

HYDRAULIC REPORT

Route: Dixie Highway
Section: Crossing of Unnamed Tributary to Cherry Creek
Water Course: Unnamed Tributary to Cherry Creek
Municipality/County: East Hazel Crest / Cook County
Project No.: P-91-060-78, PTB #154/020, WO #007
Structure No.: N/A

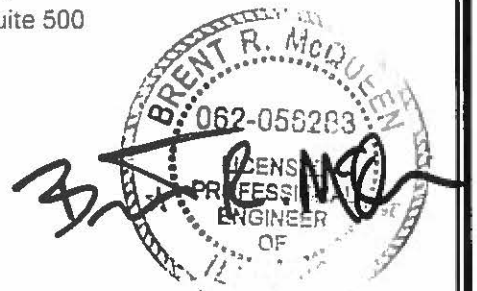
FOR

**DISTRICT ONE
HYDRAULICS SECTION
BUREAU OF PROGRAMMING
IDOT - DIVISION OF HIGHWAYS**

Prepared By:



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Dated: August 31, 2011

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SECTION 1

NARRATIVE

HYDRAULIC REPORT NARRATIVE

DIXIE HIGHWAY SOUTH OF 174TH STREET

I. PROJECT DESCRIPTION

The subject of this project is an existing 3' x 8' box culvert under Dixie Highway, located just south of 174th Street in East Hazel Crest, Illinois. The existing box culvert is in poor condition at the construction joints, with soil leaking through the joints. Due to its poor condition, the structure is proposed to be replaced in the near future. The goal of this report is to determine the appropriate size of the box culvert replacement.

This project will analyze the approximately 0.05 square-mile upstream drainage area that is tributary to the box culvert. In addition, this report will analyze approximately 1600' of the unnamed tributary to Cherry Creek, located immediately downstream of the subject culvert.

II. SITE INFORMATION

The existing box culvert under Dixie Highway has a span of 8 feet, a height of 3 feet, and a hydraulic length of 65 feet. Both the upstream and downstream side of the existing culvert contain sediment and debris reducing the allowable flow area and capacity of the culvert. To our knowledge, there are no projects currently under construction, nor are there any known proposed projects located upstream or downstream that may be affected by the replacement of the existing box culvert.

The subject box culvert is located in a highly developed area with residential, commercial, and institutional developments in the immediate area. The majority of the upstream tributary area is comprised of hardscape, including houses, roadways, and parking lots. A residential subdivision and a strip mall commercial building exist only a few hundred feet upstream of the existing culvert. The foundation elevations and lowest entry elevations for these buildings were determined by the topographic survey for the project.

Downstream of the existing box culvert, the unnamed tributary to Cherry Creek flows through the Calumet Country Club Golf Course. There are periodic golf cart crossings spaced throughout the channel length, where the channel flows under a grassed or paved cart crossings via a storm sewer. The tributary eventually flows into a culvert that outlets into Cherry Creek and ultimately flows under the Interstate 80/294 through three large box culverts. Per the Federal Emergency Management Agency's Flood Insurance Rate Map Number 17031C0733J, the unnamed tributary to Cherry Creek is not located in the regulatory floodway or floodplain.

A site plan depicting the location of the existing box culvert and surrounding areas is shown on Exhibit 6.1, while photos of the channel and structure are shown on Exhibit 5.1. A streambed profile for the unnamed tributary is depicted on Exhibit 6.5. Cross-sections of the existing channel are shown on Exhibit 6.2.

III. RESULTS OF FIELD INSPECTIONS

Site observations showed that the existing 3' x 8' box culvert contains a layer of sediment and debris on both the upstream and downstream faces. The downstream culvert opening is blocked by branches, tree brush, and an existing chain link fence.

IV. HISTORICAL OBSERVATIONS

The Bureau of Maintenance has reported no record of Dixie Highway flooding at the immediate location of the box culvert subject to this report. Local residents and golf course employees noted the presence of water in the channel travelling through the golf course, but did not remember any flooding issues associated with the culvert.

V. OTHER STUDIES AND AFFECTED AGENCIES

As stated previously, the existing box culvert and the immediate upstream and downstream areas are not located within the FEMA designated floodplain. Therefore, no existing model of the unnamed tributary to Cherry Creek exists.

The Illinois State Toll Highway Authority (ISTHA) commissioned Stanley Consultants, Inc. to prepare a Final Concept Drainage Report for the roadway and bridge widening of the Tri-State Tollway I-294/I-80 in 2004. This included study of the existing triple box culvert that carries Cherry Creek under the Tri-State Tollway. Copies of the proposed plans and report were provided by the ISTHA. The proposed head water elevation listed in the Waterway Information Table for the triple box culvert was utilized as the starting tail water elevation for this analysis. Copies of the Report and Plans are included in Exhibits 10.1 and 10.2 of this report.

The datum utilized for the ISTHA plans and report was NAVD 88. NAVD 88 datum was utilized for the stream survey and topographic survey performed by Mackie Consultants, LLC in connection with this report.

VI. SENSITIVE FLOOD RECEPTORS

As mentioned previously, a residential subdivision and a strip mall commercial building exist only a few hundred feet upstream of the existing culvert. The foundation elevations and lowest entry elevations for these buildings were determined by the topographic survey for the project. These adjacent buildings are depicted in the Plan View / Survey Layout Exhibit 6.1.

VII. HYDROLOGIC METHODOLOGY

The existing upstream tributary area was determined through the interpretation of existing 1' contour mapping provided by IDOT, proposed Engineering Plans for 175th Street, Dixie Highway Improvements prepared in 1999, aerial photography, and field observations. This analysis determined an upstream tributary area of approximately 0.05 square miles separated into three smaller tributary areas. Runoff curve numbers and times of concentration were determined for each tributary area using TR-55 methodology.

Precipitation data was obtained using Illinois State Water Survey Bulletin 70 Isohyetal patterns for the Chicago Urban area and Huff Distributions. The 500-year storm depth was extrapolated on lognormal paper by plotting the 10-year, 50-year, and 100-year events.

A critical storm duration analysis of the upstream tributary areas to the existing box culvert was performed using the Soil Conservation Service TR-20 Program. The 1, 3, 6, 12, and 24-hour storm events were modeled for the 100-year storm frequency. The results of the critical duration analysis are depicted in the table below:

Storm Duration	1-hour	3-hour	6-hour	12-hour	24-hour
Peak Flow (cfs)	119.71	93.51	71.28	41.73	27.56

Based on the critical duration analysis results depicted above, it was determined that the 1-hour storm event produces the highest flows.

A flow analysis was then performed for the 1-hour duration storms using the TR-20 program. The 1-year, 2-year, 5-year, 10-year, 50-year, 100-year, and 500-year storm frequencies were modeled. The results of the TR-20 model are depicted in the table below:

Storm Frequency	1-year	2-year	5-year	10-year	50-year	100-year	500-year
Peak Flow (cfs)	23.48	31.43	46.64	60.41	98.71	119.71	155.82

A copy of the TR-20 input calculations and both TR-20 models have been included in Section 8 of this report.

VIII. HYDRAULIC ANALYSIS

The Army Corps of Engineers' HEC-RAS computer program was used to model the unnamed tributary to Cherry Creek. The tributary was analyzed at a point approximately

1700' downstream of the box culvert under Dixie Highway to a point approximately 60' upstream of the culvert. Flows calculated in the hydrologic analysis of the upstream tributary area were utilized in the HEC-RAS model.

All cross-sections used in the model were surveyed by Mackie Consultants, LLC perpendicular to the existing channel flow. In an effort to extend the cross-sections out from the channel as far as possible, surveyed cross-section data was supplemented with data from the 1' contour map provided by IDOT. Channel and overbank Manning's roughness coefficients were assigned values based on field inspection and survey data.

Copies of proposed improvement plans and the final Concept Drainage Report associated with the Roadway and Bridge Widening of I-294 / I-80 were provided by the Illinois State Toll Highway Authority. These documents included the triple box culvert under I-294 / I-80 (Structure 122C) which the unnamed tributary to Cherry Creek outlets into. The proposed head water elevation for the culverts was utilized as the starting proposed tail water elevation for this study.

A summary of the calculated existing conditions is provided below:

100-Yr Design Water Surface Elevation: 623.97

Low Road Elevation: 624.66

The Small Culvert Waterway Information Table provided in Section 3 summarizes the inputs and results of the existing model.

IX. PROPOSED CONDITIONS

Based upon site observations, the existing 3' x 8' box culvert under Dixie Highway at 174th Street is deteriorating and should be replaced. Based on the existing hydrologic and hydraulic analysis, the existing culvert appears to be functioning adequately. Therefore, in the proposed conditions analysis, a new 3' x 8' box culvert is proposed to replace the existing culvert. The HEC-RAS program was again utilized to model the unnamed tributary to Cherry Creek with a new culvert under Dixie Highway.

The bottom of the existing box culvert is filled with a layer of sediment that has accumulated over time. In addition, there is existing foliage and debris that restricts some of the flow through the existing culvert. In the proposed model, these existing restriction are corrected. All other inputs into the proposed conditions model remained the same as the existing conditions model.

A summary of the calculated proposed conditions is provided below:

100-Yr Design Water Surface Elevation: 624.00

Low Road Elevation: 624.66

The Small Culvert Waterway Information Table provided in Section 3 summarizes the inputs and results of the proposed model.

X. PERMIT REQUIREMENTS

Since the unnamed tributary is not located in a floodway or floodplain, no permits through the Office of Water Resources or the Army Corps of Engineers should be required.

XI. CONCLUSIONS

The following are the conclusions of this report:

- The flows of the unnamed tributary to Cherry Creek as it travels under Dixie Highway were determined to be:

10-year:	60.41 cfs
50-year:	98.71 cfs
100-year:	119.71 cfs
500-year:	155.82 cfs
- The design (50-year) and base (100-year) water surface elevations for the existing 3' x 8' box culvert are well below the existing Dixie Highway and adjacent structures.
- The existing culvert size of 3' x 8' appears to be adequate.

SECTION 2

HYDRAULIC REPORT DATA SHEETS



Route	<u>Dixie Highway</u>	P or D #	<u>P-91-060-78</u>
Section	<u>Crossing of Unnamed Trib to Cherry Creek</u>	PTB #	<u>154/020</u>
County	<u>Cook</u>		
Exist SN	<u>N/A</u>		
Prop SN	<u>N/A</u>		

General Information

- Name of the Stream: Unnamed Cherry Creek Tributary
- Location of the Structure: SE Township 1/4 of the 36N, SW Range 14E 1/4 of Section 30, of the 3RD P.M.
- Hydraulic Report Prepared By: Consultant Mackie Consultants, LLC
 District
- Hydraulic Report Approval Authority: District – Post PDF of HR to BBS Hydraulics SharePoint Server
 BBS Hydraulics - Submit 2 hard copies of HR to BBS Hydraulics

Site Design Data

- Drainage Area (sq. mi.): 0.05
- Highway Classification: Rural Principal Arterial
 Urban Minor Arterial
 Other Collector
 Local
- Design Frequency: 30 yr 50 Yr. Other _____
- Number of Waterway Information Tables (WIT): 1
If more than one, explain: _____

Hydrologic & Hydraulic Analysis

- Hydrology Modeling (check all that apply): USGS/Stream Stats FIS Gage Data
 Other TR-20
- Hydraulic Modeling (check all that apply):
 - Method: HEC-RAS WSPRO Other _____
 - Manning's "n" values determined as per IDOT DM CH.5? Yes No
If no, explain: _____
 - Source of Starting WSE: IDOT CHERRY CREEK CULVERT (122C) PLAN DATA
 - Non- IDOT encroachments in Survey? Yes No
If yes, are they accounted for? Yes No
 - Does the Tailwater Control? Yes No
If yes, list: _____
 - Were the Expansion/Contraction cones properly addressed? Yes No N/A
If No or N/A, explain: _____

g. What Expansion and Contraction Rates were used?

Expansion: 4 (X:1)

Contraction: 1 (X:1)

IDNR - OWR Floodway Permit

11. Is area experiencing urbanization or expected to urbanize within 10 years? [X] Yes [] No

12. Are there any sensitive flood receptors located upstream within possible backwater influence? [] Yes [X] No
If yes, list and describe critical upstream flood damageable properties and their elevations.

13. Is there any History of Flooding or Overtopping problems? [] Yes [X] No
Sources of Observed Highwater:

14. Is the structure hydraulically connected to or within the floodway of an IDNR-OWR designated Public Body of Water? [] Yes [X] No

15. Required IDNR - OWR Permit type:
[] Individual [] SWP #2 [] SWP #12 [] Floodway
[X] None [] Other

Proposed Structure Data

16. Project Scope (check all that apply):

- a. [X] Complete Replacement
b. [] Superstructure Replacement
c. [] Superstructure Widening; Length of Pier Extension in the water:
U/S _____ D/S _____
d. [] Bridge [] Culvert
e. [] New Alignment
f. Work Planned Below Q100 HWE? [] Yes [] No
g. [] Profile Raise

17. If a bridge is proposed, supply:
Flow line elevation (ft): _____ Abutment type: _____
Preliminary low beam elevation (ft): _____ Skew (degrees): _____
Width of deck (ft): _____ Number of spans: _____
Total length from face to face of abutment (ft) _____

18. If a culvert is proposed, supply:
Type and size: 3'x8' Box Length (ft): 65
Upstream invert elevation (ft): 620.04 Entrance type: 90 degree headwall
Downstream invert elevation (ft): 619.35 Skew (degrees): _____
Note: Upstream and downstream elevations should reflect the elevations before the 3" drop is applied

19. If a three-sided structure is proposed, supply:
Flow line elevation (ft): _____ Skew (degrees): _____
Span (ft): _____ Length (ft): _____
Height (ft): _____ Number of spans: _____

20. a. Is the IDOT Clearance Policy Met? [] Yes [] No [X] NA Value (ft): _____
b. Is the IDOT Freeboard Policy Met? [] Yes [X] No [] NA Value (ft): 1.6

21. Type of streambed soil: [] Clay [] Silt [] Sand [X] Loam [] _____

22. Scour/ Migration Problems: None/Minimal Significant Severe

Comments:

Ice Concerns: None/Minimal Significant Severe

Comments:

Debris Concerns: None/Minimal Significant Severe

Comments:

Countermeasures Proposed:

Existing Structure Data

	Structure U/S	Subject Structure	Structure D/S
23. Distance from proposed structure: (ft.)	N/A	-	2500
24. Type of structure:		3'x8'Concrete Box	3-7'x12' Concrete Box
25. Low beam elevation:		622.74	623.59
26. Flow line elevation:		619.74	616.59
27. Maximum known high water elevation:		-	-
28. Date of maximum high water:		-	-
29. Cause (backwater, headwater, etc.):		-	-
30. Does structure carry entire design flood flow?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
If not, state area of additional waterway opening: (ft ²)		-	-
31. Type and size of existing overflow structures:		-	-
32. Has adverse scour occurred under or adjacent to the structure?		No	No
33. Classify type of scour and/or aggradation / degradation:		-	-

Required Additional Data

34. Deviations from the General Procedures presented in IDOT DM CH. 2, CH.6, and CH.7:

35. Information regarding high water from other streams, reservoirs, flood control projects, proposed channel changes, or other controls affecting proposed waterway area:

36. Site Inspection made by: Brent McQueen

Date: 06-23-11

Remarks:

37. Prepared by: Brent McQueen

Date 08-29-11

Signed (QA/QC): 

Date 8-31-11

SECTION 3

WATERWAY INFORMATION TABLE

GENERAL INFORMATION:

ROUTE: Dixie Highway
SECTION: Crossing of Unnamed Tributary to Cherry Creek
COUNTY: Cook

PREPARED BY: TRB
DATE: 08/25/11
CHECKED BY: BRM
DATE: 08/26/11

WATERWAY INFORMATION

Drainage Area: 32.45 Acres Low Grade Elevation Exist. : 624.66 Low Grade Elevation Prop. : 624.66				
Flood	Freq. (Yr.)	Q (C.F.S.)	Headwater El. (Ft.)	
			Exist.	Prop.
Ten-Year	10	60.4	623.31	623.32
Design	50	98.7	623.73	623.75
Base	100	119.7	623.97	624.00
Max. Calc.	500	155.8	624.76	624.78
10-year Velocity through Existing Culvert = 2.52ft/s 10-year Velocity through Proposed Culvert = 2.52ft/s				

SCOPE OF WORK: Replace Existing Box Culvert

EXISTING CULVERT:
Type: 3ft x 8 ft Single Barrel Concrete Box
Length: 65ft
U/S Flowline: 620.04
D/S Flowline: 619.35
Skew: 0°

PROPOSED CULVERT:
Type: 3ft x 8 ft Single Barrel Concrete Box
Length: 65ft
U/S Flowline: 619.74
D/S Flowline: 619.03
Skew: 0°

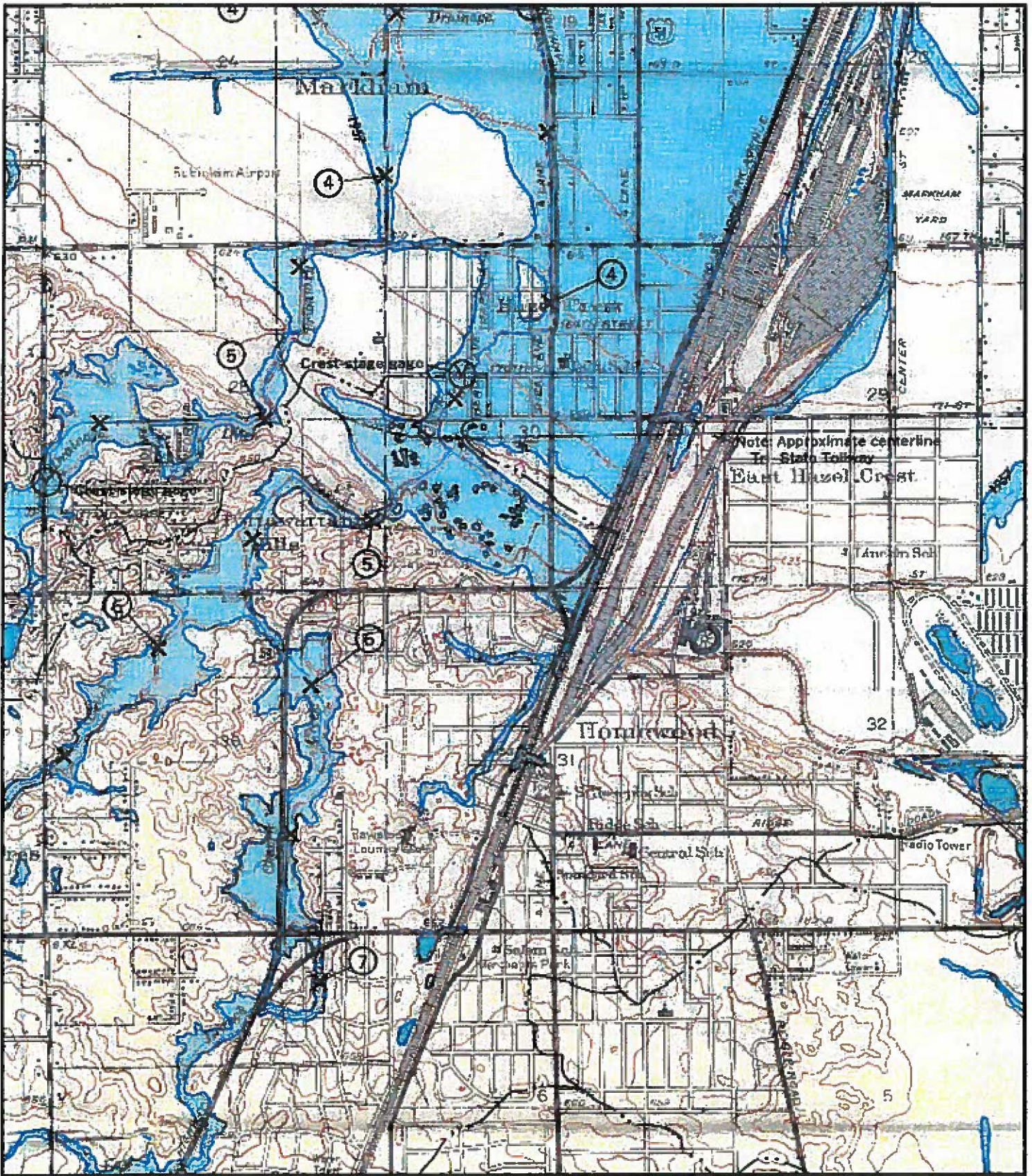
EXISTING DROPBOX: N/A

PROPOSED DROPBOX: N/A

COMMENTS:

SECTION 4

USGS HYDROLOGIC INVESTIGATIONS ATLAS



Note: Approximate centerline
To State Tollway
East Hazel Crest.



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DATE	DESCRIPTION OF REVISION	BY

LOT	
DESIGNED	
DRAWN	
APPROVED	
DATE	08-30-11
SCALE	1:24000

**USGS HYDROLOGIC
ATLAS EXHIBIT
DIXIE HIGHWAY
AT 174TH STREET
EAST HAZEL CREST, IL**

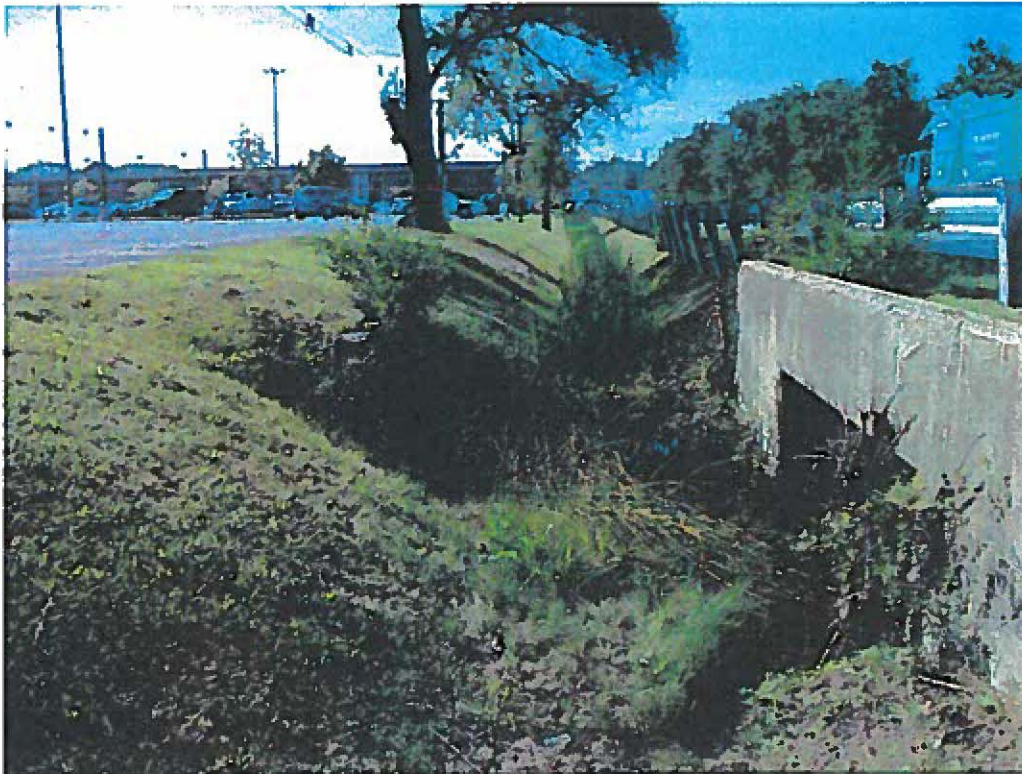
SHEET	1 OF 1
PROJECT	1909
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SECTION 5

PHOTOGRAPHS

EXHIBIT 5.1

GENERAL SITE PHOTOGRAPHS



Upstream view of Unnamed Tributary to Cherry Creek from Dixie Highway Culvert



Existing 3'x8' Box Culvert (Upstream View)



Existing 3'x8' Box Culvert (Downstream View)



Downstream View of Unnamed Tributary from Dixie Highway Culvert



Wooden Bridge Crossing Unnamed Tributary to Cherry Creek

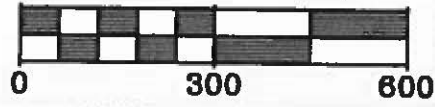


Downstream View of Unnamed Tributary from Wooden Bridge

I-294 / I-80

N

SCALE 1" = 300'



175TH STREET

DIXIE HIGHWAY

GOVERNOR'S HIGHWAY

M
Mackie Consultants, LLC
8575 W. Maple Road, Suite 600
Rosemont, IL 60018
630-477-1400
www.mackieconsultants.com

CLIENT:
ILLINOIS DEPT. OF TRANSPORTATION
201 W. CENTER COURT
SCHAUMBURG, ILLINOIS 60196

DATE	DESCRIPTION OF REVISION	BY

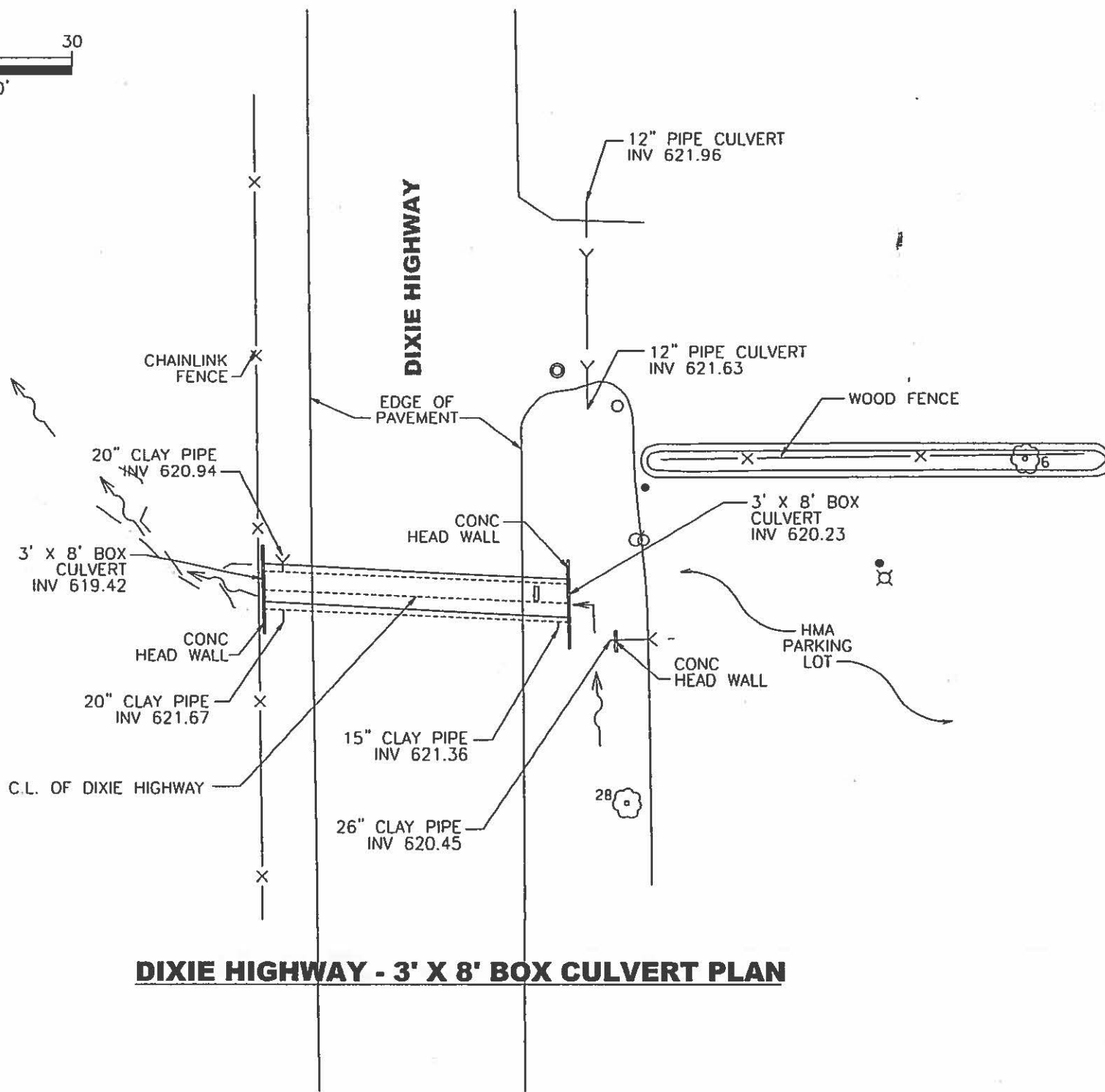
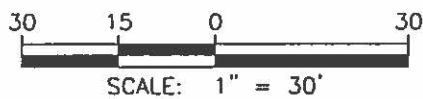
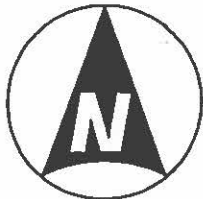
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APPROVED	DAS
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AERIAL EXHIBIT
DIXIE HIGHWAY AND 174TH STREET
EAST HAZEL CREST, ILLINOIS

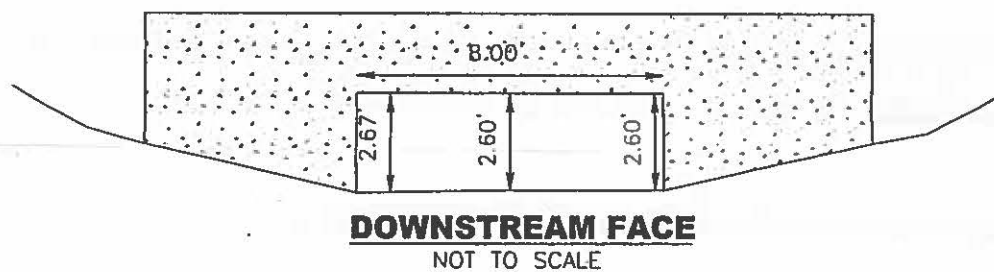
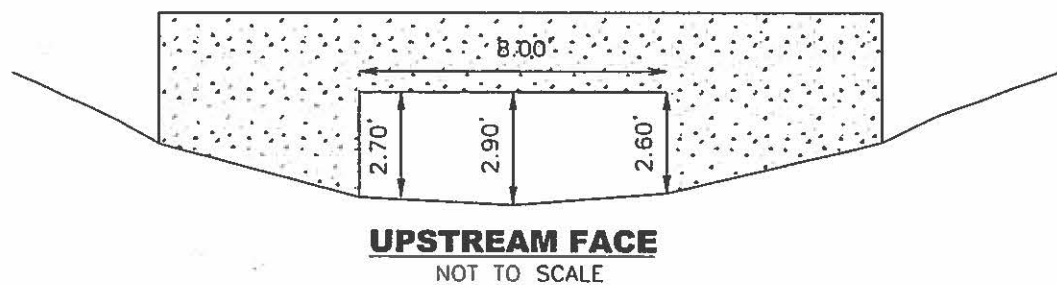
EXHIBIT
5.2
PROJECT NUMBER: 100
ENGINEER CONSULTANTS U.S. INC.
ILLINOIS PROFESSIONAL LICENSE 04-00284

SECTION 6

CROSS SECTION, PLAN AND PROFILE DRAWINGS



DIXIE HIGHWAY - 3' X 8' BOX CULVERT PLAN



TITLE: DIXIE HIGHWAY CULVERT
 ROUTE: DIXIE HIGHWAY
 WATERCOURSE: CHANNEL TO CHERRY CREEK
 SURVEY DATE: AUGUST 2011
 PLOTTED BY: SMC DATE: 8/24/2011
 CHECKED BY: BRM DATE: 8/24/2011

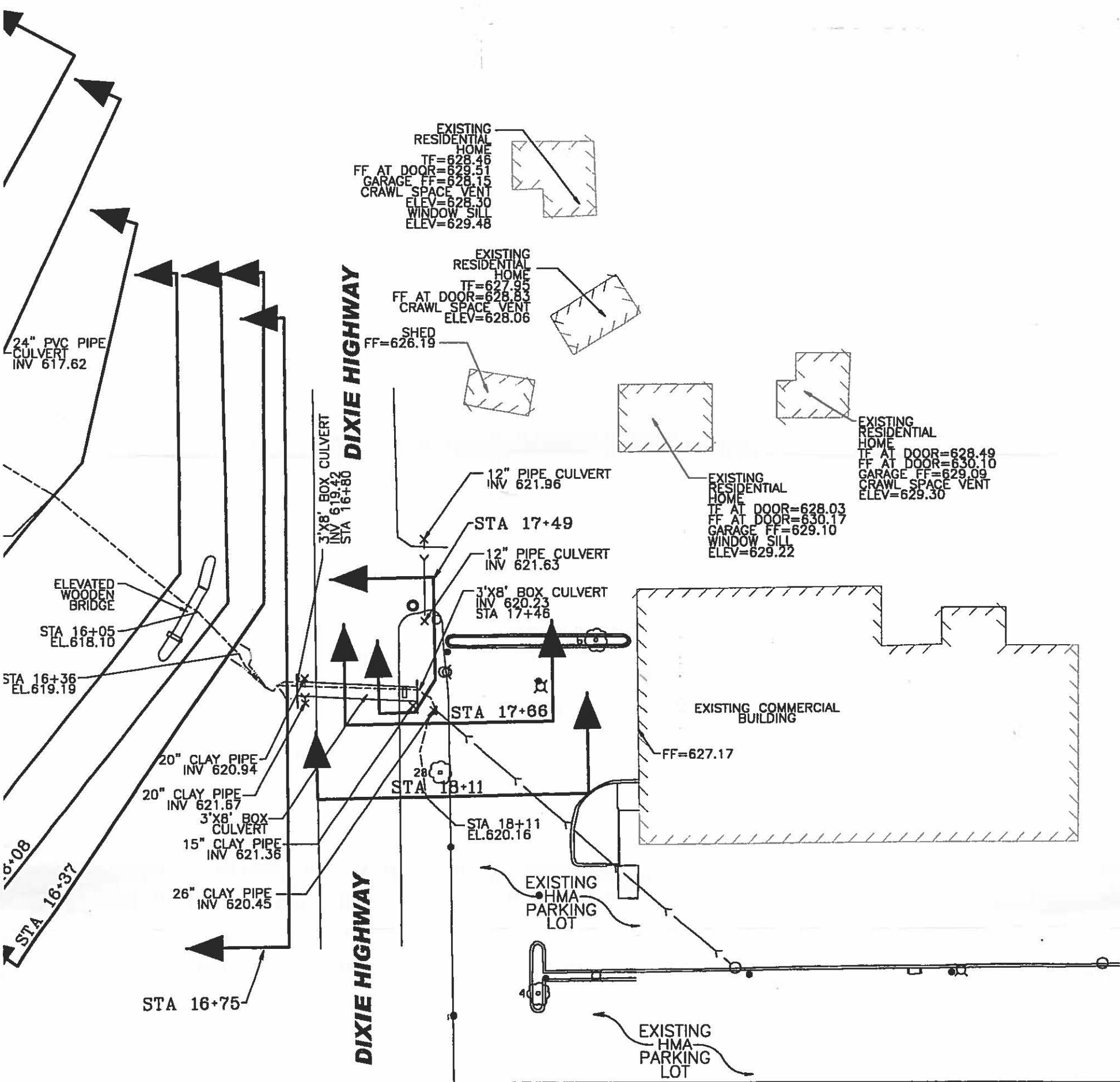


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 www.mackieconsult.com

DATE	DESCRIPTION	BY

EXHIBIT 6.3
3' X 8' BOX CULVERT PLAN
DIXIE HIGHWAY
EAST HAZEL CREST, IL

DATE: 08-23-11 DR BY: SMC PROJ NO: 1999



**PLAN VIEW / SURVEY LAYOUT
 UNNAMED TRIBUTARY TO CHERRY CREEK
 DIXIE HIGHWAY - EAST HAZEL CREST, ILLINOIS**

EX
 PROJECT
 © MACKIE
 ILLINOIS

ORTATION

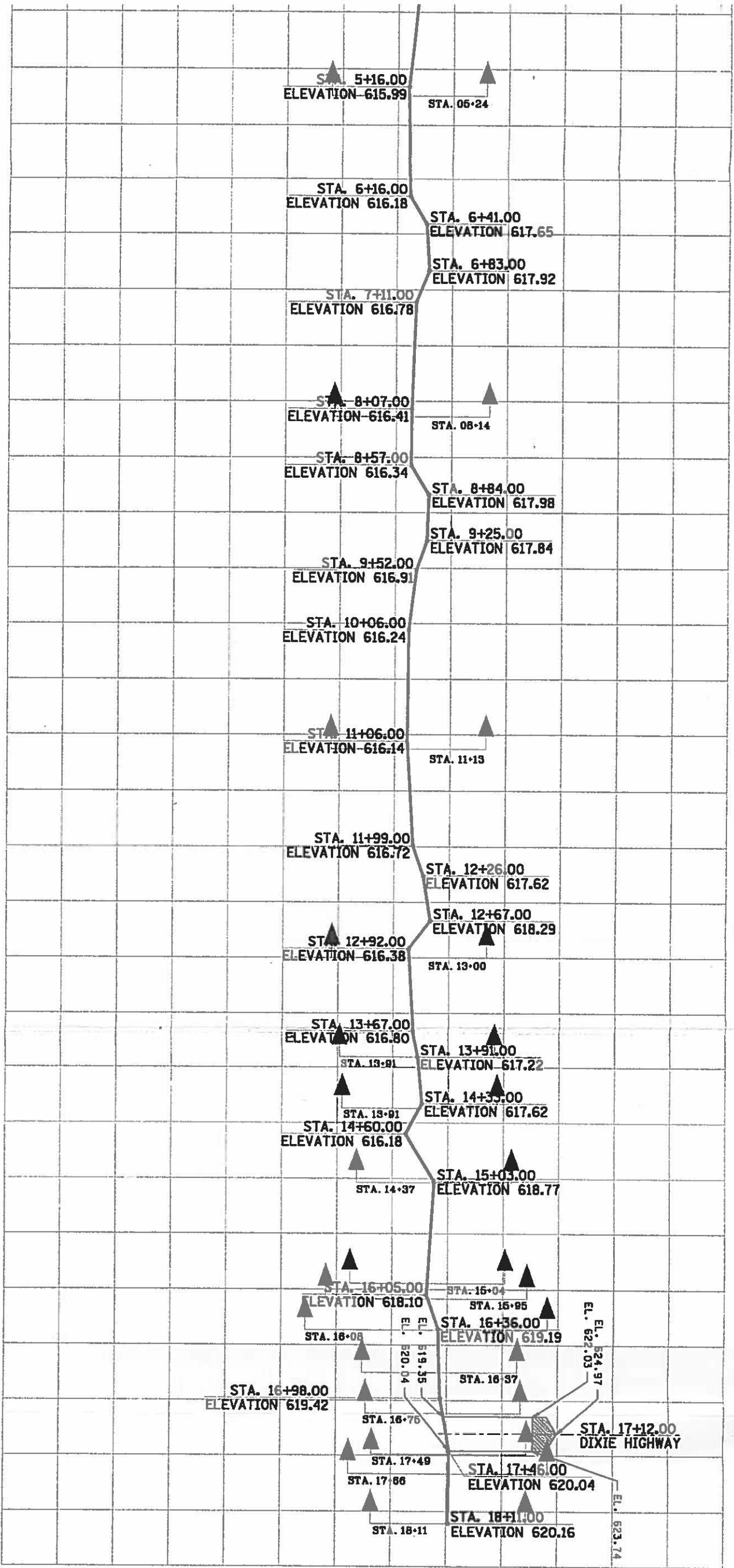
DESIGNED	DATE	BY
DRAWN	DATE	BY
APPROVED	DATE	BY
SCALE	DATE	BY

**UNNAMED CHERRY CREEK TRIBUTARY STREAMBED PROFILE
DIXIE HIGHWAY AT 174TH STREET
EAST HAZEL CREST, ILLINOIS**

EXHIBIT 6.5

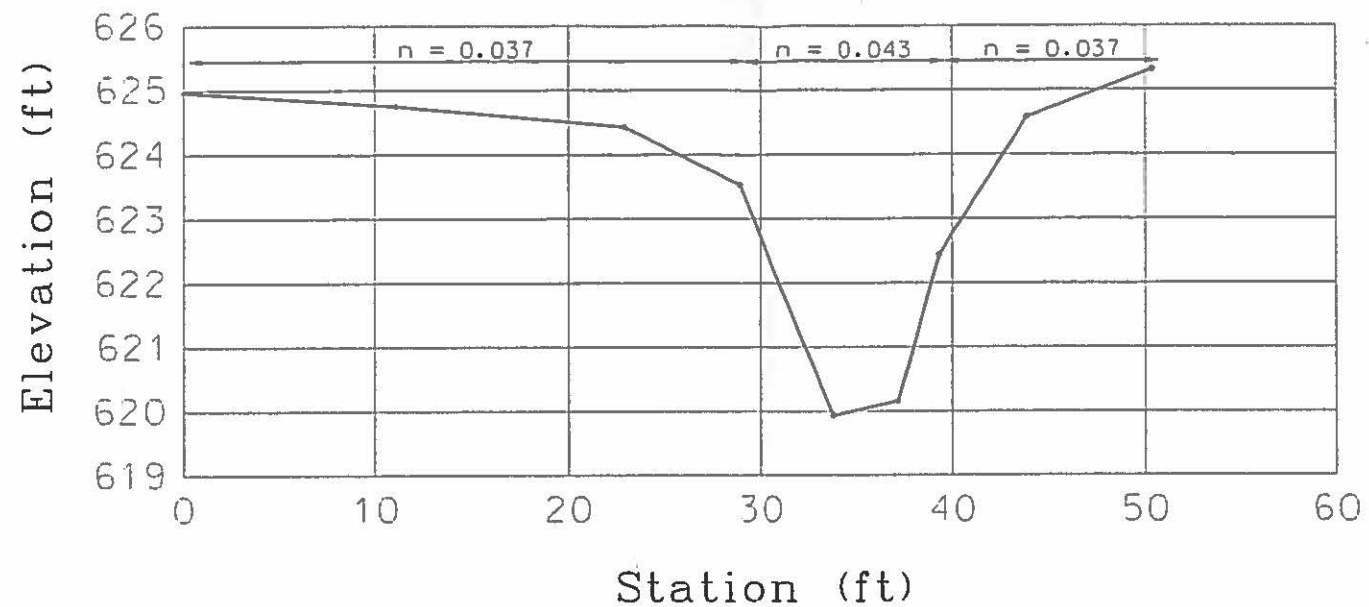
Station (ft)

5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00

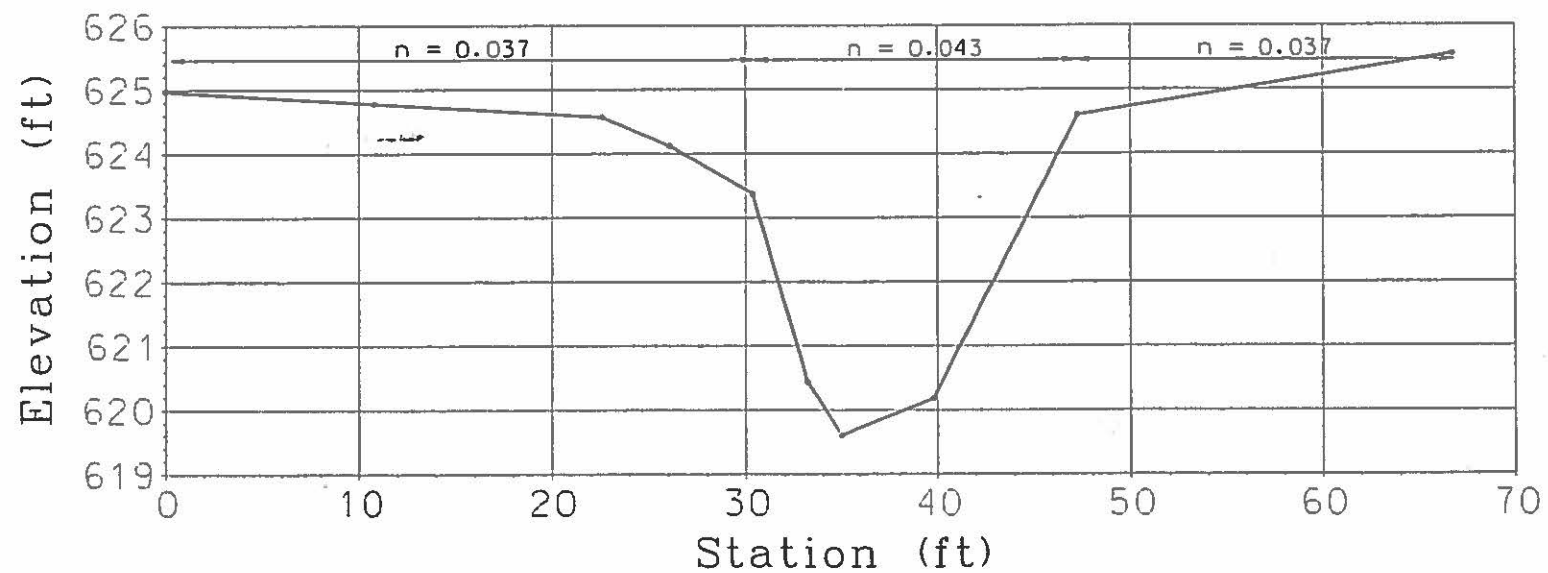


PROJECT NUMBER: 300
DESIGNED BY: J. J. JONES, INC.

Existing
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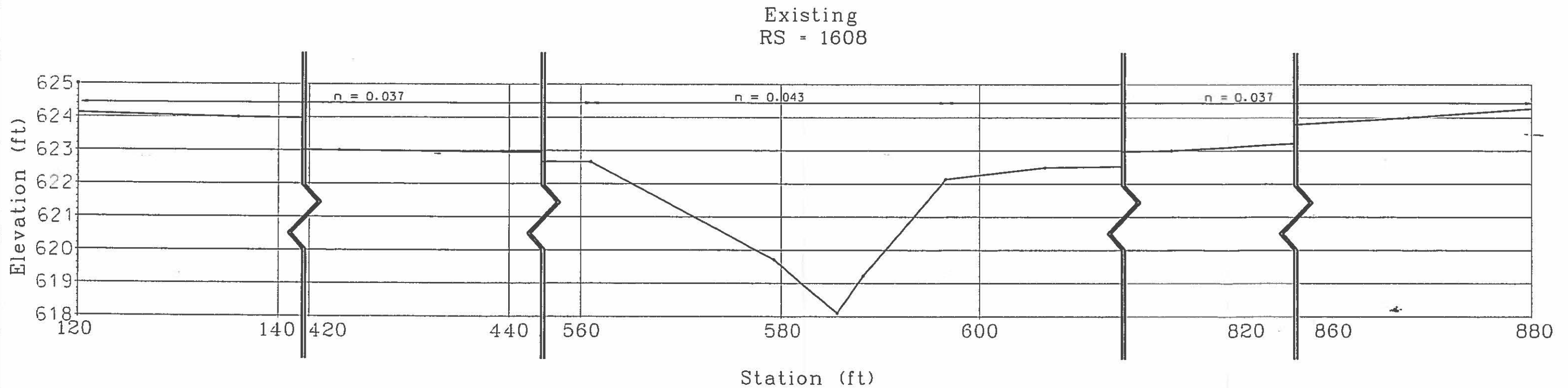
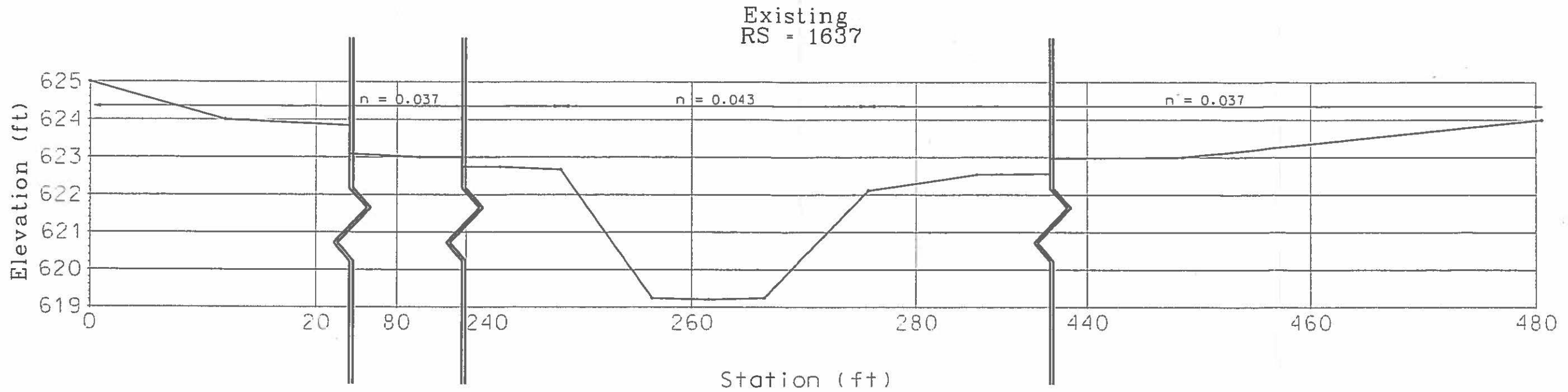


Existing
RS = 1766



DATE	DESCRIPTION OF REVISION	BY

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DRAWN	TRB
APPROVED	DAS
DATE	8-31-11
SCALE	1"=10H, 1"=3V



DATE	DESCRIPTION OF REVISION	BY	SCALE

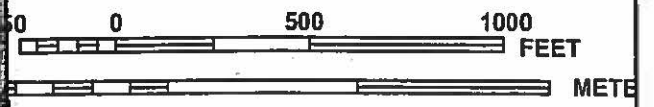
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DRAWN	TRB
APPROVED	DAS
DATE	8-31-11
SCALE	1"=10H, 1"=3V

SECTION 7

FEDERAL EMERGENCY MANAGEMENT AGENCY INFORMATION



MAP SCALE 1" = 500'



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0733J

FIRM
 FLOOD INSURANCE RATE MAP
 COOK COUNTY,
 ILLINOIS
 AND INCORPORATED AREAS

PANEL 733 OF 832
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COOK COUNTY	170054	0733	J
EAST HAZEL CREST, VILLAGE OF	170065	0733	J
HAZEL CREST, VILLAGE OF	170102	0733	J
HOMWOOD, VILLAGE OF	170109	0733	J
MARSHAM, CITY OF	175189	0733	J

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER
 17031C0733J
 MAP REVISED
 AUGUST 19, 2008

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



TRIBUTARY AREA A
AREA = 17.60 ACRES

DIXIE HIGHWAY

174TH