

Engineering Report



**Cherokee Nation
Housing Authority**

**709 N. Thompson Street
Vinita, Oklahoma
Craig County**

Prepared by:

Holloway, Updike and Bellen, Inc.

April 2023



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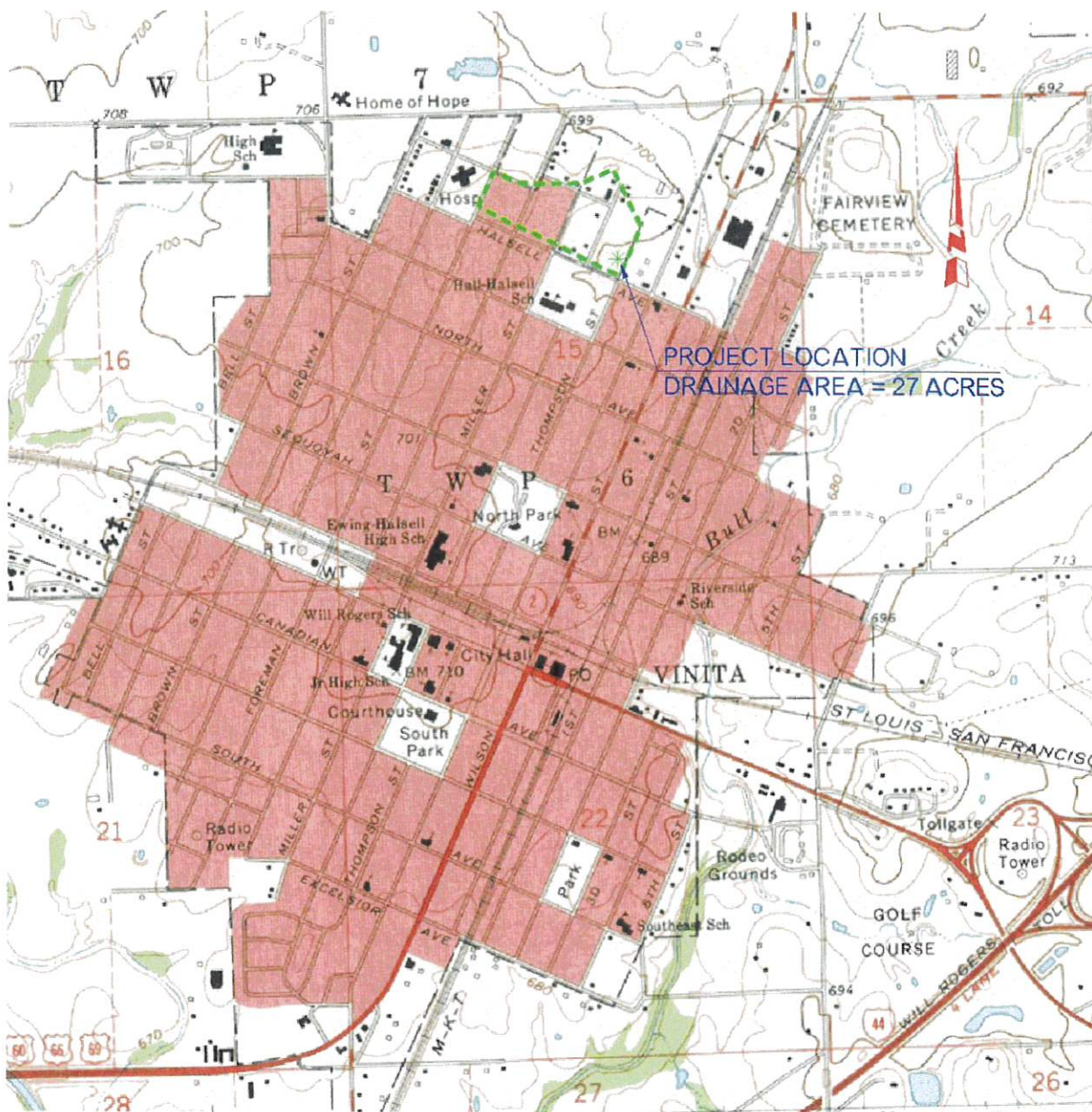
I Introduction

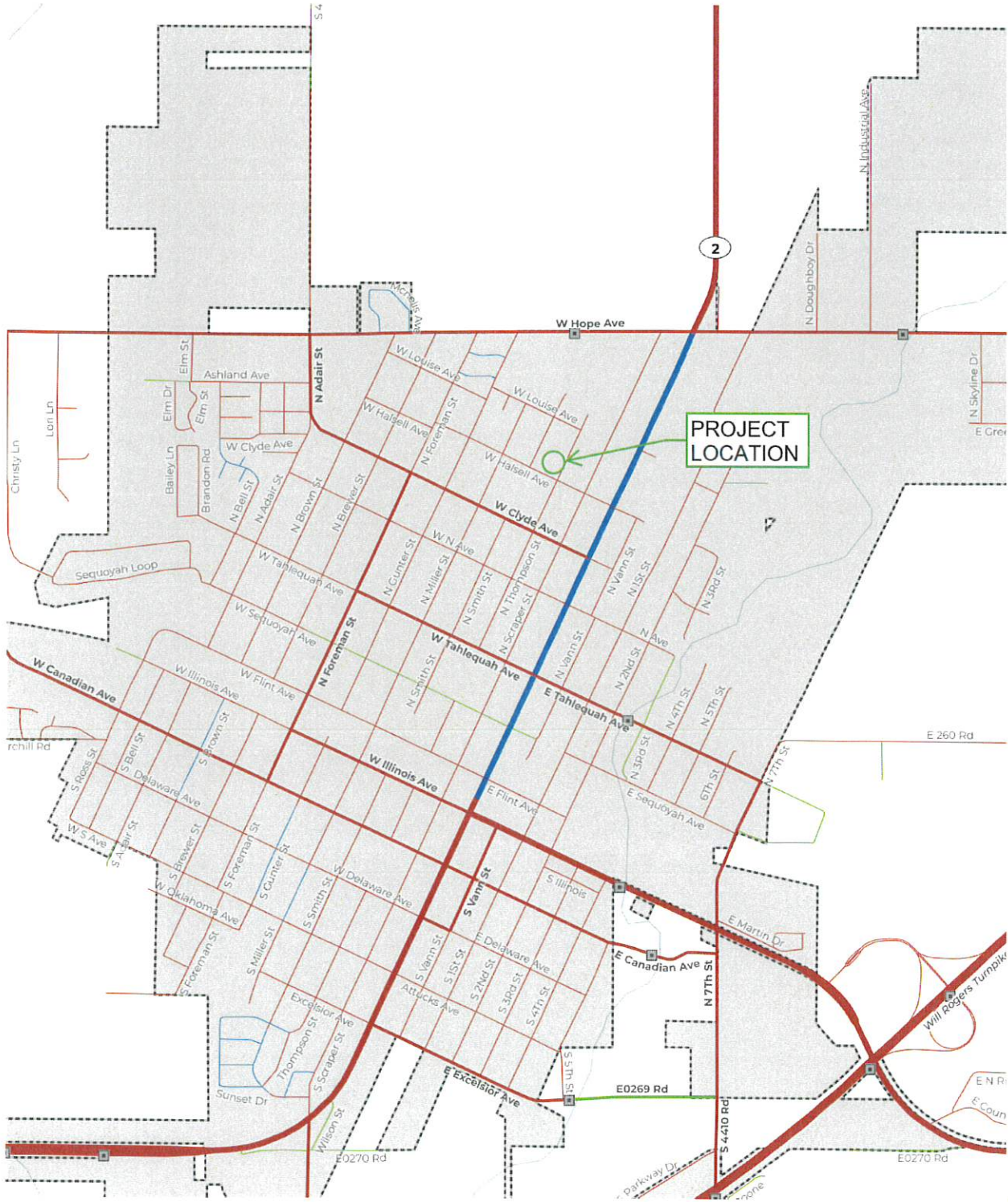
This report contains the Hydrology & Hydraulic findings, HEC models, and recommendations for the home located at 709 N. Thompson Street in Vinita, Oklahoma. The home is inundated with flash-flood waters that have happened in recent years and at particularly frequent intervals.

This homesite is in a portion of Craig County in vinita Limits and is designated as a FEMA Zone X.

Legal Description of Project Location: T25N R20E SEC 15.

Craig County





II General

The existing home has sustained water damage from flash flooding numerous times in recent years. Drainage from the northwest meanders and makes its way to the backyard of the property via a 12" diameter corrugated steel pipe crossing the alley, as well as, under and the privacy fencing. This drainage flows east towards the south side of the house where it is restricted by an 8" diameter concrete pipe that flows to Thompson Street. This inlet to this 8" pipe is susceptible to clogging from trash and debris collecting in the southeast portion of backyard area. Once clogged, the privacy fencing further restricts flow resulting in flash flood water rising above the finished floor elevation **699.01** of the home.

Future development is minimal and land use will not change over the life of the existing home.

III Design Flows / Hydrology

Hydrologic Method

Rational

NOAA Atlas 14, Volume 8, Version 2 VINITA 2 N
Station ID: 34-9203



Location name: Vinita, Oklahoma, USA*
Latitude: 36.6803°, Longitude: -95.1322°
Elevation:
Elevation (station metadata): 735 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

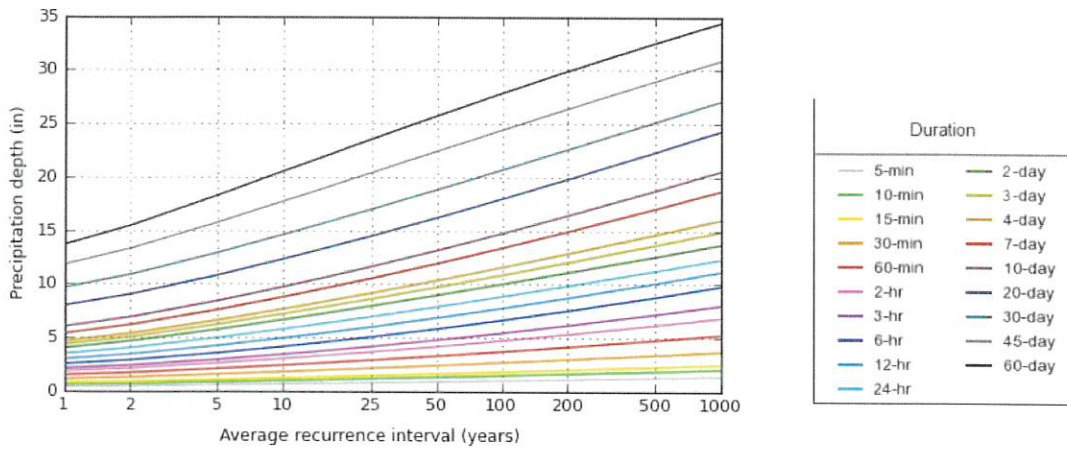
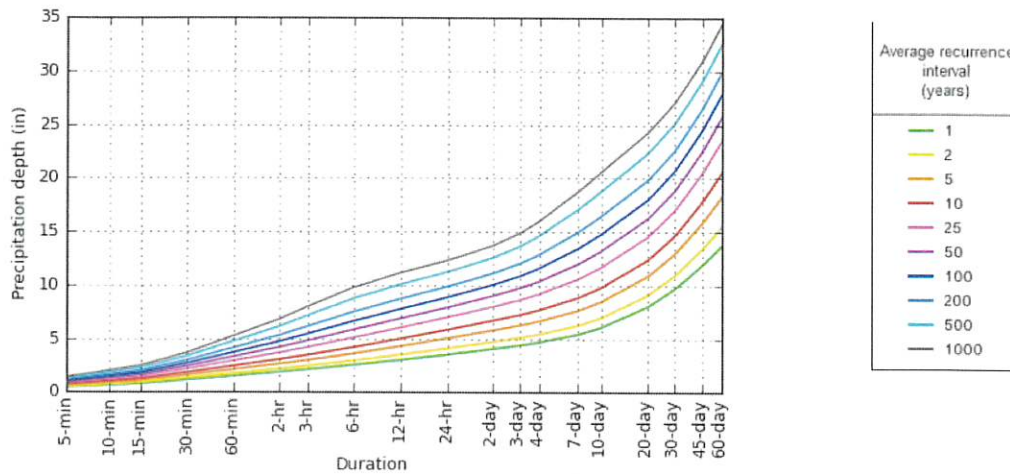
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.428 (0.338-0.536)	0.488 (0.385-0.612)	0.589 (0.464-0.741)	0.676 (0.530-0.855)	0.801 (0.610-1.05)	0.901 (0.672-1.19)	1.00 (0.725-1.36)	1.11 (0.773-1.55)	1.26 (0.845-1.80)	1.38 (0.899-1.99)
10-min	0.626 (0.495-0.785)	0.714 (0.564-0.896)	0.863 (0.679-1.09)	0.990 (0.776-1.25)	1.17 (0.894-1.53)	1.32 (0.983-1.75)	1.47 (1.06-1.99)	1.63 (1.13-2.26)	1.85 (1.24-2.63)	2.02 (1.32-2.91)
15-min	0.764 (0.604-0.958)	0.871 (0.688-1.09)	1.05 (0.828-1.32)	1.21 (0.946-1.53)	1.43 (1.09-1.87)	1.61 (1.20-2.13)	1.79 (1.30-2.43)	1.99 (1.38-2.76)	2.25 (1.51-3.21)	2.46 (1.61-3.55)
30-min	1.12 (0.884-1.40)	1.28 (1.01-1.61)	1.55 (1.22-1.95)	1.79 (1.40-2.26)	2.12 (1.62-2.77)	2.39 (1.78-3.16)	2.67 (1.93-3.61)	2.96 (2.05-4.11)	3.35 (2.25-4.78)	3.66 (2.39-5.29)
60-min	1.49 (1.18-1.87)	1.70 (1.35-2.14)	2.07 (1.63-2.61)	2.40 (1.88-3.03)	2.88 (2.20-3.78)	3.28 (2.44-4.35)	3.69 (2.67-5.01)	4.13 (2.87-5.75)	4.74 (3.18-6.78)	5.23 (3.42-7.56)
2-hr	1.86 (1.49-2.31)	2.13 (1.70-2.64)	2.60 (2.07-3.23)	3.02 (2.39-3.76)	3.64 (2.82-4.73)	4.16 (3.15-5.46)	4.71 (3.46-6.33)	5.30 (3.75-7.31)	6.14 (4.18-8.67)	6.81 (4.51-9.70)
3-hr	2.10 (1.70-2.59)	2.40 (1.93-2.96)	2.93 (2.36-3.62)	3.42 (2.73-4.24)	4.15 (3.25-5.37)	4.77 (3.64-6.23)	5.43 (4.02-7.25)	6.14 (4.38-8.41)	7.16 (4.93-10.0)	7.98 (5.34-11.3)
6-hr	2.53 (2.07-3.08)	2.90 (2.37-3.53)	3.56 (2.90-4.34)	4.16 (3.37-5.09)	5.06 (4.02-6.46)	5.82 (4.51-7.51)	6.63 (4.99-8.75)	7.52 (5.44-10.2)	8.77 (6.13-12.1)	9.78 (6.65-13.6)
12-hr	2.99 (2.48-3.59)	3.45 (2.85-4.15)	4.25 (3.50-5.12)	4.96 (4.07-5.99)	6.00 (4.81-7.53)	6.85 (5.38-8.77)	7.76 (5.90-10.1)	8.72 (6.40-11.6)	10.1 (7.13-13.7)	11.1 (7.69-15.3)
24-hr	3.49 (2.93-4.14)	4.05 (3.39-4.80)	4.99 (4.17-5.93)	5.80 (4.82-6.92)	6.96 (5.64-8.58)	7.89 (6.26-9.83)	8.85 (6.82-11.3)	9.85 (7.32-12.9)	11.2 (8.07-15.0)	12.3 (8.63-16.7)
2-day	4.04 (3.43-4.72)	4.68 (3.97-5.47)	5.75 (4.87-6.75)	6.67 (5.61-7.85)	7.96 (6.53-9.66)	8.98 (7.22-11.0)	10.0 (7.83-12.6)	11.1 (8.37-14.3)	12.6 (9.16-16.6)	13.7 (9.77-18.3)
3-day	4.38 (3.75-5.08)	5.06 (4.33-5.88)	6.22 (5.30-7.24)	7.20 (6.11-8.41)	8.60 (7.11-10.4)	9.70 (7.87-11.8)	10.8 (8.55-13.5)	12.0 (9.16-15.3)	13.6 (10.0-17.8)	14.9 (10.7-19.7)
4-day	4.65 (4.01-5.37)	5.37 (4.62-6.21)	6.59 (5.66-7.63)	7.64 (6.52-8.88)	9.13 (7.61-11.0)	10.3 (8.43-12.5)	11.6 (9.18-14.3)	12.8 (9.85-16.3)	14.6 (10.8-19.0)	16.0 (11.6-21.0)
7-day	5.37 (4.67-6.13)	6.18 (5.37-7.06)	7.57 (6.56-8.66)	8.77 (7.57-10.1)	10.5 (8.87-12.5)	11.9 (9.85-14.3)	13.4 (10.7-16.4)	14.9 (11.6-18.7)	17.0 (12.8-21.9)	18.7 (13.7-24.3)
10-day	6.02 (5.28-6.83)	6.91 (6.05-7.84)	8.41 (7.35-9.57)	9.72 (8.45-11.1)	11.6 (9.87-13.7)	13.1 (11.0-15.7)	14.7 (11.9-17.9)	16.4 (12.9-20.5)	18.7 (14.2-23.9)	20.5 (15.2-26.5)
20-day	7.99 (7.10-8.94)	9.04 (8.03-10.1)	10.8 (9.58-12.1)	12.3 (10.9-13.9)	14.5 (12.5-16.8)	16.2 (13.7-19.0)	18.0 (14.8-21.5)	19.8 (15.8-24.3)	22.3 (17.2-28.0)	24.3 (18.3-30.8)
30-day	9.67 (8.67-10.7)	10.9 (9.76-12.1)	12.9 (11.5-14.4)	14.6 (13.0-16.3)	17.0 (14.7-19.5)	18.8 (16.0-21.8)	20.7 (17.1-24.5)	22.6 (18.1-27.4)	25.1 (19.6-31.2)	27.1 (20.7-34.1)
45-day	11.8 (10.7-13.0)	13.3 (12.0-14.7)	15.7 (14.2-17.4)	17.7 (15.9-19.6)	20.4 (17.8-23.1)	22.4 (19.2-25.7)	24.4 (20.4-28.6)	26.4 (21.4-31.6)	29.0 (22.7-35.6)	30.9 (23.8-38.6)
60-day	13.7 (12.5-15.0)	15.5 (14.0-16.9)	18.3 (16.6-20.1)	20.5 (18.5-22.6)	23.5 (20.6-26.4)	25.7 (22.2-29.3)	27.8 (23.4-32.3)	29.9 (24.3-35.6)	32.5 (25.7-39.6)	34.4 (26.7-42.7)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves
 Latitude: 36.6803°, Longitude: -95.1322°



NOAA Atlas 14, Volume 8, Version 2

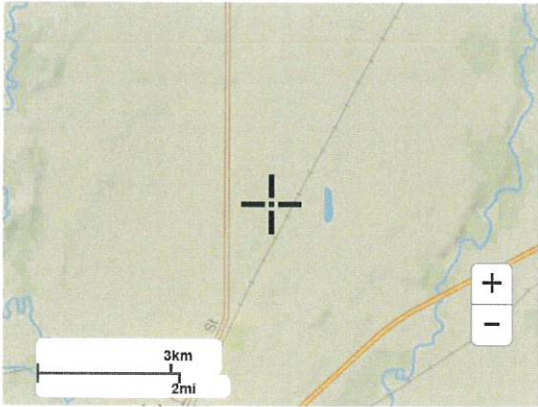
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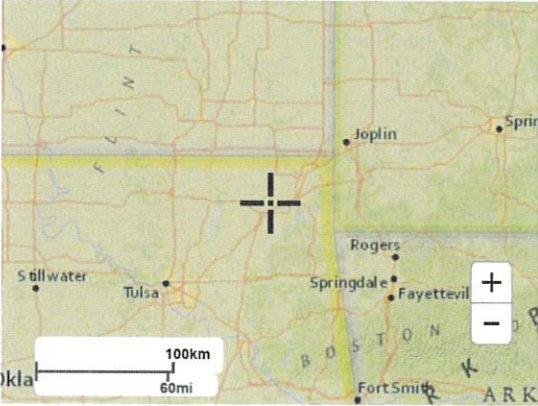
Maps & aeriels

Small scale terrain

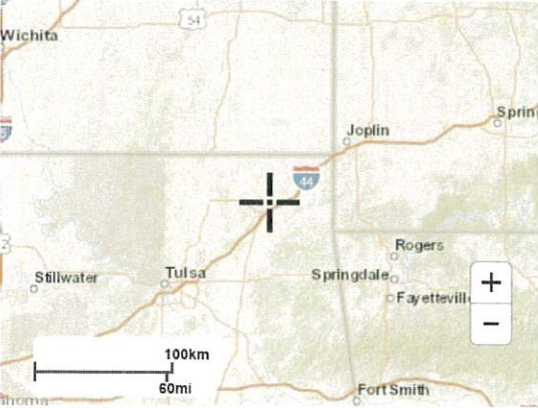
StreamStat data for downstream tributary convergence.



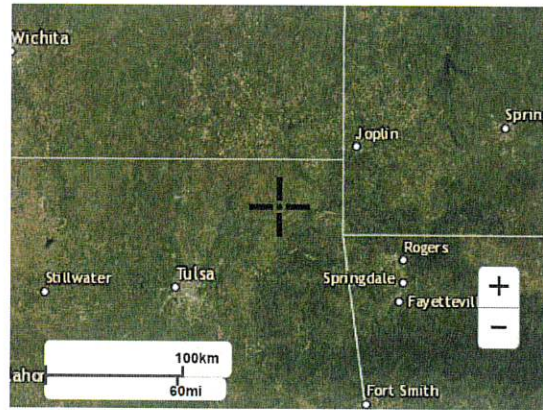
Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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PEAK DISCHARGE CALCULATIONS

Time of Concentration, minutes

$$T_c = T_o + T_f$$

To Overland flow $T_o = k(L_o^{0.37}) / (S_o^{0.20})$

Tf Channel flow $T_f = k'(L_f^{0.77}) / (S_f^{0.385})$

k/k' dimensionless coefficient

Lo length of overland travel, ft

So slope of overland flow, ft/ft

Lf length of channel, ft

Sf channel slope, ft/ft

k for Overland Ground Cover

Surface Type	k
Concrete, Asphalt	0.372
Commercial	0.445
Residential	0.511
Rocky, Bare soil	0.604
Cultivated	0.775
Woodland, Thin Grass	0.942
Average Pasture	1.040
Tall Grass	1.130

k' for various Channels

Surface Type	k'
straight, clean streams	0.00592
Avg. stream, few obstructions	0.00835
Meandering Stream w/ pools	0.01020
V-ditch	0.01252

Description of Drainage Area	Str. No.	To for Overland Flow				Tf for Channel Flow				Tc
		k	Lo	So	To	k'	Lf	Sf	Tf	
Residential	1	0.445	1600	0.02	14.92	0.0102	180	0.02	2.508	17.42

Description of Drainage Area	Str. No.	Area	C	Rainfall Intensity		Peak Discharge	
				I10 (IN/HR)	I100 (IN/HR)	Q10(CFS)	Q100(CFS)
Residential	1	27	0.95	5.8	8.85	149	227.01

IV Hydraulic Analysis

HEC-RAS was used to determine existing & proposed water surface elevations adjacent to the residence. This tributary was not modeled by FEMA. Manning's values were determined to be 0.04 for the overbanks and 0.035 in the channel for the residential development area. Cross sections were cut from field survey data collected in fall of 2022. Normal starting water surfaces at the downstream boundary were based on normal depth using a slope of 0.0193 calculated from survey data.

Hydraulic analysis was performed using Hec-RAS 6.2.0

V Existing Data

Finished Floor Elevation	At Back door: 699.39 At Front door: 699.01
High-water Mark	699.732 (Estimated at bottom of electrical outlet near back door) (This information collected from resident during site assessment)
8" Pipe Data	Inlet Flowline: 696.6 (At privacy fence gate) Outlet Flowline: 695.99 (at Street)
18" Pipe Data (under Thompson St.)	Inlet Flowline: 696.25 (west end) Outlet Flowline: 695.93 (east end)
Low Top of Road	698.66 (Thompson Street in front of residence) (Only 4" below finished floor at front door)
Crossing Designation	FEMA Zone X

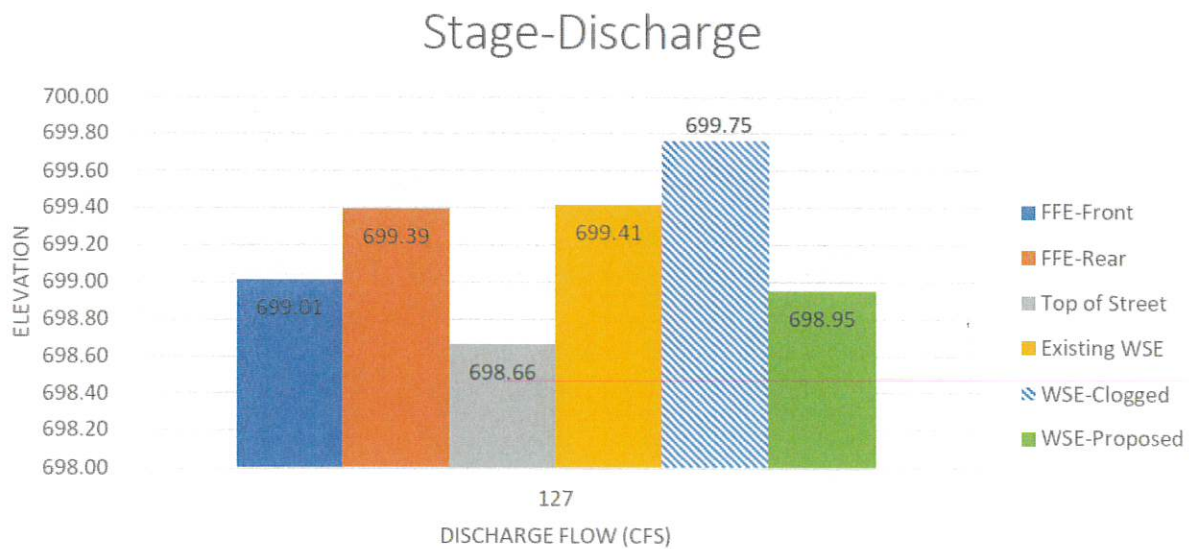
A site assessment was conducted in June 2022 where pictures and visual data were collected. The resident stated that flood waters were at or above the electrical outlet that is on the back porch. I have used this as high-water mark reference point (elev. 699.732). The resident also confirmed that the small 8" pipe would frequently clog with leaves, limbs, and other debris during high flow events. The privacy fence and gate adjacent to the house also restricts flow out of the backyard during flash flooding.

After visually noticing that most of the backyard is higher than the finished floor of the house, this was confirmed with survey data collected and processed via CAD software. All the runoff water is channeled to the south side of the residence where it enters the 8" pipe and is funneled to the front of the house to Thompson Street. The south privacy fence in the back yard is essentially the center of the drainage swale between the site and the adjacent yard to the south. That yard is bounded by a chain-link fence that collects leaves/limbs but allows flow above the debris line.

VI Recommendation

After analyzing the data collected, hydraulic analysis was performed on multiple scenarios consisting of existing model, existing model under clogged conditions and proposed model. This analysis shows that the existing conditions, even in an **unclogged state**, are not conducive to the high flows seen during flash flood events. The existing water surface profile at the back of the house is approximately 1” above the finished floor. The Stage-Discharge graphic below in the recommendations depicts the water surface profiles in bar graph form.

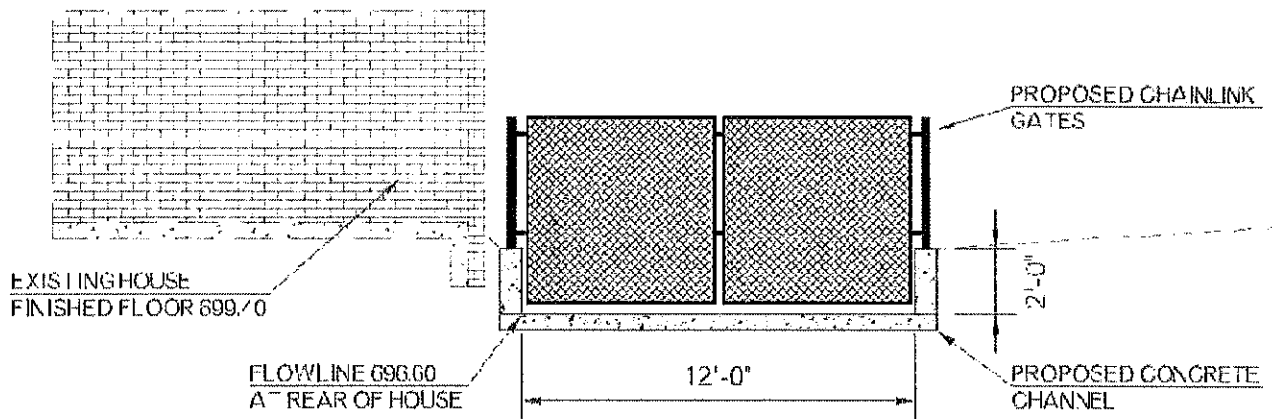
Discharge	Finished Floor		Water Surface Elevation (WSE)			
	Front	Rear	Top of Street	Existing	Existing Clogged	Proposed
127	699.01	699.39	698.66	699.41	699.75	698.95
127	699.01	699.39	698.66	699.41	699.75	698.95
127	699.01	699.39	698.66	699.41	699.75	698.95
127	699.01	699.39	698.66	699.41	699.75	698.95
127	699.01	699.39	698.66	699.41	699.75	698.95



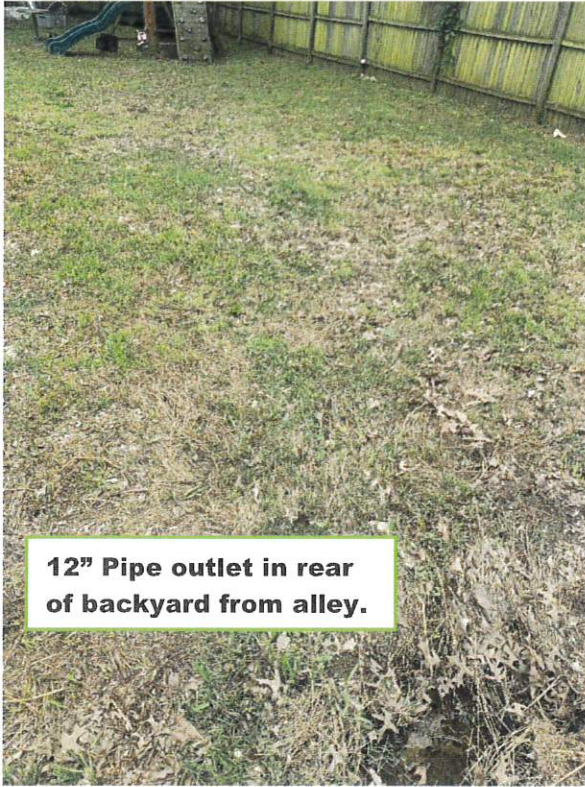
It is recommended, at a minimum, to regrade the south driveway and replace the privacy fence gates with chain-link fence gates. The area must remain clear of debris and flow obstructions. This alternative will still have potential for flood waters to enter the house.

Leaves, limbs and trash should be removed regularly and the flow path from the back of the yard all the way to front ditch should be kept in a clean manner to allow free flow of any storm water.

The preferred alternative is to remove the south driveway completely and install a paved channel from the back corner of the residence all the way to the front ditch. This will involve removing the existing pipe, grading & constructing a new paved ditch, and installing new chain-link gates. This alternative also requires that obstructions and debris be kept to an absolute minimum for the this to work. The drainage basin collects a tremendous amount of storm flows that concentrate in the front ditch. Continual effort must be made to ensure storm water flow is maintained.



**Appendix A
Photos**





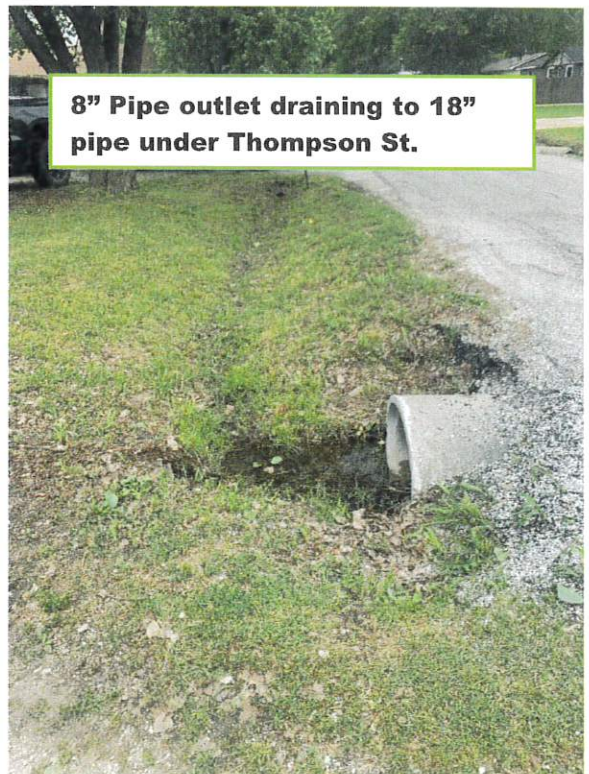
**8" Pipe in front of backyard
draining to street.**



**8" Pipe in front of backyard
draining to street.**



**8" Pipe outlet draining to 18"
pipe under Thompson St.**



**8" Pipe outlet draining to 18"
pipe under Thompson St.**



Appendix B
Hydraulic Model, Existing Conditions

HEC-RAS Plan: exist River: Vinita Unnamed Reach: Stream1 Profile: Q100

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Stream1	1000	Q100	227.00	699.95	700.58	700.32	700.60	0.003552	1.85	141.87	290.38	0.41
Stream1	999	Q100	227.00	698.33	700.30	699.55	700.33	0.004250	1.52	157.53	252.06	0.19
Stream1	998	Q100	227.00	697.93	699.41	699.41	699.57	0.029542	2.03	76.50	254.43	0.47
Stream1	997.72		Culvert									
Stream1	997	Q100	227.00	698.66	699.13	699.12	699.28	0.020118	3.20	76.09	228.82	0.91
Stream1	996.78		Culvert									
Stream1	996	Q100	227.00	695.06	698.00	698.00	698.25	0.007682	4.21	70.38	186.66	0.67

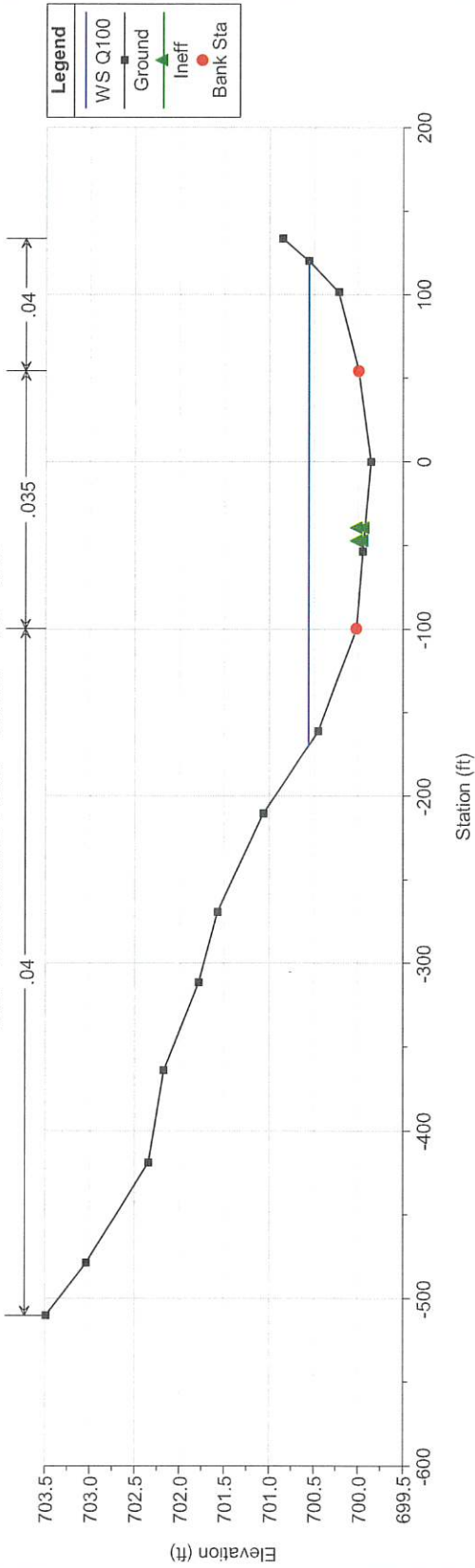
HEC-RAS Plan: exist River: Vinita Unnamed Reach: Stream1 Profile: Q100

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Stream1	1000	Q100	700.60	700.66	0.05	0.27	0.00	20.06	178.71	28.23	290.38
Stream1	999	Q100	700.33	700.30	0.04	0.75	0.01	65.10	81.18	80.75	252.06
Stream1	998	Q100	699.57	699.41	0.16			37.89	8.38	180.73	254.43
Stream1	997.72		Culvert								
Stream1	997	Q100	699.28	699.13	0.15			7.69	209.30	10.01	228.92
Stream1	996.78		Culvert								
Stream1	996	Q100	698.25	698.00	0.25				208.38	18.62	186.56

HEC-RAS Model Plan: Existing 4/7/2023

Geom: Existing

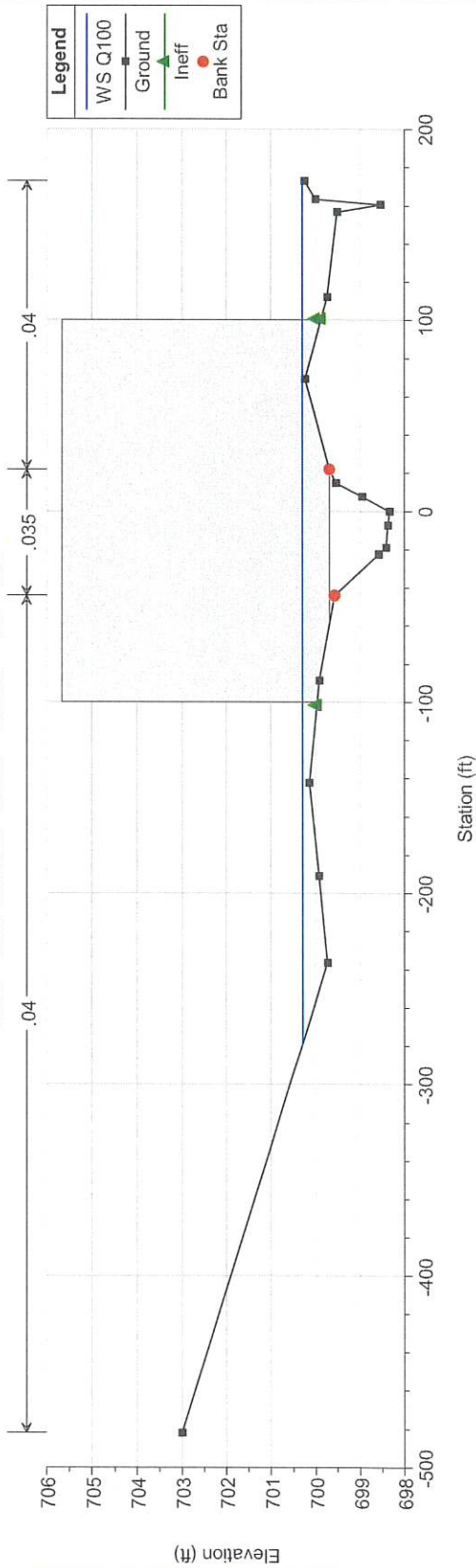
River = Vinita Unnamed Reach = Stream1 RS = 1000



HEC-RAS Model Plan: Existing 4/7/2023

Geom: Existing

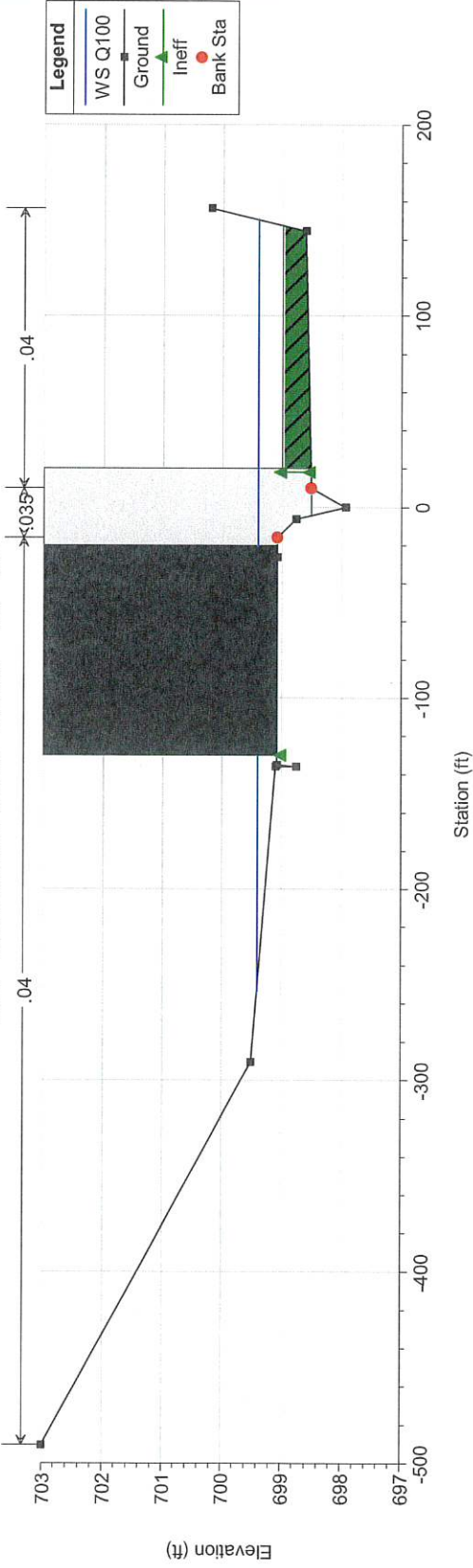
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HEC-RAS Model Plan: Existing 4/7/2023

Geom: Existing

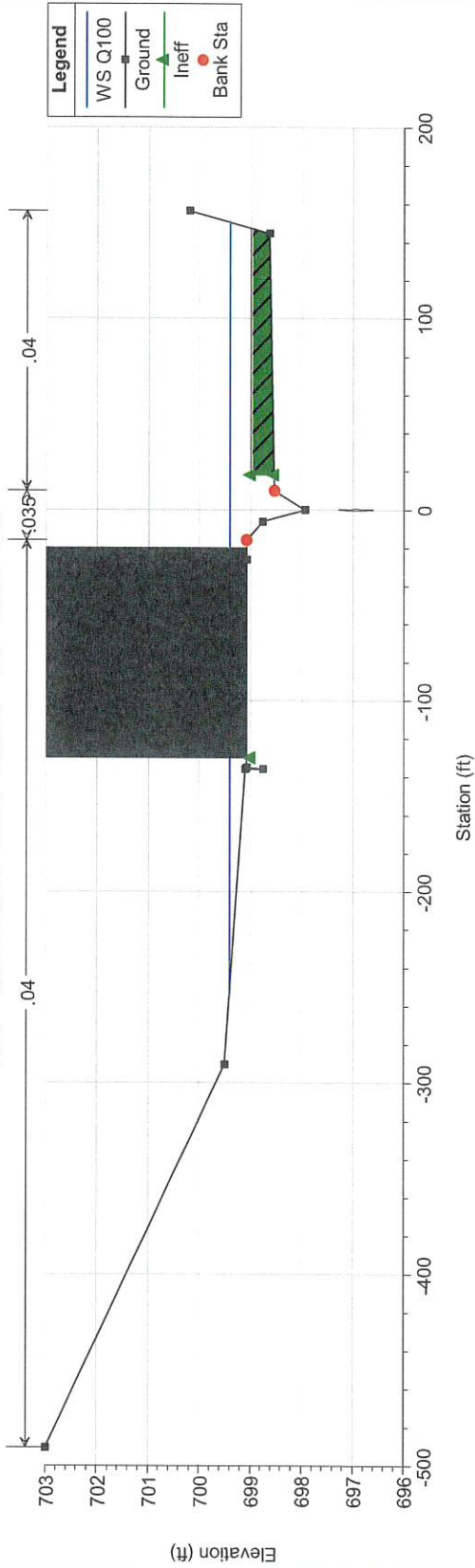
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HEC-RAS Model Plan: Existing 4/7/2023

Geom: Existing

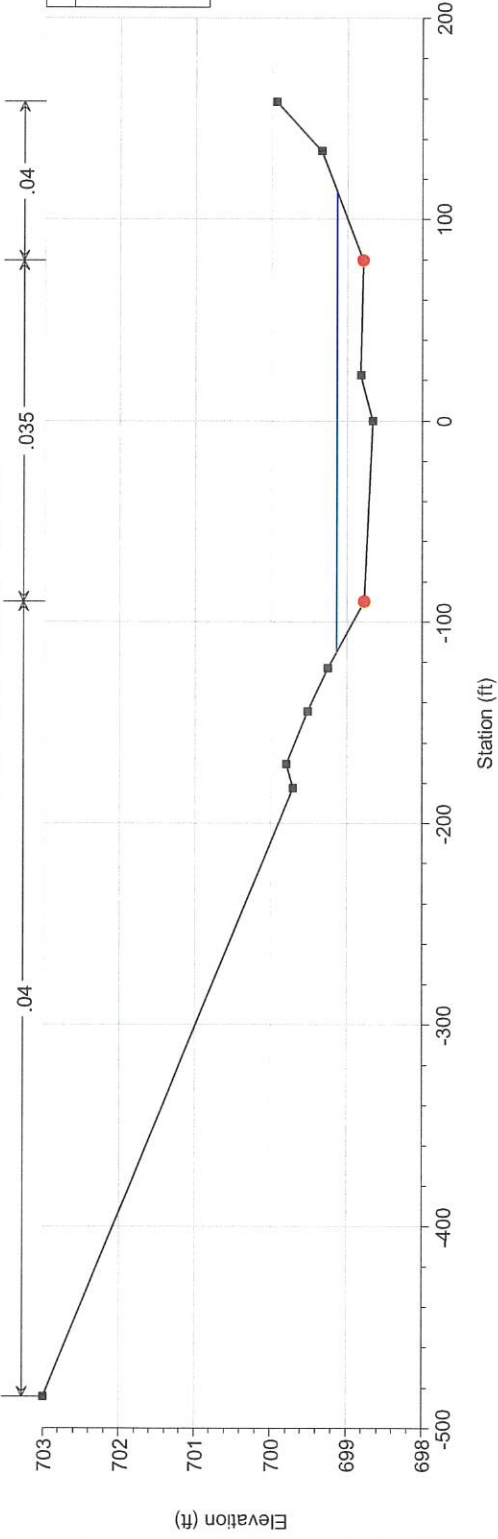
River = Vinita Unnamed Reach = Stream1 RS = 997.72 Culv



HEC-RAS Model Plan: Existing 4/7/2023

Geom: Existing

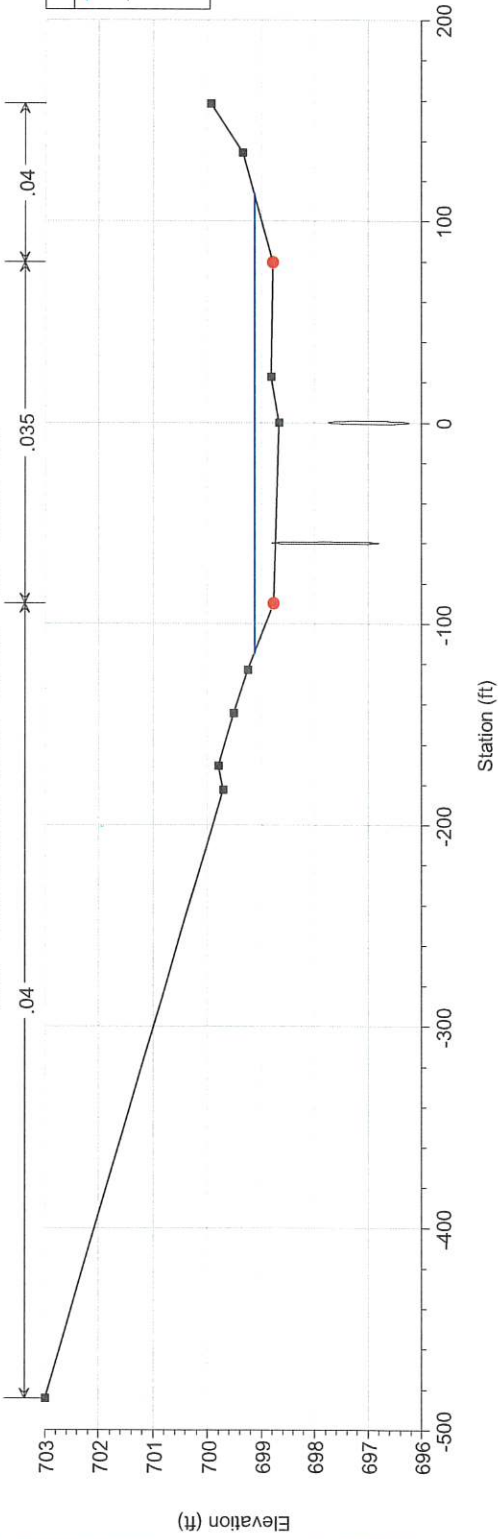
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HEC-RAS Model Plan: Existing 4/7/2023

Geom: Existing

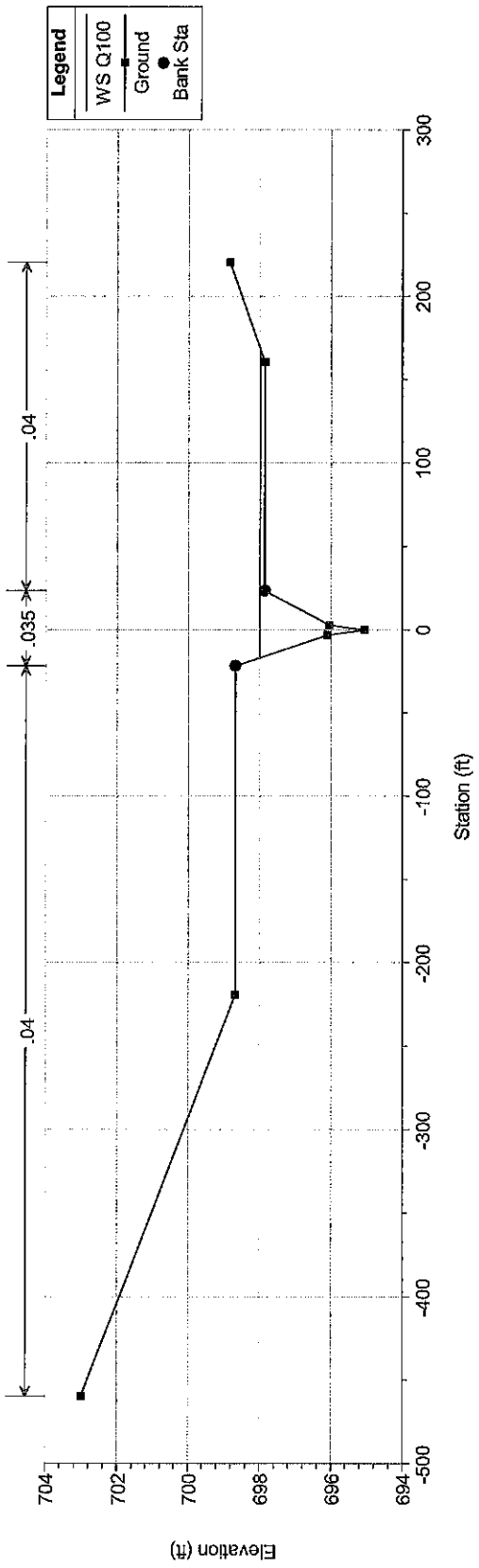
River = Vinita Unnamed Reach = Stream1 RS = 996.78 Culv



HEC-RAS Model Plan: Existing 4/7/2023

Geom: Existing

River = Vinita Unnamed Reach = Stream1 RS = 996



HEC-RAS HEC-RAS 6.2 March 2022
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X   X  XXXXXX   XXXX       XXXX       XX       XXXX
X   X  X       X   X       X   X       X   X       X
X   X  X       X           X   X       X   X       X
XXXXXXXX XXXX   X           XXX XXXX   XXXXXX   XXXX
X   X  X       X           X   X       X   X       X
X   X  X       X   X       X   X       X   X       X
X   X  XXXXXX   XXXX       X   X       X   X       XXXXX
```

PROJECT DATA

Project Title: HEC-RAS Model
Project File : VINITA_CNHA.prj
Run Date and Time: 4/11/2023 3:41:27 PM

Project in English units

Project Description:

CRS Info=<SpatialReference> <CoordinateSystem Code="3640"
Unit="US_survey_Foot" AcadCode="NSRS07.OK-NF" /></SpatialReference>

PLAN DATA

Plan Title: Existing
Plan File : G:\2022\22CNHA01 Vinita Site Development\DESIGN\HEC-RAS\VINITA_CNHA.p01

Geometry Title: Existing
Geometry File : G:\2022\22CNHA01 Vinita Site
Development\DESIGN\HEC-RAS\VINITA_CNHA.g01

Flow Title : Rational
Flow File : G:\2022\22CNHA01 Vinita Site
Development\DESIGN\HEC-RAS\VINITA_CNHA.f01

Plan Description:
Default Scenario

Plan Summary Information:

Number of: Cross Sections = 5 Multiple Openings = 0
Culverts = 2 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information

Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.33
Flow tolerance factor = 0.001

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Rational

Flow File : G:\2022\22CNHA01 Vinita Site Development\DESIGN\HEC-RAS\VINITA_CNHA.f01

Flow Data (cfs)

River	Reach	RS	Q100
Vinita Unnamed	Stream1	1000	227

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
Vinita Unnamed	Stream1	Q100	Normal S = 0.019319

Normal S = 0.019319

GEOMETRY DATA

Geometry Title: Existing

Geometry File : G:\2022\22CNHA01 Vinita Site
Development\DESIGN\HEC-RAS\VINITA_CNHA.g01

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 1000

INPUT

Description:

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-510.39	703.49	-478.88	703.039	-418.8	702.342	-363.79	702.174	-311.21	701.783
-269.3	701.57	-210.68	701.059	-161.06	700.445	-99.79	700.016	-53.44	699.946
0	699.854	54.32	699.988	101.44	700.219	120.31	700.56	133.31	700.85

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-510.39	.04	-99.79	.035	54.32	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-99.79	54.32	70.59	70.59	70.59	.1	.3
--------	-------	-------	-------	-------	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-510.39	-47.38	700	F
-39.66	133.31	700	F

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 999

INPUT

Description:

Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-481.81	703	-236.29	699.72	-190.92	699.92	-142.19	700.14	-88.59	699.91
-44.25	699.55	-22.56	698.57	-19.11	698.41	-7.56	698.36	0	698.33
7.44	698.94	14.69	699.53	21.64	699.67	69.05	700.24	112.12	699.73
156.55	699.5	160.5	698.54	163.31	700	172.66	700.25		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-481.81	.04	-44.25	.035	21.64	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-44.25	21.64	84.12	84.12	84.12	.1	.3
--------	-------	-------	-------	-------	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-481.81	-101.6	700	F
100.62	172.66	700	F

Cross Section Lid

```

num=      2
  Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
-100  705.67  699.67      100  705.67  699.67

```

CROSS SECTION

```

RIVER: Vinita Unnamed
REACH: Stream1          RS: 998

```

INPUT

Description:

```

Station Elevation Data      num=      12
  Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev
-490.41  703 -290.41  699.5  -136  699.1  -136  698.75  -135  699.08
-26.27  699.08  -16  699.08  -6.32  698.76   0  697.933  9.59  698.52
 144.59  698.62  156.31  700.2

```

```

Manning's n Values          num=      3
  Sta   n Val   Sta   n Val   Sta   n Val
-490.41   .04  -16   .035  9.59   .04

```

```

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
          -16   9.59           31.99  31.99  31.99           .1           .3

```

```

Ineffective Flow          num=      2
  Sta L   Sta R   Elev   Permanent
-490.41  -130   699     T
  18  156.31  699     T

```

```

Blocked Obstructions      num=      1
  Sta L   Sta R   Elev
-130    -20    703

```

```

Cross Section Lid
num=      2
  Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
-20    703  698.52      20    703  698.52

```

CULVERT

```

RIVER: Vinita Unnamed
REACH: Stream1          RS: 997.72

```

INPUT

Description:

```

Distance from Upstream XS =      10
Deck/Roadway Width         =      4
Weir Coefficient           =     2.6

```

```

Upstream Deck/Roadway Coordinates
num=      2
  Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
-10  697.92      10  697.92

```

Upstream Bridge Cross Section Data

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-490.41	703	-290.41	699.5	-136	699.1	-136	698.75	-135	699.08
-26.27	699.08	-16	699.08	-6.32	698.76	0	697.933	9.59	698.52
144.59	698.62	156.31	700.2						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-490.41	.04	-16	.035	9.59	.04

Bank Sta: Left Right Coeff Contr. Expan.

-16	9.59	.1	.3
-----	------	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-490.41	-130	699	T
18	156.31	699	T

Blocked Obstructions num= 1

Sta L	Sta R	Elev
-130	-20	703

Downstream Deck/Roadway Coordinates

num= 2

Sta Hi	Cord	Lo Cord	Sta Hi	Cord	Lo Cord
-10	698.38		10	698.14	

Downstream Bridge Cross Section Data

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-484.31	703	-182.64	699.705	-170.55	699.799	-144.48	699.514	-122.91	699.248
-89.88	698.772	0	698.66	22.63	698.819	79.41	698.783	133.97	699.339
158.3	699.937								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-484.31	.04	-89.88	.035	79.41	.04

Bank Sta: Left Right Coeff Contr. Expan.

-89.88	79.41	.1	.3
--------	-------	----	----

Upstream Embankment side slope = 1 horiz. to 1.0 vertical
 Downstream Embankment side slope = 1 horiz. to 1.0 vertical
 Maximum allowable submergence for weir flow = .98
 Elevation at which weir flow begins = 697.72
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
 Culvert #1 Circular .667
 FHWA Chart # 1 - Concrete Pipe Culvert
 FHWA Scale # 1 - Square edge entrance with headwall
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 10 20 .013 .013 0 .5
 1
 Upstream Elevation = 696.6
 Centerline Station = 0
 Downstream Elevation = 695.99
 Centerline Station = 0

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 997

INPUT

Description:

Station Elevation Data num= 11
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 -484.31 703 -182.64 699.705 -170.55 699.799 -144.48 699.514 -122.91 699.248
 -89.88 698.772 0 698.66 22.63 698.819 79.41 698.783 133.97 699.339
 158.3 699.937

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 -484.31 .04 -89.88 .035 79.41 .04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -89.88 79.41 61.29 61.29 61.29 .1 .3

CULVERT

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 996.78

INPUT

Description:

Distance from Upstream XS = 10
 Deck/Roadway Width = 4
 Weir Coefficient = 2.6
 Upstream Deck/Roadway Coordinates
 num= 2
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
 -493.13 0 199.69 0

Upstream Bridge Cross Section Data

Station Elevation Data num= 11
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 -484.31 703 -182.64 699.705 -170.55 699.799 -144.48 699.514 -122.91 699.248
 -89.88 698.772 0 698.66 22.63 698.819 79.41 698.783 133.97 699.339
 158.3 699.937

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 -484.31 .04 -89.88 .035 79.41 .04

Bank Sta: Left Right Coeff Contr. Expan.
 -89.88 79.41 .1 .3

Downstream Deck/Roadway Coordinates
 num= 2
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
 -761.3 0 -68.48 0

Downstream Bridge Cross Section Data

Station Elevation Data num= 11
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 -484.31 703 -182.64 699.705 -170.55 699.799 -144.48 699.514 -122.91 699.248
 -89.88 698.772 0 698.66 22.63 698.819 79.41 698.783 133.97 699.339
 158.3 699.937

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 -484.31 .04 -89.88 .035 79.41 .04

Bank Sta: Left Right Coeff Contr. Expan.
 -89.88 79.41 .1 .3

Upstream Embankment side slope = 1 horiz. to 1.0 vertical
 Downstream Embankment side slope = 1 horiz. to 1.0 vertical
 Maximum allowable submergence for weir flow = .98
 Elevation at which weir flow begins =
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 2

Culvert Name Shape Rise Span
 Culvert #1 Ellipse 2 1.167
 FHWA Chart # 30- Vertical Ellipse; Concrete
 FHWA Scale # 1 - Square edge with headwall
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 10 40 .013 .013 0 .5

1
 Upstream Elevation = 696.8
 Centerline Station = -60
 Downstream Elevation = 695.06
 Centerline Station = -60

Culvert Name Shape Rise Span
 Culvert #2 Circular 1.5
 FHWA Chart # 1 - Concrete Pipe Culvert
 FHWA Scale # 1 - Square edge entrance with headwall
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 10 27 .013 .013 0 .5

1
 Upstream Elevation = 696.24
 Centerline Station = 0
 Downstream Elevation = 695.93
 Centerline Station = 0

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 996

INPUT

Description:

Station Elevation Data num= 9
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 -459.73 703 -219.59 698.676 -22 698.676 -3.22 696.092 0 695.063
 2.78 696.049 23.42 697.85 160.52 697.852 220.59 698.835

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 -459.73 .04 -22 .035 23.42 .04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -22 23.42 0 0 0 .1 .3

SUMMARY OF MANNING'S N VALUES

River:Vinita Unnamed

Reach	River Sta.	n1	n2	n3
Stream1	1000	.04	.035	.04
Stream1	999	.04	.035	.04
Stream1	998	.04	.035	.04

Stream1	997.72	Culvert		
Stream1	997	.04	.035	.04
Stream1	996.78	Culvert		
Stream1	996	.04	.035	.04

SUMMARY OF REACH LENGTHS

River: Vinita Unnamed

Reach	River Sta.	Left	Channel	Right
Stream1	1000	70.59	70.59	70.59
Stream1	999	84.12	84.12	84.12
Stream1	998	31.99	31.99	31.99
Stream1	997.72	Culvert		
Stream1	997	61.29	61.29	61.29
Stream1	996.78	Culvert		
Stream1	996	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Vinita Unnamed

Reach	River Sta.	Contr.	Expan.
Stream1	1000	.1	.3
Stream1	999	.1	.3
Stream1	998	.1	.3
Stream1	997.72	Culvert	
Stream1	997	.1	.3
Stream1	996.78	Culvert	
Stream1	996	.1	.3

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.
E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	(ft)	(ft)
Stream1	1000	Q100	227.00	699.85	700.56	700.32
700.60	0.003552	1.85	141.67	290.38	0.41	

Stream1	999	Q100	227.00	698.33	700.30	699.55
700.33	0.004250	1.52	157.53	252.06	0.19	
Stream1	998	Q100	227.00	697.93	699.41	699.41
699.57	0.029542	2.03	76.50	254.43	0.47	
Stream1	997.72		Culvert			
Stream1	997	Q100	227.00	698.66	699.13	699.12
699.28	0.020118	3.20	76.09	228.92	0.91	
Stream1	996.78		Culvert			
Stream1	996	Q100	227.00	695.06	698.00	698.00
698.25	0.007682	4.21	70.36	186.56	0.67	

Appendix C
Hydraulic Model, Existing (Clogged)

HEC-RAS Plan; exist River: Vinita Unnamed Reach: Stream1 Profile: Q100

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Stream1	1000	Q100	227.00	699.86	700.60	700.32	700.64	0.002715	1.70	155.15	298.18	0.37
Stream1	989	Q100	227.00	698.33	700.44	699.55	700.47	0.002219	1.10	195.22	263.02	0.15
Stream1	988	Q100	227.00	697.93	699.75	699.75	699.98	0.030883	0.49	59.75	307.96	0.50
Stream1	997.72		Culvert									
Stream1	997	Q100	227.00	698.66	699.13	699.12	699.28	0.020118	3.20	76.00	228.92	0.91
Stream1	996.78		Culvert									
Stream1	996	Q100	227.00	695.06	698.00	698.00	698.25	0.007682	4.21	70.36	186.56	0.67

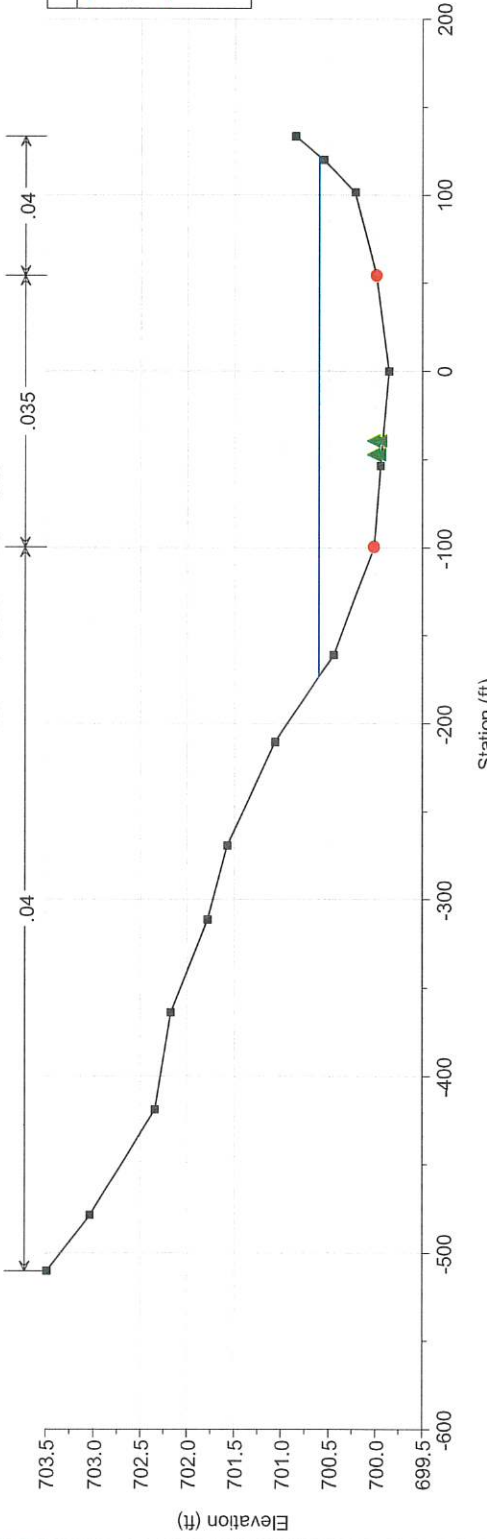
HEC-RAS Plan: exist River: Vinita Unnamed Reach: Stream1 Profile: Q100

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Stream1	1000	Q100	700.64	700.60	0.04	0.17	0.00	21.75	175.83	29.42	296.18
Stream1	999	Q100	700.47	700.44	0.02	0.46	0.02	85.93	58.84	82.43	263.02
Stream1	998	Q100	699.98	699.75	0.22				0.03	226.97	307.96
Stream1	997.72		Culvert								
Stream1	997	Q100	699.28	699.13	0.15			7.69	209.30	10.01	228.92
Stream1	996.78		Culvert								
Stream1	996	Q100	698.25	698.00	0.25				208.38	18.62	186.56

HEC-RAS Model Plan: Existing 4/11/2023

Geom: Exist_clogged

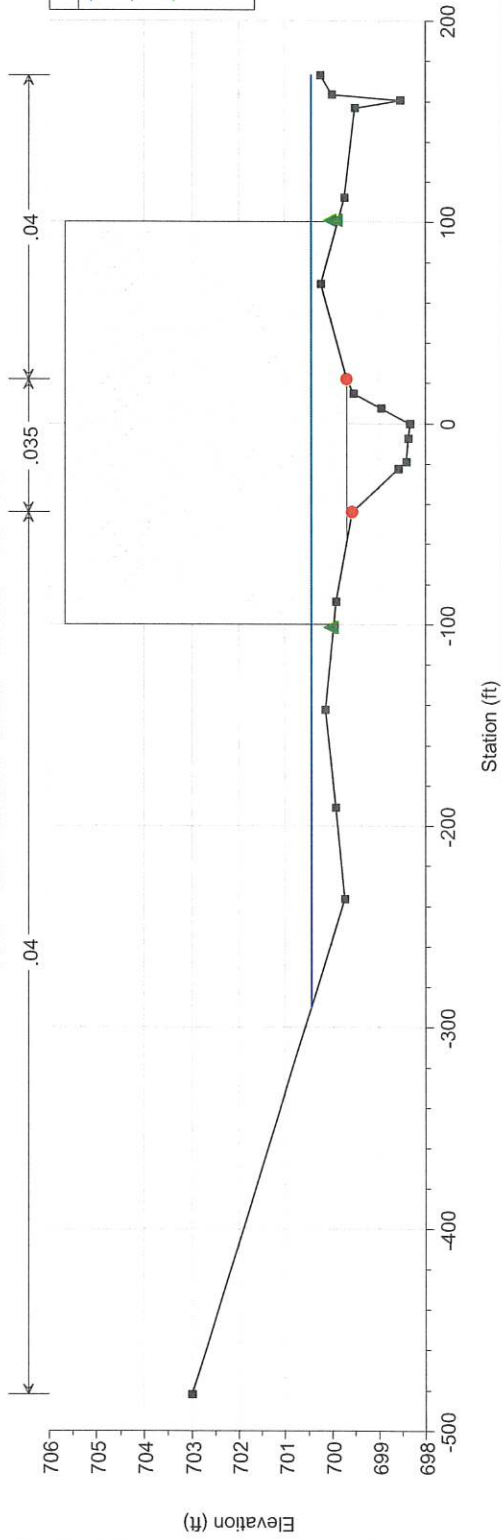
River = Vinita Unnamed Reach = Stream1 RS = 1000



HEC-RAS Model Plan: Existing 4/11/2023

Geom: Exist_clogged

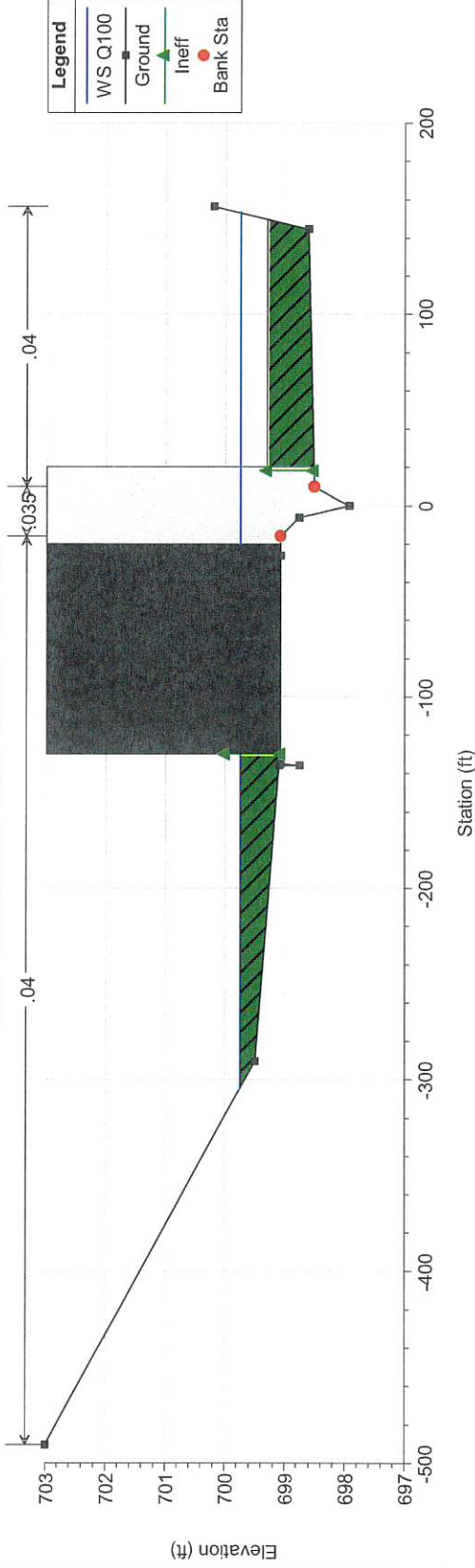
River = Vinita Unnamed Reach = Stream1 RS = 999



HEC-RAS Model Plan: Existing 4/11/2023

Geom: Exist_clogged

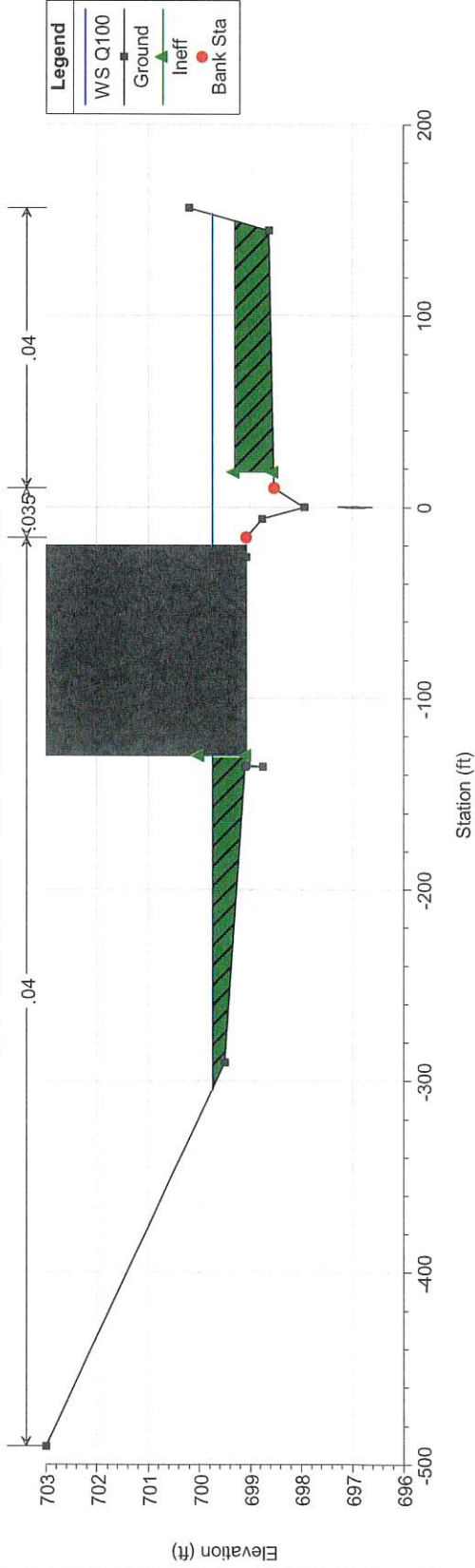
River = Vinita Unnamed Reach = Stream1 RS = 998



HEC-RAS Model Plan: Existing 4/11/2023

Geom: Exist_clogged

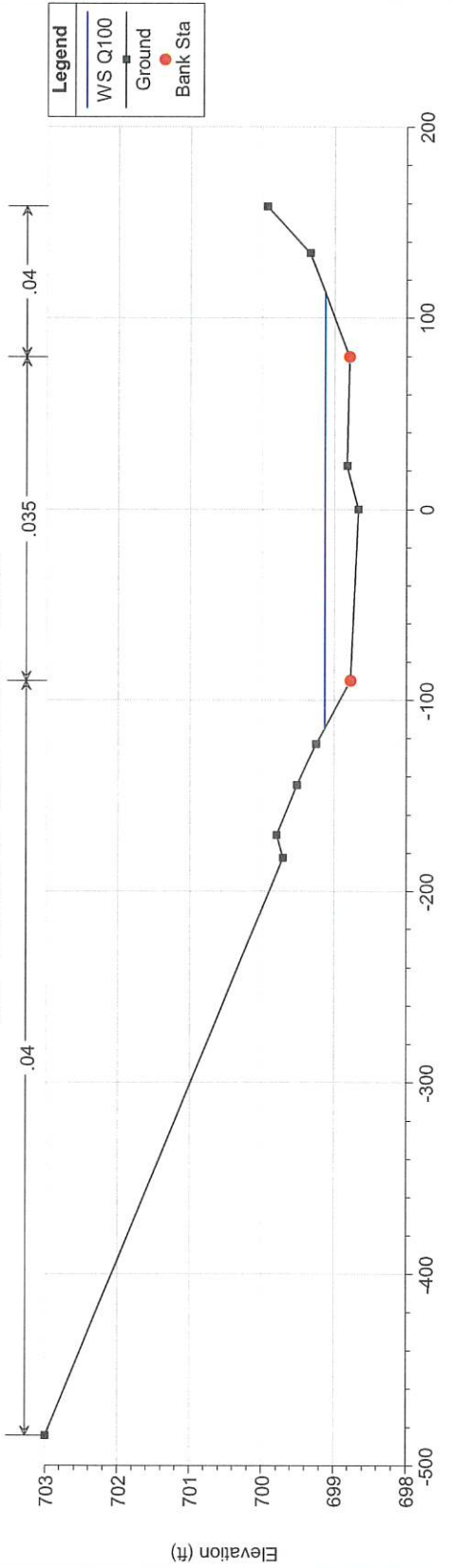
River = Vinita Unnamed Reach = Stream1 RS = 997.72 Culv



HEC-RAS Model Plan: Existing 4/11/2023

Geom: Exist_clogged

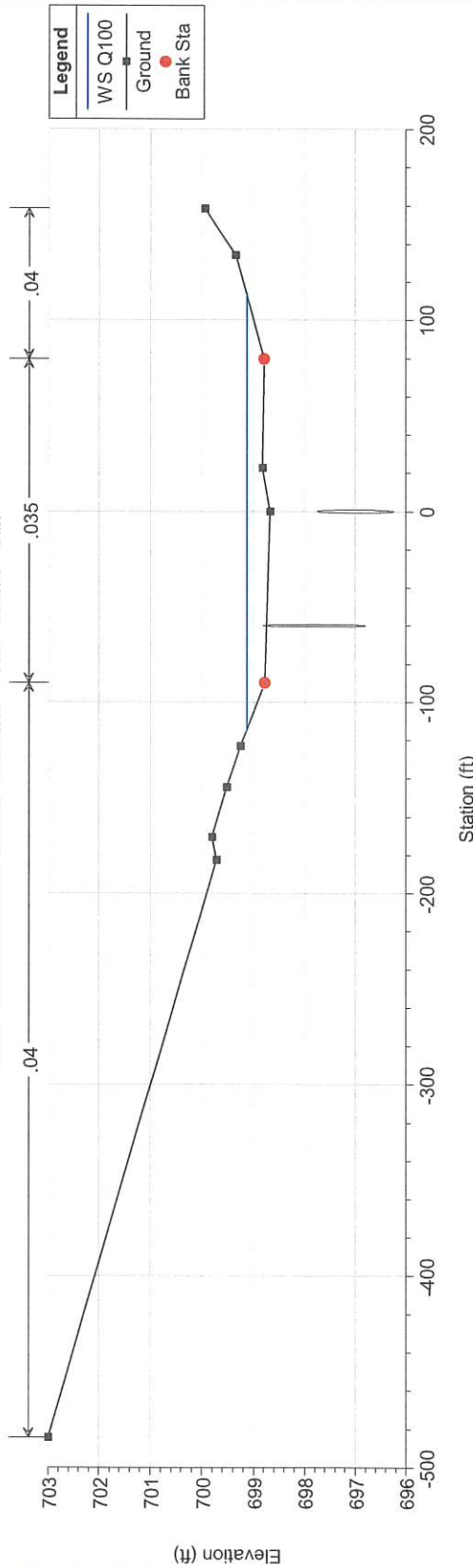
River = Vinita Unnamed Reach = Stream1 RS = 997



HEC-RAS Model Plan: Existing 4/11/2023

Geom: Exist_clogged

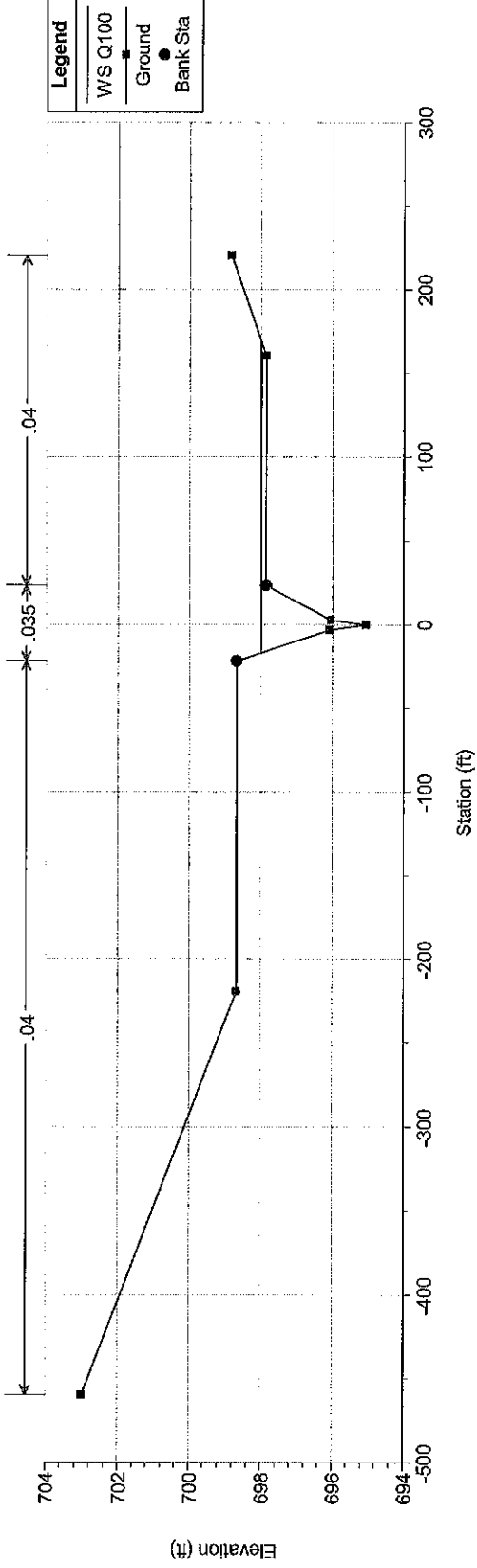
River = Vinita Unnamed Reach = Stream1 RS = 996.78 Culv



HEC-RAS Model Plan: Existing 4/11/2023

Geom: Exist_clogged

River = Vinita Unnamed Reach = Stream1 RS = 996



HEC-RAS HEC-RAS 6.2 March 2022
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X   X  XXXXXX   XXXX       XXXX       XX       XXXX
X   X  X        X   X       X   X       X   X       X
X   X  X        X           X   X       X   X       X
XXXXXXXX XXXX   X           XXX  XXXX   XXXXXX   XXXX
X   X  X        X           X   X       X   X           X
X   X  X        X   X       X   X       X   X       X
X   X  XXXXXX   XXXX       X   X       X   X       XXXXX
```

PROJECT DATA

Project Title: HEC-RAS Model
Project File : VINITA_CNHA.prj
Run Date and Time: 4/11/2023 3:44:48 PM

Project in English units

Project Description:

CRS Info=<SpatialReference> <CoordinateSystem Code="3640"
Unit="US_survey_Foot" AcadCode="NSRS07.OK-NF" /></SpatialReference>

PLAN DATA

Plan Title: Existing
Plan File : G:\2022\22CNHA01 Vinita Site Development\DESIGN\HEC-RAS\VINITA_CNHA.p01

Geometry Title: Exist_clogged
Geometry File : G:\2022\22CNHA01 Vinita Site
Development\DESIGN\HEC-RAS\VINITA_CNHA.g05

Flow Title : Rational
Flow File : G:\2022\22CNHA01 Vinita Site
Development\DESIGN\HEC-RAS\VINITA_CNHA.f01

Plan Description:
Default Scenario

Plan Summary Information:

Number of: Cross Sections = 5 Multiple Openings = 0
Culverts = 2 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information

Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.33
Flow tolerance factor = 0.001

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Rational

Flow File : G:\2022\22CNHA01 Vinita Site Development\DESIGN\HEC-RAS\VINITA_CNHA.f01

Flow Data (cfs)

River	Reach	RS	Q100
Vinita Unnamed	Stream1	1000	227

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
Vinita Unnamed	Stream1	Q100	Normal S = 0.019319

Normal S = 0.019319

GEOMETRY DATA

Geometry Title: Exist_clogged

Geometry File : G:\2022\22CNHA01 Vinita Site
Development\DESIGN\HEC-RAS\VINITA_CNHA.g05

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 1000

INPUT

Description:

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-510.39	703.49	-478.88	703.039	-418.8	702.342	-363.79	702.174	-311.21	701.783
-269.3	701.57	-210.68	701.059	-161.06	700.445	-99.79	700.016	-53.44	699.946
0	699.854	54.32	699.988	101.44	700.219	120.31	700.56	133.31	700.85

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-510.39	.04	-99.79	.035	54.32	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-99.79	54.32	70.59	70.59	70.59	.1	.3
--------	-------	-------	-------	-------	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-510.39	-47.38	700	F
-39.66	133.31	700	F

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 999

INPUT

Description:

Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-481.81	703	-236.29	699.72	-190.92	699.92	-142.19	700.14	-88.59	699.91
-44.25	699.55	-22.56	698.57	-19.11	698.41	-7.56	698.36	0	698.33
7.44	698.94	14.69	699.53	21.64	699.67	69.05	700.24	112.12	699.73
156.55	699.5	160.5	698.54	163.31	700	172.66	700.25		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-481.81	.04	-44.25	.035	21.64	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-44.25	21.64	84.12	84.12	84.12	.1	.3
--------	-------	-------	-------	-------	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-481.81	-101.6	700	F
100.62	172.66	700	F

Cross Section Lid

```

num=      2
Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
-100  705.67  699.67      100  705.67  699.67

```

CROSS SECTION

```

RIVER: Vinita Unnamed
REACH: Stream1          RS: 998

```

INPUT

Description:

```

Station Elevation Data      num=      12
Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev
-490.41  703 -290.41  699.5  -136  699.1  -136  698.75  -135  699.08
-26.27  699.08  -16  699.08  -6.32  698.76      0  697.933  9.59  698.52
144.59  698.62  156.31  700.2

```

```

Manning's n Values      num=      3
Sta   n Val   Sta   n Val   Sta   n Val
-490.41   .04  -16   .035  9.59   .04

```

```

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
          -16   9.59          31.99   31.99   31.99          .1          .3

```

```

Ineffective Flow      num=      2
Sta L   Sta R   Elev   Permanent
-490.41  -130   700     T
  18  156.31  699.3     T

```

```

Blocked Obstructions  num=      1
Sta L   Sta R   Elev
-130   -20   703

```

```

Cross Section Lid
num=      2
Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
-20   703   698      20   703   698

```

CULVERT

```

RIVER: Vinita Unnamed
REACH: Stream1          RS: 997.72

```

INPUT

Description:

```

Distance from Upstream XS =      10
Deck/Roadway Width        =      4
Weir Coefficient          =      2.6

```

```

Upstream Deck/Roadway Coordinates
num=      2
Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
-10  697.92      10  697.92

```

Upstream Bridge Cross Section Data

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-490.41	703	-290.41	699.5	-136	699.1	-136	698.75	-135	699.08
-26.27	699.08	-16	699.08	-6.32	698.76	0	697.933	9.59	698.52
144.59	698.62	156.31	700.2						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-490.41	.04	-16	.035	9.59	.04

Bank Sta: Left Right Coeff Contr. Expan.

-16	9.59	.1	.3
-----	------	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-490.41	-130	700	T
18	156.31	699.3	T

Blocked Obstructions num= 1

Sta L	Sta R	Elev
-130	-20	703

Downstream Deck/Roadway Coordinates

num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
-10	698.38	10	698.14

Downstream Bridge Cross Section Data

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-484.31	703	-182.64	699.705	-170.55	699.799	-144.48	699.514	-122.91	699.248
-89.88	698.772	0	698.66	22.63	698.819	79.41	698.783	133.97	699.339
158.3	699.937								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-484.31	.04	-89.88	.035	79.41	.04

Bank Sta: Left Right Coeff Contr. Expan.

-89.88	79.41	.1	.3
--------	-------	----	----

Upstream Embankment side slope = 1 horiz. to 1.0 vertical
 Downstream Embankment side slope = 1 horiz. to 1.0 vertical
 Maximum allowable submergence for weir flow = .98
 Elevation at which weir flow begins = 697.72
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
 Culvert #1 Circular .667
 FHWA Chart # 1 - Concrete Pipe Culvert
 FHWA Scale # 1 - Square edge entrance with headwall
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 10 20 .013 .013 .6 .5
 1
 Upstream Elevation = 696.6
 Centerline Station = 0
 Downstream Elevation = 695.99
 Centerline Station = 0

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 997

INPUT

Description:

Station Elevation Data num= 11
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 -484.31 703 -182.64 699.705 -170.55 699.799 -144.48 699.514 -122.91 699.248
 -89.88 698.772 0 698.66 22.63 698.819 79.41 698.783 133.97 699.339
 158.3 699.937

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 -484.31 .04 -89.88 .035 79.41 .04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -89.88 79.41 61.29 61.29 61.29 .1 .3

CULVERT

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 996.78

INPUT

Description:

Distance from Upstream XS = 10
 Deck/Roadway Width = 4
 Weir Coefficient = 2.6
 Upstream Deck/Roadway Coordinates
 num= 2
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
 -493.13 0 199.69 0

Upstream Bridge Cross Section Data

Station Elevation Data num= 11									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-484.31	703	-182.64	699.705	-170.55	699.799	-144.48	699.514	-122.91	699.248
-89.88	698.772	0	698.66	22.63	698.819	79.41	698.783	133.97	699.339
158.3	699.937								

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
-484.31	.04	-89.88	.035	79.41	.04

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	-89.88	79.41		.1	.3

Downstream Deck/Roadway Coordinates num= 2									
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
-761.3		0			-68.48		0		

Downstream Bridge Cross Section Data

Station Elevation Data num= 11									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-484.31	703	-182.64	699.705	-170.55	699.799	-144.48	699.514	-122.91	699.248
-89.88	698.772	0	698.66	22.63	698.819	79.41	698.783	133.97	699.339
158.3	699.937								

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
-484.31	.04	-89.88	.035	79.41	.04

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	-89.88	79.41		.1	.3

Upstream Embankment side slope = 1 horiz. to 1.0 vertical
 Downstream Embankment side slope = 1 horiz. to 1.0 vertical
 Maximum allowable submergence for weir flow = .98
 Elevation at which weir flow begins =
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 2

Culvert Name	Shape	Rise	Span	Depth Blocked	Entrance Loss Coef	
Culvert #1	Ellipse	2	1.167			
FHWA Chart # 30- Vertical Ellipse; Concrete						
FHWA Scale # 1 - Square edge with headwall						
Solution Criteria = Highest U.S. EG						
Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef
	10	40	.013	.013	0	.5

1
 Upstream Elevation = 696.8
 Centerline Station = -60
 Downstream Elevation = 695.06
 Centerline Station = -60

Culvert Name Shape Rise Span
 Culvert #2 Circular 1.5
 FHWA Chart # 1 - Concrete Pipe Culvert
 FHWA Scale # 1 - Square edge entrance with headwall
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 10 27 .013 .013 0 .5

1
 Upstream Elevation = 696.24
 Centerline Station = 0
 Downstream Elevation = 695.93
 Centerline Station = 0

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 996

INPUT

Description:

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-459.73	703	-219.59	698.676	-22	698.676	-3.22	696.092	0	695.063
2.78	696.049	23.42	697.85	160.52	697.852	220.59	698.835		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-459.73	.04	-22	.035	23.42	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	-22	23.42		0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Vinita Unnamed

Reach	River Sta.	n1	n2	n3
Stream1	1000	.04	.035	.04
Stream1	999	.04	.035	.04
Stream1	998	.04	.035	.04

Stream1	997.72	Culvert			
Stream1	997	.04	.035	.04	
Stream1	996.78	Culvert			
Stream1	996	.04	.035	.04	

SUMMARY OF REACH LENGTHS

River: Vinita Unnamed

Reach	River Sta.	Left	Channel	Right
Stream1	1000	70.59	70.59	70.59
Stream1	999	84.12	84.12	84.12
Stream1	998	31.99	31.99	31.99
Stream1	997.72	Culvert		
Stream1	997	61.29	61.29	61.29
Stream1	996.78	Culvert		
Stream1	996	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Vinita Unnamed

Reach	River Sta.	Contr.	Expan.
Stream1	1000	.1	.3
Stream1	999	.1	.3
Stream1	998	.1	.3
Stream1	997.72	Culvert	
Stream1	997	.1	.3
Stream1	996.78	Culvert	
Stream1	996	.1	.3

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.
E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	
(ft)	(ft/ft)	(ft/s)	(cfs)	(ft)	(ft)	(ft)
			(sq ft)	(ft)		
Stream1	1000	Q100	227.00	699.85	700.60	700.32
700.64	0.002715	1.70	155.15	296.18	0.37	

Stream1	999	Q100	227.00	698.33	700.44	699.55
700.47	0.002219	1.10	195.22	263.02	0.15	
Stream1	998	Q100	227.00	697.93	699.75	699.75
699.98	0.030883	0.49	59.75	307.96	0.50	
Stream1	997.72		Culvert			
Stream1	997	Q100	227.00	698.66	699.13	699.12
699.28	0.020118	3.20	76.09	228.92	0.91	
Stream1	996.78		Culvert			
Stream1	996	Q100	227.00	695.06	698.00	698.00
698.25	0.007682	4.21	70.36	186.56	0.67	

Appendix D
Hydraulic Model, Proposed Channel

HEC-RAS Plan: exist River: Vinita Unnamed Reach: Stream1 Profile: Q100

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Stream1	1000	Q100	227.00	699.85	700.51	700.32	700.57	0.004609	2.04	127.82	283.82	0.47
Stream1	999	Q100	227.00	698.33	699.55	699.55	699.93	0.019365	4.94	45.91	59.88	1.00
Stream1	998	Q100	227.00	696.80	698.95	698.64	699.41	0.001133	5.42	41.89	23.73	0.72
Stream1	997	Q100	227.00	696.25	698.38	698.36	699.31	0.002368	7.81	29.08	16.51	1.00
Stream1	996.78		Culvert									
Stream1	996	Q100	227.00	695.06	698.00	698.00	698.25	0.007682	4.21	70.36	186.56	0.67

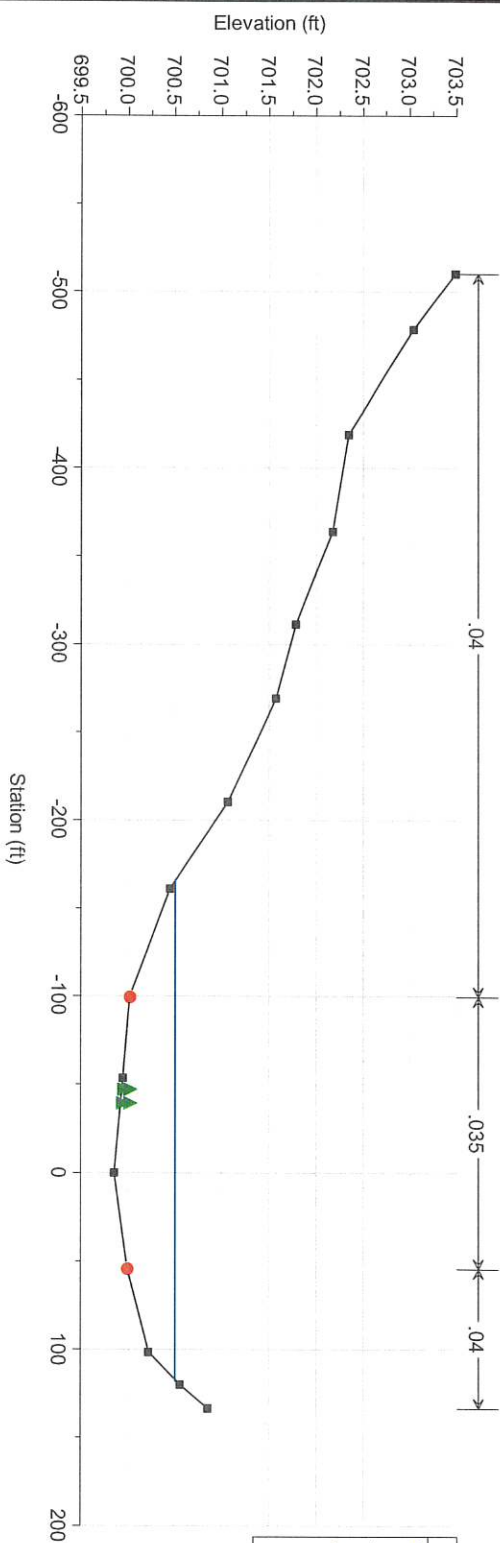
HEC-RAS Plan: exist River: Vinita Unnamed Reach: Stream1 Profile: Q100

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Stream1	1000	Q100	700.57	700.51	0.06	0.60	0.03	18.12	181.94	26.94	283.82
Stream1	999	Q100	699.93	699.55	0.38	0.25	0.01		227.00		59.88
Stream1	998	Q100	699.41	698.95	0.46	0.05	0.05		227.00	0.00	23.73
Stream1	997	Q100	699.31	698.36	0.95				227.00		15.51
Stream1	996.78	Culvert									
Stream1	996	Q100	698.25	698.00	0.25				208.38	18.62	186.56

HEC-RAS Model Plan: Existing 4/11/2023

Geom: PROPOSED_1 RS = 1000

River = Vinitia Unnamed Reach = Stream1

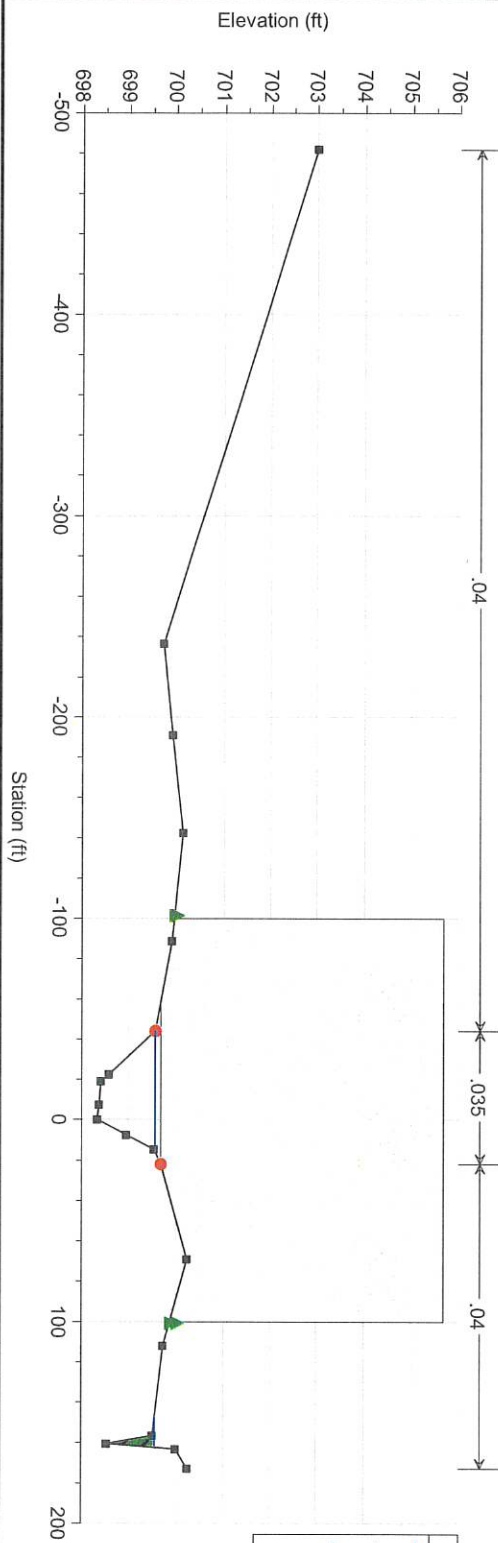


Legend	
W/S Q100	Red Circle
Ground	Black Square
Ineff	Green Triangle
Bank Sta	Red Circle

HEC-RAS Model Plan: Existing 4/11/2023

Geom: PROPOSED_1 RS = 999

River = Vinitia Unnamed Reach = Stream1

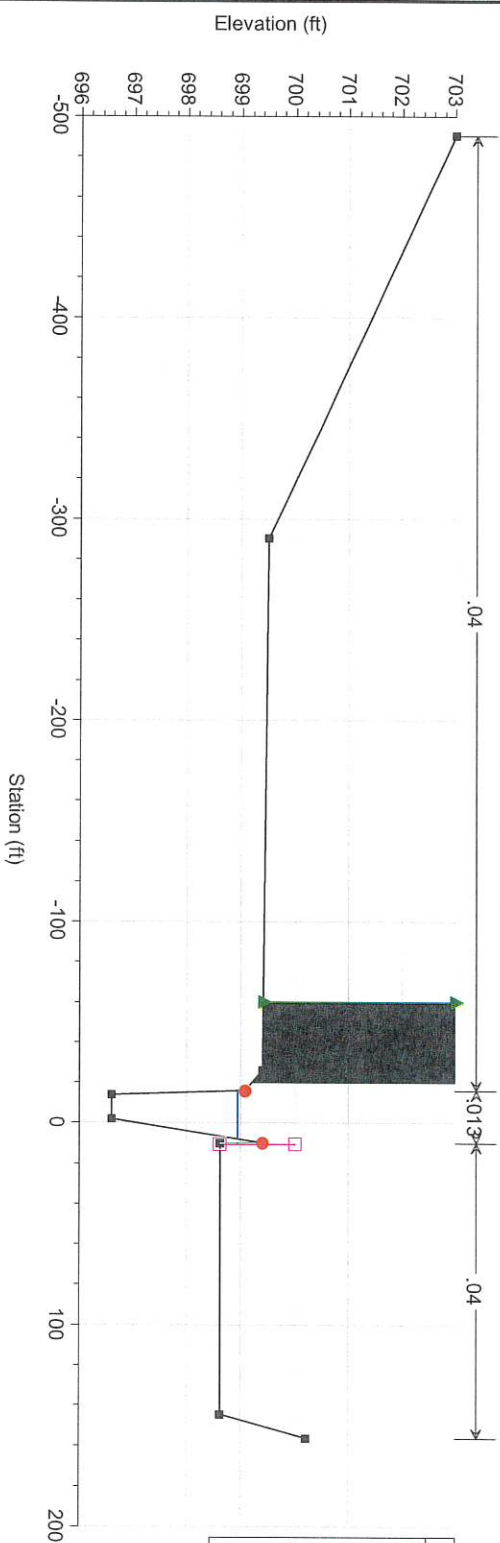


Legend	
W/S Q100	Red Circle
Ground	Black Square
Ineff	Green Triangle
Bank Sta	Red Circle

HEC-RAS Model Plan: Existing 4/11/2023

Geom: PROPOSED_1

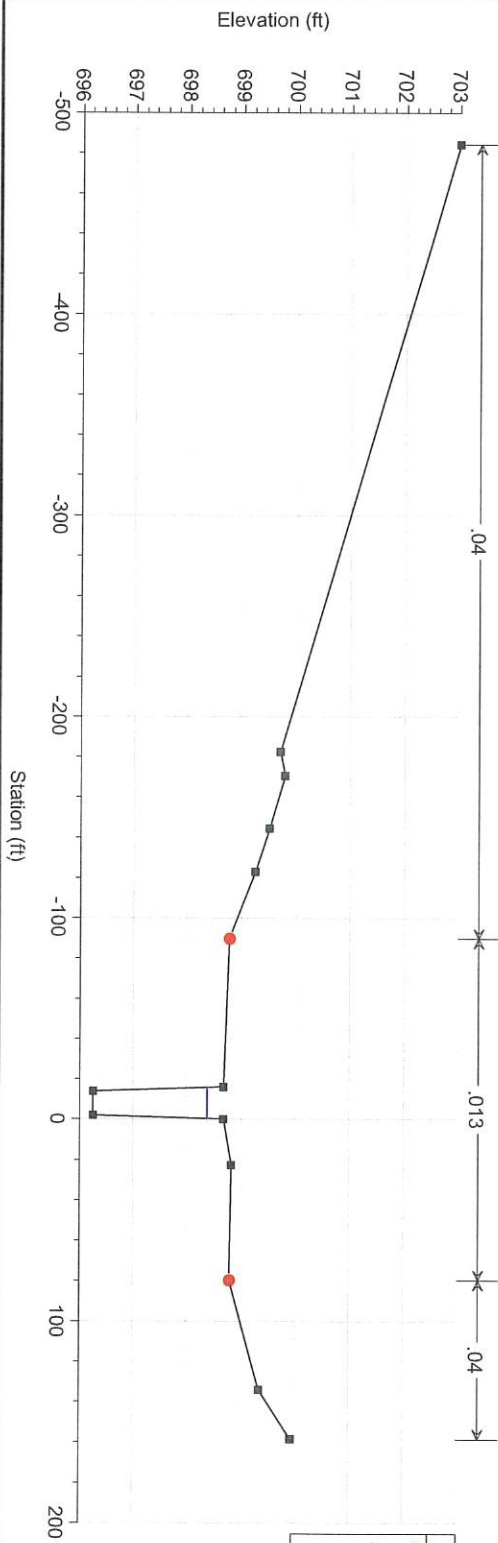
River = Vinita Unnamed Reach = Stream1 RS = 998



HEC-RAS Model Plan: Existing 4/11/2023

Geom: PROPOSED_1

River = Vinita Unnamed Reach = Stream1 RS = 997



Legend

W/S Q100

Ground

Levee

Ineff

Bank Sta

Legend

W/S Q100

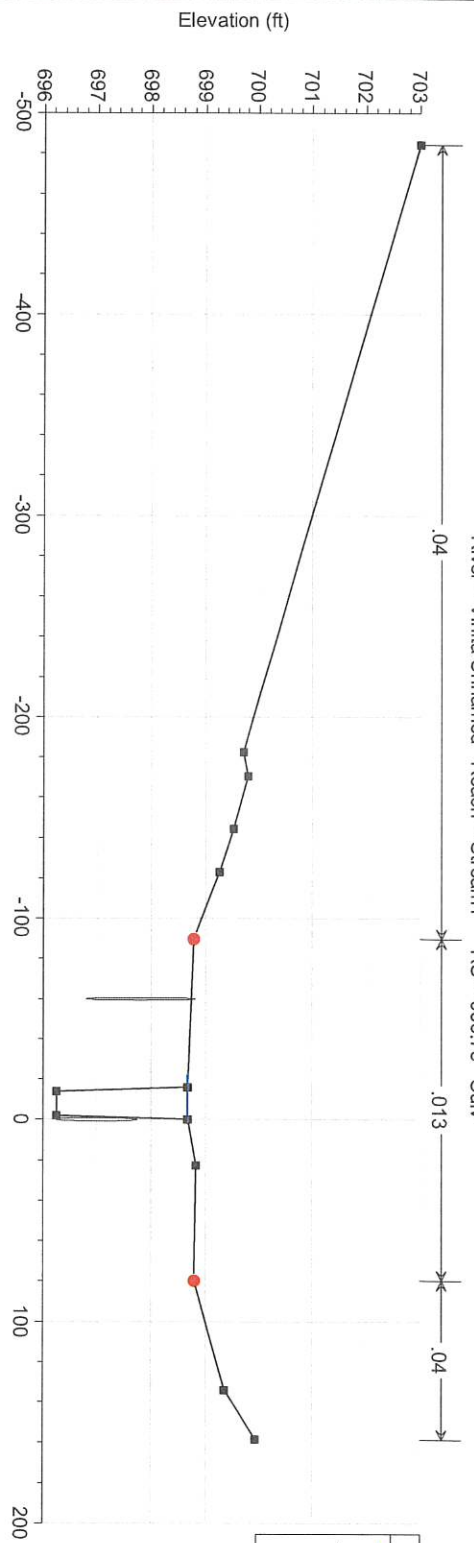
Ground

Bank Sta

HEC-RAS Model Plan: Existing 4/11/2023

Geom: PROPOSED_1

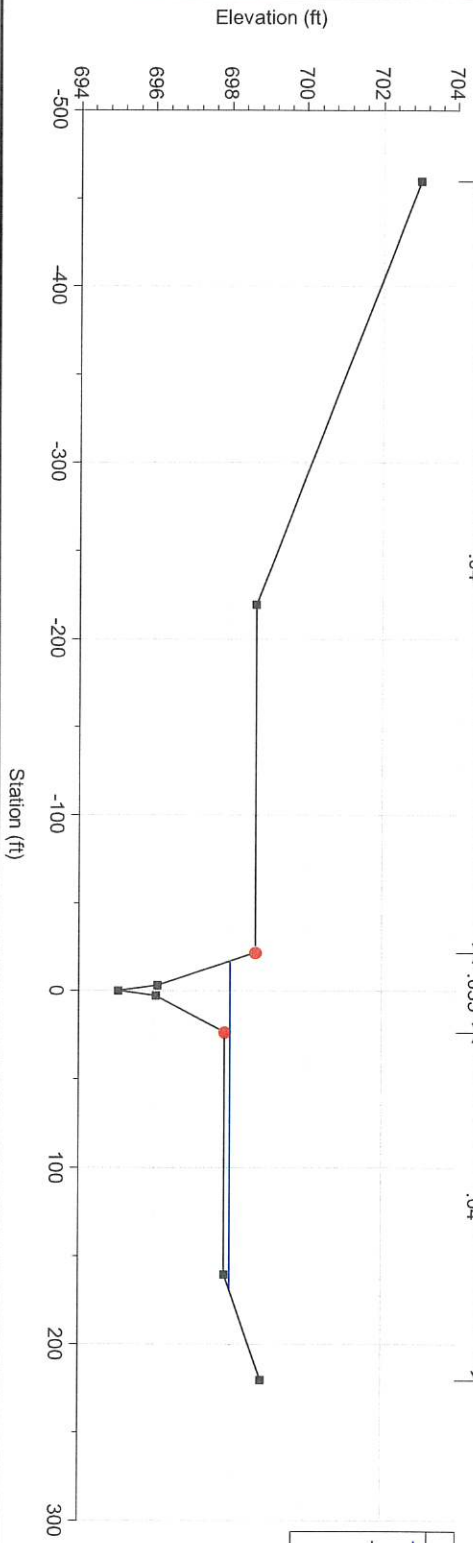
River = Vinita Unnamed Reach = Stream1 RS = 996.78 Culv



HEC-RAS Model Plan: Existing 4/11/2023

Geom: PROPOSED_1

River = Vinita Unnamed Reach = Stream1 RS = 996



HEC-RAS HEC-RAS 6.2 March 2022
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X   X  XXXXXX   XXXX       XXXX       XX       XXXX
X   X  X       X   X       X   X       X   X       X
X   X  X       X           X   X       X   X       X
XXXXXXXX XXXX   X           XXX XXXX   XXXXXX   XXXX
X   X  X       X           X   X       X   X       X
X   X  X       X   X       X   X       X   X       X
X   X  XXXXXX   XXXX       X   X       X   X       XXXXX
```

PROJECT DATA

Project Title: HEC-RAS Model
Project File : VINITA_CNHA.prj
Run Date and Time: 4/11/2023 3:34:22 PM

Project in English units

Project Description:

CRS Info=<SpatialReference> <CoordinateSystem Code="3640"
Unit="US_survey_Foot" AcadCode="NSRS07.OK-NF" /></SpatialReference>

PLAN DATA

Plan Title: Existing
Plan File : G:\2022\22CNHA01 Vinita Site Development\DESIGN\HEC-RAS\VINITA_CNHA.p01

Geometry Title: PROPOSED_1
Geometry File : G:\2022\22CNHA01 Vinita Site
Development\DESIGN\HEC-RAS\VINITA_CNHA.g06

Flow Title : Rational
Flow File : G:\2022\22CNHA01 Vinita Site
Development\DESIGN\HEC-RAS\VINITA_CNHA.f01

Plan Description:
Default Scenario

Plan Summary Information:

Number of: Cross Sections = 5 Multiple Openings = 0
Culverts = 1 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information

Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.33
Flow tolerance factor = 0.001

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Rational

Flow File : G:\2022\22CNHA01 Vinita Site Development\DESIGN\HEC-RAS\VINITA_CNHA.f01

Flow Data (cfs)

River	Reach	RS	Q100
Vinita Unnamed	Stream1	1000	227

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
Vinita Unnamed	Stream1	Q100	Normal S = 0.019319

GEOMETRY DATA

Geometry Title: PROPOSED_1

Geometry File : G:\2022\22CNHA01 Vinita Site Development\DESIGN\HEC-RAS\VINITA_CNHA.g06

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 1000

INPUT

Description:

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-510.39	703.49	-478.88	703.039	-418.8	702.342	-363.79	702.174	-311.21	701.783
-269.3	701.57	-210.68	701.059	-161.06	700.445	-99.79	700.016	-53.44	699.946
0	699.854	54.32	699.988	101.44	700.219	120.31	700.56	133.31	700.85

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-510.39	.04	-99.79	.035	54.32	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -99.79 54.32 70.59 70.59 70.59 .1 .3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-510.39	-47.38	700	F
-39.66	133.31	700	F

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 999

INPUT

Description:

Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-481.81	703	-236.29	699.72	-190.92	699.92	-142.19	700.14	-88.59	699.91
-44.25	699.55	-22.56	698.57	-19.11	698.41	-7.56	698.36	0	698.33
7.44	698.94	14.69	699.53	21.64	699.67	69.05	700.24	112.12	699.73
156.55	699.5	160.5	698.54	163.31	700	172.66	700.25		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-481.81	.04	-44.25	.035	21.64	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -44.25 21.64 84.12 84.12 84.12 .1 .3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-481.81	-101.6	700	F
100.62	172.66	700	F

Cross Section Lid

```

num=      2
Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
-100  705.67  699.67      100  705.67  699.67

```

CROSS SECTION

```

RIVER: Vinita Unnamed
REACH: Stream1          RS: 998

```

INPUT

Description:

```

Station Elevation Data      num=      11
Sta      Elev      Sta      Elev      Sta      Elev      Sta      Elev      Sta      Elev
-490.41  703 -290.41  699.5 -26.27  699.4 -16  699.08 -14  696.6
-2  696.6  9.59  699.4  9.75  699.4  10  698.62  144.59  698.62
156.31  700.2

```

```

Manning's n Values          num=      3
Sta      n Val      Sta      n Val      Sta      n Val
-490.41  .04 -16  .013  9.59  .04

```

```

Bank Sta: Left      Right      Lengths: Left Channel      Right      Coeff Contr.      Expan.
          -16      9.59          31.99      31.99      31.99          .1          .3

```

```

Ineffective Flow          num=      1
Sta L      Sta R      Elev      Permanent
-490.41  -60.23          F
Right Levee      Station=      10      Elevation=      700
Blocked Obstructions          num=      1
Sta L      Sta R      Elev
-60      -20      703

```

CROSS SECTION

```

RIVER: Vinita Unnamed
REACH: Stream1          RS: 997

```

INPUT

Description:

```

Station Elevation Data      num=      14
Sta      Elev      Sta      Elev      Sta      Elev      Sta      Elev      Sta      Elev
-484.31  703 -182.64  699.705 -170.55  699.799 -144.48  699.514 -122.91  699.248
-89.88  698.772 -16  698.66 -14  696.25 -2  696.25 0  698.66
22.63  698.819 79.41  698.783 133.97  699.339 158.3  699.937

```

```

Manning's n Values          num=      3
Sta      n Val      Sta      n Val      Sta      n Val
-484.31  .04 -89.88  .013  79.41  .04

```

```

Bank Sta: Left      Right      Lengths: Left Channel      Right      Coeff Contr.      Expan.

```

-89.88 79.41 61.29 61.29 61.29 .1 .3

CULVERT

RIVER: Vinita Unnamed
REACH: Stream1 RS: 996.78

INPUT

Description:

Distance from Upstream XS = 10
Deck/Roadway Width = 4
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates

num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
-493.13 0 199.69 0

Upstream Bridge Cross Section Data

Station Elevation Data num= 14
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
-484.31 703 -182.64 699.705 -170.55 699.799 -144.48 699.514 -122.91 699.248
-89.88 698.772 -16 698.66 -14 696.25 -2 696.25 0 698.66
22.63 698.819 79.41 698.783 133.97 699.339 158.3 699.937

Manning's n Values

num= 3
Sta n Val Sta n Val Sta n Val
-484.31 .04 -89.88 .013 79.41 .04

Bank Sta: Left Right Coeff Contr. Expan.
-89.88 79.41 .1 .3

Downstream Deck/Roadway Coordinates

num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
-761.3 0 -68.48 0

Downstream Bridge Cross Section Data

Station Elevation Data num= 11
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
-484.31 703 -182.64 699.705 -170.55 699.799 -144.48 699.514 -122.91 699.248
-89.88 698.772 0 698.66 22.63 698.819 79.41 698.783 133.97 699.339
158.3 699.937

Manning's n Values

num= 3
Sta n Val Sta n Val Sta n Val
-484.31 .04 -89.88 .035 79.41 .04

Bank Sta: Left Right Coeff Contr. Expan.
-89.88 79.41 .1 .3

Upstream Embankment side slope = 1 horiz. to 1.0 vertical
 Downstream Embankment side slope = 1 horiz. to 1.0 vertical
 Maximum allowable submergence for weir flow = .98
 Elevation at which weir flow begins =
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 2

Culvert Name Shape Rise Span
 Culvert #1 Ellipse 2 1.167
 FHWA Chart # 30- Vertical Ellipse; Concrete
 FHWA Scale # 1 - Square edge with headwall
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

1	10	40	.013	.013	0	.5
---	----	----	------	------	---	----

Upstream Elevation = 696.8
 Centerline Station = -60
 Downstream Elevation = 695.06
 Centerline Station = -60

Culvert Name Shape Rise Span
 Culvert #2 Circular 1.5
 FHWA Chart # 1 - Concrete Pipe Culvert
 FHWA Scale # 1 - Square edge entrance with headwall
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

1	10	27	.013	.013	0	.5
---	----	----	------	------	---	----

Upstream Elevation = 696.24
 Centerline Station = 0
 Downstream Elevation = 695.93
 Centerline Station = 0

CROSS SECTION

RIVER: Vinita Unnamed
 REACH: Stream1 RS: 996

INPUT

Description:

Station Elevation Data		num=		9					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-459.73	703	-219.59	698.676	-22	698.676	-3.22	696.092	0	695.063
2.78	696.049	23.42	697.85	160.52	697.852	220.59	698.835		

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 -459.73 .04 -22 .035 23.42 .04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 -22 23.42 0 0 0 .1 .3

SUMMARY OF MANNING'S N VALUES

River: Vinita Unnamed

Reach	River Sta.	n1	n2	n3
Stream1	1000	.04	.035	.04
Stream1	999	.04	.035	.04
Stream1	998	.04	.013	.04
Stream1	997	.04	.013	.04
Stream1	996.78	Culvert		
Stream1	996	.04	.035	.04

SUMMARY OF REACH LENGTHS

River: Vinita Unnamed

Reach	River Sta.	Left	Channel	Right
Stream1	1000	70.59	70.59	70.59
Stream1	999	84.12	84.12	84.12
Stream1	998	31.99	31.99	31.99
Stream1	997	61.29	61.29	61.29
Stream1	996.78	Culvert		
Stream1	996	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Vinita Unnamed

Reach	River Sta.	Contr.	Expan.
Stream1	1000	.1	.3
Stream1	999	.1	.3
Stream1	998	.1	.3
Stream1	997	.1	.3

Stream1	996.78	Culvert		
Stream1	996		.1	.3

Profile Output Table - Standard Table 1

Reach E.G. Elev (ft)	River Sta E.G. Slope (ft/ft)	Profile Vel Chnl (ft/s)	Q Total Flow Area (cfs) (sq ft)	Min Ch El Top Width (ft)	W.S. Elev Froude # Chl (ft)	Crit W.S. (ft)
Stream1 700.57	1000 0.004809	Q100 2.04	227.00 127.82	699.85 283.82	700.51 0.47	700.32
Stream1 699.93	999 0.019365	Q100 4.94	227.00 45.91	698.33 59.88	699.55 1.00	699.55
Stream1 699.41	998 0.001133	Q100 5.42	227.00 41.89	696.60 23.73	698.95 0.72	698.54
Stream1 699.31	997 0.002368	Q100 7.81	227.00 29.08	696.25 15.51	698.36 1.00	698.36
Stream1	996.78		Culvert			
Stream1 698.25	996 0.007682	Q100 4.21	227.00 70.36	695.06 186.56	698.00 0.67	698.00

Appendix E FEMA Firmette

National Flood Hazard Layer FIRMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) Zone A, X, AE
- With BFE or Depth Zone AE, AD, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/24/2022 at 1:02 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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