Federal SPECIFICATIONs A-A-59354 Superseding MIL-H-46001D SPECIFICATION for machine tool hydraulic systems.
    iii. The Environmental Protection Agency (EPA) 2013 Vessel General Permit (VGP) guidelines for Environmentally Acceptable Lubricants (EALs) and should be used in hydraulic systems where LOW TOXICITY, BIODEGRADABILITY and NON- BIOACUMMULATION properties are required.
    iv. The acute toxicity (LC-50 / EC-50 >1000 ppm) criteria adopted by the US Fish and Wildlife Service and the US EPA.
    v. Oxidative Stability: Have a Rotary Pressure Vessel Oxidation Test (RPVOT): life over 200 minutes.
    vi. Extreme Pressure/Antiwear: When properly formulated, passed FZG stage 12, Shell 4 Ball Wear results (1800 and 1200 rpm, 20 and 40 kg, 1 hour) were 0.30 to 0.40mm.
    vii. Meet the Factory Mutual as a less hazardous fluid “SPECIFICATION Tested” ISO/CD 15029 3 rating HFDU, and ISO/TS 15029-2 Spray Ignition-Ignitability (Class H)
4. Hydraulic Line: Hydraulic Line (tubing) shall be 3/8-inch diameter Type 304 stainless steel with a minimum wall thickness of 0.049 inch and minimum working pressures as specified above. Fittings shall be stainless steel with equivalent or greater strength than the tubing.
5. Hydraulic hoses shall be rated for minimum working pressures as specified above and be attached with stainless steel quick connects and stainless steel fittings or approved equal. Hose shall be Parker 471TCor approved

equal. Where routed under lip panel, tubing shall be fastened to the gate support slab at no greater than 4 feet intervals with stainless steel straps. All hoses shall be protected with stainless steel anti-abrasion sleeves or wraps.

6. Where not routed in conduits or carrier pipes, hoses shall be fastened at no greater than 4 feet intervals with stainless steel straps, supports, or guides.
7. Heavy Duty Hydraulic Hose Spiral Wrap. All hoses inside and outside of conduits and carrier pipes shall be wrapped with appropriately sized spiral hose wrap. The material shall be HDPE (High-Density Polyethylene) with an operating temperature: -40°F to 280°F and a tensile Strength @Break of 360 kg/cm2 and be designed specifically for heavy-duty bundling and protection of hydraulic and pneumatic hoses used across various industries. Heavy duty spiral hose wrap shall be Mine Safety and Health Administration (MSHA) certified and UV resistant and protect against damage caused by depreciation, abrasion, regular misuse, poor maintenance, or severe working environments. Hose protector tubing shall have rounded edges for reduced risk of exposed sharp edges and resist all Hydraulic Fluids including Glycol & Phosphate ester.
8. Valves: Ball and check valves shall be stainless steel. Supplier shall design valving scheme to allow raising and lowering of the gate using the Manual Hydraulic Pump by opening and closing valves to allow extension of the cylinder or retraction of the cylinder. Check or other valves shall be included in the design such that when transitioning from moving the gate up to down or down to up there is no loss of pressure in the system or movement of the gate.
9. Control Valve: Shall be a hydraulic directional control Valve, NFPA Size D03, Lever Operated Operation Type, with closed center position. Valve Ways and Positions shall be 4-Way/3-Position. Max. Flow 22.0 gpm or more as required to meet, Max. Pressure - Hydraulic Valves 5000 psi, Max. Tank Pressure (PSI) 500, Adjustable PSI Range -, Nitrile O-Ring Seal Type.
10. Pressure Relief Valves (PRV) Valves: PRV valves in the hydraulic system of the Wave Shaper Gates shall release pressure so as not to allow over pressuring of any cylinder at any time. PRV valves shall be self-actuated safety valves designed to relieve excess upstream pressure from the line. The PRV valves shall be adjustable from 1000 psi to 3000 psi. The PRV valves shall be connected to a drain valve so that hydraulic fluid is released back to the hydraulic pump reservoir.

11. Electric Hydraulic Pump and Reservoir: The CONTRACTOR shall supply a hydraulic pump capable of operating the hydraulic cylinders required to operate the Adjustable Wave Feature. The pump shall be single speed with a minimum reservoir capacity equal to at least 2 times the difference between the volume of hydraulic fluid between all cylinders up and all cylinders down plus 10 gallons. It shall have a maximum operating pressure of 3000 psi. The pump shall be capable of moving the Gate through one full range within 5 minutes but no faster than 60 seconds. The pump shall have a pressure regulating valve to adjust the maximum operating outlet pressure from 1000 psi to 3000 psi. The pump shall be designed to WORK with vegetable based hydraulic fluid.
12. Hydraulic Handpump: A handpump for backup use shall be provided. The pump shall be rated for at least 2800 psi but no more than 5000 psi. The displacement per stroke will be approximately 0.15 cubic inches and shall have a required force of no more the 40 pounds at the handle. The pump shall have an external load release valve and internal pressure-relief valve for overload protection. The pump shall be made of materials and/or painted and otherwise designed for application in damp areas.
13. Pressure Gages: Provide liquid filled pressure gages approved by the ENGINEER rated per the maximum system operating pressure. Include an isolation valve between gage and hydraulic system. The pressure gauge shall be a rugged, solid-front aluminum case gauge. Dial sizes shall be 6 inches in diameter or larger. All cases shall be coated with black epoxy which will withstand most environmental conditions. The gauge shall have a 0.5% full scale (Grade 2A, ASME B40.100) accuracy, meet IP54 dry case weather protection, have a glass window and a micrometer adjustable pointer. The movement shall be rotary, 400 SS, with a Teflon coated pinion gear and segment.

2.08 REMOVEABLE ACCESS PLATES

A. Removable steel access plates and all attachment hardware as shown on the DRAWINGs, shall be supplied with all Adjustable Wave Feature. These shall allow access to all hydraulic cylinders and have adequate clearances to allow access below the gate for a 6-inch diameter hose for removal of sediment/debris. All plates and hardware shall be flush to the surrounding gate and shall be smooth with no sharp edges.

2.09 HINGES

A. The hinges shall be reinforced type. Hinges and attachment hardware shall be flush or slightly recessed below the concrete foundation upstream of the hinge unless covered by reinforced rubber cover approved by ENGINEER. Attachment hardware shall allow for adjustment of hinge elevation following installation of the Adjustable Wave Feature as indicated on the DRAWINGs.

2.10 ADJUSTABLE WAVE FEATURE RACKS

A. The Adjustable Wave Feature racks shall be constructed of stainless steel components as indicated on the DRAWINGs.
    1. The rack including all connectors will be constructed of Type 304 stainless steel.
    2. The racks shall be designed to be removed or rotated down to access below the gates during maintenance.
    3. The clearance between the bottom member of the rack frame and foundation shall be a maximum of 4 inches.

2.11 DROP KICKER ASSEMBLY

A. Drop Kicker Assembly shall be constructed of Type 304 stainless steel.

2.12 FINISHES

A. See Section 09 90 00 – Painting, for coating of all steel members other than fasteners, and stainless-steel components.

2.13 SOLAR POWER SYSTEM

A. Unless otherwise specified it shall be the CONTRACTOR's responsibility to furnish and install a Solar Photovoltaic (SPV) power system to supply electricity to the hydraulic system for operation of the Adjustable Wave Feature. The SPV system must be designed with the necessary features to store/supply electricity for continuous (no loss of power) operation of the Adjustable Wave Feature (during daytime). The SPV system shall be designed and installed in such a way so as to deliver proper voltage, and current to ensure desired power output for the Adjustable Wave Feature hydraulic system. The Solar Power System to be so provided includes but is not limited to the following:
    1. Polycrystalline Solar Photovoltaic Modules (10-year minimum warranty).
    2. Module Pole Mounting Structure
    3. Battery Bank (AGM Lead Acid Batteries) with Steel Housing Structure.
    4. Charge Controller
    5. Circuit Breakers
    6. Service Disconnects
    7. Junction Boxes

8. Earthing and Lighting Protection
9. Wiring
10. All necessary materials and devices that may not be indicated in the DRAWINGs or mentioned in the SPECIFICATIONs, but which are necessary for compliance with Codes and for successful operation of the Adjustable Wave Feature hydraulic system.

2.14 COORDINATION OF WORK

A. Verify all equipment sizes and the control of the motors and equipment before starting wiring. Consult with other suppliers and other trades to confirm exact requirements for equipment furnished and carefully do all WORK in accordance with shop DRAWINGs and recommendations of the equipment manufacturer, as approved by the ENGINEER. If any piece of equipment is different in phase, voltage, sequence of operation, horsepower, size, or space requirements, coordinate and make changes required to successfully complete the installation. The CONTRACTOR shall have full responsibility for the functional operation of power, control and instrumentation systems. The CONTRACTOR shall perform all tasks necessary to select unspecified components, to produce complete wiring diagrams, and to furnish, install, connect, calibrate, and place into operation all sensors, instruments, control panels, accessories, and all other equipment as specified herein

2.15 TESTING RECORDS

A. Submit written certificate attesting to product compliance with physical material requirements of this Section prior to installation of the Gates and any related equipment.

PART 3 – EXECUTION

3.01 PIPING, FOUNDATION SLAB AND WALL GENERAL REQUIREMENTS

A. The CONTRACTOR shall store, protect, and install all manufacturer provided components listed in Part 2 of this Section.
B. The CONTRACTOR shall prepare the foundations for the Gates, including all anchors, sleeves, and embedments. Provide anchor bolts of length to allow for 1-1/2 inches of grout under base plates and adequate anchorage into structural concrete. Other specifically detailed lengths either shown or specified will supersede this requirement. Provide sleeves of at least 1 1/2 times anchor bolt diameter and of the same material as the anchor bolts. Anchor bolts shall be stainless steel Type 304 which conforms to ASTM A193.

C. Supplier shall inspect the location of the anchors prior to placement of concrete foundations.
D. The Supplier shall furnish and install all auxiliary components necessary to make a complete and operational Gate.
E. A lubricating compound approved by the ENGINEER shall be used for all stainless steel anchor bolts and fasteners. The anti-seize shall be applicable to stainless steel, prevent galvanic corrosion, be intended for marine applications, and contain no copper.
F. The reinforcing steel and embeds will be placed in the foundation slab, with careful placement to achieve pull out capacity requirements of anchors as specified by the Gate System Supplier and structural engineering requirements. Care will be taken such that complete concrete penetration under and around embeds is achieved.
G. A steel trowel finish will be used on the base slabs below and downstream of the gates. Any rough points, edges or other defects will be ground smooth and as directed.
H. The foundation walls will be placed with a tolerance of plus or minus 1/8-inch of the designated vertical plane, with no edges, form ridges or other defects.
I. Reinforced Rubber Spacer (or J Bulbs) shall be provided to fill the gap between all Adjustable Wave Feature panels and the concrete foundation walls. The design and detailing of this Reinforced Rubber Spacer shall prevent the formation of gaps during operations and shall provide for the longest practical life without maintenance. Smallest practical gaps and rubber spacers shall be used.
J. All embeds will be cleaned, threads cleaned, and bolts temporarily placed to determine that threads are clean and in good condition. Torque test pull-out resistance as directed.
K. Hydraulic piping shall be run in conduit, embedded in concrete foundation, or in covered raceway as shown on the DRAWINGs. Conduits shall have long-radius bends and pull boxes at bends to facilitate pulling hydraulic piping lines through the conduit. Outside of conduits all lines shall be securely fastened with stainless steel connectors to prevent vibration, abrasion and damage and to uniformly support the hydraulic piping.

3.02 INSTALLATION

A. General Requirements:
    1. Installation PLAN and Facilities. CONTRACTOR shall develop an installation PLAN describing site storage and WORK areas, equipment needs and other

details in consultation with the Gate System Supplier so that the Gates and controls can be properly installed, tested, and operated.

2. Installation: The gates will be installed to achieve the requirements of the PLANs and SPECIFICATIONs, and as directed by the Gate System Supplier. All materials and surfaces will be protected against damage. The sequence of construction will be as directed by the Gate System Supplier's technical advisor and to achieve the gate operational characteristics.
3. Testing: The equipment, panels, hinges, and controls will be tested by or under direct supervision of Gate System Supplier in advance and during initial operation. Thereafter, any defects repaired as directed.

B. Gate System Supplier’s Technical Advisor and ENGINEER’s Representative:
   1. General: The Supplier shall provide a factory-trained technical advisor to oversee installation of the Gates, startup and testing of the operating equipment, and to instruct operating personnel. A representative of the ENGINEER will attend all meetings and installations as may be designated.
   2. Pre-installation Meeting: A pre-installation meeting to be attended by the Supplier, ENGINEER, and CONTRACTOR personnel will be held within two weeks prior to the scheduled installation of any Gate or gate component. The technical advisor shall provide the attendees with information regarding the proper procedures for installing the Gates and related equipment.
   3. Pre-installation Inspection: The manufacturer's technical advisor and ENGINEER shall inspect the concrete foundation with anchoring system hardware and reinforcing steel prior to placement of concrete. The ENGINEER and Supplier shall receive 10 days advance notice of the scheduled concrete placement.
   4. The installation of the hydraulic cylinders and gate panels, including preparatory WORK, shall be done with the ENGINEER at the site. The ENGINEER and Supplier will receive 10 days advance notice of scheduled installation. The technical advisor shall notify the ENGINEER as soon as possible of any discrepancies discovered in the WORK which may hinder successful installation of the Gates.
   5. Final Testing: The installed systems shall be pressure tested, as specified elsewhere, for leakage by the CONTRACTOR with the assistance of the Supplier’s technical advisor.

6. Final Inspection: A final inspection of the Gate installation and related equipment will be performed by the ENGINEER with the assistance of the Supplier's technical advisor in conjunction with the final testing.

C. Testing:
   1. General:
      i. The CONTRACTOR shall be responsible for conducting testing of the installed system. Tests shall be conducted in the presence of the ENGINEER and the Supplier's technical advisor.
      ii. All hydraulic lines and hoses shall be tested and accepted before installation of the Gates commences.
      iii. Hydraulic lines and hoses shall be tested by pressurizing to 3,000 psi. Pressure readings and ambient air temperature shall be recorded at six different times during each test. Any joints or fittings exhibiting leakage during this time shall be repaired or replaced.
      iv. After installation of the system the Gates shall be fully raised and lowered three times. The Gates shall operate smoothly with no binding. Adjustable Wave Feature gates shall be tested an additional three times, each time varying the position of each lip throughout the range of operation.
      v. After installation of the Gates with hydraulic cylinders, the hydraulic system shall be isolated from the pump system and held at a pressure of 3,000 psi for 24 hours. All hydraulic lines and hoses shall have no drop in pressure over a 24-hour period.
   2. Reporting:
      i. The Supplier's technical advisor shall prepare a written report of all tests. The report shall be attached to an Installation Acceptance which shall be submitted within two weeks of the end of the testing period.
   3. Adjustments:
      i. During the Startup and Tuning Phase, the Gates shall be adjusted and tested as directed by ENGINEER to verify a fully functioning system in the active flow condition.

END OF SECTION

SECTION 35 23 00

START-UP & TUNING OF WHITEWATER FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The WORK of this Section consists of the start-up, observation of flows and hydraulic performance by the ENGINEER, and tuning of the whitewater course to be performed during the construction phase of the PROJECT that will include modifications or potential addition of in-river features and grading based on the observed performance. Specific activities are expected to include iterative trials and testing, modifications, and adjustments to Adjustable Wave Feature tuning blocks, sculpted rock, and modifications and additions to boulder surfaces, jetties, and other in-river features in and around the drops and pools of the whitewater course. The intent of the start-up and tuning efforts are to provide low-hazard recreation, optimize hydraulic performance to the extent practicable, and improve ease of course operations.

B. Additional tuning may be required following construction completion.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONs which may be related to this section:

1. Section 03 31 00, Structural Concrete
2. Section 03 31 01, Sculpted Concrete
3. Section 05 50 00, Miscellaneous Metals
4. Section 31 38 00, Rock
5. Section 31 23 00, Excavation and Fill
6. Section 31 23 19, Water Control and Dewatering
7. Section 35 22 70, Adjustable Wave Feature and Gates

1.03 NOT USED IN THIS SPECIFICATION

1.04 NOT USED IN THIS SPECIFICATION

1.05 NOT USED IN THIS SPECIFICATION

1.06 JOB CONDITIONS

A. Protection of Structures, Banks, Riverbed and Vegetation: All structures, final grading, existing banks, riverbed, and existing natural vegetation both inside and outside of the PROJECT boundaries shall be protected from injury during modifications and operational tuning of the PROJECT. Any damage to such facilities or resources shall be repaired by the CONTRACTOR to a condition equal to or better

than original at no additional expense to the OWNER. Any required repairs shall be made to the satisfaction of the ENGINEER.

B. Permits: The CONTRACTOR shall be responsible for adhering to all permits associated with or obtained for the PROJECT during any WORK carried out under the Modifications phase of the PROJECT.
C. Water Control: The CONTRACTOR shall be responsible for all elements of water control required to carry out the WORK covered by this Section of the SPECIFICATIONs. It is anticipated that local water control and dewatering needed to install invert blocks, boulders, and sculpted concrete will be required during this phase. The CONTRACTOR shall be responsible for safely passing all flows during the start-up and tuning phase, regardless of the flow magnitudes that occur, while maintaining the existing levels of flood protection.
D. Coordination: The CONTRACTOR shall coordinate with the ENGINEER during the execution of the Tuning. Following substantial completion of the PROJECT the CONTRACTOR shall provide notice to the OWNER and ENGINEER.
E. Safety: Conditions within the river channel will be free from construction-related debris and hazards to the maximum extent possible and will be suitable for in-river access by the public during each observation and testing period. It will be the responsibility of the park operator to remove debris from the whitewater course and maintain low-hazard conditions in the river following final acceptance and operation of the whitewater course.

PART 2 – PRODUCTS

2.01 SURVEY

A. As-built topographic survey of the whitewater course (bank to bank) in dewatered conditions will be required for submittal to the ENGINEER 3 weeks or more prior to start of tuning phase. CONTRACTOR provision of survey data incrementally at the final completion of phased construction of the whitewater course is permissible upon approval by the ENGINEER. CONTRACTOR shall provide precise horizontal and vertical measurement of all stepped and sloped features within the whitewater course that includes all side slopes, grouted and ungrouted rock, sculpted concrete, and structural concrete to an accuracy of ±0.1 foot. (i.e. LiDAR or other ENGINEER approved method).

2.02 RELATED WORK

A. As required for the various related WORK - see Part 1.02 RELATED SECTIONS. This is applicable to final/permanent modifications determined during and after

completion of the iterative testing, and as required to support the individual trials and testing.

2.03 ITERATIVE TRIALS

A. As required to support iterative testing and trials of tuning modifications including temporary wood structures (plywood, framing wood, concrete anchors, etc.) anchored to concrete, rock, and/or sandbags to temporarily direct flows. CONTRACTOR should assume at least $30,000 worth of direct materials costs (unburdened, locally available but not delivered) for these miscellaneous temporary structures used in the iterative testing. CONTRACTOR will keep receipts and provide itemized list on an on-going basis for all such materials

PART 3 – EXECUTION

3.01 GENERAL

A. The start-up and tuning phase consists of iterative trials, observation periods, installation of temporary and permanent structures, modifications to previous WORK, adjustments to the Adjustable Wave Feature and appurtenances, installation/adjustments of tuning blocks, pool banks, jetties, etc. WORK shall support:
    1. Iteration Trials and Testing: CONTRACTOR shall install temporary structures (plywood, sandbags, etc.), piles of rock or granular material, and/or sandbags to provide for temporary blockage or partial blockage of flows, to guide flow during iterative trials and redirect flow during relocation, and/or addition of Tuning Blocks, placement of submerged Grouted Boulders, and placement of sculpted concrete. These efforts will likely focus on modifications to drop structures and jetties and will aim to reduce hazards and improve hydraulic performance.
    2. Iterations: Testing and Modification Iterations will typically include:
        i. ENGINEER with CONTRACTOR support shall complete observation of performance of the improvements at typical river flows that are available during construction.
        ii. ENGINEER will prepare a tuning iteration field directive with DRAWINGs, exhibits, and descriptions as required for modifications to the course. This will identify movement of invert blocks, temporary placement of materials on existing or potentially new structures if needed, locations of grout or grouted boulders and/or sculpted concrete to be placed.

iii. CONTRACTOR to review the field directive and provide a submittal that includes approach and specifics to complete the Tuning iteration for review by ENGINEER.
iv. Once an iteration has been reviewed and agreed to by CONTRACTOR and ENGINEER, the CONTRACTOR shall implement the modifications including temporary localized dewatering as required, then remove any temporary dewatering structures and rewater the area for further observations.
v. ENGINEER shall observe the last Iteration and the above process shall be repeated.

3. Final Modifications: After all iterative trials are completed, WORK including the addition of localized grouted boulders (likely placed in a submerged condition) and/or sculpted concrete to replace any remaining temporary features if required, mechanically grinding any remaining sharp edges to a radius of 3 inches or greater on exposed surfaces of Rounded Surface Boulders and Rounded Feature Boulders as directed by the ENGINEER, and cleanup of the site will be completed.

3.02 START-UP

A. Adjustable Wave Feature Gate Systems will be operated to verify and/or rectify any issues with adjustability ranges, smooth operation of all components and overall system functionality will be verified prior to re-watering. Once gate systems are approved by ENGINEER in the dewatered condition, the whitewater course will be re-watered and observation of the gate operations and course performance in flow will be completed.
B. The river will be observed at normal flow rates during start-up. Adequate time for the ENGINEER to observe, survey and complete documentation shall be allowed for all available flow conditions (3 flows in range – 8 hours per flow for observation). It is anticipated that the period for observation of performance and the tuning activities during the construction phase of the PROJECT will occur for up to a 3-month period after initial re-watering of the course is performed.

3.03 TUNING AND MODIFICATIONS

A. Tuning of all Drops is anticipated after initial flows are observed through all the Drops. Adequate observation time shall be allowed for the ENGINEER to observe, survey and complete documentation for before and after installed modifications and tuning efforts. Following the start-up, re-watering, and initial observation of performance of the course; three iterations of rearranging, adding, attaching, and removing the tuning blocks and materials in the required tuning areas are

anticipated over a period of up to 3 months. These modifications will require remobilization, dewatering and/or working in submerged conditions. In the last iteration, the materials in the tuning areas will be permanently replaced with grouted boulders and/or sculpted concrete.

B. Tuning and modifications will include but not be limited to the following:
    1. Adjustable Wave Feature and Appurtenances: Including operating the Adjustable Wave Feature over a range of flows, installing and adjusting apparatus that is designed to be adjusted or modified, calibrating, and verification of inclinometers. Adjustable Wave Feature system will be operated by the CONTRACTOR as directed by the ENGINEER to evaluate the hydraulic (wave) performance over the system range. CONTRACTOR will assist ENGINEER in documenting hydraulic and system performance. CONTRACTOR at the direction of the ENGINEER shall construct temporary items to attach to the Adjustable Wave Feature gates or foundation/structures adjacent. CONTRACTOR shall fabricate and install permanent items per ENGINEER modification DRAWINGs/sketches.
    2. Tuning Blocks: Precast concrete tuning blocks are used for altering hydraulic characteristics of in-river structures. Tuning blocks shall be attached to the drops as shown on the DRAWINGs or as directed by the ENGINEER. During the observation period, the ENGINEER will evaluate needed modifications to the tuning block configurations to achieve the desired hydraulic conditions. The CONTRACTOR shall provide localized water control and dewatering for installation of the blocks, attach new blocks, rearrange original blocks, or a combination of the two as directed by the ENGINEER
    3. Adjustments to Grouted Boulders, Loose Boulders, Sculpted Concrete, and Riverbed: Shape and sizes of individual surface boulders and sculpted concrete vary significantly, and local flow patterns often need to be modified. Because of these and other factors, adjustment to, addition of, or replacement of, individual grouted boulders and/or addition of grout masses and/or sculpted concrete may be required to achieve performance goals for the overall PROJECT. The CONTRACTOR shall exercise proper care in this WORK so that all other portions of the PROJECT remain undamaged. Adjustments should be expected at each drop and each jetty.
    4. Time Period for Modifications: The CONTRACTOR shall be responsible for providing all materials, localized water control and dewatering, equipment and personnel required to facilitate observation of performance and carry out Modifications as directed by the ENGINEER. The maximum river flow that

may occur during completion of the tuning WORK during the construction phase is dependent on the type and location of tuning modifications to be completed by the CONTRACTOR and the available river flows. The scheduling of these tuning efforts can be adjusted as coordinated by the CONTRACTOR to target lower river flows and will be coordinated and agreed upon with the ENGINEER. It should be anticipated that 10 crew days over a period of up to 3 months (dependent on river flows and complexities of the tuning modifications required) for completion of tuning and modifications will be required prior to final acceptance of the whitewater course and completion of construction. During the tuning phase, the crew shall be prepared to perform modifications within 2 days after receiving direction of the ENGINEER.

5. Payment Methods for Tuning Modifications: Following the start-up, and during the observation period, the ENGINEER will prepare memorandums and sketches detailing requested Modifications. Tuning and modifications of Tuning Blocks (including furnishing blocks) and Adjustable Wave Feature shall be included in the CONTRACTORs Lump Sum BID Price. Other Items requiring Modifications for tuning will be paid for by negotiating change orders based on existing unit prices in the Schedule of Values provided by the CONTRACTOR. If the required adjustment is a result of workmanship that does not meet the tolerances for grades or the dimensions provided on the DRAWINGs, the costs of adjustment will be borne by the CONTRACTOR.
6. Additional Tuning Efforts: Efforts and modifications for other tuning measures beyond the iterations and tuning modification efforts discussed in this SPECIFICATION; including but not limited to removal of loose or grouted boulders, addition of grouted boulders, addition of concrete or sculpted concrete, or modification of the Adjustable Wave Feature; will be paid for by either negotiating change orders based on the existing contract unit prices or time and material pricing provided by the CONTRACTOR. Due to the fact that the river flows available for observations and tuning modifications during the PROJECT construction period may be limited, it is possible that evaluation of the whitewater course may not be feasible for all of the target flows. Therefore, it should be expected that post-construction tuning of the whitewater course may be required to enhance hydraulic performance of the whitewater features. If required, any future post-construction tuning will be performed under a separate contract at the discretion of the Client.

END OF SECTION