



December 6, 2022  
AVO 37449.004

Ms. Ramie Hammonds  
Development Services Director/Building Official  
City of Sanger  
201 Bolivar Street  
P.O. Box 1729  
Sanger, Texas 76266

**Re: Ridgeview Addition– Drainage Study in support of the Preliminary Plat - First Review**

Dear Ms. Hammonds,

Halff Associates, Inc. was requested by the City of Sanger to provide a review of the drainage study and downstream assessment in support of the preliminary plat for the Ridgeview Addition development. The drainage study prepared Allison Engineering Group was received on November 21, 2022.

We have completed our review and offer the following comments. Please refer to the Denton County Subdivision Rules and Regulations dated July 2009 for drainage criteria; hereafter referred to as Criteria Manual.

**General:**

1. Plans and plat are reviewed separately. Please note an accepted drainage study is required prior to plat acceptance.
2. Please address comments on attached markups and provide annotated responses on markups.
3. Please include the following on the final plat: (a) provide minimum finished floor elevations 2' above pond 100-yr water surface elevation for lots adjacent to pond; (b) update private drainage easement for the pond as needed.
4. Please note, additional comments may result once additional info is provided.

**Hydrology and Hydraulics:**

5. Provide a comparison of existing and proposed flows at each site outfall. If flows are increased, please provide a hydraulic analysis of the receiving systems to demonstrate no adverse impacts thru the zone of influence (see additional comments on the attached markups). If obtaining permission for increases from adjacent owner, please provide documentation; include exhibits and calculations.

**Address the following comments with future Drainage Study (Final Drainage Study) to support Final Plat and Construction plans:**

December 6, 2022

Page 2 of 2

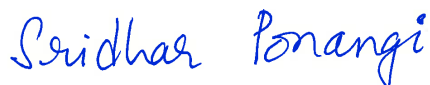
6. Provide RAS model for all proposed channels and culverts. Verify proposed channels contain the fully developed 100-yr flow with 1' freeboard. Use  $n=.04$  for earthen channel. Include a RAS workmap or add RAS cross sections to the grading plans. Extend RAS model downstream of property line to establish backwater.
7. Provide RAS model for all proposed roadside ditches (Criteria Manual Section IV.3.4). Include proposed culverts and driveway culverts and verify the 100-yr fully developed flow is contained within the right of way. If not contained within ROW, additional DE must be dedicated to contain the fully developed 100-yr water surface elevation. Please note, a RAS model will be required for proposed culverts to confirm backwater, headwater, and freeboard.
8. Provide a hydraulic workmap for the RAS models.
9. Show and label proposed driveway culvert on street plan and profile. Include 100-yr HGL. Design driveway culvert to pass the fully developed 100-yr flood event. Use RAS to evaluate backwater and tailwater at proposed culverts.
10. Provide Plan and profile for all proposed channels. Show and label the fully developed 100-yr water surface profile and left and right top of bank; verify 1' freeboard. Include culverts and verify 1' freeboard to top of road.
11. Per the City variance, lot to lot drainage is only allowed across two lots before being picked up in a drainage easement. Provide side yard swales as needed to direct lot flows to the roads.
12. Concentrated flow must be taken to an acceptable outfall (storm drain or channel) or spread back to mimic existing conditions flow spread or sheet flow.
13. Please note, an updated drainage study will be required to support final plat once more detailed grading/plans are available. Update drainage/flood study as necessary to correspond to plans.

The Engineer shall revise the hydrologic study and/or plans in accordance with the above comments and/or provide a written response that addresses each comment. If you have any questions or need additional information, please do not hesitate to call me at (817) 764-7474.

Sincerely,

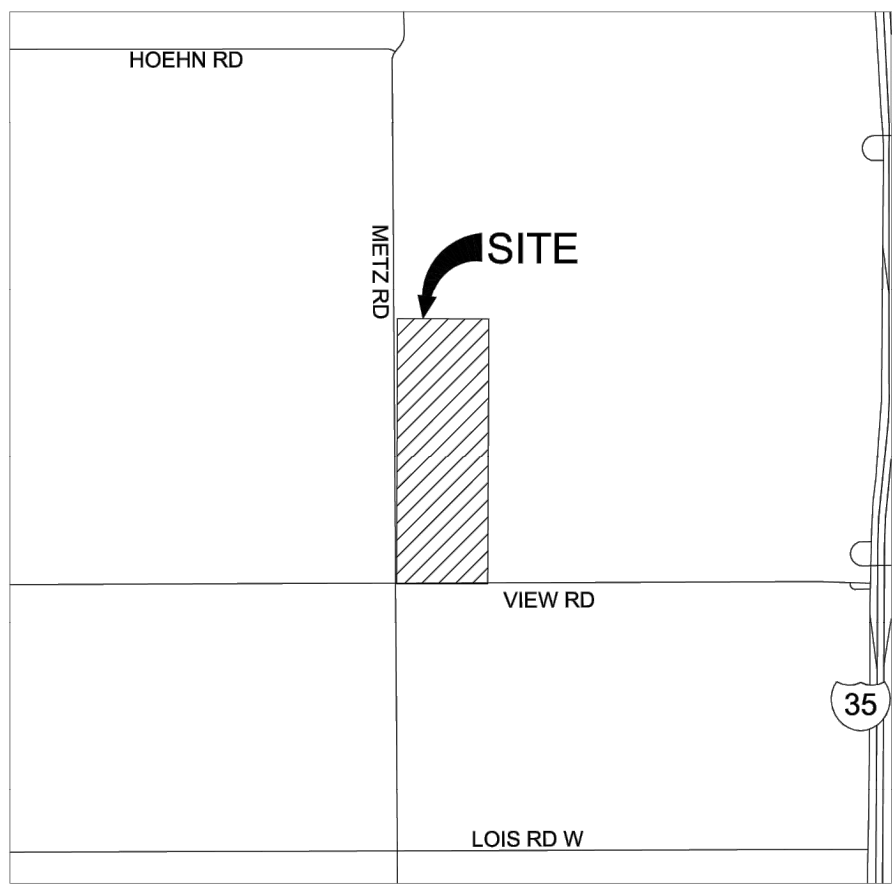
**HALFF ASSOCIATES, INC.**

Firm No. 0312



Sridhar Ponangi, P.E., CFM

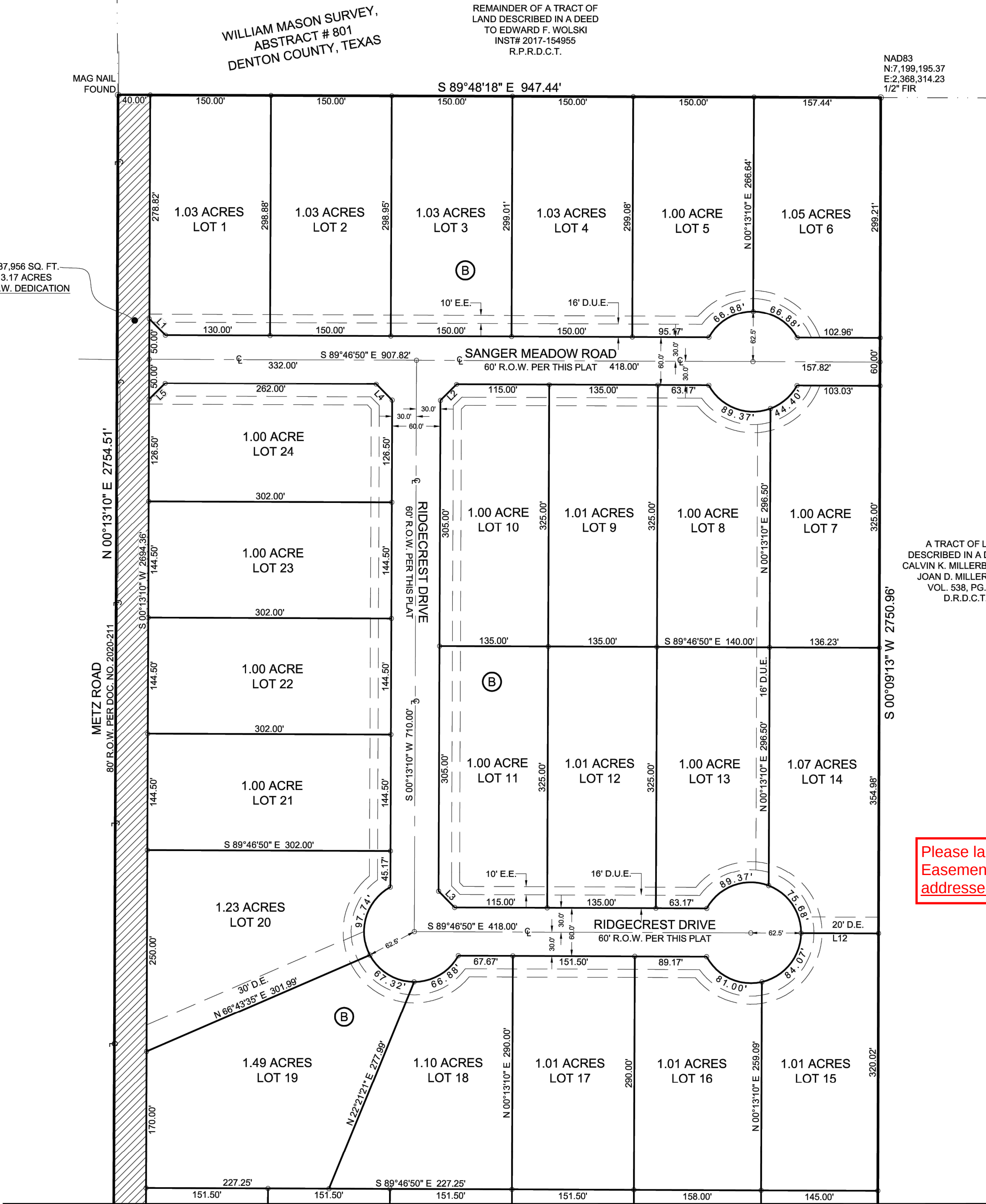
Drainage Review Consultant for the City of Sanger



VICINITY MAP  
NOT TO SCALE

GENERAL NOTES:

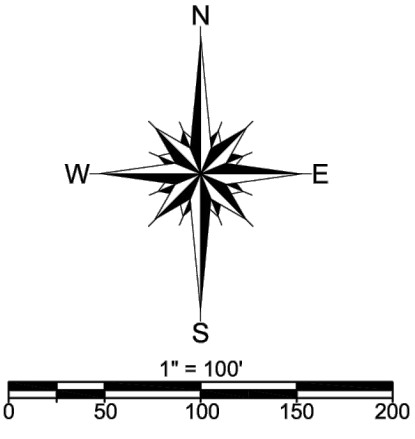
- ALL CORNERS ARE MARKED WITH CAPPED 1/2" IRON RODS STAMPED "KAZ" UNLESS OTHERWISE NOTED.
- FLOOD STATEMENT: I HAVE REVIEWED THE F.E.M.A. FLOOD INSURANCE RATE MAP FOR THE CITY OF SANGER, COMMUNITY NUMBER 480786 EFFECTIVE DATE 04-18-2011 AND THAT MAP INDICATES AS SCALED, THAT THIS PROPERTY IS WITHIN "NON-SHADED ZONE X" DEFINED AS "AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD (500-YEAR)" AS SHOWN ON PANEL 70 G OF SAID MAP.
- BEARINGS SHOWN HEREON ARE REFERENCED TO THE TEXAS COORDINATE SYSTEM OF 1983, NORTH CENTRAL ZONE (4202), AND ARE BASED ON THE NORTH AMERICAN DATUM OF 1983, 2011 ADJUSTMENT.
- THE PURPOSE OF THIS PRELIMINARY PLAT IS TO CREATE 47 RESIDENTIAL LOTS.
- WATER SERVICE TO BE PROVIDED BY: BOLIVAR WATER SUPPLY CORPORATION.  
4151 FARM TO MARKET ROAD 455  
SANGER, TX 76228  
PHONE: (940) 458-3931
- SANITARY SEWER TO BE HANDLED BY PRIVATE FACILITIES APPROVED BY THE DENTON COUNTY PUBLIC HEALTH.
- ELECTRIC SERVICE TO BE PROVIDED BY: COSERV ELECTRIC  
7701 S. STEMMONS FREEWAY  
CORINTH, TX 76210  
PHONE: (940) 321-7800
- THE MAINTENANCE OF PAVING, GRADING AND DRAINAGE IMPROVEMENTS AND/OR EASEMENTS SHOWN ON THIS PLAT ARE THE RESPONSIBILITY OF THE INDIVIDUAL PROPERTY OWNER AND DOES NOT CONSTITUTE ACCEPTANCE OF SAME FOR MAINTENANCE PURPOSES BY DENTON COUNTY.
- ALL SURFACE DRAINAGE EASEMENTS SHALL BE KEPT CLEAR OF FENCES, BUILDINGS, FOUNDATION, PLANTINGS AND OTHER OBSTRUCTIONS TO THE OPERATION AND MAINTENANCE OF THE DRAINAGE FACILITY.
- BLOCKING THE FLOW OF WATER OR CONSTRUCTING IMPROVEMENTS IN SURFACE DRAINAGE EASEMENTS, AND FILLING OR OBSTRUCTING THE FLOODWAY IS PROHIBITED.
- DENTON COUNTY WILL NOT BE RESPONSIBLE FOR ANY DAMAGE, PERSONAL INJURY OR LOSE OF LIFE OR PROPERTY OCCASIONED BY FLOODING OR FLOODING CONDITIONS.
- THE EXISTING CREEKS OR DRAINAGE CHANNELS TRAVERSING ALONG OR ACROSS THE ADDITION WILL REMAIN AS OPEN CHANNELS AND WILL BE MAINTAINED BY THE INDIVIDUAL PROPERTY OWNERS OF THE LOT OR LOT THAT ARE TRAVERSED BY OR ADJACENT TO THE DRAINAGE COURSES ALONG OR ACROSS THE LOTS.
- CONSTRUCTION NOT COMPLETE WITHIN TWO YEARS OF THE CITY OF SANGER APPROVAL SHALL BE SUBJECT TO CURRENT CITY OF SANGER CODE OF ORDINANCES AND DENTON COUNTY SUBDIVISION RULES AND REGULATIONS.
- A DRIVEWAY CULVERT PERMIT MUST BE OBTAINED FROM THE ROAD AND BRIDGE DEPARTMENT BY THE OWNER OF EACH LOT PRIOR TO THE CONSTRUCTION, INSTALLATION OR PLACEMENT OF ANY DRIVEWAY ACCESS IMPROVEMENTS WITHIN THE DEDICATED RIGHT-OF-WAY.
- NO CONSTRUCTION WITHOUT WRITTEN APPROVAL FROM DENTON COUNTY SHALL BE ALLOWED WITHIN AN IDENTIFIED "FIRM" FLOODPLAIN AREA, AND THEN ONLY AFTER A DETAILED FLOODPLAIN DEVELOPMENT PERMIT INCLUDING ENGINEERING PLANS AND STUDIES SHOW THAT NO RISE IN THE BASE FLOOD ELEVATION (BFE) WILL RESULT, THAT NO FLOODING WILL RESULT, THAT NO OBSTRUCTION TO THE NATURAL FLOW OF WATER WILL RESULT, AND SUBJECT TO ALL OWNERS OF THE PROPERTY AFFECTED BY SUCH CONSTRUCTION BECOMING A PARTY TO THE REQUEST, WHERE CONSTRUCTION IS PERMITTED, ALL FINISHED FLOOR ELEVATIONS SHALL BE A MINIMUM OF TWO FEET ABOVE THE 100-YEAR FLOOD ELEVATION.
- DENTON COUNTY SHALL NOT BE RESPONSIBLE FOR MAINTENANCE OF PRIVATE STREETS, DRIVES, EMERGENCY ACCESS EASEMENTS, RECREATION AREAS AND OPEN SPACES; AND THE OWNERS SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF PRIVATE STREETS, DRIVES, EMERGENCY ACCESS EASEMENTS, RECREATION AREAS AND OPEN SPACES, AND SAID OWNERS AGREE TO INDEMNIFY AND HOLD HARMLESS DENTON COUNTY FROM ALL CLAIMS, DAMAGES AND LOSSES ARISING OUT OF OR RESULTING FROM PERFORMANCE OF THE OBLIGATIONS OF SAID OWNERS SET FORTH IN THIS PARAGRAPH.
- THE CITY OF SANGER IS NOT RESPONSIBLE FOR REPLACING ANY IMPROVEMENTS IN, UNDER, OR OVER ANY EASEMENTS CAUSED BY MAINTENANCE OR REPAIR.
- UTILITY EASEMENTS MAY ALSO BE USED FOR THE MUTUAL USE AND ACCOMMODATION OF ALL PUBLIC UTILITIES DESIRING TO USE OR USING THE SAME UNLESS THE EASEMENT LIMITS THE USE TO PARTICULAR UTILITIES, SAID USE BY THE PUBLIC UTILITIES BEING SUBORDINATE TO THE PUBLIC'S AND CITY OF SANGERS USE THEREOF.
- THE CITY OF SANGER AND PUBLIC UTILITIES SHALL HAVE THE RIGHT TO REMOVE AND KEEP REMOVED ALL OR PART OF ANY BUILDING, FENCES, TREES, SHRUBS, OR OTHER IMPROVEMENTS OR GROWTHS WHICH MAY IN ANY WAY ENDANGER OR INTERFERE WITH THE CONSTRUCTION, MAINTENANCE, OR EFFICIENCY OF THEIR RESPECTIVE SYSTEMS IN THE EASEMENTS.
- THE CITY OF SANGER AND PUBLIC UTILITIES SHALL AT ALL TIMES HAVE THE FULL RIGHT OF INGRESS AND EGRESS TO OR FROM THEIR RESPECTIVE EASEMENTS FOR THE PURPOSE OF CONSTRUCTING, RECONSTRUCTING, INSPECTING, PATROLLING, MAINTAINING, READING METERS, AND ADDING TO OR REMOVING ALL OR PARTS OF THEIR RESPECTIVE SYSTEMS WITHOUT THE NECESSITY AT ANY TIME PROCURING PERMISSION FROM ANYONE.
- ALL MODIFICATIONS TO THIS DOCUMENT SHALL BE BY MEANS OF PLAT AND APPROVED BY THE CITY OF SANGER.
- THIS PLAT IS HEREBY ADOPTED BY THE OWNERS AND APPROVED BY THE CITY OF SANGER (CALLED "CITY") SUBJECT TO THE FOLLOWING CONDITIONS WHICH SHALL BE BINDING UPON THE OWNERS, THEIR HEIRS, GRANTEES, SUCCESSORS AND ASSIGNS: THE DRAINAGE EASEMENTS WITHIN THE LIMITS OF THIS ADDITION, WILL REMAIN OPEN AT ALL TIMES AND WILL BE MAINTAINED IN A SAFE AND SANITARY CONDITION BY THE OWNERS OF THE LOT OR LOTS THAT ARE TRAVERSED BY OR ADJACENT TO THE DRAINAGE EASEMENT. NEITHER THE CITY NOR THE COUNTY WILL BE RESPONSIBLE FOR THE MAINTENANCE AND OPERATION OF SAID EASEMENT OR FOR ANY DAMAGE TO PRIVATE PROPERTY OR PERSON THAT RESULTS FROM THE EASEMENT, OR FOR THE CONTROL OF EROSION. NO OBSTRUCTIONS TO THE NATURAL FLOW OR STORM WATER RUN-OFF SHALL BE PERMITTED BY CONSTRUCTION OF ANY TYPE OF BUILDING, FENCE OR ANY OTHER STRUCTURE WITHIN THE DRAINAGE AND DETENTION EASEMENT, AS HEREIN ABOVE DEFINED, UNLESS APPROVED BY THE CITY ENGINEER AND COUNTY ENGINEER. PROVIDED, HOWEVER, IT IS UNDERSTOOD THAT IN THE EVENT IT BECOMES NECESSARY FOR THE CITY OR COUNTY TO ERECT OR CONSIDER ERECTING ANY TYPE OF DRAINAGE STRUCTURE IN ORDER TO IMPROVE THE STORM DRAINAGE THAT MAY BE OCCASIONED BY DRAINAGE IN OR ADJACENT TO THE SUBDIVISION, THEN IN SUCH EVENT, THE CITY OR COUNTY SHALL HAVE THE RIGHT TO ENTER UPON THE DRAINAGE EASEMENT AT ANY POINT, OR POINTS, TO INVESTIGATE, SURVEY OR TO ERECT, CONSTRUCT AND MAINTAIN ANY DRAINAGE FACILITY DEEMED NECESSARY FOR DRAINAGE PURPOSES. EACH PROPERTY OWNER SHALL KEEP THE DRAINAGE EASEMENT CLEAN AND FREE OF DEBRIS, SILT, AND ANY SUBSTANCE WHICH WOULD RESULT IN UNSANITARY CONDITIONS OR OBSTRUCT THE FLOW OF WATER; AND THE CITY OR COUNTY SHALL HAVE THE RIGHT OF INGRESS AND EGRESS FOR THE PURPOSE OF INSPECTION AND SUPERVISION OF MAINTENANCE WORK BY THE PROPERTY OWNER TO ALLEVIATE ANY UNDESIRABLE CONDITIONS WHICH MAY OCCUR. THE NATURAL DRAINAGE THROUGH THE DRAINAGE EASEMENT IS SUBJECT TO STORM WATER OVERFLOW AND NATURAL BANK EROSION TO AN EXTENT WHICH CANNOT BE DEFINITELY DEFINED. NEITHER THE CITY, NOR THE COUNTY, SHALL BE HELD LIABLE FOR ANY SUCH DAMAGES OF ANY NATURE RESULTING FORM THE OCCURRENCE OF THESE NATURAL PHENOMENA, OR RESULTING FROM THE FAILURE OF ANY STRUCTURE OR STRUCTURES, WITHIN THE EASEMENT.
- ALL LOTS COMPLY WITH THE MINIMUM SIZE REQUIREMENTS OF THE ZONING DISTRICT.
- NOTICE - SELLING A PORTION OF THIS ADDITION BY METES AND BOUNDS IS A VIOLATION OF CITY ORDINANCE AND STATE LAW AND IS SUBJECT TO FINES AND WITHHOLDING OF UTILITIES AND BUILDING PERMITS.
- THIS PLAT DOES NOT ALTER OR REMOVE EXISTING DEED RESTRICTIONS IF ANY, ON THIS PROPERTY.
- THIS PROPERTY MAY BE SUBJECT TO CHARGES RELATED TO IMPACT FEES AND THE APPLICANT SHOULD CONTACT THE CITY REGARDING ANY APPLICABLE FEES DUE.
- ALL COMMON AREAS, DRAINAGE EASEMENTS, AND DETENTION FACILITIES WILL BE OWNED AND MAINTAINED BY THE HOA/POA. ANY COMMON AREA WITHIN THE CITY'S RIGHT-OF-WAY WILL REQUIRE A FACILITIES AGREEMENT, TO BE REVIEWED AND APPROVED BY THE CITY.



MATCHLINE

LEGEND

POB = POINT OF BEGINNING  
SIR = IRON ROD SET  
FIR = IRON ROD FOUND  
R.O.W. = RIGHT OF WAY  
D.U.E. = DRAINAGE & UTILITY EASEMENT  
E.E. = ELECTRIC EASEMENT  
D.DET.E. = DRAINAGE & DETENTION EASEMENT  
D.E. = DRAINAGE EASEMENT  
CL = CENTERLINE OF ROAD



SURVEYOR:  
KAZ SURVEYING, INC.  
1720 WESTMINSTER STREET  
DENTON, TEXAS 76205  
PHONE: (940) 382-3446  
TBPLS FIRM #10002100

OWNER:  
EDWARD F. WOLSKI  
13424 CASHES MILL RD  
SANGER, TEXAS 76266  
PHONE: (940) 300-0002

ENGINEER:  
ALLISON ENGINEERING GROUP  
2415 N. ELM STREET  
DENTON, TEXAS 76201  
PHONE: (940) 380-9453  
TBPE FIRM #F-7898



| LINE TABLE |               |          |
|------------|---------------|----------|
| LINE       | BEARING       | DISTANCE |
| L1         | S 44°46'50" E | 28.28'   |
| L2         | S 45°13'10" W | 28.28'   |
| L3         | S 44°46'45" E | 28.28'   |
| L4         | N 44°46'50" W | 28.28'   |
| L5         | S 45°13'10" W | 28.28'   |
| L6         | S 44°46'50" E | 28.28'   |
| L7         | S 45°13'10" W | 28.28'   |
| L8         | S 44°46'50" E | 28.28'   |
| L9         | N 44°46'50" W | 28.28'   |
| L10        | S 45°13'10" W | 28.28'   |
| L11        | N 44°54'02" W | 42.34'   |
| L12        | S 89°46'57" E | 96.13'   |
| L13        | S 89°46'50" E | 96.87'   |

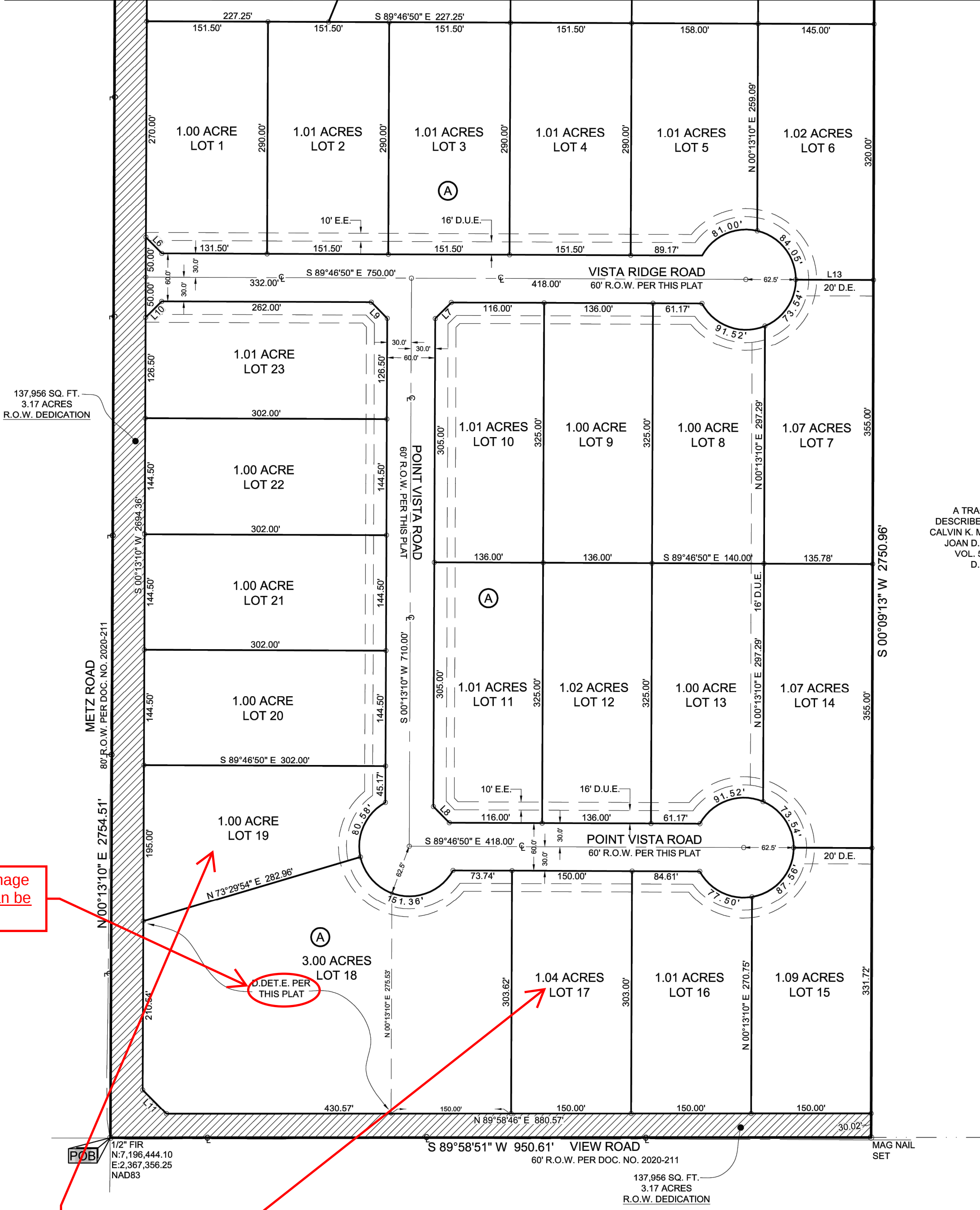
PRELIMINARY PLAT FOR  
REVIEW PURPOSES ONLY

**PRELIMINARY PLAT**  
**TOTAL LOTS: 47 RESIDENTIAL**  
**LOTS 1-23, BLOCK A,**  
**LOTS 1-24, BLOCK B**  
**METZ/VIEW ADDITION**

BEING 59.97 ACRES, 3.17 ACRES R.O.W. DEDICATION, IN THE WILLIAM MASON SURVEY, ABSTRACT NUMBER 801, DENTON COUNTY, TEXAS, IN THE EXTRATERRITORIAL JURISDICTION OF THE CITY OF SANGER, DENTON COUNTY, TEXAS

Please label as Private Drainage  
Easement. This comment can be  
addressed with Final Plat.

Provide min FFE for lots around the  
pond. This comment can be addressed  
with Final Plat.



A TRACT OF LAND  
DESCRIBED IN A DEED TO  
CALVIN K. MILLERBORG AND  
JOAN D. MILLERBORG  
VOL. 538, PG. 159  
D.R.D.C.T.

1/2" FIR  
N7.196,444.10  
E2.367,356.25  
NAD83

137,956 SQ. FT.  
3.17 ACRES  
R.O.W. DEDICATION

137,956 SQ. FT.  
3.17 ACRES  
R.O.W. DEDICATION

A TRACT OF LAND  
DESCRIBED IN A DEED TO  
CALVIN K. MILLERBORG AND  
JOAN D. MILLERBORG  
VOL. 538, PG. 159  
D.R.D.C.T.

Plotted By: Jason Mark  
Plot Date: Wednesday, November 16, 2022 4:32:20 PM  
File Name: P:\Projects\IRE2101 - NE Mez - View SFRDOWG, CEP4 EXISTING DRAINAGE AREA MAP.dwg  
Save Date: Wednesday, November 16, 2022 4:07:20 PM  
Plot Style Table: Allison.ctb

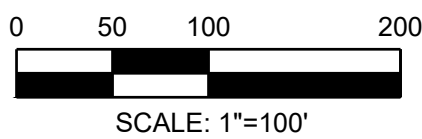
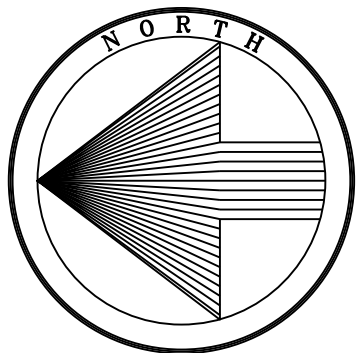
| Time of Concentration |             |                              |                    |                       |           |               |         |                |                    |                            |                             |         |                      |                   |                  |                       |          |      |
|-----------------------|-------------|------------------------------|--------------------|-----------------------|-----------|---------------|---------|----------------|--------------------|----------------------------|-----------------------------|---------|----------------------|-------------------|------------------|-----------------------|----------|------|
| Drainage Basin        | Flow Type   | Surface Condition            | Flow Distance (ft) | Elevation Change (ft) | Slope (%) | Roughness (n) | K-Value | Velocity (fps) | Channel Depth (ft) | Channel Bottom Length (ft) | Channel Angle of Embankment | Radians | Cross Sectional Area | Side Slopes (x:1) | Wetted Perimeter | Hydraulic Radius (ft) | Tc (min) |      |
| A                     | Sheet Flow  | Grass - Dense                | 44                 | 0.5                   | 1.1%      | 0.24          | -       | 0.08           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 8.8      |      |
|                       | Shallow     | Unpaved - Rills and Rivulets | 415                | 8.8                   | 2.1%      | -             | 16.13   | 2.34           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 2.96     |      |
|                       | Shallow     | Unpaved - Rills and Rivulets | 460                | 5                     | 1.1%      | -             | 16.13   | 1.69           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 4.53     |      |
|                       | Channelized | Borrow Ditch                 | 848                | 7                     | 0.8%      | 0.04          | -       | 4.50           | 3                  | 2                          | 14                          | 0.24    | 42                   | 4                 | 26.74            | 1.57                  | 3.14     |      |
|                       |             |                              |                    |                       |           |               |         |                |                    |                            |                             |         |                      |                   |                  | Total                 | 19.4     |      |
| B                     | Sheet Flow  | Grass - Dense                | 93                 | 4.7                   | 5.0%      | 0.24          | -       | 0.18           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 8.8      |      |
|                       | Shallow     | Unpaved - Rills and Rivulets | 480                | 9.5                   | 2.0%      | -             | 16.13   | 2.28           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 3.51     |      |
|                       |             |                              |                    |                       |           |               |         |                |                    |                            |                             |         |                      |                   |                  |                       | Total    | 12.3 |
| C                     | Sheet Flow  | Grass - Dense                | 65                 | 1.5                   | 2.4%      | 0.24          | -       | 0.12           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 15.0     |      |
|                       | Shallow     | Unpaved - Rills and Rivulets | 450                | 24                    | 5.3%      | -             | 16.13   | 3.71           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 2.02     |      |
|                       | Shallow     | Unpaved - Rills and Rivulets | 285                | 7                     | 2.5%      | -             | 16.13   | 2.55           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 1.86     |      |
|                       |             |                              |                    |                       |           |               |         |                |                    |                            |                             |         |                      |                   |                  |                       | Total    | 12.7 |
| D                     | Sheet Flow  | Grass - Dense                | 87                 | 3.8                   | 4.4%      | 0.24          | -       | 0.17           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 8.8      |      |
|                       | Shallow     | Unpaved - Rills and Rivulets | 551                | 24.5                  | 4.4%      | -             | 16.13   | 3.38           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 2.71     |      |
|                       |             |                              |                    |                       |           |               |         |                |                    |                            |                             |         |                      |                   |                  |                       | Total    | 11.5 |
| E                     | Sheet Flow  | Grass - Dense                | 71                 | 2.1                   | 2.9%      | 0.24          | -       | 0.13           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 8.8      |      |
|                       | Shallow     | Unpaved - Rills and Rivulets | 279                | 8.5                   | 3.0%      | -             | 16.13   | 2.79           | -                  | -                          | -                           | -       | -                    | -                 | -                | -                     | 1.66     |      |
|                       |             |                              |                    |                       |           |               |         |                |                    |                            |                             |         |                      |                   |                  |                       | Total    | 10.4 |
|                       |             |                              |                    |                       |           |               |         |                |                    |                            |                             |         |                      |                   |                  |                       | Minimum  | 15.0 |

Please verify the calculated Tc.  
Please identify the equation you are using to calculate Tc.

NOTES:  
1. MINIMUM TIME OF CONCENTRATION OF 15 MINUTES USED PER CITY OF SANGER DEVELOPMENT CODE

#### LEGEND

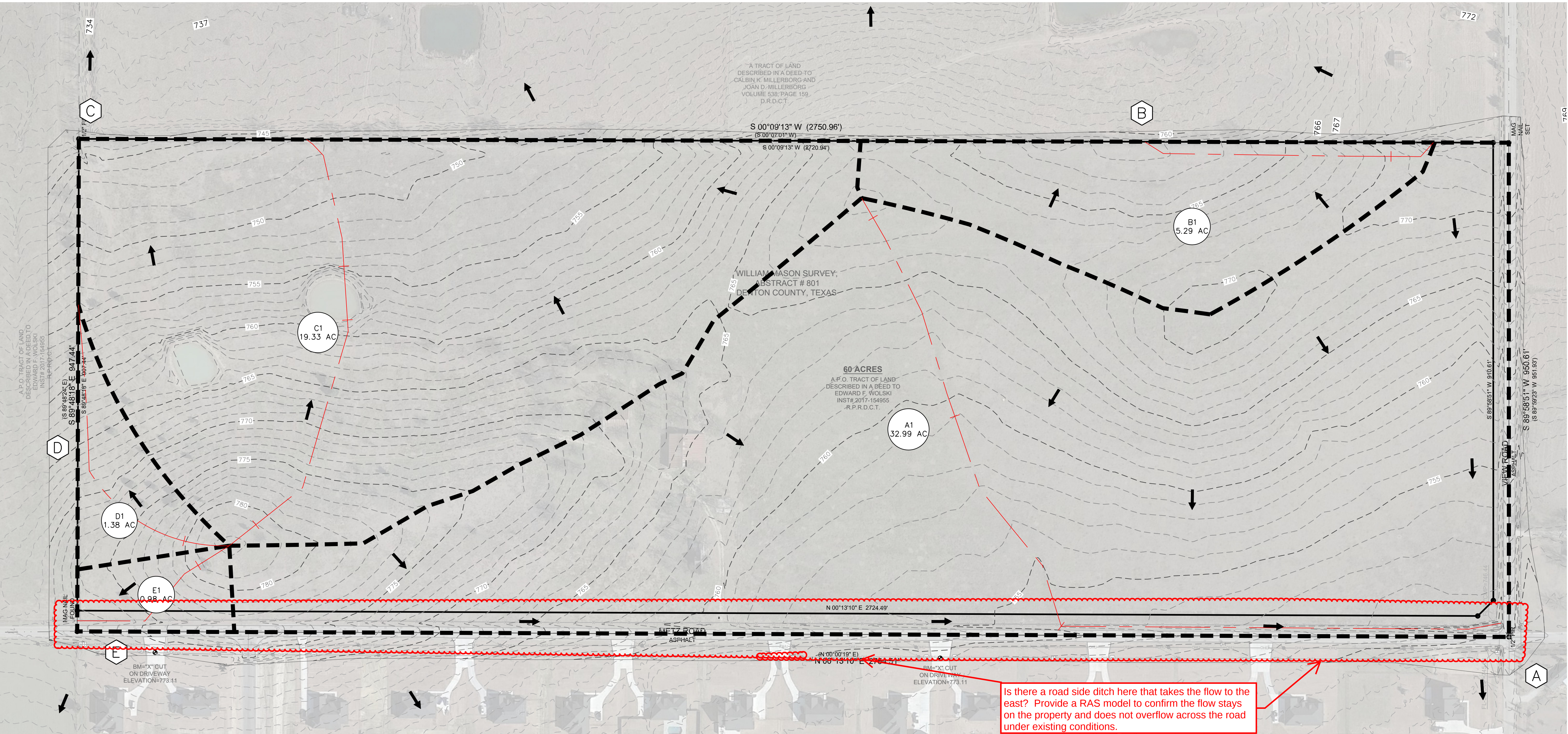
- PROPERTY BOUNDARY
- EXISTING MINOR CONTOUR
- DRAINAGE BOUNDARY
- TIME OF CONCENTRATION LINE
- DRAINAGE FLOW ARROW
- DRAINAGE AREA LABEL
- DESIGN POINT



#### CAUTION!!

EXISTING UNDERGROUND UTILITIES. CONTRACTOR TO FIELD VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO START OF ANY CONSTRUCTION AND SHALL IMMEDIATELY NOTIFY THE ENGINEER OF ANY CONFLICTS DISCOVERED. CONTRACTOR RESPONSIBLE FOR COORDINATING UTILITY RELOCATION WHERE NECESSARY AND PROTECTING EXISTING UTILITIES (SHOWN OR NOT SHOWN). IF ANY EXISTING UTILITIES ARE DAMAGED, THE CONTRACTOR SHALL REPLACE THEM AT THEIR OWN EXPENSE.

| Existing Conditions |                   |            |      |                      |                  |                   |                       |              |                  |                   |                       |              |                  |                   |                       |              |                  |                   |                       |               |                  |                   |                       |               |                  |                   |                       |               |                  |                   |                       |                |
|---------------------|-------------------|------------|------|----------------------|------------------|-------------------|-----------------------|--------------|------------------|-------------------|-----------------------|--------------|------------------|-------------------|-----------------------|--------------|------------------|-------------------|-----------------------|---------------|------------------|-------------------|-----------------------|---------------|------------------|-------------------|-----------------------|---------------|------------------|-------------------|-----------------------|----------------|
|                     |                   |            |      |                      | 1 Yr             |                   |                       |              | 2 Yr             |                   |                       |              | 5 Yr             |                   |                       |              | 10 Yr            |                   |                       |               | 25 Yr            |                   |                       |               | 50 Yr            |                   |                       |               | 100 Yr           |                   |                       |                |
| Drainage Basin      | Drainage Area No. | Area (Ac.) | "C"  | Time of Conc. (min.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 1 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 2 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 5 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 10 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 25 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 50 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 100 (c.f.s.) |
| A                   | A1                | 32.99      | 0.30 | 19.4                 | 1.00             | 0.30              | 2.90                  | 28.70        | 1.00             | 0.30              | 3.44                  | 34.05        | 1.00             | 0.30              | 4.32                  | 42.76        | 1.00             | 0.30              | 4.91                  | 48.59         | 1.10             | 0.33              | 5.74                  | 62.49         | 1.20             | 0.36              | 6.43                  | 76.37         | 1.25             | 0.38              | 7.13                  | 88.21          |
|                     |                   | 32.99      |      |                      |                  |                   |                       | 28.70        |                  |                   |                       | 34.05        |                  |                   |                       | 42.76        |                  |                   | 4.91                  | 48.59         |                  |                   | 5.74                  | 62.49         |                  |                   | 6.43                  | 76.37         |                  |                   | 7.13                  | 88.21          |
| B                   | B1                | 5.29       | 0.30 | 15                   | 1.00             | 0.30              | 3.31                  | 5.25         | 1.00             | 0.30              | 3.90                  | 6.19         | 1.00             | 0.30              | 4.85                  | 7.70         | 1.00             | 0.30              | 5.50                  | 8.73          | 1.10             | 0.33              | 6.41                  | 11.19         | 1.20             | 0.36              | 7.14                  | 13.60         | 1.25             | 0.38              | 7.91                  | 15.69          |
|                     |                   | 5.29       |      |                      |                  |                   |                       | 5.25         |                  |                   |                       | 6.19         |                  |                   |                       | 7.70         |                  |                   | 5.50                  | 8.73          |                  |                   | 6.41                  | 11.19         |                  |                   | 7.14                  | 13.60         |                  |                   | 7.91                  | 15.69          |
| C                   | C1                | 19.33      | 0.30 | 15                   | 1.00             | 0.30              | 3.31                  | 19.20        | 1.00             | 0.30              | 3.90                  | 22.62        | 1.00             | 0.30              | 4.85                  | 28.13        | 1.00             | 0.30              | 5.50                  | 31.90         | 1.10             | 0.33              | 6.41                  | 40.89         | 1.20             | 0.36              | 7.14                  | 49.69         | 1.25             | 0.38              | 7.91                  | 57.34          |
|                     |                   | 19.33      |      |                      |                  |                   |                       | 19.20        |                  |                   |                       | 22.62        |                  |                   |                       | 28.13        |                  |                   | 5.50                  | 31.90         |                  |                   | 6.41                  | 40.89         |                  |                   | 7.14                  | 49.69         |                  |                   | 7.91                  | 57.34          |
| D                   | D1                | 1.38       | 0.30 | 15                   | 1.00             | 0.30              | 3.31                  | 1.38         | 1.00             | 0.30              | 3.90                  | 1.62         | 1.00             | 0.30              | 4.85                  | 2.01         | 1.00             | 0.30              | 5.50                  | 2.28          | 1.10             | 0.33              | 6.41                  | 2.93          | 1.20             | 0.36              | 7.14                  | 3.56          | 1.25             | 0.38              | 7.91                  | 4.11           |
|                     |                   | 1.38       |      |                      |                  |                   |                       | 1.38         |                  |                   |                       | 1.62         |                  |                   |                       | 2.01         |                  |                   | 5.50                  | 2.28          |                  |                   | 6.41                  | 2.93          |                  |                   | 7.14                  | 3.56          |                  |                   | 7.91                  | 4.11           |
| E                   | E1                | 0.98       | 0.30 | 15                   | 1.00             | 0.30              | 3.31                  | 0.97         | 1.00             | 0.30              | 3.90                  | 1.14         | 1.00             | 0.30              | 4.85                  | 1.42         | 1.00             | 0.30              | 5.50                  | 1.61          | 1.10             | 0.33              | 6.41                  | 2.06          | 1.20             | 0.36              | 7.14                  | 2.51          | 1.25             | 0.38              | 7.91                  | 2.89           |
|                     |                   | 0.98       |      |                      |                  |                   |                       | 0.97         |                  |                   |                       | 1.14         |                  |                   |                       | 1.42         |                  |                   | 5.50                  | 1.61          |                  |                   | 6.41                  | 2.06          |                  |                   | 7.14                  | 2.51          |                  |                   | 7.91                  | 2.89           |



|        |
|--------|
| REV. 1 |
| REV. 2 |
| REV. 3 |
| REV. 4 |
| REV. 5 |

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THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF LEE K. ALLISON P.E. 53647  
IT IS NOT TO BE USED FOR THE PURPOSES OF CONSTRUCTION, BIDDING, PERMITTING, ETC.

Drawn by: TMM  
Checked by: LKA

INVESTMENT REAL ESTATE  
CONSTRUCTION PLANS  
RIDGEVIEW ADDITION  
CITY OF SANGER, ETJ, DENTON COUNTY, TEXAS

EXISTING DRAINAGE AREA MAP

| Proposed Conditions Storm |                   |            |      |                    |             |              |             |           |             |              |             |       |             |              |             |       |             |              |             |           |             |              |             |       |             |              |             |       |             |              |             |       |
|---------------------------|-------------------|------------|------|--------------------|-------------|--------------|-------------|-----------|-------------|--------------|-------------|-------|-------------|--------------|-------------|-------|-------------|--------------|-------------|-----------|-------------|--------------|-------------|-------|-------------|--------------|-------------|-------|-------------|--------------|-------------|-------|
| Drainage Basin            | Drainage Area No. | Area (Ac.) | C    | Time of Conc (min) | 1 Yr        |              |             |           | 2 Yr        |              |             |       | 5 Yr        |              |             |       | 10 Yr       |              |             |           | 25 Yr       |              |             |       | 50 Yr       |              |             |       | 100 Yr      |              |             |       |
|                           |                   |            |      |                    | Freq Factor | Runoff Coeff | Intensity I | Q 1       | Freq Factor | Runoff Coeff | Intensity I | Q 2   | Freq Factor | Runoff Coeff | Intensity I | Q 5   | Freq Factor | Runoff Coeff | Intensity I | Q 10      | Freq Factor | Runoff Coeff | Intensity I | Q 25  | Freq Factor | Runoff Coeff | Intensity I | Q 50  | Freq Factor | Runoff Coeff | Intensity I | Q 100 |
|                           |                   |            |      |                    |             |              |             | (in./hr.) | (c.f.s.)    |              |             |       |             | (in./hr.)    | (c.f.s.)    |       |             |              |             | (in./hr.) | (c.f.s.)    |              |             |       | (in./hr.)   | (c.f.s.)     |             |       | (in./hr.)   | (c.f.s.)     |             |       |
| A                         | A1                | 0.30       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.39      | 1.00        | 0.39         | 3.90        | 0.46  | 1.00        | 0.39         | 4.85        | 0.57  | 1.00        | 0.39         | 5.50        | 0.64      | 1.10        | 0.43         | 6.41        | 0.83  | 1.20        | 0.47         | 7.14        | 1.00  | 1.25        | 0.49         | 7.91        | 1.16  |
|                           | A2                | 3.70       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 4.78      | 1.00        | 0.39         | 3.90        | 5.63  | 1.00        | 0.39         | 4.85        | 7.00  | 1.00        | 0.39         | 5.50        | 7.94      | 1.10        | 0.43         | 6.41        | 10.17 | 1.20        | 0.47         | 7.14        | 12.36 | 1.25        | 0.49         | 7.91        | 14.27 |
|                           | A3                | 0.86       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 1.11      | 1.00        | 0.39         | 3.90        | 1.31  | 1.00        | 0.39         | 4.85        | 1.63  | 1.00        | 0.39         | 5.50        | 1.84      | 1.10        | 0.43         | 6.41        | 2.36  | 1.20        | 0.47         | 7.14        | 2.87  | 1.25        | 0.49         | 7.91        | 3.31  |
|                           | A4                | 6.85       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 8.84      | 1.00        | 0.39         | 3.90        | 10.42 | 1.00        | 0.39         | 4.85        | 12.96 | 1.00        | 0.39         | 5.50        | 14.70     | 1.10        | 0.43         | 6.41        | 18.84 | 1.20        | 0.47         | 7.14        | 22.89 | 1.25        | 0.49         | 7.91        | 26.42 |
|                           | A5                | 1.79       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 2.31      | 1.00        | 0.39         | 3.90        | 2.72  | 1.00        | 0.39         | 4.85        | 3.38  | 1.00        | 0.39         | 5.50        | 3.83      | 1.10        | 0.43         | 6.41        | 4.91  | 1.20        | 0.47         | 7.14        | 5.97  | 1.25        | 0.49         | 7.91        | 6.89  |
|                           | A6                | 4.13       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 5.33      | 1.00        | 0.39         | 3.90        | 6.28  | 1.00        | 0.39         | 4.85        | 7.81  | 1.00        | 0.39         | 5.50        | 8.86      | 1.10        | 0.43         | 6.41        | 11.36 | 1.20        | 0.47         | 7.14        | 13.90 | 1.25        | 0.49         | 7.91        | 15.93 |
|                           | A7                | 0.88       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 1.14      | 1.00        | 0.39         | 3.90        | 1.34  | 1.00        | 0.39         | 4.85        | 1.66  | 1.00        | 0.39         | 5.50        | 1.86      | 1.10        | 0.43         | 6.41        | 2.39  | 1.20        | 0.47         | 7.14        | 2.91  | 1.25        | 0.49         | 7.91        | 3.40  |
|                           | A8                | 0.27       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.34      | 1.00        | 0.39         | 3.90        | 0.40  | 1.00        | 0.39         | 4.85        | 0.50  | 1.00        | 0.39         | 5.50        | 0.57      | 1.10        | 0.43         | 6.41        | 0.73  | 1.20        | 0.47         | 7.14        | 0.89  | 1.25        | 0.49         | 7.91        | 1.03  |
|                           | A9                | 1.46       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 1.89      | 1.00        | 0.39         | 3.90        | 2.22  | 1.00        | 0.39         | 4.85        | 2.76  | 1.00        | 0.39         | 5.50        | 3.13      | 1.10        | 0.43         | 6.41        | 4.02  | 1.20        | 0.47         | 7.14        | 4.88  | 1.25        | 0.49         | 7.91        | 5.63  |
|                           | A10               | 0.57       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.73      | 1.00        | 0.39         | 3.90        | 0.86  | 1.00        | 0.39         | 4.85        | 1.07  | 1.00        | 0.39         | 5.50        | 1.22      | 1.10        | 0.43         | 6.41        | 1.56  | 1.20        | 0.47         | 7.14        | 1.90  | 1.25        | 0.49         | 7.91        | 2.19  |
|                           | A11               | 4.65       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 6.00      | 1.00        | 0.39         | 3.90        | 7.07  | 1.00        | 0.39         | 4.85        | 8.79  | 1.00        | 0.39         | 5.50        | 9.97      | 1.10        | 0.43         | 6.41        | 12.78 | 1.20        | 0.47         | 7.14        | 15.53 | 1.25        | 0.49         | 7.91        | 17.93 |
|                           | A12               | 3.45       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 4.46      | 1.00        | 0.39         | 3.90        | 5.25  | 1.00        | 0.39         | 4.85        | 6.53  | 1.00        | 0.39         | 5.50        | 7.40      | 1.10        | 0.43         | 6.41        | 9.49  | 1.20        | 0.47         | 7.14        | 11.53 | 1.25        | 0.49         | 7.91        | 13.31 |
|                           | A13               | 1.97       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 2.55      | 1.00        | 0.39         | 3.90        | 3.00  | 1.00        | 0.39         | 4.85        | 3.73  | 1.00        | 0.39         | 5.50        | 4.23      | 1.10        | 0.43         | 6.41        | 5.42  | 1.20        | 0.47         | 7.14        | 6.64  | 1.25        | 0.49         | 7.91        | 7.61  |
|                           |                   | 30.87      |      |                    |             |              | 39.86       |           |             |              | 46.96       |       |             |              | 58.40       |       |             |              | 66.23       |           |             |              | 84.90       |       |             |              | 103.17      |       |             |              | 119.05      |       |
| OS-A1                     |                   | 0.79       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 1.02      | 1.00        | 0.39         | 3.90        | 1.20  | 1.00        | 0.39         | 4.85        | 1.49  | 1.00        | 0.39         | 5.50        | 1.69      | 1.10        | 0.43         | 6.41        | 2.17  | 1.20        | 0.47         | 7.14        | 2.64  | 1.25        | 0.49         | 7.91        | 3.05  |
|                           | OS-A2             | 0.45       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.58      | 1.00        | 0.39         | 3.90        | 0.68  | 1.00        | 0.39         | 4.85        | 0.85  | 1.00        | 0.39         | 5.50        | 0.97      | 1.10        | 0.43         | 6.41        | 1.24  | 1.20        | 0.47         | 7.14        | 1.50  | 1.25        | 0.49         | 7.91        | 1.74  |
|                           | OS-A3             | 0.74       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.95      | 1.00        | 0.39         | 3.90        | 1.12  | 1.00        | 0.39         | 4.85        | 1.40  | 1.00        | 0.39         | 5.50        | 1.59      | 1.10        | 0.43         | 6.41        | 2.03  | 1.20        | 0.47         | 7.14        | 2.47  | 1.25        | 0.49         | 7.91        | 2.85  |
|                           | OS-A4             | 0.41       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.53      | 1.00        | 0.39         | 3.90        | 0.63  | 1.00        | 0.39         | 4.85        | 0.78  | 1.00        | 0.39         | 5.50        | 0.89      | 1.10        | 0.43         | 6.41        | 1.14  | 1.20        | 0.47         | 7.14        | 1.38  | 1.25        | 0.49         | 7.91        | 1.59  |
|                           |                   | 2.39       |      |                    |             |              | 3.09        |           |             |              | 3.64        |       |             |              | 4.53        |       |             |              | 5.67        |           |             |              | 6.58        |       |             |              | 7.99        |       |             |              | 9.23        |       |
| BYPASS                    | 3.00              | 0.39       | 15   | 1.00               | 0.39        | 3.31         | 3.87        | 1.00      | 0.39        | 3.90         | 4.56        | 1.00  | 0.39        | 4.85         | 5.67        | 1.00  | 0.39        | 5.50         | 6.44        | 1.10      | 0.43        | 6.41         | 8.25        | 1.20  | 0.47        | 7.14         | 10.02       | 1.25  | 0.49        | 7.91         | 11.87       |       |
|                           | 3.00              |            |      |                    |             | 3.87         |             |           |             | 4.56         |             |       |             | 5.67         |             |       |             | 6.44         |             |           |             | 8.25         |             |       |             | 10.02        |             |       |             | 11.87        |             |       |
| B1                        |                   | 4.98       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 6.43      | 1.00        | 0.39         | 3.90        | 7.58  | 1.00        | 0.39         | 4.85        | 9.42  | 1.00        | 0.39         | 5.50        | 10.68     | 1.10        | 0.43         | 6.41        | 13.70 | 1.20        | 0.47         | 7.14        | 16.64 | 1.25        | 0.49         | 7.91        | 19.21 |
|                           |                   | 4.98       |      |                    |             |              | 6.43        |           |             |              | 7.58        |       |             |              | 9.42        |       |             |              | 10.68       |           |             |              | 13.70       |       |             |              | 16.64       |       |             |              | 19.21       |       |
| C1                        |                   | 3.43       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 4.43      | 1.00        | 0.39         | 3.90        | 5.22  | 1.00        | 0.39         | 4.85        | 6.49  | 1.00        | 0.39         | 5.50        | 7.36      | 1.10        | 0.43         | 6.41        | 9.43  | 1.20        | 0.47         | 7.14        | 11.46 | 1.25        | 0.49         | 7.91        | 13.23 |
|                           | C2                | 1.73       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 2.23      | 1.00        | 0.39         | 3.90        | 2.63  | 1.00        | 0.39         | 4.85        | 3.27  | 1.00        | 0.39         | 5.50        | 3.71      | 1.10        | 0.43         | 6.41        | 4.76  | 1.20        | 0.47         | 7.14        | 5.78  | 1.25        | 0.49         | 7.91        | 6.67  |
|                           | C3                | 2.49       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 3.21      | 1.00        | 0.39         | 3.90        | 3.79  | 1.00        | 0.39         | 4.85        | 4.71  | 1.00        | 0.39         | 5.50        | 5.34      | 1.10        | 0.43         | 6.41        | 6.85  | 1.20        | 0.47         | 7.14        | 8.32  | 1.25        | 0.49         | 7.91        | 9.60  |
|                           | C4                | 5.25       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 6.78      | 1.00        | 0.39         | 3.90        | 7.99  | 1.00        | 0.39         | 4.85        | 9.93  | 1.00        | 0.39         | 5.50        | 11.26     | 1.10        | 0.43         | 6.41        | 14.44 | 1.20        | 0.47         | 7.14        | 17.55 | 1.25        | 0.49         | 7.91        | 20.25 |
|                           | C5                | 1.65       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 2.13      | 1.00        | 0.39         | 3.90        | 2.51  | 1.00        | 0.39         | 4.85        | 3.13  | 1.00        | 0.39         | 5.50        | 3.54      | 1.10        | 0.43         | 6.41        | 4.54  | 1.20        | 0.47         | 7.14        | 5.54  | 1.25        | 0.49         | 7.91        | 6.54  |
|                           | C6                | 2.67       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 3.45      | 1.00        | 0.39         | 3.90        | 4.06  | 1.00        | 0.39         | 4.85        | 5.05  | 1.00        | 0.39         | 5.50        | 5.73      | 1.10        | 0.43         | 6.41        | 7.35  | 1.20        | 0.47         | 7.14        | 8.93  | 1.25        | 0.49         | 7.91        | 10.30 |
|                           | C7                | 0.57       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.73      | 1.00        | 0.39         | 3.90        | 0.86  | 1.00        | 0.39         | 4.85        | 1.07  | 1.00        | 0.39         | 5.50        | 1.21      | 1.10        | 0.43         | 6.41        | 1.56  | 1.20        | 0.47         | 7.14        | 1.89  | 1.25        | 0.49         | 7.91        | 2.18  |
|                           | C8                | 1.47       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 1.89      | 1.00        | 0.39         | 3.90        | 2.23  | 1.00        | 0.39         | 4.85        | 2.77  | 1.00        | 0.39         | 5.50        | 3.15      | 1.10        | 0.43         | 6.41        | 4.03  | 1.20        | 0.47         | 7.14        | 4.90  | 1.25        | 0.49         | 7.91        | 5.66  |
|                           | 19.25             |            |      |                    |             | 24.86        |             |           |             | 29.29        |             |       |             | 36.42        |             |       |             | 41.30        |             |           |             | 52.95        |             |       |             | 64.34        |             |       |             | 74.25        |             |       |
| D1                        |                   | 0.77       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.99      | 1.00        | 0.39         | 3.90        | 1.17  | 1.00        | 0.39         | 4.85        | 1.45  | 1.00        | 0.39         | 5.50        | 1.64      | 1.10        | 0.43         | 6.41        | 2.11  | 1.20        | 0.47         | 7.14        | 2.56  | 1.25        | 0.49         | 7.91        | 2.95  |
|                           | D2                | 0.27       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.35      | 1.00        | 0.39         | 3.90        | 0.41  | 1.00        | 0.39         | 4.85        | 0.52  | 1.00        | 0.39         | 5.50        | 0.59      | 1.10        | 0.43         | 6.41        | 0.75  | 1.20        | 0.47         | 7.14        | 0.91  | 1.25        | 0.49         | 7.91        | 1.05  |
|                           | 1.04              |            |      |                    |             |              | 1.34        |           |             |              | 1.58        |       |             |              | 1.97        |       |             |              | 2.23        |           |             |              | 2.86        |       |             |              | 3.47        |       |             |              | 4.07        |       |
| E1                        |                   | 0.41       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.53      | 1.00        | 0.39         | 3.90        | 0.63  | 1.00        | 0.39         | 4.85        | 0.78  | 1.00        | 0.39         | 5.50        | 0.89      | 1.10        | 0.43         | 6.41        | 1.14  | 1.20        | 0.47         | 7.14        | 1.38  | 1.25        | 0.49         | 7.91        | 1.59  |
|                           | E2                | 0.24       | 0.39 | 15                 | 1.00        | 0.39         | 3.31        | 0.31      | 1.00        | 0.39         | 3.90        | 0.37  | 1.00        | 0.39         | 4.85        | 0.46  | 1.00        | 0.39         | 5.50        | 0.52      | 1.10        | 0.43         | 6.41        | 0.67  | 1.20        | 0.47         | 7.14        | 0.81  | 1.25        | 0.49         | 7.91        | 0.94  |
|                           | 0.66              |            |      |                    |             | 0.85         |             |           |             | 1.00         |             |       |             | 1.24         |             |       |             | 1.41         |             |           |             | 1.81         |             |       |             | 2.20         |             |       |             | 2.63         |             |       |

NOTES:  
1. MINIMUM TIME OF CONCENTRATION OF 15 MINUTES  
USED PER CITY OF SANGER DEVELOPMENT CODE

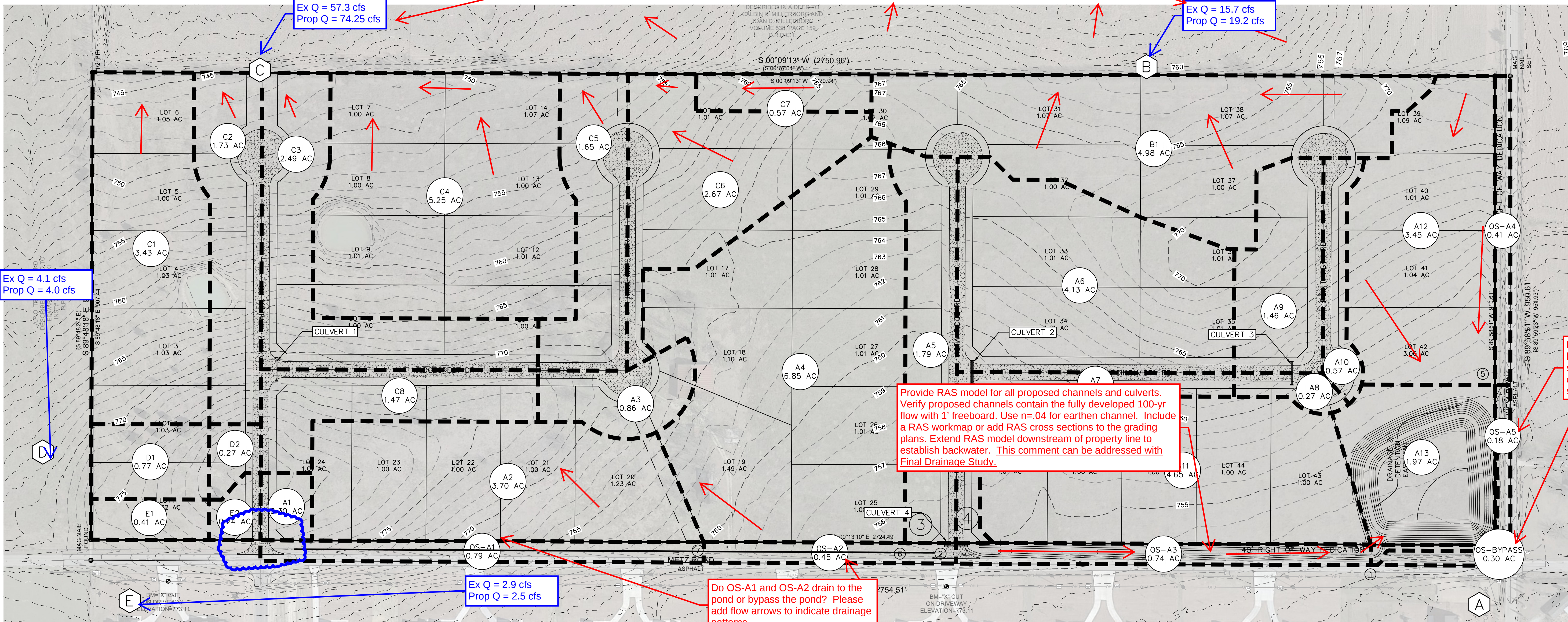
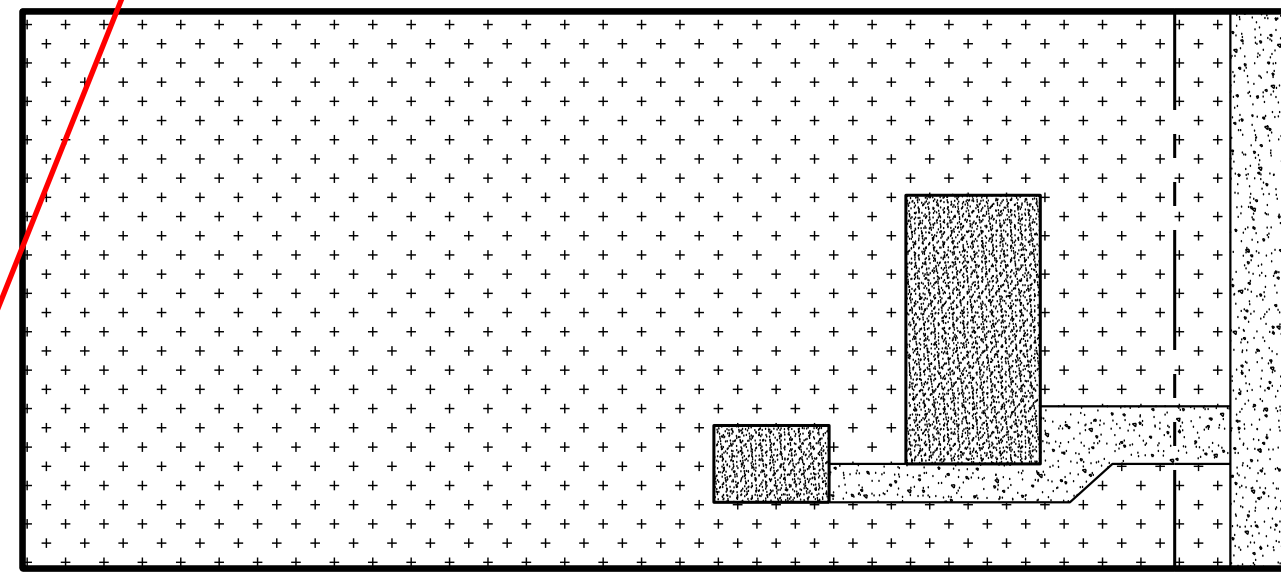
What is the plan to mitigate increases on flow? If obtaining permission for increases from adjacent owner, please provide documentation; include exhibits and calculations.

| Weighted "C" (Detention Volume)               |              |      |           |
|-----------------------------------------------|--------------|------|-----------|
|                                               | Area sq feet | A    | C         |
| Building                                      | 3,050        | 0.07 | 0.95      |
| Grass (Lot)                                   | 39,244       | 0.90 | 0.30      |
| Paving (Lot)                                  | 1,208        | 0.03 | 0.95      |
| Grass (ROW)                                   | 1,885        | 0.04 | 0.30      |
| ROW                                           | 2,465        | 0.06 | 0.95      |
| Sum:                                          | 47,852       | 1.10 | Sum: 0.43 |
| Weighted Runoff Coefficient = 0.39            |              |      |           |
| COMPOSITE WEIGHTED "C" PER TYPICAL 1 ACRE LOT |              |      |           |

Please use a C-value of 0.45 per the Denton County standards. See Table IV.1-4.

General Comments:  
1. Please add directional flow arrows onsite and offsite to indicate drainage patterns.  
2. Provide a comparison of existing and proposed flows at each outfall.  
3. Outfalls must be taken to the flow line of the receiving ditch, normal pool of the pond (or) spread back to mimic existing conditions flow spread (or) sheet flow. This comment can be addressed with Final Drainage Study.

RELOCATION WHERE NECESSARY AND PROTECTING EXISTING UTILITIES (SHOWN OR NOT SHOWN). IF ANY EXISTING UTILITIES ARE DAMAGED, THE CONTRACTOR SHALL REPLACE THEM AT THEIR OWN EXPENSE.



Provide RAS model for all proposed channels and culverts. Verify proposed channels contain the fully developed 100-yr flow with 1' freeboard. Use n=.04 for earthen channel. Include a RAS workmap or add RAS cross sections to the grading plans. Extend RAS model downstream of property line to establish backwater. This comment can be addressed with Final Drainage Study.

Please move the labels to clearly show proposed contours and structures.

Do OS-A1 and OS-A2 drain to the pond or bypass the pond? Please add flow arrows to indicate drainage patterns.

REV. 1  
REV. 2  
REV. 3  
REV. 4  
REV. 5

2415 N. ELM STREET  
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Texas Board of Professional Engineers  
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Drawn by:TMM  
Checked by:LKA

REAL ESTATE  
ITION PLANS  
W ADDITION  
CITY OF SANGER, ETJ, DENTON COUNTY, TEXAS

PROPOSED DRAINAGE AREA MAP

Job: IRE2101  
SHEET  
5

Save Date: Wednesday, November 16, 2022 4:09:36 PM File Name: P:\Projects\IRE2101 - NE Mez - View SFRD\DWG\_CEP\DETENTION POND PLAN.dwg Plot Date: Wednesday, November 16, 2022 4:32:39 PM Plot Style Table: Allison.ctb

## Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Friday, 10/21/2022

### Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 746.80 ft

#### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Stor. |
|------------|----------------|---------------------|-------------|
| 0.00       | 746.80         | 25,258              | 5.1         |
| 0.20       | 747.00         | 25,789              | 5.1         |
| 1.20       | 748.00         | 28,517              | 27.1        |
| 2.20       | 749.00         | 31,370              | 29,829      |
| 3.20       | 750.00         | 34,348              | 32,844      |
| 4.20       | 751.00         | 37,452              | 35,885      |

Please indicate if this information is relevant to the proposed pond and delete if not pertinent.

#### Culvert / Orifice Structures

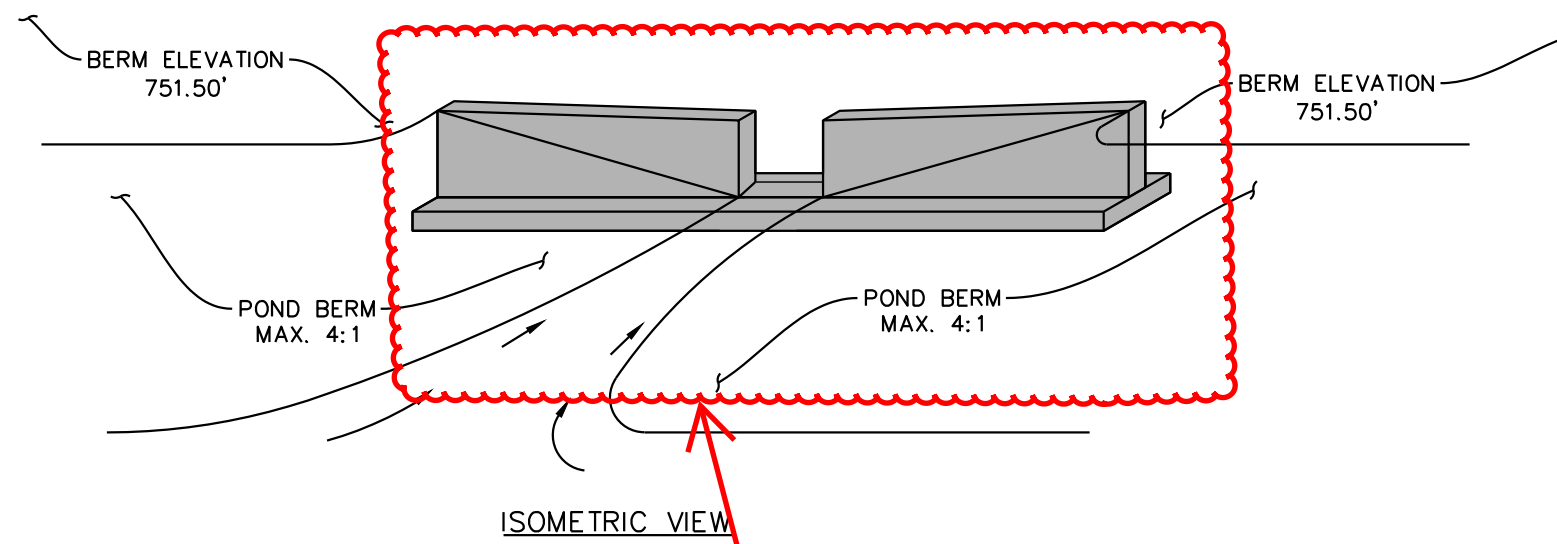
|                 | [A]    | [B]  | [C]  | [PrfRsr] |
|-----------------|--------|------|------|----------|
| Rise (in)       | = 0.00 | 0.00 | 0.00 | 0.00     |
| Span (in)       | = 0.00 | 0.00 | 0.00 | 0.00     |
| No. Barrels     | = 0    | 0    | 0    | 0        |
| Invert El. (ft) | = 0.00 | 0.00 | 0.00 | 0.00     |
| Length (ft)     | = 0.00 | 0.00 | 0.00 | 0.00     |
| Slope (%)       | = 0.00 | 0.00 | 0.00 | 0.00     |
| N-Value         | = 0.00 | 0.00 | n/a  | n/a      |
| Orifice Coeff.  | = 0.00 | 0.00 | 0.00 | 0.00     |
| Multi-Stage     | = n/a  | No   | No   | No       |

#### Weir Structures

|                | [A]                   | [B]  | [C]  | [D]  |
|----------------|-----------------------|------|------|------|
| Crest Len (ft) | = 0.00                | 0.00 | 0.00 | 0.00 |
| Crest El. (ft) | = 0.00                | 0.00 | 0.00 | 0.00 |
| Weir Coeff.    | = 0.00                | 0.00 | 0.00 | 0.00 |
| Weir Type      | = ---                 | ---  | ---  | ---  |
| Multi-Stage    | = No                  | No   | No   | No   |
| Exfil. (in/hr) | = 0.000 (by Wet area) |      |      |      |
| TW Elev. (ft)  | = 0.00                |      |      |      |

#### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Civ A cfs | Civ B cfs | Civ C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|----------|--------------|--------------|-----------|-----------|-----------|------------|----------|----------|----------|----------|-----------|----------|-----------|
| 0.00     | 0            | 746.80       | ---       | ---       | ---       | ---        | ---      | ---      | ---      | ---      | ---       | ---      | 0.000     |
| 0.20     | 5,104        | 747.00       | ---       | ---       | ---       | ---        | ---      | ---      | ---      | ---      | ---       | ---      | 0.000     |
| 1.20     | 32,243       | 748.00       | ---       | ---       | ---       | ---        | ---      | ---      | ---      | ---      | ---       | ---      | 0.000     |
| 2.20     | 62,172       | 749.00       | ---       | ---       | ---       | ---        | ---      | ---      | ---      | ---      | ---       | ---      | 0.000     |
| 3.20     | 95,017       | 750.00       | ---       | ---       | ---       | ---        | ---      | ---      | ---      | ---      | ---       | ---      | 0.000     |
| 4.20     | 130,902      | 751.00       | ---       | ---       | ---       | ---        | ---      | ---      | ---      | ---      | ---       | ---      | 0.000     |



| MODIFIED RATIONAL DETENTION CALCULATION                    |                                                                                                                  |        |        |        |        |        |        |                 |                 |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|-----------------|-----------------|
| Return Interval                                            | =                                                                                                                | 2      | 5      | 10     | 25     | 50     | 100    | yr              |                 |
| Ex T <sub>r</sub>                                          | =                                                                                                                |        |        |        |        |        |        |                 | 19.4 min        |
| Allowable Release                                          |                                                                                                                  |        |        |        |        |        |        |                 |                 |
| Eq. 1.26                                                   | Q <sub>a</sub> = C <sub>r</sub> *I <sub>a</sub> *A                                                               | =      | 31.08  | 39.04  | 44.37  | 51.87  | 58.10  | 64.43           | cfs             |
| Predevelopment C <sub>r</sub>                              | =                                                                                                                |        |        |        |        |        |        |                 | 0.30            |
| I <sub>a</sub>                                             | =                                                                                                                | 3.44   | 4.32   | 4.91   | 5.74   | 6.43   | 7.13   | 7.13            | in/hr           |
| A                                                          | =                                                                                                                |        |        |        |        |        |        |                 | 30.12 acres     |
| Critical Duration of Storm                                 |                                                                                                                  |        |        |        |        |        |        |                 |                 |
| a                                                          | =                                                                                                                | 124.47 | 173.1  | 205.74 | 248.54 | 283.99 | 325.18 |                 |                 |
| b                                                          | =                                                                                                                | 16.121 | 19.754 | 21.358 | 22.615 | 23.508 | 24.822 |                 |                 |
| Eq. 1.27                                                   | T <sub>d</sub> = [(2CAab)/Q <sub>a</sub> ] <sup>1/2</sup> - b                                                    | =      | 23.37  | 26.25  | 27.56  | 28.55  | 29.18  | 30.19           | min             |
| Q <sub>a</sub>                                             | =                                                                                                                | 31.08  | 39.04  | 44.37  | 51.87  | 58.1   |        |                 | 64.43 cfs       |
| Developed C                                                | =                                                                                                                |        |        |        |        |        |        |                 | 0.39            |
| A                                                          | =                                                                                                                |        |        |        |        |        |        |                 | 30.87 acres     |
| Preliminary Required Storage Volume                        |                                                                                                                  |        |        |        |        |        |        |                 |                 |
| Eq. 1.28a                                                  | V <sub>prelim</sub> = 60[CAa - (2CabAQ <sub>a</sub> ) <sup>1/2</sup> + (Q <sub>a</sub> /2)(b - T <sub>d</sub> )] | =      | 17,612 | 23,278 | 28,430 | 32,752 | 36,993 | 41,998          | ft <sup>3</sup> |
| V <sub>prelim</sub>                                        | =                                                                                                                |        |        |        |        |        |        |                 | 15 min          |
| Pr T <sub>d</sub>                                          | =                                                                                                                |        |        |        |        |        |        |                 | 0.39            |
| Developed C                                                | =                                                                                                                |        |        |        |        |        |        |                 | 0.39            |
| a                                                          | =                                                                                                                | 124.47 | 173.1  | 205.74 | 248.54 | 283.99 | 325.18 |                 |                 |
| b                                                          | =                                                                                                                | 16.121 | 19.754 | 21.358 | 22.615 | 23.508 | 24.822 |                 |                 |
| A                                                          | =                                                                                                                |        |        |        |        |        |        |                 | 30.87 acres     |
| Q <sub>a</sub>                                             | =                                                                                                                | 31.08  | 39.04  | 44.37  | 51.87  | 58.1   |        |                 | 64.43 cfs       |
| Required Storage Volume                                    |                                                                                                                  |        |        |        |        |        |        |                 |                 |
| V <sub>prelim</sub>                                        | =                                                                                                                | 17,612 | 23,278 | 28,430 | 32,752 | 36,993 | 41,998 | ft <sup>3</sup> |                 |
| P <sub>180</sub> = 180 * (180/60)                          | =                                                                                                                | 2.22   | 2.97   | 3.45   | 4.14   | 4.74   | 5.37   | in              |                 |
| i <sub>180</sub>                                           | =                                                                                                                | 0.74   | 0.99   | 1.15   | 1.38   | 1.58   | 1.79   | in/hr           |                 |
| P <sub>180</sub> = i <sub>180</sub> * (T <sub>d</sub> /60) | =                                                                                                                | 1.20   | 1.60   | 1.84   | 2.19   | 2.52   | 2.85   | in              |                 |
| i <sub>tot</sub>                                           | =                                                                                                                | 3.09   | 3.66   | 4.00   | 4.60   | 5.18   | 5.66   | in/hr           |                 |
| Eq. 1.28b                                                  | V <sub>max</sub> = V <sub>prelim</sub> * P <sub>180</sub> / P <sub>tot</sub>                                     | =      | 32,582 | 43,210 | 53,306 | 61,915 | 69,582 | 79,133          | ft <sup>3</sup> |
| Req'd Vol. Plus 10% Add'l Storage                          | =                                                                                                                | 35,840 | 47,531 | 58,637 | 68,107 | 76,540 | 87,046 | ft <sup>3</sup> |                 |
| VOLUME INCREASED BY 10% FOR CITY VARIANCE APPROVAL         |                                                                                                                  |        |        |        |        |        |        |                 |                 |

Please provide the digital files for the Hydrograph model. This comment can be addressed with Final Drainage Study.

## Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 11/16/2022

### Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 746.90 ft

#### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|------------|----------------|---------------------|----------------------|----------------------|
| 0.00       | 746.90         | 0                   | 0                    | 0                    |
| 0.10       | 747.00         | 48,479              | 1,549                | 1,549                |
| 0.82       | 747.72         | 49,166              | 34,424               | 35,973               |
| 1.08       | 747.96         | 49,598              | 11,850               | 47,824               |
| 1.10       | 748.00         | 49,765              | 1,987                | 49,811               |
| 1.28       | 748.18         | 50,367              | 9,011                | 58,822               |
| 1.47       | 748.37         | 50,568              | 9,588                | 68,410               |
| 1.63       | 748.53         | 51,886              | 8,195                | 76,605               |
| 1.84       | 748.74         | 52,683              | 10,979               | 87,583               |
| 2.10       | 749.00         | 54,382              | 13,917               | 101,500              |
| 3.10       | 750.00         | 60,355              | 57,337               | 158,837              |

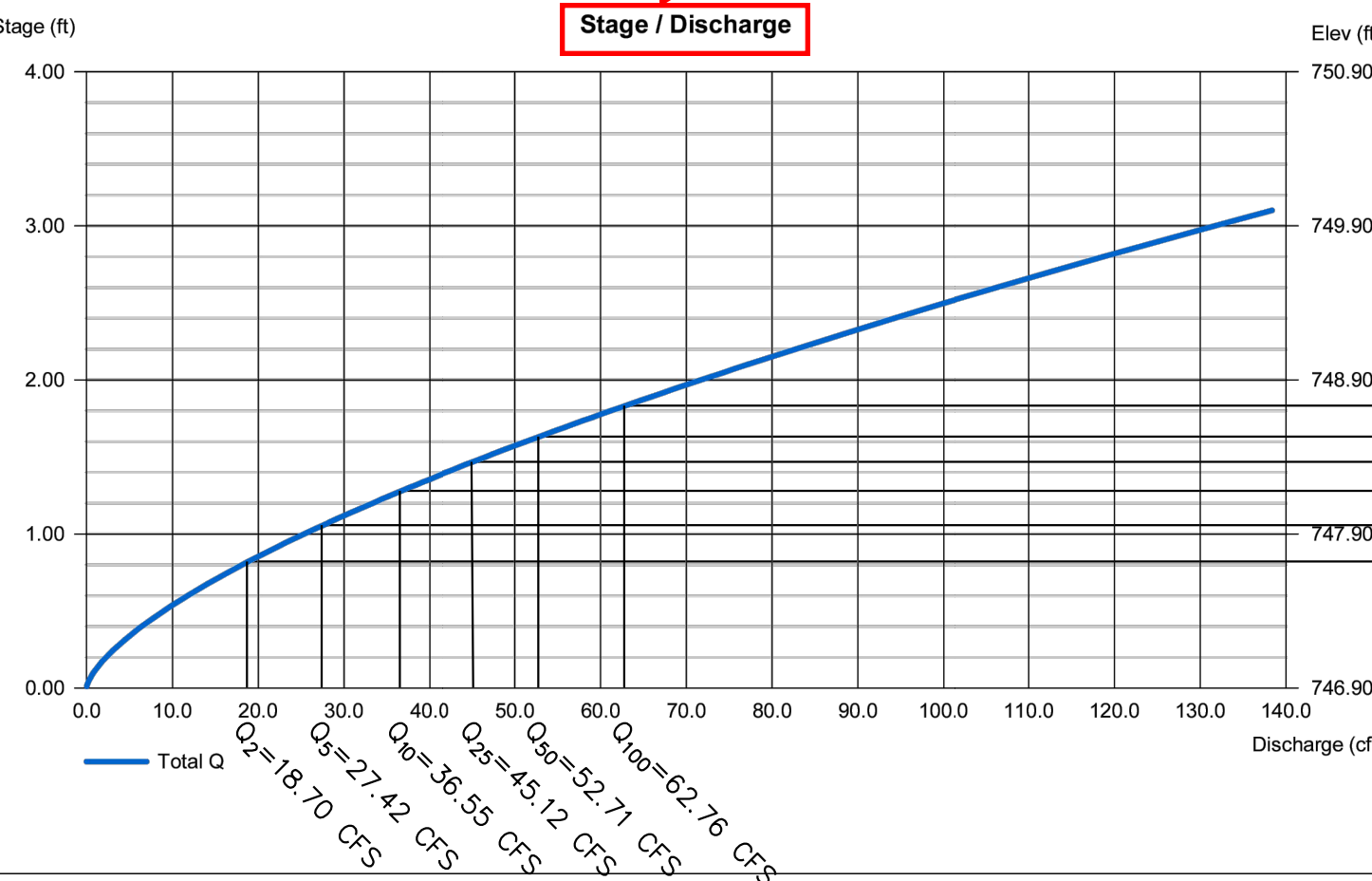
#### Culvert / Orifice Structures

|                 | [A]        | [B]      | [C]  | [PrfRsr] |
|-----------------|------------|----------|------|----------|
| Rise (in)       | = 12.00    | Inactive | 0.00 | 0.00     |
| Span (in)       | = 12000.00 | 18.00    | 0.00 | 0.00     |
| No. Barrels     | = 1        | 0        | 0    | 0        |
| Invert El. (ft) | = 751.50   | 746.89   | 0.00 | 0.00     |
| Length (ft)     | = 50.00    | 50.00    | 0.00 | 0.00     |
| Slope (%)       | = 0.50     | 0.50     | 0.00 | n/a      |
| N-Value         | = .013     | .015     | .013 | n/a      |
| Orifice Coeff.  | = 0.60     | 0.60     | 0.60 | 0.60     |
| Multi-Stage     | = n/a      | Yes      | No   | No       |

#### Weir Structures

|                | [A]                   | [B]    | [C]  | [D]  |
|----------------|-----------------------|--------|------|------|
| Crest Len (ft) | = 9.75                | 20.00  | 0.00 | 0.00 |
| Crest El. (ft) | = 746.90              | 750.00 | 0.00 | 0.00 |
| Weir Coeff.    | = 2.60                | 2.60   | 3.33 | 3.33 |
| Weir Type      | = Broad               | Broad  | ---  | ---  |
| Multi-Stage    | = No                  | No     | No   | No   |
| Exfil. (in/hr) | = 0.000 (by Wet area) |        |      |      |
| TW Elev. (ft)  | = 0.00                |        |      |      |

Please account for backwater influence in the receiving drainage system on the stage discharge and provide calculations/model. This comment can be addressed with Final Drainage Study.



## Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 11/16/2022

### Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 746.90 ft

#### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|------------|----------------|---------------------|----------------------|----------------------|
| 0.00       | 746.90         | 0                   | 0                    | 0                    |
| 0.10       | 747.00         | 48,479              | 1,549                | 1,549                |
| 0.82       | 747.72         | 49,166              | 34,424               | 35,973               |
| 1.08       | 747.96         | 49,598              | 11,850               | 47,824               |
| 1.10       | 748.00         | 49,765              | 1,987                | 49,811               |
| 1.28       | 748.18         | 50,367              | 9,011                | 58,822               |
| 1.47       | 748.37         | 50,568              | 9,588                | 68,410               |
| 1.63       | 748.53         | 51,886              | 8,195                | 76,605               |
| 1.84       | 748.74         | 52,683              | 10,979               | 87,583               |
| 2.10       | 749.00         | 54,382              | 13,917               | 101,500              |
| 3.10       | 750.00         | 60,355              | 57,337               | 158,837              |

#### Culvert / Orifice Structures

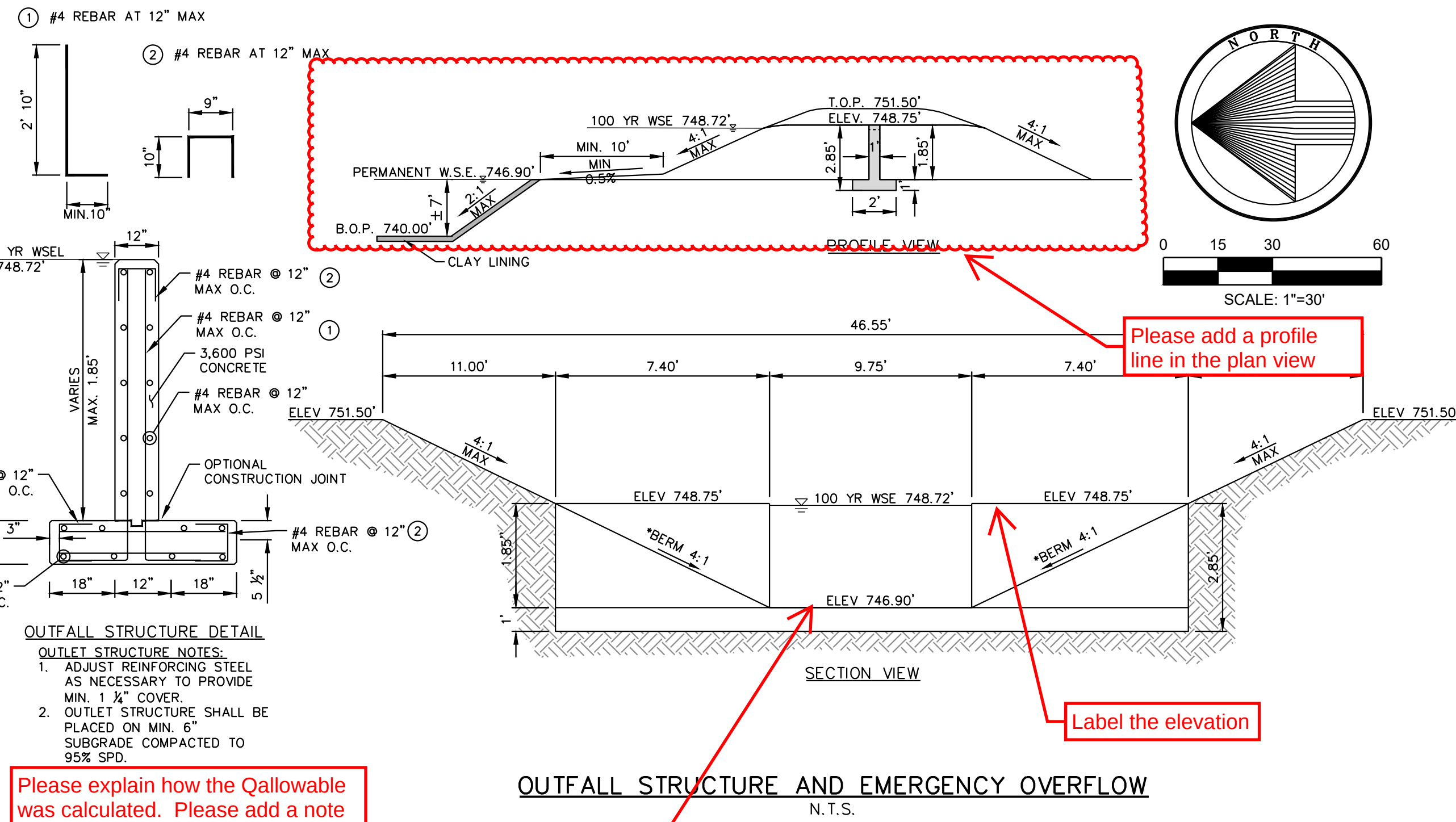
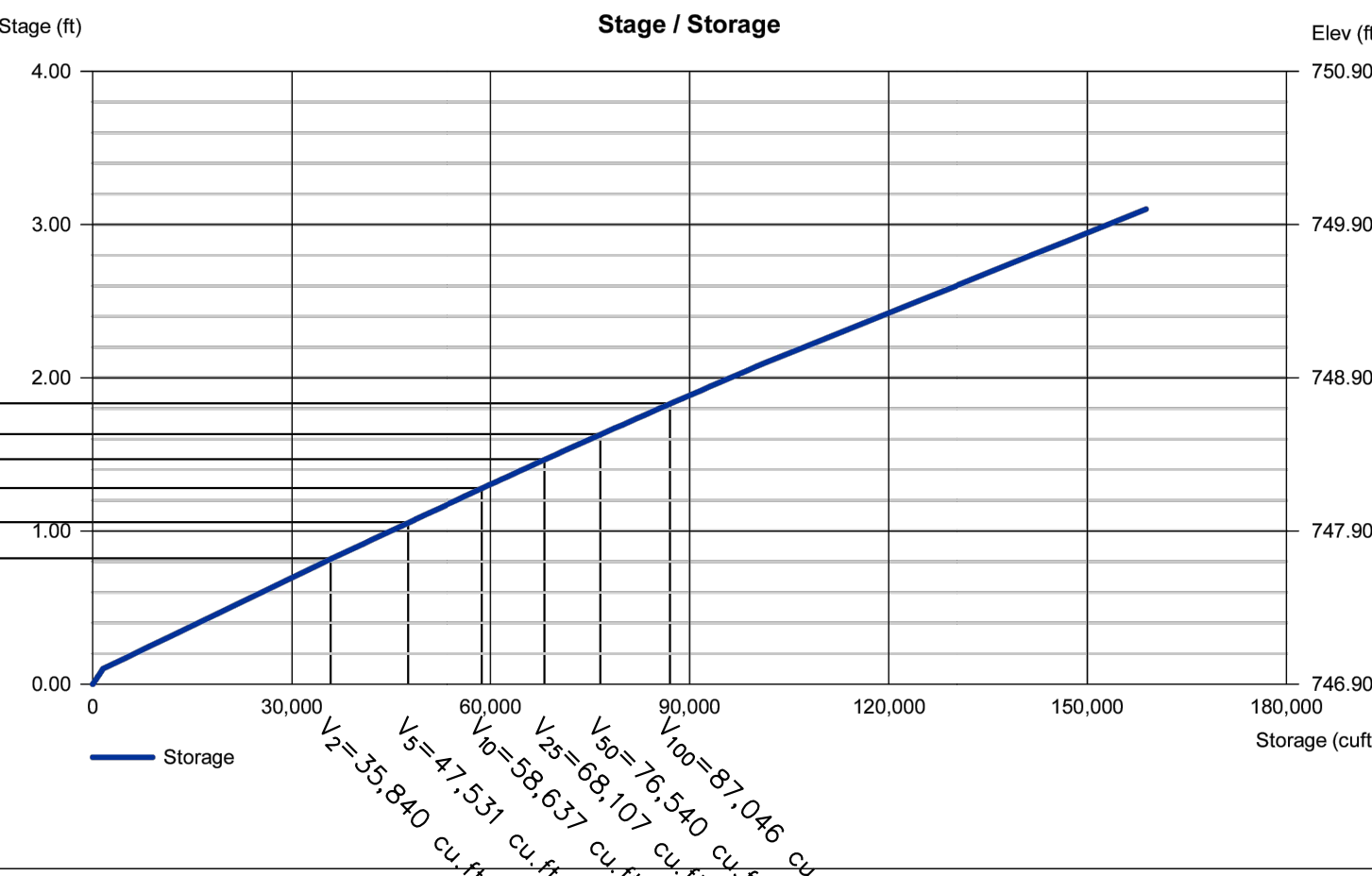
|                 | [A]        | [B]      | [C]  | [PrfRsr] |
|-----------------|------------|----------|------|----------|
| Rise (in)       | = 12.00    | Inactive | 0.00 | 0.00     |
| Span (in)       | = 12000.00 | 18.00    | 0.00 | 0.00     |
| No. Barrels     | = 1        | 0        | 0    | 0        |
| Invert El. (ft) | = 751.50   | 746.89   | 0.00 | 0.00     |
| Length (ft)     | = 50.00    | 50.00    | 0.00 | 0.00     |
| Slope (%)       | = 0.50     | 0.50     | 0.00 | n/a      |
| N-Value         | = .013     | .015     | .013 | n/a      |
| Orifice Coeff.  | = 0.60     | 0.60     | 0.60 | 0.60     |
| Multi-Stage     | = n/a      | Yes      | No   | No       |

#### Weir Structures

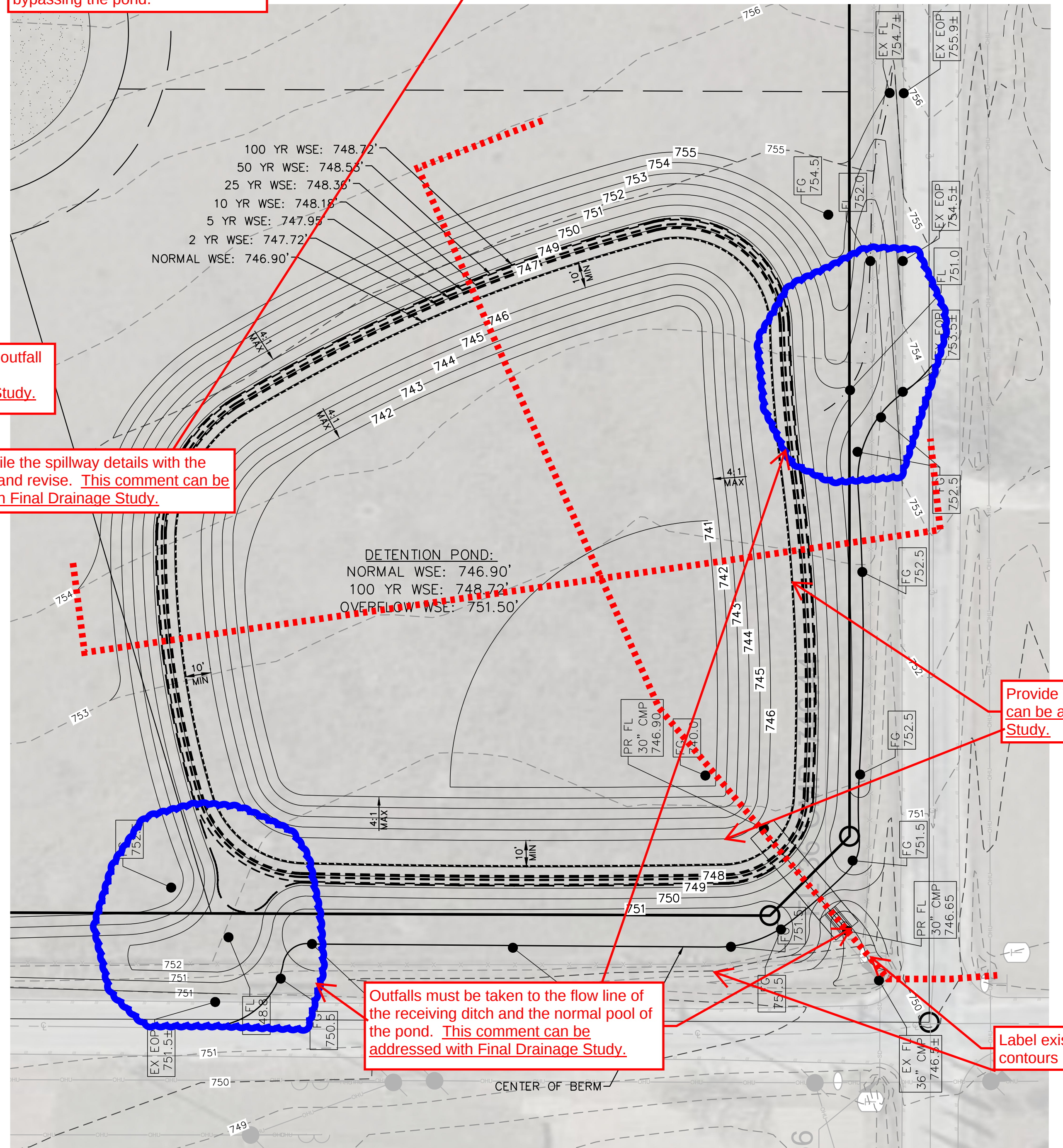
|                | [A]                   | [B]    | [C]  | [D]  |
|----------------|-----------------------|--------|------|------|
| Crest Len (ft) | = 9.75                | 20.00  | 0.00 | 0.00 |
| Crest El. (ft) | = 746.90              | 750.00 | 0.00 | 0.00 |
| Weir Coeff.    | = 2.60                | 2.60   | 3.33 | 3.33 |
| Weir Type      | = Broad               | Broad  | ---  | ---  |
| Multi-Stage    | = No                  | No     | No   | No   |
| Exfil. (in/hr) | = 0.000 (by Wet area) |        |      |      |
| TW Elev. (ft)  | = 0.00                |        |      |      |

Provide structural details for the outfall structure. This comment can be addressed with Final Drainage Study.

Please reconcile the spillway details with the model details and revise. This comment can be addressed with Final Drainage Study.



Please explain how the Qallowable was calculated. Please add a note below the chart to indicate areas draining to the pond and the areas bypassing the pond.



Outfalls must be taken to the flow line of the receiving ditch and the normal pool of the pond. This comment can be addressed with Final Drainage Study.

Provide cross-sections. This comment can be addressed with Final Drainage Study.

Label existing/proposed contours

REV. 1  
REV. 2  
REV. 3  
REV. 4  
REV. 5

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**Allison Engineering Group**  
Planning Communities - Designing the Systems That Serve Them

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IT IS NOT TO BE USED FOR THE PURPOSES OF CONSTRUCTION, BIDDING, PERMITTING, ETC.

Drawn by: TMM  
Checked by: LKA

AL ESTATE  
PLANS  
ADDITION  
ON COUNTY, TEXAS  
INVESTMENT  
CONSTRUCTION  
RIDGEVIEW  
CITY OF SANGER, TEXAS  
DETENTION POND PLAN

Job: IRE2101

SHEET

6

Save Date: Wednesday, November 16, 2022 4:30:54 PM File Name: P:\Projects\IRE2101 - NE Maz - View SFRDOWG\_CEP7 CULVERT REPORTS.dwg Plot Date: Wednesday, November 16, 2022 4:38:27 PM Plot Style Table: Allison.ctb

Plotted By: Jason Mack

| Storm Analysis Ditch Sizing |                   |            |      |                      |                  |                   |                       |              |                  |                   |                       |              |                  |                   |                       |              |                  |                   |                       |               |                  |                   |                       |
|-----------------------------|-------------------|------------|------|----------------------|------------------|-------------------|-----------------------|--------------|------------------|-------------------|-----------------------|--------------|------------------|-------------------|-----------------------|--------------|------------------|-------------------|-----------------------|---------------|------------------|-------------------|-----------------------|
|                             |                   |            |      | 1 Yr                 |                  |                   |                       | 2 Yr         |                  |                   |                       | 5 Yr         |                  |                   |                       | 10 Yr        |                  |                   |                       | 25 Yr         |                  |                   |                       |
| Design point                | Drainage Area No. | Area (Ac.) | "C"  | Time of Conc. (min.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 1 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 2 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 5 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) | Q 10 (c.f.s.) | Freq. Factor "F" | Runoff Coeff. "C" | Intensity I (in./hr.) |
| DP 1                        | DP 2              | 14.74      | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 19.02        | 1.00             | 0.39              | 3.90                  | 22.41        | 1.00             | 0.39              | 4.85                  | 27.87        | 1.00             | 0.39              | 5.50                  | 31.61         | 1.10             | 0.43              | 6.41                  |
|                             | DP 4              | 5.01       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 6.47         | 1.00             | 0.39              | 3.90                  | 7.62         | 1.00             | 0.39              | 4.85                  | 9.48         | 1.00             | 0.39              | 5.50                  | 10.75         | 1.10             | 0.43              | 13.78                 |
|                             | A11               | 4.65       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 6.00         | 1.00             | 0.39              | 3.90                  | 7.07         | 1.00             | 0.39              | 4.85                  | 8.79         | 1.00             | 0.39              | 5.50                  | 9.97          | 1.10             | 0.43              | 12.78                 |
|                             | OS-A3             | 0.74       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 0.95         | 1.00             | 0.39              | 3.90                  | 1.12         | 1.00             | 0.39              | 4.85                  | 1.40         | 1.00             | 0.39              | 5.50                  | 1.59          | 1.10             | 0.43              | 2.03                  |
|                             |                   | 25.13      |      |                      |                  |                   |                       | 32.45        |                  |                   |                       | 38.23        |                  |                   |                       | 47.54        |                  |                   |                       | 53.91         |                  |                   | 69.12                 |
| DP 2                        | DP 3              | 1.79       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 2.31         | 1.00             | 0.39              | 3.90                  | 2.72         | 1.00             | 0.39              | 4.85                  | 3.38         | 1.00             | 0.39              | 5.50                  | 3.83          | 1.10             | 0.43              | 4.91                  |
|                             | DP 6              | 12.95      | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 16.72        | 1.00             | 0.39              | 3.90                  | 19.70        | 1.00             | 0.39              | 4.85                  | 24.49        | 1.00             | 0.39              | 5.50                  | 27.78         | 1.10             | 0.43              | 35.61                 |
| DP 3                        | A5                | 1.79       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 2.31         | 1.00             | 0.39              | 3.90                  | 2.72         | 1.00             | 0.39              | 4.85                  | 3.38         | 1.00             | 0.39              | 5.50                  | 3.83          | 1.10             | 0.43              | 4.91                  |
|                             |                   | 1.79       |      |                      |                  |                   |                       | 2.31         |                  |                   |                       | 2.72         |                  |                   |                       | 3.38         |                  |                   |                       | 3.83          |                  |                   | 4.91                  |
| DP 4                        | A6                | 4.13       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 5.33         | 1.00             | 0.39              | 3.90                  | 6.28         | 1.00             | 0.39              | 4.85                  | 7.81         | 1.00             | 0.39              | 5.50                  | 8.86          | 1.10             | 0.43              | 11.36                 |
|                             | A7                | 0.88       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 1.14         | 1.00             | 0.39              | 3.90                  | 1.34         | 1.00             | 0.39              | 4.85                  | 1.66         | 1.00             | 0.39              | 5.50                  | 1.89          | 1.10             | 0.43              | 2.42                  |
| DP 5                        | A12               | 3.45       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 4.46         | 1.00             | 0.39              | 3.90                  | 5.25         | 1.00             | 0.39              | 4.85                  | 6.53         | 1.00             | 0.39              | 5.50                  | 7.40          | 1.10             | 0.43              | 9.49                  |
|                             | OS-A4             | 0.41       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 0.53         | 1.00             | 0.39              | 3.90                  | 0.63         | 1.00             | 0.39              | 4.85                  | 0.78         | 1.00             | 0.39              | 5.50                  | 0.89          | 1.10             | 0.43              | 1.14                  |
| DP 6                        | A4                | 6.85       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 8.84         | 1.00             | 0.39              | 3.90                  | 10.42        | 1.00             | 0.39              | 4.85                  | 12.96        | 1.00             | 0.39              | 5.50                  | 14.70         | 1.10             | 0.43              | 18.84                 |
|                             | OS-A2             | 0.45       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 0.58         | 1.00             | 0.39              | 3.90                  | 0.68         | 1.00             | 0.39              | 4.85                  | 0.85         | 1.00             | 0.39              | 5.50                  | 0.97          | 1.10             | 0.43              | 1.24                  |
| DP 7                        | DP 7              | 5.65       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 7.29         | 1.00             | 0.39              | 3.90                  | 8.59         | 1.00             | 0.39              | 4.85                  | 10.68        | 1.00             | 0.39              | 5.50                  | 12.12         | 1.10             | 0.43              | 15.53                 |
|                             |                   | 12.95      |      |                      |                  |                   |                       | 16.72        |                  |                   |                       | 19.70        |                  |                   |                       | 24.49        |                  |                   |                       | 27.78         |                  |                   | 35.61                 |
| DP 7                        | A1                | 0.30       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 0.39         | 1.00             | 0.39              | 3.90                  | 0.46         | 1.00             | 0.39              | 4.85                  | 0.57         | 1.00             | 0.39              | 5.50                  | 0.64          | 1.10             | 0.43              | 0.83                  |
|                             | A2                | 3.70       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 4.78         | 1.00             | 0.39              | 3.90                  | 5.63         | 1.00             | 0.39              | 4.85                  | 7.00         | 1.00             | 0.39              | 5.50                  | 7.94          | 1.10             | 0.43              | 10.17                 |
|                             | A3                | 0.86       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 1.11         | 1.00             | 0.39              | 3.90                  | 1.31         | 1.00             | 0.39              | 4.85                  | 1.63         | 1.00             | 0.39              | 5.50                  | 1.84          | 1.10             | 0.43              | 2.36                  |
|                             | OS-A1             | 0.79       | 0.39 | 15                   | 1.00             | 0.39              | 3.31                  | 1.02         | 1.00             | 0.39              | 3.90                  | 1.20         | 1.00             | 0.39              | 4.85                  | 1.49         | 1.00             | 0.39              | 5.50                  | 1.69          | 1.10             | 0.43              | 2.17                  |
|                             |                   | 5.65       |      |                      |                  |                   |                       | 7.29         |                  |                   |                       | 8.59         |                  |                   |                       | 10.68        |                  |                   |                       | 12.12         |                  |                   | 15.53                 |

| Culverts    |                   |            |      |                      |                  |                   |                |
|-------------|-------------------|------------|------|----------------------|------------------|-------------------|----------------|
| 100 Yr      |                   |            |      |                      |                  |                   |                |
| Culvert No. | Drainage Area No. | Area (Ac.) | "C"  | Time of Conc. (min.) | Freq. Factor "F" | Runoff Coeff. "C" | Q 100 (c.f.s.) |
| 1           | C8                | 1.47       | 0.39 | 15                   | 1.25             | 0.49              | 7.91           |
|             |                   | 1.47       |      |                      |                  |                   | 5.66           |
| 2           | A6                | 4.13       | 0.39 | 15                   | 1.25             | 0.49              | 7.91           |
|             |                   | 4.13       |      |                      |                  |                   | 15.93          |
| 3           | A9                | 1.46       | 0.39 | 15                   | 1.25             | 0.49              | 7.91           |
|             |                   | 1.46       |      |                      |                  |                   | 5.63           |
| 4           | DP 2              | 14.74      | 0.39 | 15                   | 1.25             | 0.49              | 7.91           |
|             |                   | 14.74      |      |                      |                  |                   | 56.82          |

Please label the design points on the proposed drainage area map.

Please use a C-value of 0.45 per the Denton County standards. See Table IV.1-4.

Provide RAS model for all proposed roadside ditches (Criteria Manual Section IV.3.4). Include proposed culverts and driveway culverts and verify the 100-yr fully developed flow is contained within the right of way. If not contained within ROW, additional DE must be dedicated to contain the fully developed 100-yr water surface elevation. This comment can be addressed with Final Drainage Study.

## Channel Report

Hydroflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

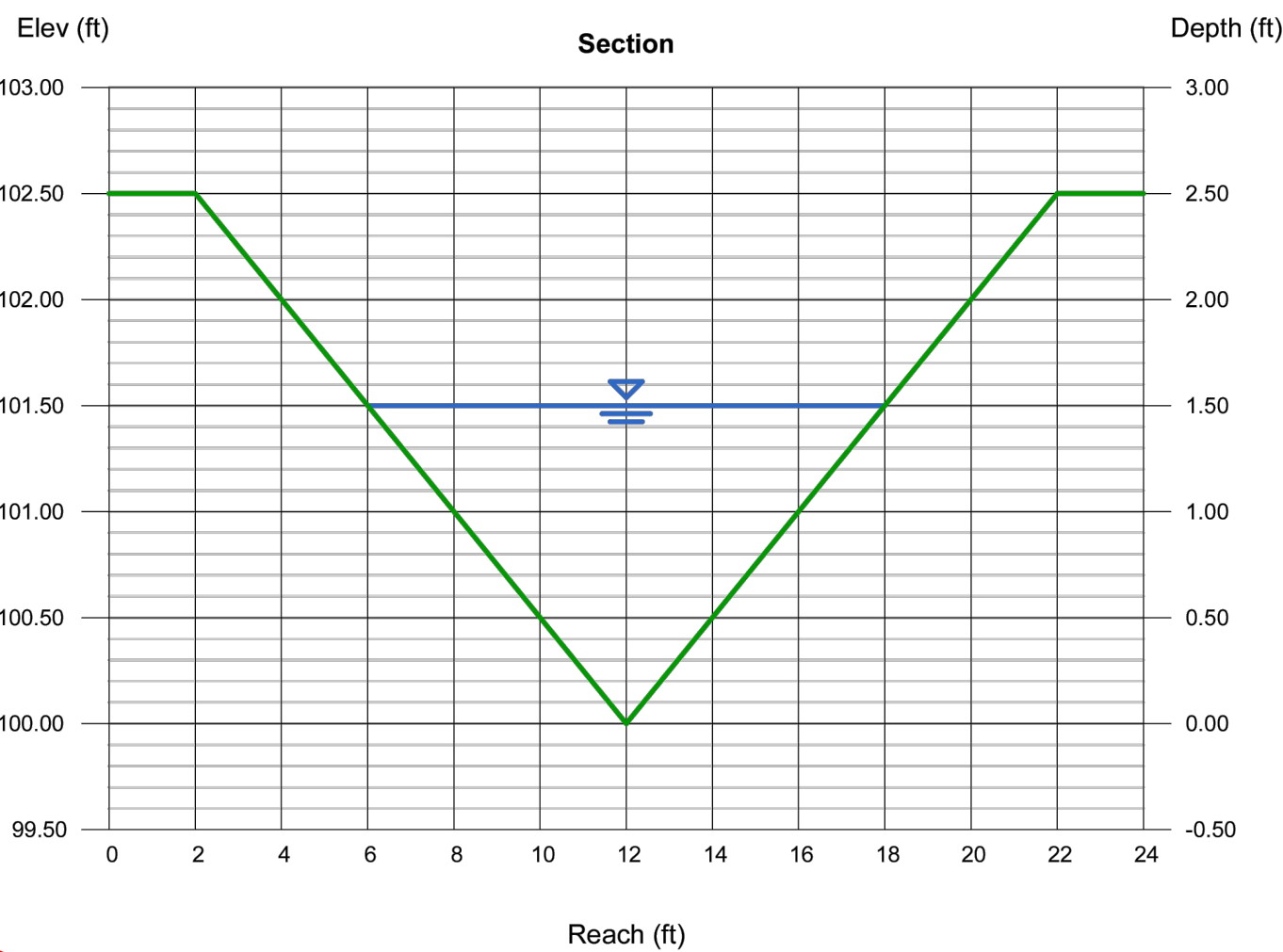
Wednesday, Nov 16 2022

### TYP Channel Section

Triangular  
Side Slopes (z:1) = 4.00, 4.00  
Total Depth (ft) = 2.50  
Invert Elev (ft) = 100.00  
Slope (%) = 0.50  
N-Value = 0.030

Highlighted  
Depth (ft) = 1.50  
Q (cfs) = 25.50  
Area (sqft) = 9.00  
Velocity (ft/s) = 2.83  
Wetted Perim (ft) = 12.37  
Crit Depth, Yc (ft) = 1.21  
Top Width (ft) = 12.00  
EGL (ft) = 1.62

Calculations  
Compute by:  
Known Depth (ft) = 1.50



## Culvert Report

Hydroflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Wednesday, Nov 16 2022

### Culvert 1

Invert Elev Dn (ft) = 768.37  
Pipe Length (ft) = 59.00  
Slope (%) = 4.31  
Invert Elev Up (ft) = 770.91  
Rise (in) = 18.0  
Shape = Circular  
Span (in) = 18.0  
No. Barrels = 1  
n-Value = 0.013  
Culvert Type = Circular Concrete  
Culvert Entrance = Square edge w/headwall (C)  
Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

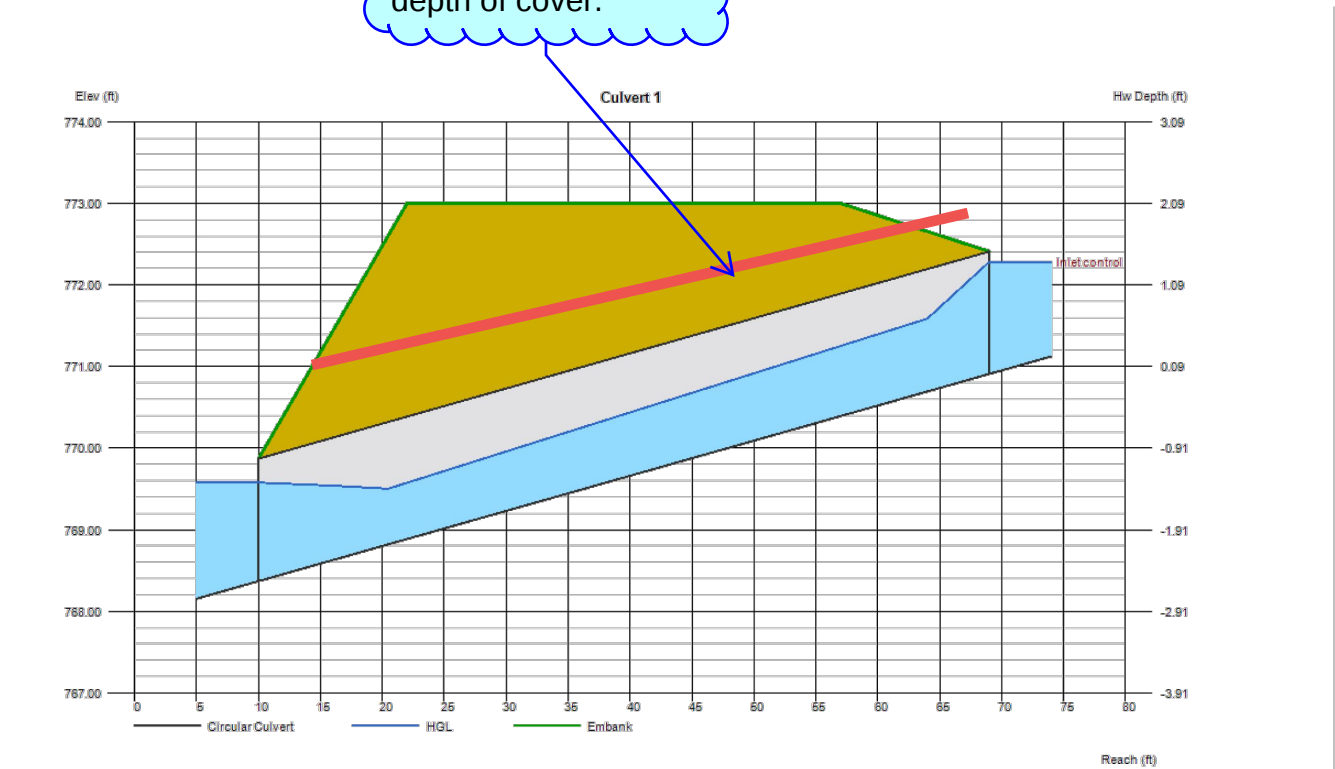
Calculations  
Qmin (cfs) = 5.66  
Qmax (cfs) = 5.66  
Tailwater Elev (ft) = (dc+D)/2

Highlighted  
Qtotal (cfs) = 5.66  
Qpipe (cfs) = 5.66  
Qovertop (cfs) = 0.00  
Veloc Dn (ft/s) = 3.71  
Veloc Up (ft/s) = 5.00  
HGL Dn (ft) = 769.58  
HGL Up (ft) = 771.83  
Hw Elev (ft) = 772.28  
Hw/D (ft) = 0.92  
Flow Regime = Inlet Control

Embankment  
Top Elevation (ft) =  
Top Width (ft) =  
Crest Width (ft) =

Top of pavement is at 772.1.

Provide culvert plan and profiles for all cross drainage structures. Make there is enough depth of cover.



## Culvert Report

Hydroflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Wednesday, Nov 16 2022

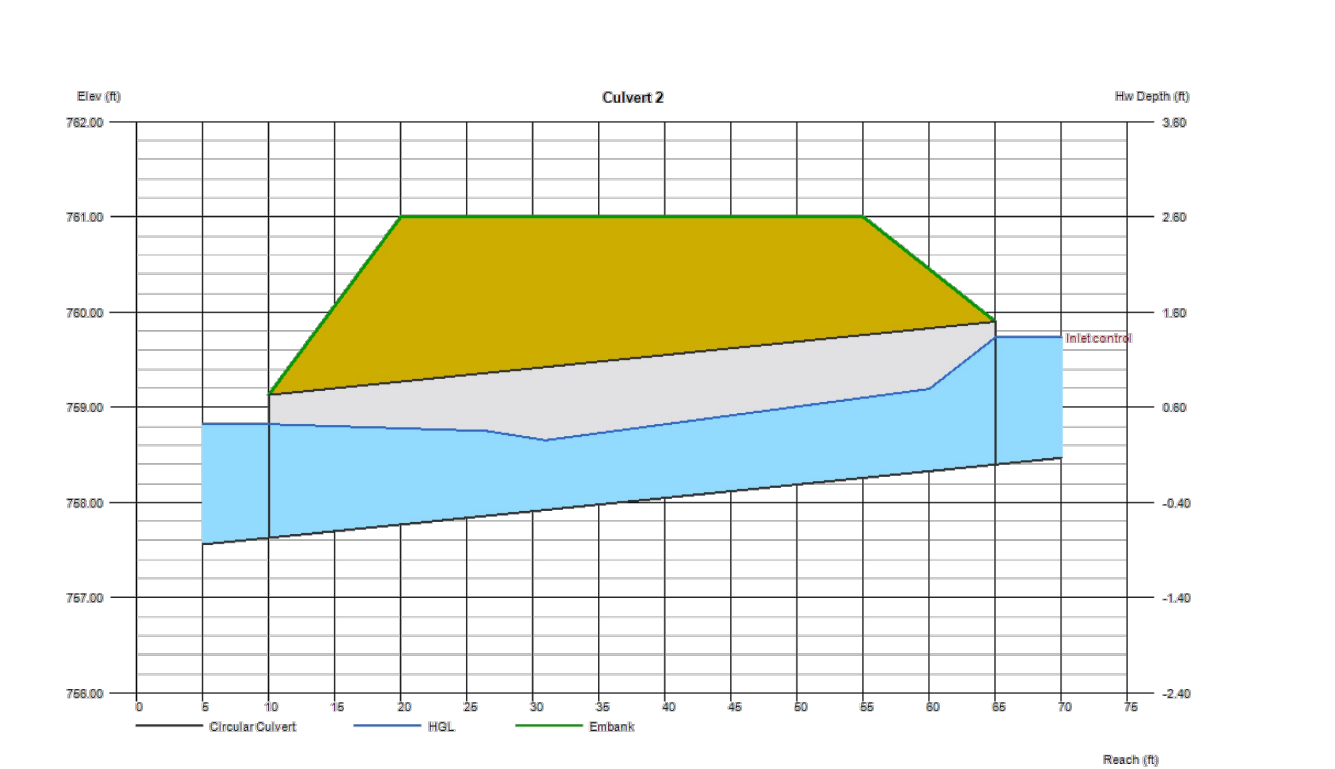
### Culvert 2

Invert Elev Dn (ft) = 757.63  
Pipe Length (ft) = 55.00  
Slope (%) = 1.40  
Invert Elev Up (ft) = 758.40  
Rise (in) = 18.0  
Shape = Circular  
Span (in) = 18.0  
No. Barrels = 3  
n-Value = 0.013  
Culvert Type = Circular Concrete  
Culvert Entrance = Square edge w/headwall (C)  
Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

Calculations  
Qmin (cfs) = 15.93  
Qmax (cfs) = 15.93  
Tailwater Elev (ft) = (dc+D)/2

Highlighted  
Qtotal (cfs) = 15.93  
Qpipe (cfs) = 15.93  
Qovertop (cfs) = 0.00  
Veloc Dn (ft/s) = 3.52  
Veloc Up (ft/s) = 4.88  
HGL Dn (ft) = 758.82  
HGL Up (ft) = 759.29  
Hw Elev (ft) = 759.74  
Hw/D (ft) = 0.89  
Flow Regime = Inlet Control

Embankment  
Top Elevation (ft) = 761.00  
Top Width (ft) = 35.00  
Crest Width (ft) = 30.00



## Culvert Report

Hydroflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Wednesday, Nov 16 2022

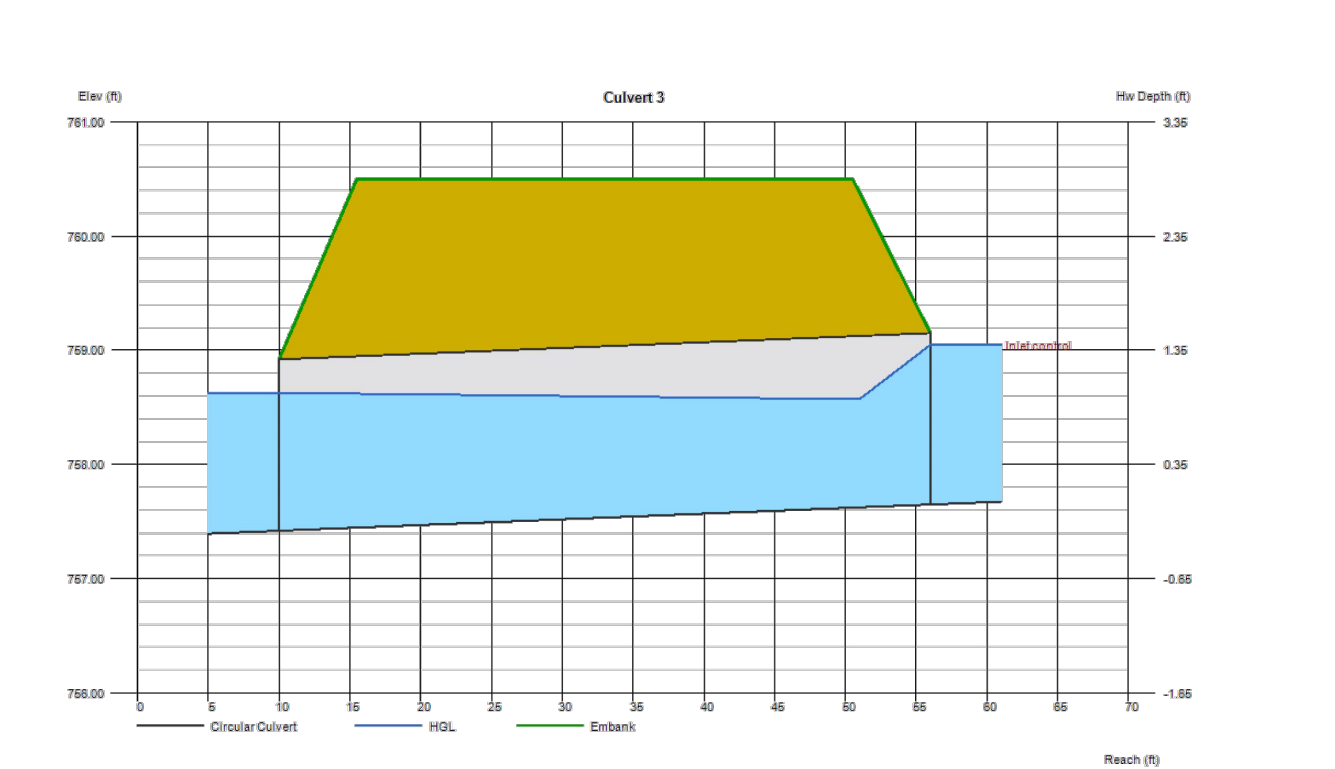
### Culvert 3

Invert Elev Dn (ft) = 757.42  
Pipe Length (ft) = 46.00  
Slope (%) = 0.50  
Invert Elev Up (ft) = 757.65  
Rise (in) = 18.0  
Shape = Circular  
Span (in) = 18.0  
No. Barrels = 1  
n-Value = 0.012  
Culvert Type = Circular Concrete  
Culvert Entrance = Square edge w/headwall (C)  
Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

Calculations  
Qmin (cfs) = 5.63  
Qmax (cfs) = 5.63  
Tailwater Elev (ft) = (dc+D)/2

Highlighted  
Qtotal (cfs) = 5.63  
Qpipe (cfs) = 5.63  
Qovertop (cfs) = 0.00  
Veloc Dn (ft/s) = 3.69  
Veloc Up (ft/s) = 4.99  
HGL Dn (ft) = 758.63  
HGL Up (ft) = 758.56  
Hw Elev (ft) = 759.05  
Hw/D (ft) = 0.93  
Flow Regime = Inlet Control

Embankment  
Top Elevation (ft) = 760.50  
Top Width (ft) = 35.00  
Crest Width (ft) = 30.00



## Culvert Report

Hydroflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Wednesday, Nov 16 2022

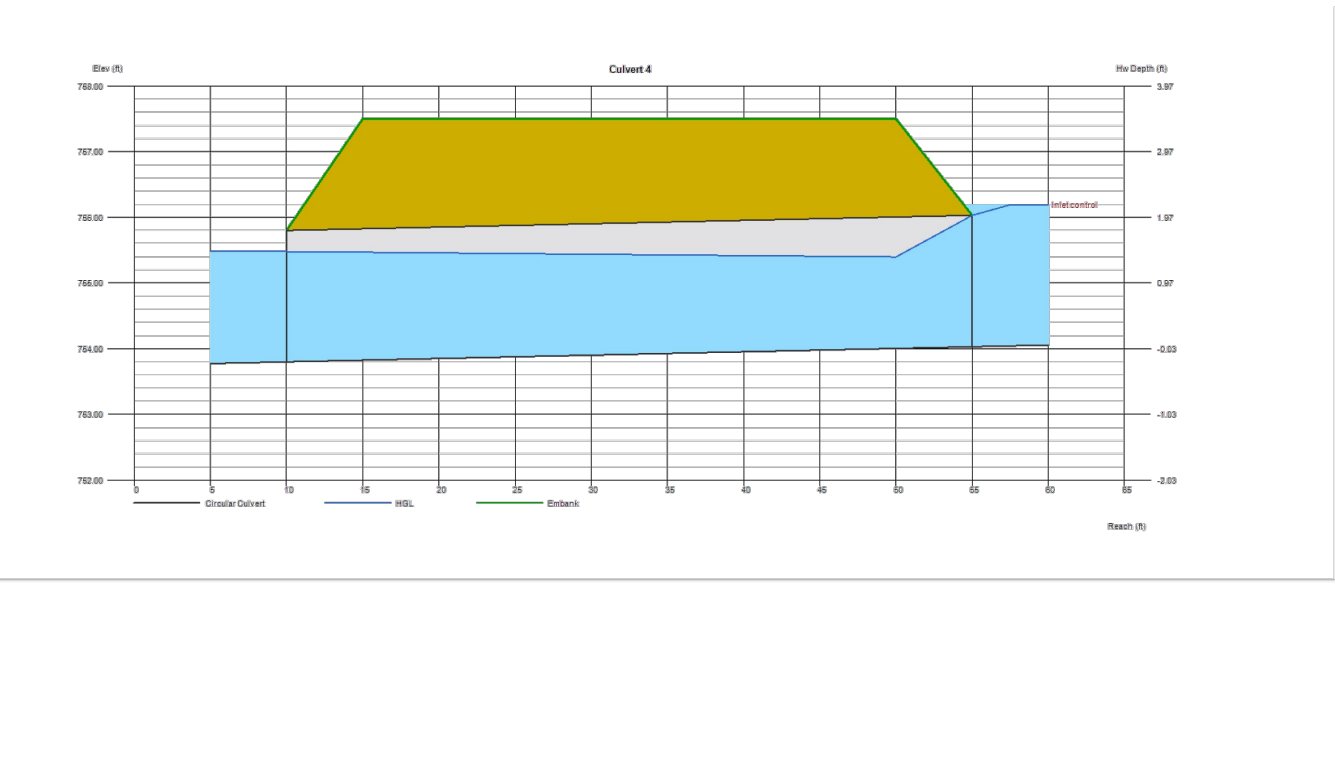
### Culvert 4

Invert Elev Dn (ft) = 753.80  
Pipe Length (ft) = 45.00  
Slope (%) = 0.51  
Invert Elev Up (ft) = 754.03  
Rise (in) = 24.0  
Shape = Circular  
Span (in) = 24.0  
No. Barrels = 4  
n-Value = 0.012  
Culvert Type = Circular Concrete  
Culvert Entrance = Square edge w/headwall (C)  
Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

Calculations  
Qmin (cfs) = 56.82  
Qmax (cfs) = 56.82  
Tailwater Elev (ft) = (dc+D)/2

Highlighted  
Qtotal (cfs) = 56.82  
Qpipe (cfs) = 56.82  
Qovertop (cfs) = 0.00  
Veloc Dn (ft/s) = 5.05  
Veloc Up (ft/s) = 6.26  
HGL Dn (ft) = 755.48  
HGL Up (ft) = 755.39  
Hw Elev (ft) = 756.19  
Hw/D (ft) = 1.08  
Flow Regime = Inlet Control

Embankment  
Top Elevation (ft) = 757.50  
Top Width (ft) = 35.00  
Crest Width (ft) = 30.00



REV. 1  
REV. 2  
REV. 3  
REV. 4  
REV. 5

2415 N. ELM STREET  
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Planning Communities - Designing the Systems That Serve Them

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IT IS NOT TO BE USED FOR THE PURPOSES OF CONSTRUCTION, BIDDING, PERMITTING, ETC.

Drawn by:TMM  
Checked by:LKA

INVESTMENT REAL ESTATE  
CONSTRUCTION PLANS  
RIDGEVIEW ADDITION  
CITY OF SANGER, ETJ, DENTON COUNTY, TEXAS

CULVERT REPORTS

Job: IRE2101

SHEET

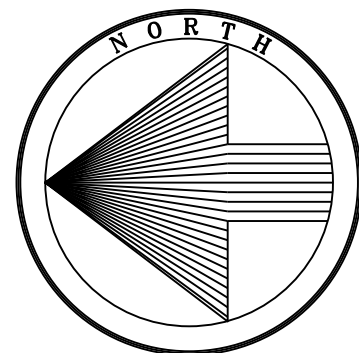
7

Plotted By: Jason Monk  
Plot Date: Wednesday, November 16, 2022 4:36:37 PM  
File Name: P:\Projects\IRE2101 - NE Metz - View SFRDWG - CEP-8 OVERALL GRADING PLAN.dwg  
Save Date: Wednesday, November 16, 2022 4:34:21 PM  
Plot Style Table: Allison.cb

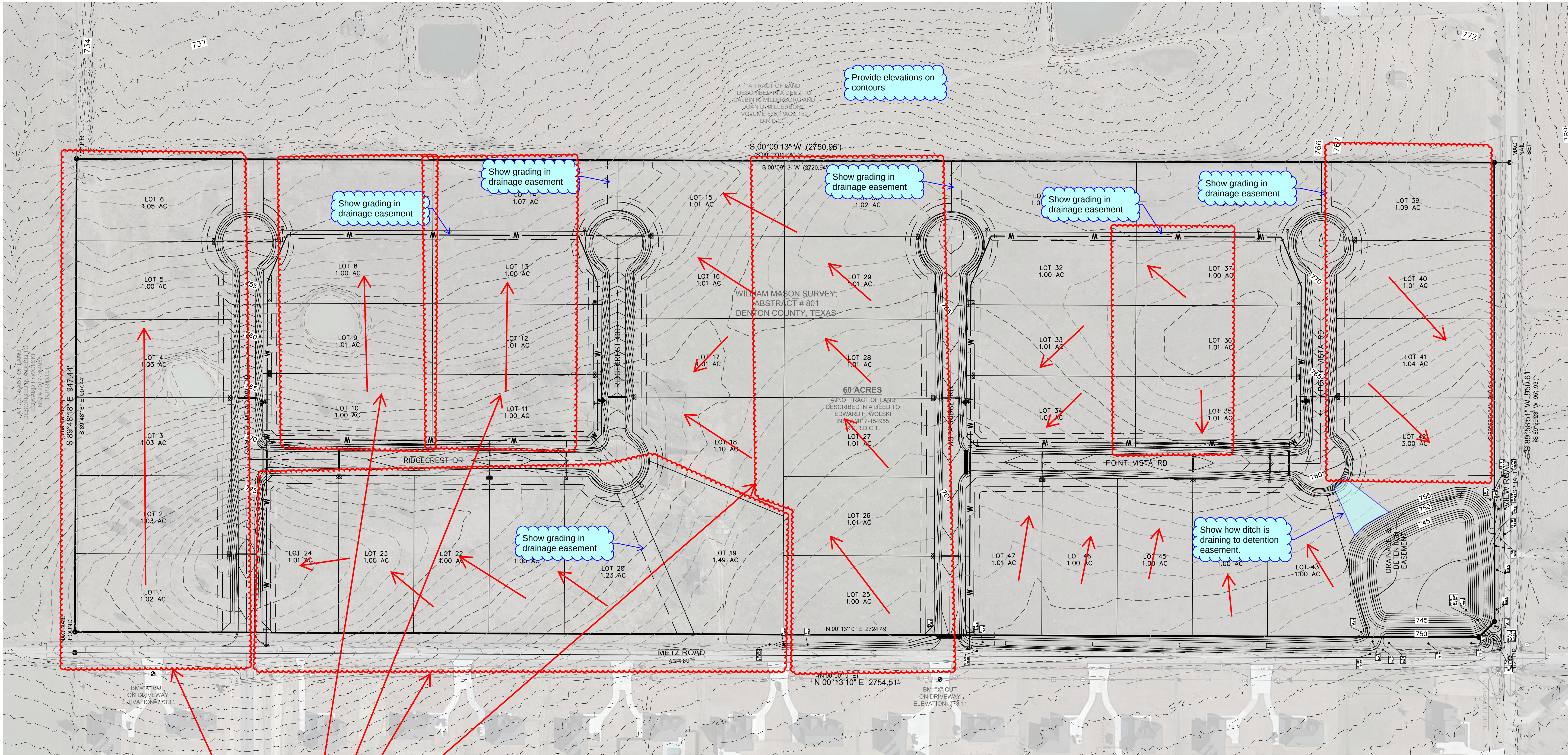
The below comments can be addressed with the Final Drainage Study

General Comments:

1. Please add flow arrows onsite and offsite to show drainage patterns.
2. Label contours (at least the index contours).3
3. Please show proposed storm drain lines and shade back.
4. Please add flow arrows along proposed road side ditches.



0 50 100 200  
SCALE: 1"=100'



The below comment can be addressed with the Final Drainage Study

Per the City variance, lot to lot drainage is only allowed across two lots before being picked up in a drainage easement. Provide side yard swales as needed to direct lot flows to the roads. Some instances have been identified. Please check for all.

|        |
|--------|
| REV. 1 |
| REV. 2 |
| REV. 3 |
| REV. 4 |
| REV. 5 |

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Drawn by: TMM  
Checked by: LKA

INVESTMENT REAL ESTATE  
CONSTRUCTION PLANS  
**RIDGEVIEW ADDITION**  
CITY OF SANGER, ETJ, DENTON COUNTY, TEXAS

OVERALL GRADING PLAN