MASTER DEVELOPMENT DRAINAGE REPORT
FOR
MEADOWLAKE RANCH
SKETCH PLAN
SKP-18-004

NOVEMBER 2018

Prepared for:
NES, INC.
619 N. CASCADE AVENUE
COLORADO SPRINGS, CO 80907
719-471-0073

Prepared by:
TERRA NOVA ENGINEERING, INC
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
(719) 635-6422

Job No. 1822.00

DRAINAGE REPORT STATEMENT

Design Engineer's Statement

This attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

____

L DUCETT, P.E. 32339 Seal

Developers Statement

I, _____________ the developer have read and will comply with all of the requirements specified in this drainage report and plan.

____

Business Name

By: ____

Title: ____

Address: ____

____

El Paso County Approval:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 & 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

____ ______________________

Jennifer Irvine, Date
County Engineer / ECM Administrator

Conditions:

TABLE OF CONTENTS:

APPENDICES

PURPOSE

This document is a Master Development Drainage Plan for the Meadowlake Ranch Sketch Plan. The purpose of this report is to schematically address on-site and off-site drainage patterns as discussed and approved within the Master Development Drainage Plan (MDDP) for Meadowlake Ranch and provide general methods to handle these flows based on the Sketch Plan via on-site detention and possible channel improvements in order to limit any flows released off-site to historic levels or less. This report will remain in general compliance with the El Paso County Drainage Criteria and will be followed up with a Preliminary Drainage Report submitted in conjunction with any Preliminary Plan submittals. Thus, some County review was completed on this report but no approval was required for the Sketch Plan approval.

GENERAL DESCRIPTION

The Meadowlake Ranch (Sketch Plan) site is located at the northwest corner of State Highway 24 and Judge Orr Road. The site is bounded on the north by Bandanero Drive and on the northwest by Eastonville Road. To the west are properties in the Woodmen Hills Filing No. 10 subdivision and to the northeast are properties owned by Distinctive Marine Company. Judge Orr Road and State Highway 24 form the southern and eastern borders, respectively. The El Paso County's Rock Island Trail runs between the eastern property line and State Highway 24.

Include acreage of the overall site included in the sketch plan

The primary site influences affecting the proposed land use are the Meadow Lake Airport and the ponds/wetlands within the property. To mitigate the impact of air traffic, industrial land use is proposed for the south-central portion of the site nearest the airport. To the west of this industrial area, urban residential land use is proposed to be served by the Woodmen Hills Metropolitan District. To the south of the urban residential area, a frontage of commercial land use is proposed along Judge Orr Road to its intersection with State Highway 24. For the balance of the property, north and east of the industrial area, rural residential land use with well and septic systems is proposed and will be accessed via Bandanero Drive.

Within the proposed urban residential area the existing ponds/wetlands will form part of an open space. The ponds/wetlands are fed by a spring in the northeast portion of the property next to the old railroad right of way along Eastonville Road. The system of ponds within the wetlands, running generally north to south, was excavated by horse-drawn equipment in the early 1900s and the ponds were reportedly connected by pipes and French drains. The ponds/wetlands are situated along the high ground between the Bennett and Haegler basins and form an independent basin within the property.

See comment on proposed drainage map. concerning the isolated Wetland area.

Soils for this project are delineated by the S.C.S. "El Paso County Area Soil Survey" as Columbine (gravelly sandy loam) and Stapleton (sandy loam) with Hydrologic Group designations of A and B, respectively (see Appendix). The majority of the site is covered with native grasses with a greater variety of vegetation along the natural drainage ways and in the wetland areas.

EXISTING DRAINAGE CONDITIONS

The boundary between the Bennett Ranch Basin and the Haegler Ranch Basin runs generally north to south along the eastern edge of the ponds/wetlands area on the property. Therefore, roughly the western third of the property is subject to the Bennett Ranch Pilot Project, Drainage Basin Planning Study, (Stormwater & Environmental Consultants, November 2001) and the remaining eastern portion is subject to the Haegler Ranch Basin, Drainage Basin Planning Study, (URS, May 2009).

The Bennett Ranch DBPS recommended regional detention ponds, roadway culvert upgrades, and channel improvements be used to mitigate flooding in and downstream of the Bennett Ranch Basin as the basin is developed. The regional detention ponds, located in the upper reaches of the basin, are required to release at 80% of existing flow values to reduce peak flows downstream. The improvements noted in the Bennett Ranch DBPS in the area of Meadowlake Ranch are in place (see Exhibit in the Appendices). The 24" pipe culvert under Judge Orr Road (Design Point 1) was not addressed in the report.

The 24 inch pipe is evaluated for ? and shown on page?

The Haegler Ranch DBPS recommended subregional detention ponds, roadway culvert upgrades, and channel improvements be used to mitigate flooding in and downstream of the Haegler Ranch Basin. The purpose of the detention basins is to limit peak discharges to existing levels and are to be installed as the basin is developed. One of the proposed subregional detention ponds (SR-2) is identified in the Haegler Ranch DBPS as located in the Meadowlake Ranch Basin EX-3 (Design Point 3). The basin is shown as providing 5 ac-ft of storage with a release value of Q100= 250 cfs (see Exhibit in the Appendices). There are no channel improvements recommended in the Haegler

Ranch DBPS for the Meadowlake Ranch property and the downstream crossing at State Highway 24 is considered adequate.

Existing drainage from the Meadowlake Ranch (Sketch Plan) site is generally from northwest to southeast by way of existing natural drainage swales. The outfall channel from the Bennett Ranch Regional Detention Pond that regulates the developed areas to the northwest of the site runs just outside the western property line. The Bennet Ranch DBPS listed the channel segment running south from Eastonville Road to Judge Orr Road along the west side of the Meadowlake Ranch property (hereafter, the Eastonville Channel) as deficient and recommended the channel be improved to carry the outflow from the then proposed Bennett Ranch Regional Detention Pond located on the north side of Eastonville Road. The natural channel was left mostly intact to preserve wetlands, but the flow capacity of the drainage way was improved by constructing an adjacent trapezoidal channel approximately 2600 ft long at a slope of 1% having a low flow channel 24 ft wide by 1 ft deep within a main channel set at 65 ft wide with drop structures every 800 ft (Eastonville Channel Improvement, Woodmen Hills Metro/GTL Development, JDS-Hydro Consultants, August 2005). Per the Final Drainage And Erosion Control – Woodmen Hills Filing No. 11 (URS, November 2002), the major storm design flow for the Eastonville Channel is 1164 cfs. At a depth of 2.5 feet the capacity of the trapezoidal channel, not including the adjacent natural channel, is approximately 1171 cfs. At that depth the drainage way's eastern bank is not overtopped (see Exhibit in the Appendices). The slope of the Meadowlake Ranch property drains away from the eastern bank of the Eastonville Channel, making the channel bank the drainage boundary and essentially separating the runoff in the channel, which flows south, from the runoff on the property, which drains east. Therefore, existing runoff from the Meadowlake Ranch site does not contribute to Bennett Ranch Regional Detention Pond outflows and runoff from the proposed conditions will be routed away from that conveyance route as well.

In addition, the Bennett Ranch DBPS recommended that the existing dual 36" pipe culverts under Judge Orr Road be replaced with a box culvert 30 ft wide by 7 ft high. However, at the time of this report, the flow from the Eastonville Channel is conveyed under Judge Orr Road via a recently constructed double 12' x 8' box culvert which has replaced the interim triple 72" CMP culverts put in place due do a roadway washout. The LOMR dated September 2008, which covers this drainage channel from just north of Judge Orr Road southward to Highway 24, indicates that Judge Orr Road

Call out who is responsible for improvements to this "natural" trapezoidal channel. Would Meadowlake Ranch be responsible for a some of these improvements as they develop next to this channel?

is overtopped by the 100 year flood at the crossing and to the west of the crossing. The Meadowlake Ranch property is minimally affected by the overtopping of Judge Orr Road.

The existing ponds/wetlands area contains five standing water ponds that have been in existence since the early 1900s and are fed by a spring and runoff from the immediately surrounding area. The downstream berms for the ponds are well vegetated and stable with no discernable outlet structures. As a consequence, the area is not considered to be contributing to the runoff from the property (see Exhibit in the Appendices). Should future development increase runoff to the ponds/wetlands area or if the ponds/wetlands are eliminated for development, then the appropriate hydrologic, hydraulic, and geotechnical analyses for this area must be included in the future Drainage Report.

Please account for the 63 acres as shown on the existing drainage plan as "wetland area"; there is not enough information included in this MDDP to support that both the 5 yr and 100 yr storms completely infiltrate for this area.

The Rock Island Trail running outside the eastern property line intercepts runoff from the site rather than allowing it to flow directly into the drainage ways along State Highway 24.

Concentrated runoff enters the site at two locations along its boundary with Bandanero Drive draining Basins OS-1 and OS-2. Per the approved design in the Final Drainage Report for 4 Way Ranch Phase 1 – Filing No. 1, (JR Engineering, March 2006) the developed flows for Basin OS-1 (118 ac) are Q5= 16 cfs and Q100= 119.0 cfs. Flow passes under Bandanero Drive via dual 36" RCP culverts. As designed, the allowable headwater elevation is 6932.40 and the computed headwater elevation for Q100 is 6932.34. A visit to the site has indicated that the pipe culverts are silted in with cattails and grasses. Should the pipe culverts not perform as designed, the flow would divert into the ditch running east along the north side of the roadway and end up at the pipe culvert conveying flow from Basin OS-2 under Bandanero Drive.

Per the approved design in the Final Drainage Report for 4 Way Ranch Phase 1 – Filing No. 1, (JR Engineering, March 2006), the developed flows for Basin OS-2 (13.4 ac) are Q5= 11.3 cfs and Q100= 25.5 cfs. Flow passes under Bandanero Drive via a 30" RCP culvert (inlet elevation 6915.31). As designed, the allowable headwater elevation is 6918.00 and the computed headwater elevation for Q100 is 6917.50. The maximum allowable headwater elevation without overtopping the roadway is 6918.80 and the capacity of the culvert under that headwater depth (assuming inlet control with HW/D= 1.4) is 33 cfs, which provides some extra capacity should any flow from Basin

OS-1 be diverted to Basin OS-2 (see Exhibit in the Appendices). In any case, should the roadway overtop at either location, the flow would continue on to Design Point 3 as before.

The topography as shown in the Final Drainage Report for 4 Way Ranch Phase I – Filing No. 1 indicates a swale ditch along the property line at northeast corner of the Meadowlake Ranch site that directs flow toward the east. Also, the topography as shown in the Master Development Drainage Plan and Preliminary Drainage Report for Four Way Ranch, (JR Engineering, March 2005) indicates that along the eastern boundary of the property the ground slopes southeast away from Meadowlake Ranch.

The hydrologic data taken from the Final Drainage Report for 4 Way Ranch Phase 1 – Filing No. 1, (JR Engineering, March 2006) for basins OS-1 and OS-2 is used in the hydrologic modeling for Meadowlake Ranch.

The runoff leaving the property is conveyed offsite at one of three locations. The first location is Design Point 1 where runoff from basin EX-1 passes through a 24" CMP under Judge Orr Road near its intersection with State Highway 24. This point drains approximately the western third of the site and encompasses range land, wetland area and the ranch house. No offsite areas contribute to this runoff. The total drainage area for EX-1 is 55.7 acres, producing runoff values of Q5= 4.0 cfs and Q100= 29.1 cfs for existing conditions. The headwater to depth ratio for a 24" pipe under inlet control is HW/D= 0.6 for the 5 year event and HW/D= 3.0 for the 100 year event (see Exhibit in the Appendices). At HW/D=3.0, Judge Orr Road would be overtopped. Therefore, the 24" pipe culvert may need to be upgraded. However, the downstream drainage way for Design Point 1 will need to be further studied in future Drainage Reports to assess the impact to Design Point 1 because just downstream of Judge Orr Rd the flow goes east under Rock Island Trail via a 42" CMP and into the ditch area between the trail and State Highway 24. The flow then passing southeast under Highway 24 is restricted by an 18" opening on the inlet end of a 10'x5' box culvert. Presumably, the runoff would pond between the State Highway 24 and Rock Island Trail, as well as the area between Rock Island Trail and Judge Orr Road. Potentially, the ponding could also extend to the north side of Judge Orr Road (see Exhibit in Appendices).

The second location is Design Point 2 where runoff from basin EX-2 passes through a 20" iron pipe under the Rock Island Trail and enters the public drainage way adjacent to State Highway 24. EX-2 encompasses a small area in the southern part of the site and includes range land and some ranch buildings. No offsite areas contribute this runoff. There are areas where the runoff from EX-2 ponds along Rock Island Trail, but the grade breaks are such that the flow would make its way to Design Point 2 before overtopping the trail. In addition, runoff likely ponds between Rock Island Trail and State Highway 24 to some degree as well. The total drainage area for EX-2 is 24.0 acres, producing runoff values of Q5= 2.3 cfs and Q100= 15.5 cfs for existing conditions.

The third location is Design Point 3 where runoff from basin EX-3 passes through dual 66" CMPs under State Highway 24 at the southeast corner of the site. Design Point 3 drains the northeastern portion of the property, including runoff from the offsite conveyances at Bandanero Drive (OS-1 & OS-2). The drainage area for EX-3, made up of primarily range land, is 168.9 acres, not including the offsite contributing areas, and produces runoff values of Q5= 13.6 cfs and Q100= 102.1 cfs for existing conditions. The combined drainage area for basins OS-1, OS-2 and EX-3 is 300.4 acres producing existing condition flows of Q5=41.1 cfs and Q100= 247.0 cfs. The headwater to depth ratio for the dual 66" pipes under inlet control is HW/D< 0.5 for the 5 year event and HW/D= 0.85 for the 100 year event; therefore, the system is adequate (see Exhibit in the Appendices). This is also the finding of the Haegler Ranch DBPS.

Changes in the 4 Way Ranch Drainage Plan to the north of the Meadowlake Ranch site could affect the drainage design of Meadowlake Ranch as given in this report and should be considered in future drainage reports for this site.

DEVELOPED DRAINAGE CONDITIONS

This MDDP is schematically addressing on-site and off-site drainage patterns for the developed conditions of this site. The individual Preliminary and Final Drainage Report(s) will better define developed flows within each basin to determine curb capacity/at-grade inlet requirements and specific sump inlet sizing based on flows for developed conditions.

Basin PR-1 will largely encompass the area addressed in EX-1. The proposed land uses for this area include urban residential, commercial, wetlands and open space. The total drainage area for PR-1 is

77.9 acres, producing runoff values of Q5= 114.4 cfs and Q100= 234.2 cfs for developed conditions. All runoff will be conveyed to Design Point 1 located near the intersection of Judge Orr Road and State Highway 24. Full Spectrum Detention will be provided at Design Point 1 by Pond-1 and proposed outflows will not exceed the flows for existing conditions.

Please also comment on the 24 inch storm sewer under Judge Orr. either indicate there will be over detention to address it or that it will be up graded.

DP-1: Pond 1 – Preliminary Sizing (Full Spectrum Detention)

Required WQCV = 1.270 ac-ft

Required EURV = 4.035 ac-ft

Required 100-Yr Detention Volume = 7.215 ac-ft

Approximate size: L= 350 ft, W= 175 ft, D=4.5 ft

Existing Flow at DP1: Q_5 = 4.0 cfs, Q_{100} = 29.1 cfs

Proposed Inflow at DP1: Q_5 = 114.4 cfs, Q_{100} = 234.2 cfs

Proposed Outflow at Pond-1: Q_5 = 4.0 cfs, Q_{100} = 29.1 cfs

Concrete Riser Box elevation = TBD

Max. 100 yr. WSE = TBD

Basin PR-2 encompasses the areas addressed in EX-2 and EX-3 by eliminating Design Point 2 and routing all the runoff for the proposed conditions to Design Point 3. The proposed land uses for this area include industrial, commercial, urban residential and rural residential. The drainage area for PR-2 is 206.9 acres, not including the offsite basins, and produces runoff values of Q5= 253.6 cfs and Q100= 553.8 cfs for developed conditions. The combined flows for PR-2, OS-1, and OS-2 for the developed conditions are Q5= 275.5 cfs and Q100=714.3 cfs.

At Design Point 3 the water quality needs for the combined area of basins PR-2, OS-1, and OS-2 for the proposed conditions will be addressed by Pond 2. The release flows for Pond-2 will be at or below the values for the existing conditions; therefore, the downstream drainage way at this location will not be affected by the elimination of Design Point 2.

DP-3: Pond 2 – Preliminary Sizing (Water Quality and Detention)

Required WQCV = 3.491 ac-ft

Required EURV = 3.968 ac-ft

Required 100-Yr Detention Volume = 16.667 ac-ft

Approximate size: L= 550 ft, W= 275 ft, D=4.5 ft

Existing Flow at DP3: Q_5 = 41.1 cfs, Q_{100} = 247.0 cfs

Proposed Inflow at DP3: Q_5 = 275.5 cfs, Q_{100} = 714.3 cfs

Proposed Outflow at Pond-2: Q_5 = 41.1 cfs, Q_{100} = 247.0 cfs

Concrete Riser Box elevation = TBD

Max. 100 yr. WSE = TBD

Please call out how the proposed pond 2 design includes the detention requirements of the regional pond SR - 02 per the Haeglar Ranch DBPS.

The drainage way for Design Point 2 as it proceeds downstream from State Highway 24 is an open field lacking a well-defined channel. Rerouting the runoff to Design Point 3 will not cause any hydraulic impact downstream of Design Point 2; however, there is a potential water rights issue stemming from the rerouting of the runoff which should be addressed in future Drainage Reports and a Deviation Request may be necessary. An alternative to rerouting the runoff from Design Point 2 would be to leave the drainage pattern as it exists and provide a detention pond at Design Point 2 that would provide water quality control and maintain post-development runoff at existing levels.

Please state: "The existing dual 60 inch culverts under Highway 24 have capacity for these proposed flows."

CHANNEL IMPROVEMENTS

Neither the Bennett Ranch DBPS nor the Haeglar Ranch DBPS recommends channel improvements within the Meadowlake Ranch project site. However, any needed channel improvements due to the developed conditions will likely be phased based on Final Platting. Channel improvement design will also be presented with each individual Final Plat. The specific areas where the natural channels are either too shallow or incised, improvements will be provided to handle the developed flows and control velocities. Probable improvements in such areas may include but not be limited to the following: minor grade control structures, weirs, vegetation enhancements and varying channel widths. Detailed design of these natural channel corridors will be further presented in the final drainage report(s).

MDDP CONFORMANCE

This proposed MDDP, from a drainage standpoint, follows the general scheme of the Master Development Drainage Plan and Preliminary Drainage Report for Four Way Ranch, (JR Engineering, March 2005).

FOUR STEP PROCESS

As part of a Low Impact Design approach, the existing ponds/wetlands in the western portion of the site will be retained as open space. In addition, the wetlands along the natural drainage ways in the eastern portion of the site will also be retained, some as part of a buffer zone between industrial and residential land uses and the remainder left in-situ and avoided by building sites. The Four Step Process to minimize the adverse effects of urbanization is addressed as follows:

<u>Reduce Runoff</u> – To promote infiltration where possible, runoff will be routed across grass buffers (MDCIA) and grass swales will be used to convey surface flow.

<u>Treat and Slowly Release WQCV</u> – Two EDBs are proposed that will provide water quality treatment for the site.

<u>Stabilize Stream Channels</u> – Existing stable channels receiving runoff from the development will receive no increase in flow due to the development. Existing channels within the development will be stabilized as needed and new channels will be designed for stability.

<u>Source Controls</u> – The site includes areas designated for commercial and industrial land use. Therefore, site specific source control practices should be implemented as appropriate to the land usage at the time of construction to protect the receiving waters.

DETENTION FACILITIES

All on-site detention facilities will be designed to accommodate the required full spectrum Excess Urban Runoff Volume (EURV) as described by the Denver Urban Drainage and Flood Control District. These facilities are proposed to be publically owned and maintained by a District. The on-site developed outflows from the detention facilities will be limited to existing levels.

Sizing and placement of the detention facilities are based on the preliminary calculations contained in the Appendix. Additional design information related to exact size, location, and outlet structure design will be provided for each facility within the final drainage report(s) on an as platted basis.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, dated May 2014. The overall drainage basin design was calculated using HEC-HMS 4.2 and the SCS methodology described in the Drainage Criteria Manual. Hydrologic Soil Group B was used for all calculations to be consistent with the procedures used in the Master

Development Drainage Plan and Preliminary Drainage Report for Four Way Ranch, (JR Engineering, March 2005) and the Final Drainage Report for 4 Way Ranch Phase 1 – Filing No. 1, (JR Engineering, March 2006).

FLOODPLAIN STATEMENT

The LOMR dated September, 2008 for Map No. 08041C575 F indicates that a small portion of the southwest corner of the Meadowlake Ranch site may fall within the FEMA 100-year floodplain.

DRAINAGE & BRIDGE FEES

Portions of this site are within both the Bennett Ranch and Haegler Ranch Drainage Basins. The Drainage and Bridge Fees are as follows:

Basin Name	Drainage Fee (per Imp. Acre)	Bridge Fee (per Imp. Acre)
Bennett Ranch	$10,832	$4,155
Haegler Ranch	$9,676	$1,428

These fees will be calculated according to which basin the developed properties lie within at time of Final Platting using the impervious acreage method approved by El Paso County.

SUMMARY

This proposed development remains consistent with the previously approved reports. All detention facilities will be designed to release at or below existing rates. The proposed development will not adversely impact surrounding developments.

PREPARED BY:

Terra Nova Engineering, Inc.

L Ducett, P.E.
President
1822.00/DRAINAGE/MDDP Report Items/182200mddp.doc

REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated May 2014.

2. Master Development Drainage Plan Bennett Ranch (URS, August 2000).

3. Bennett Ranch Pilot Project, Drainage Basin Planning Study, (Stormwater & Environmental Consultants, November 2001).

4. Final Drainage And Erosion Control – Woodmen Hills Filing No. 11 (URS, November 2002).

5. Master Development Drainage Plan and Preliminary Drainage Report for Four Way Ranch, (JR Engineering, March 2005).

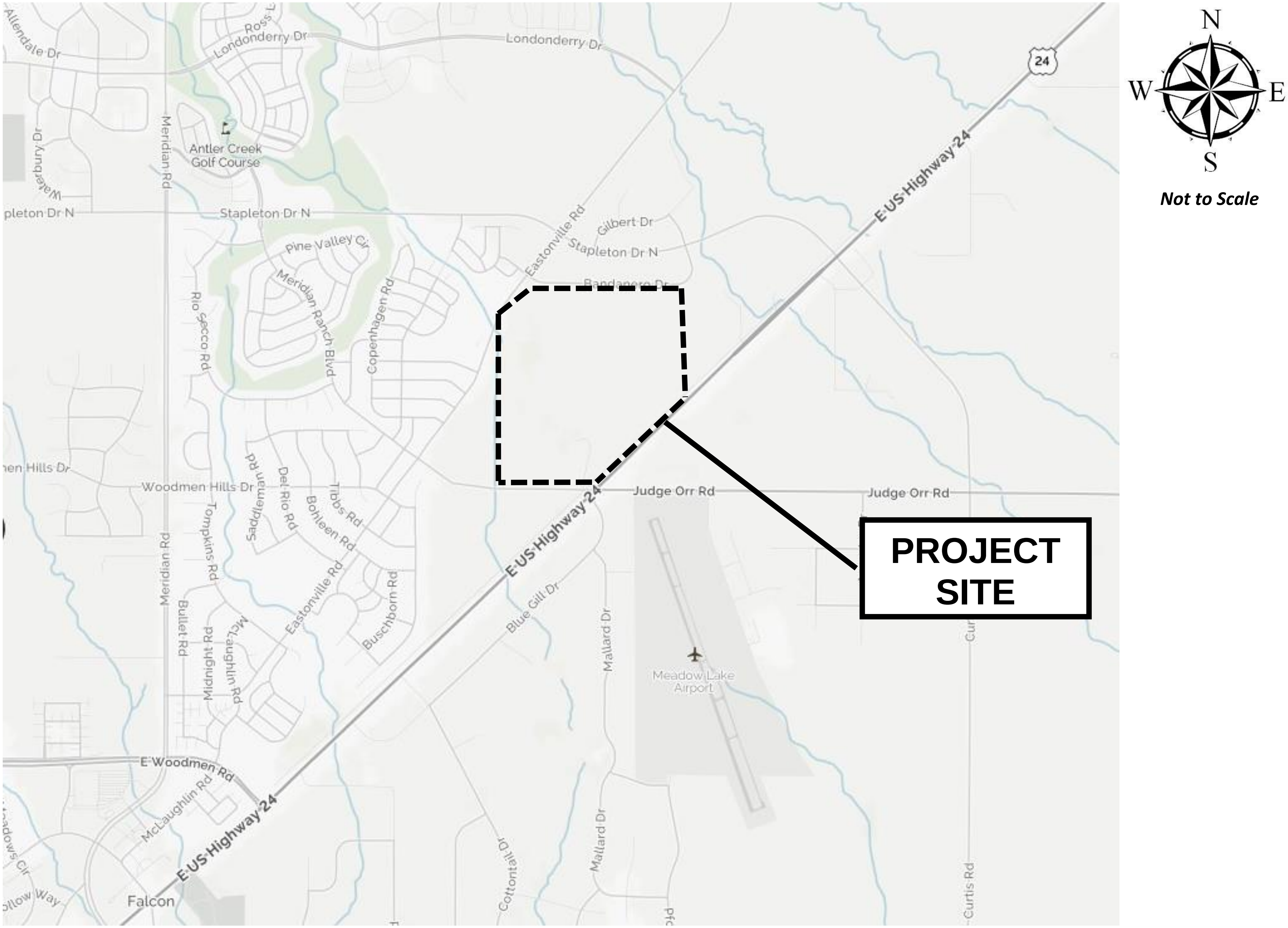
6. Final Drainage Report for 4 Way Ranch Phase 1 – Filing No. 1, (JR Engineering, March 2006).

7. Eastonville Channel Improvement, Woodmen Hills Metro / GTL Development, (JDS-Hydro Consultants, August 2005).

8. Haegler Ranch Basin, Drainage Basin Planning Study, (URS, May 2009).

APPENDICES

VICINITY MAP



1822.00 Meadowlake Ranch

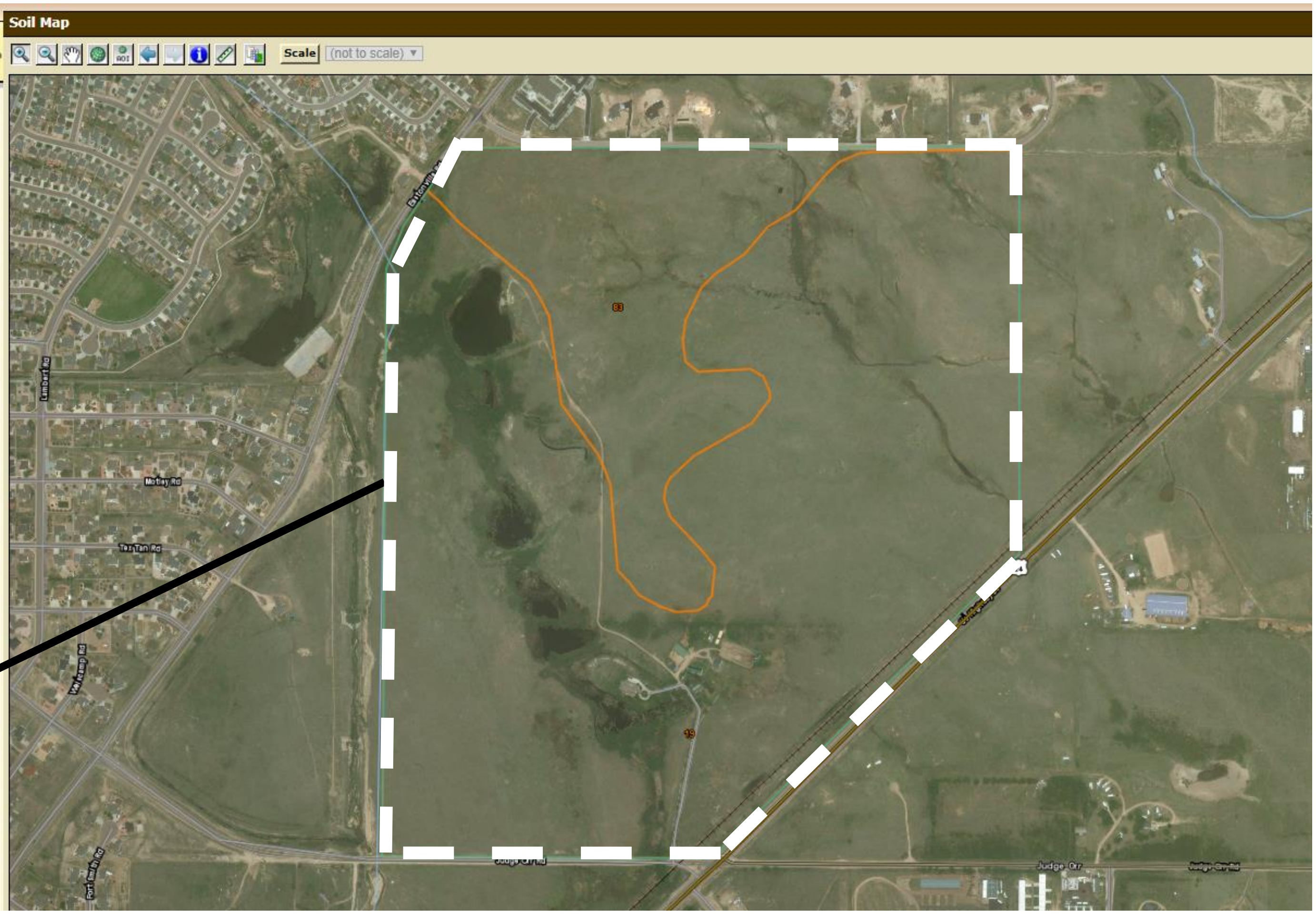
VICINITY MAP

SOILS MAP

Search

Map Unit Legend

El Paso County Area, Colorado (CO625)			
El Paso County Area, Colorado (CO625)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19 A	Columbine gravelly sandy loam, 0 to 3 percent slopes	227.4	79.4%
83 B	Stapleton sandy loam, 3 to 8 percent slopes	58.8	20.6%
Totals for Area of Interest		**286.2**	**100.0%**



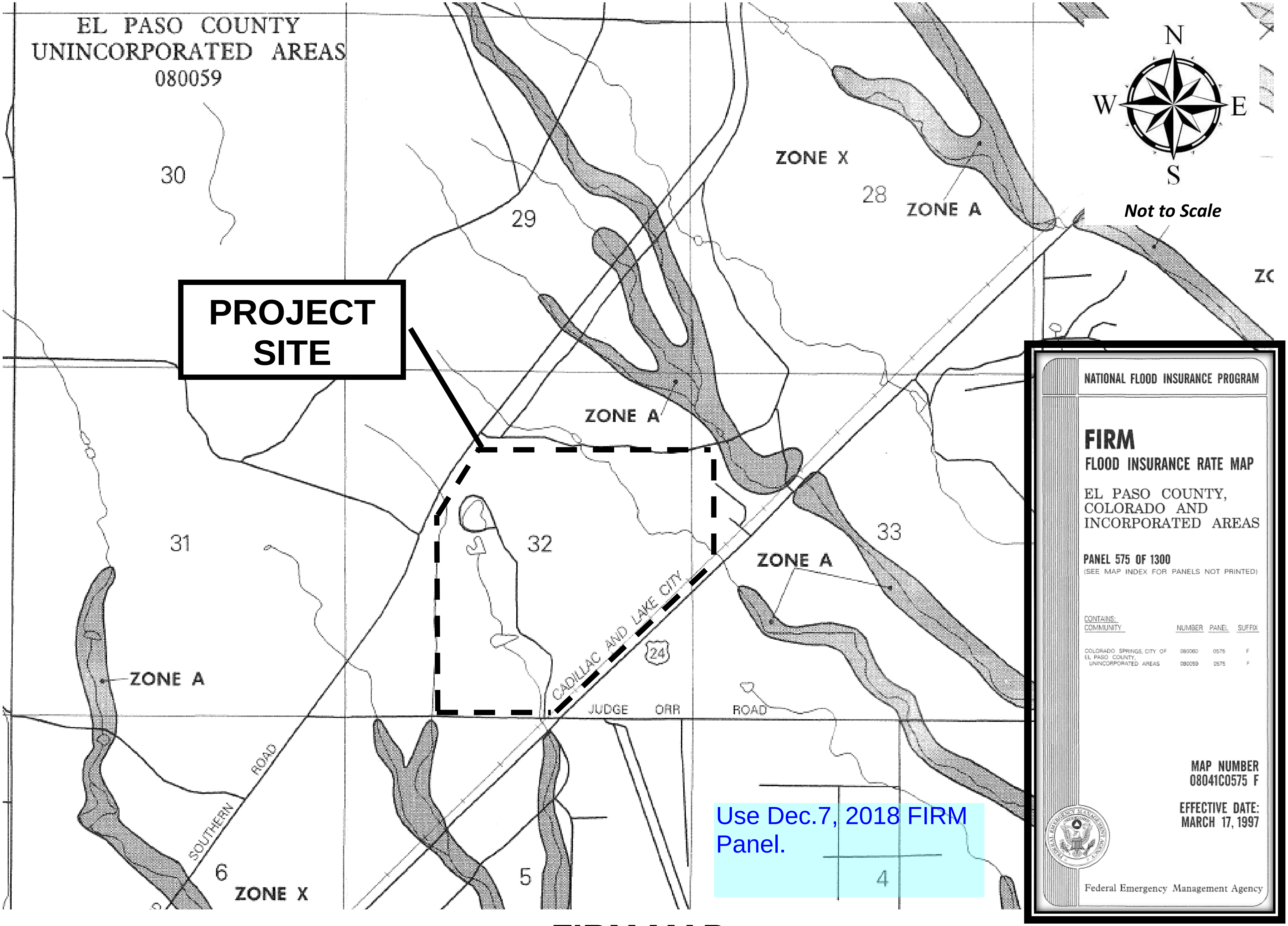
PROJECT SITE

Not to Scale

1822.00 Meadowlake Ranch

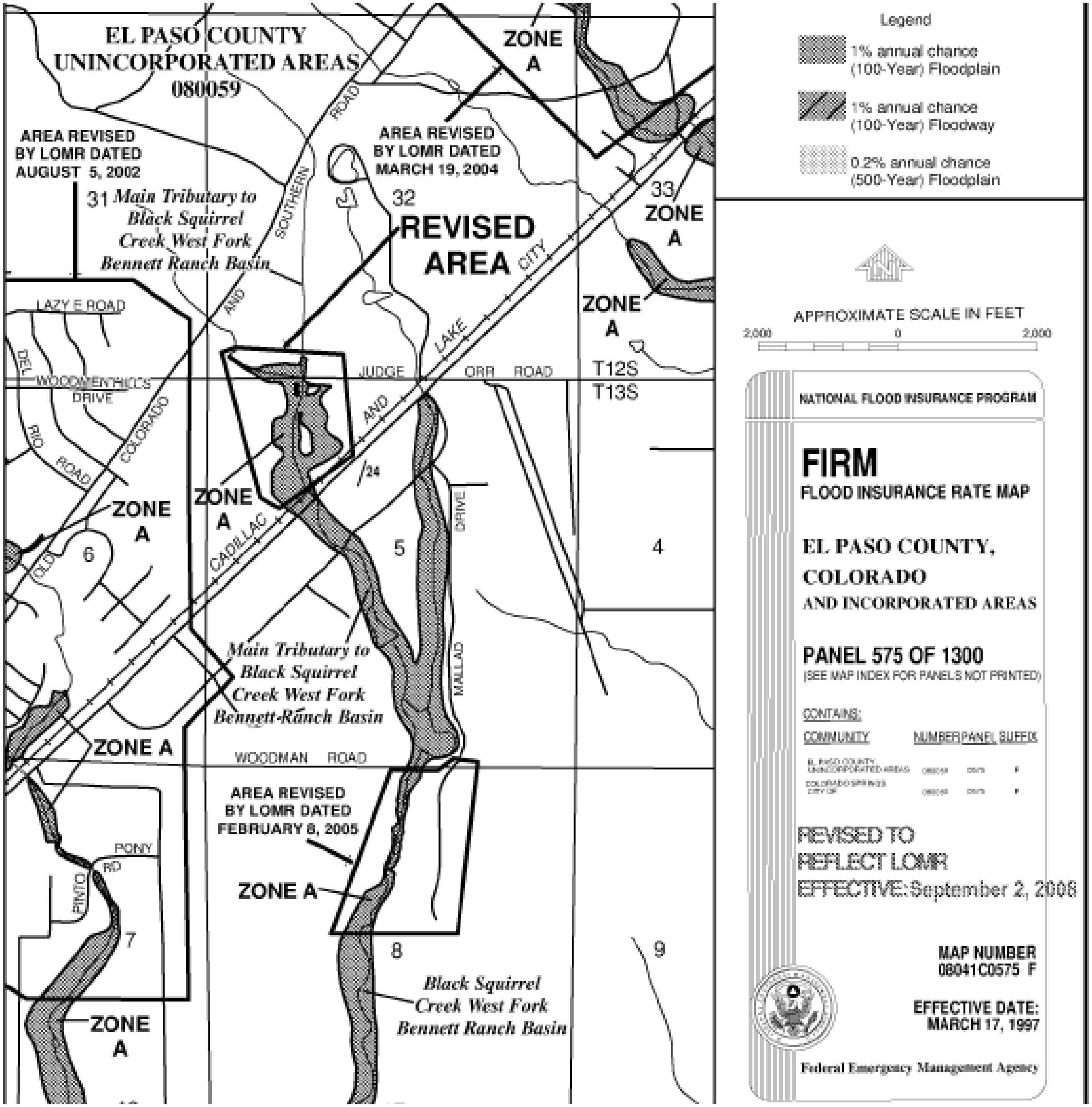
SOILS MAP

F.E.M.A MAP



1822.00 Meadowlake Ranch

FIRM MAP


EL PASO COUNTY
UNINCORPORATED AREAS
080059
ZONE A
AREA REVISED BY LOMR DATED AUGUST 5, 2002
AREA REVISED BY LOMR DATED MARCH 19, 2004
31 Main Tributary to Black Squirrel Creek West Fork Bennett Ranch Basin
32
33
REVISED AREA
SOUTHERN ROAD
LAZY E ROAD
DEL
WOODMEN HILLS DRIVE
RIO ROAD
COLORADO
AND
CITY
LAKE
JUDGE ORR ROAD
T12S
T13S
CADILLAC
OLD
6
5
4
24
DRIVE
MALLAD
Main Tributary to Black Squirrel Creek West Fork Bennett-Ranch Basin
WOODMAN ROAD
AREA REVISED BY LOMR DATED FEBRUARY 8, 2005
PONY RD
PINTO
7
8
9
Black Squirrel Creek West Fork Bennett Ranch Basin
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
2,000 0 2,000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 575 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
REVISED TO REFLECT LOMR
EFFECTIVE: September 2, 2008
MAP NUMBER
08041C0575 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency


N
W
E
S

Not to Scale

EXHIBITS

Bennett Ranch DBPS Plans

Haegler Ranch DBPS Plans

Eastonville Channel Improvements

Meadowlake Ranch Pond/Wetland Areas

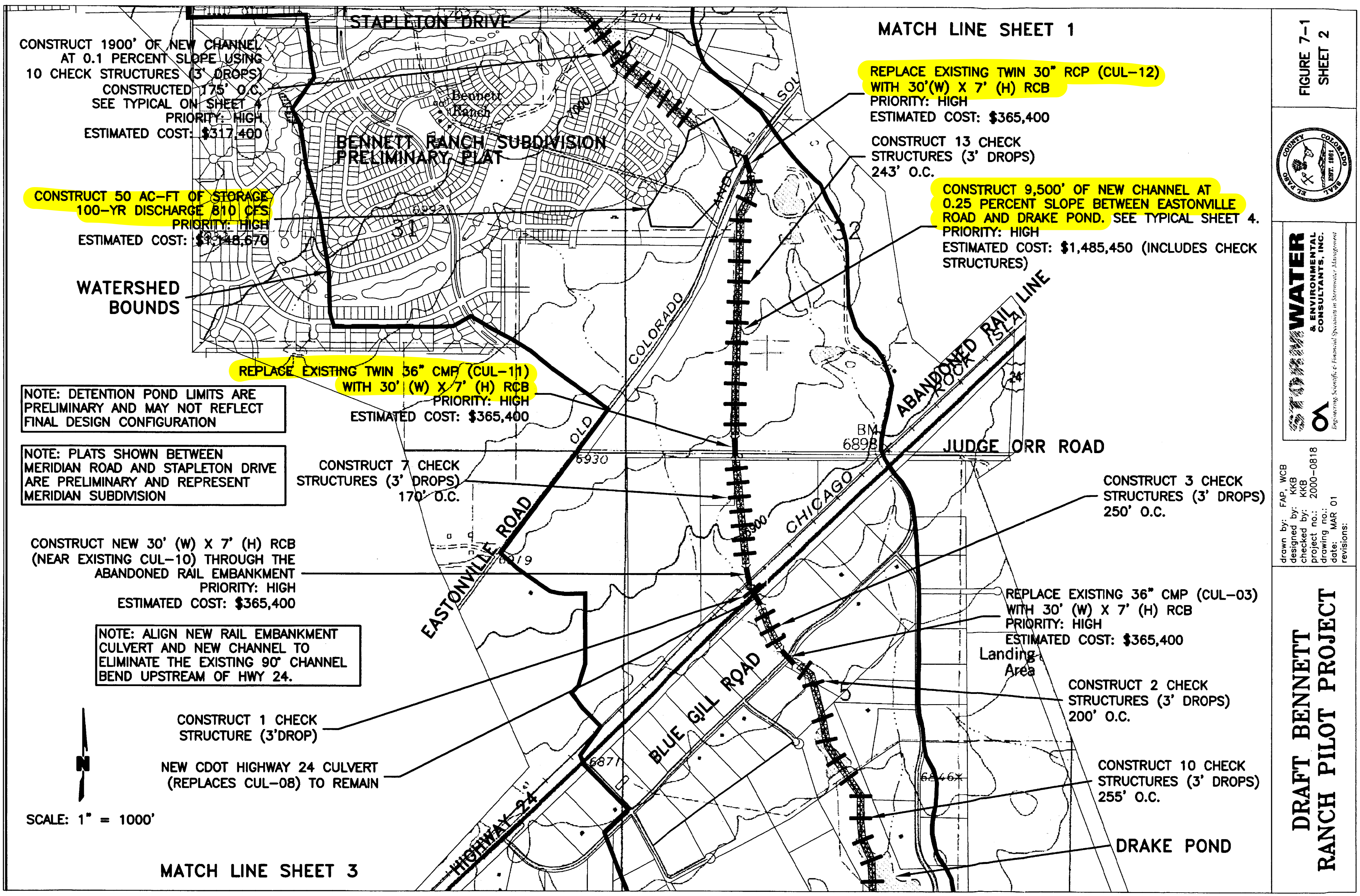
Bandanero Drive – HW/D for 30" Pipe Culvert at Basin OS-2

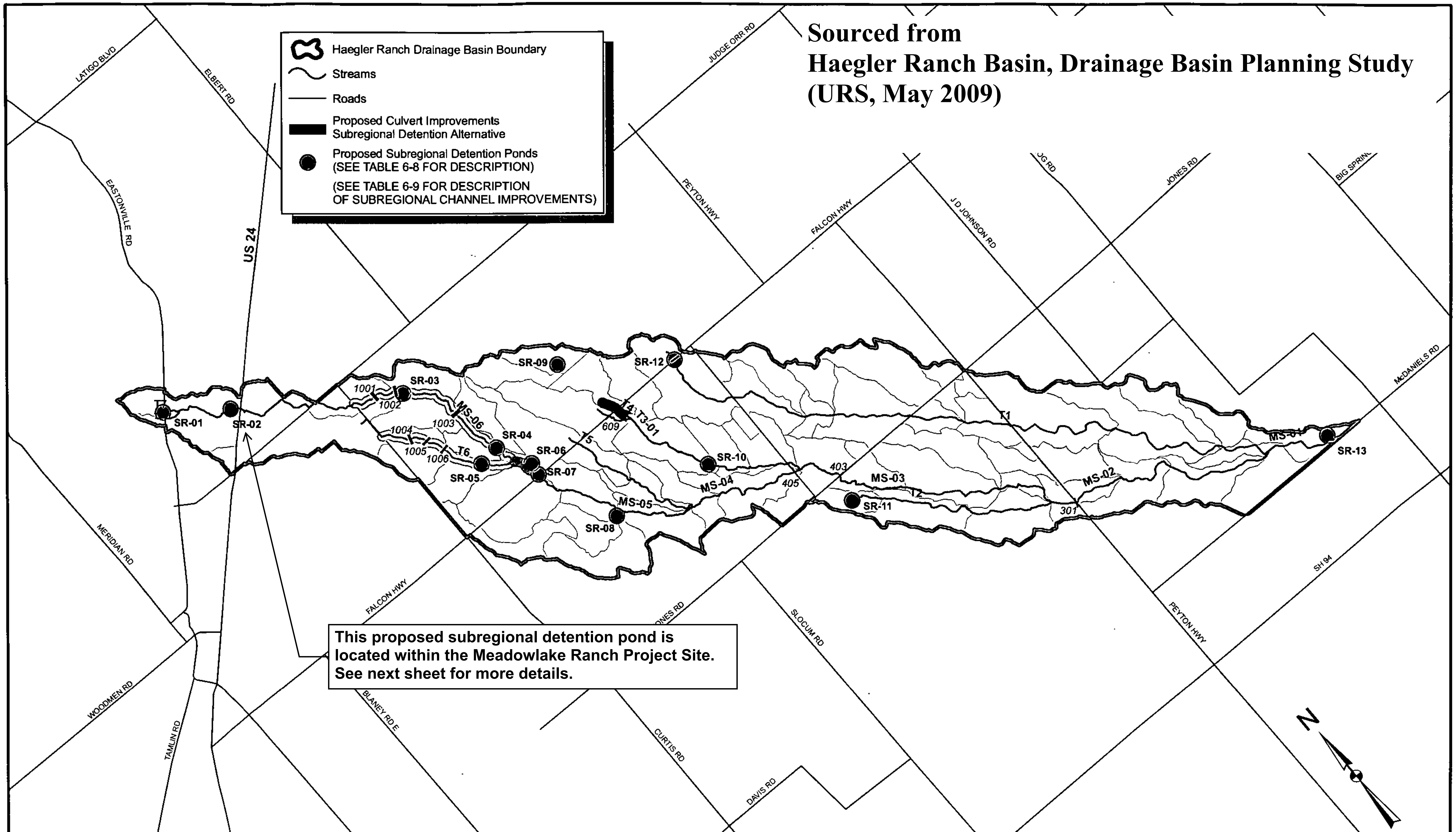
Judge Orr Road – HW/D for 24" Pipe Culvert at Basin EX-1

Design Point 1 Downstream Drainage Way

State Highway 24 – HW/D for Dual 66" Pipe Culverts at Basin EX-3

Sourced from Bennett Ranch Pilot Project, Drainage Basin Planning Study, (Stormwater & Environmental Consultants, November 2001). Highlighted areas are in the vicinity of the Meadowlake Ranch project site.





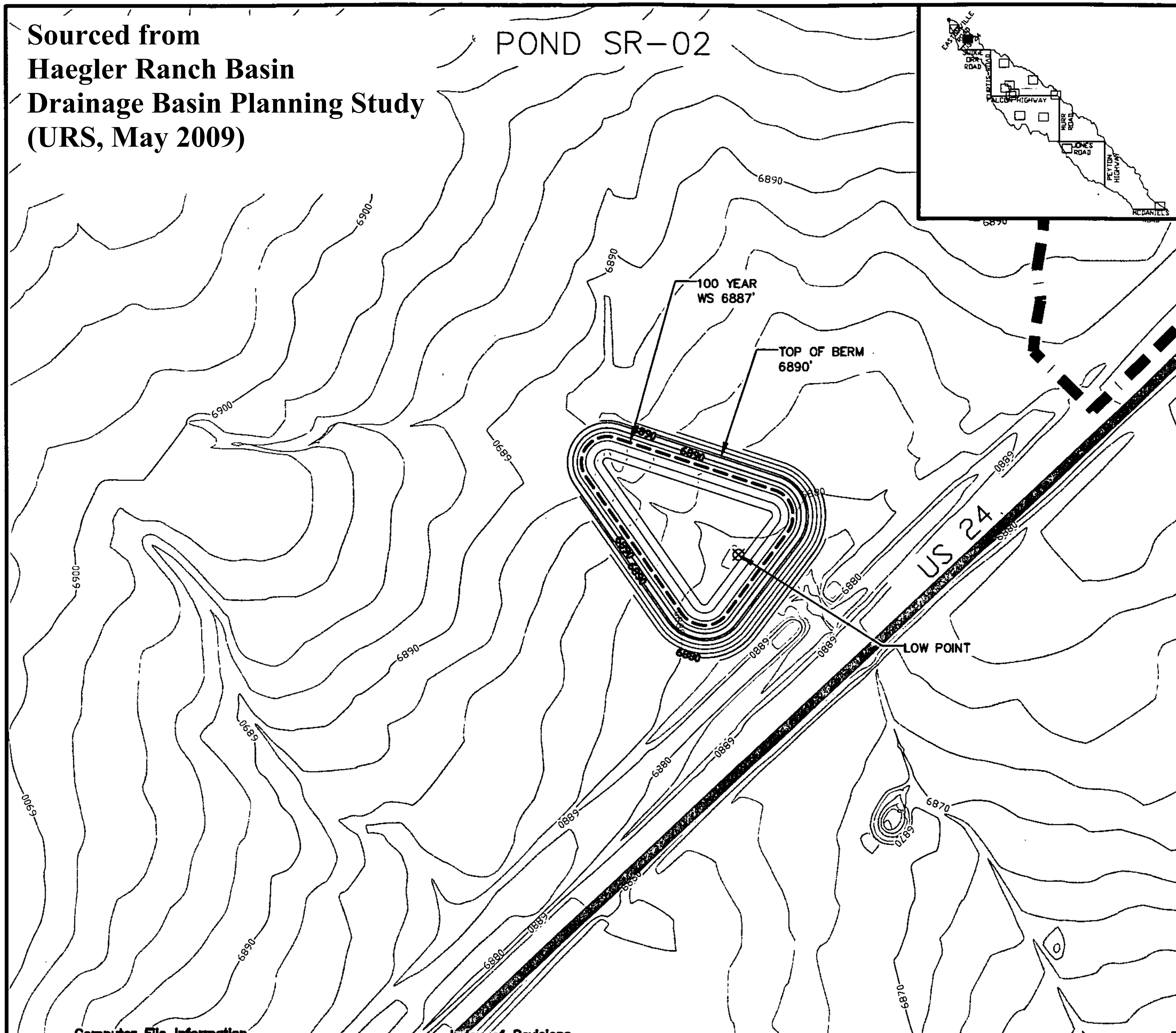
URS
9960 Federal Dr.
Suite 300
Colorado Springs, CO 80921
719.531.0001

DATE: 05/08

HAEGLER RANCH DRAINAGE BASIN
SUBREGIONAL DETENTION ALTERNATIVES
FIGURE 6-2

URS NO. 21711039

Sourced from Haegler Ranch Basin Drainage Basin Planning Study (URS, May 2009)



LEGEND

6630	PROPOSED CONTOURS – MAJOR ELEVATION
	PROPOSED CONTOURS – MINOR ELEVATION
6630	EXISTING CONTOURS – MAJOR ELEVATION
	EXISTING CONTOURS – MINOR ELEVATION
	WATERSHED BOUNDARY
	ROADS
	RIVER
	100 YEAR WATER SURFACE ELEVATION
⊠	OUTLET

POND SR-02
DISCHARGE

Q100	250 CFS
Q2	3 CFS
POND VOLUME AC FT	5
BERM WIDTH	10'
SIDESLOPES	8:1

N

1"=200'

200 0 200 400

Computer File Information

Full Path:	P:\21711039\CAD\PLANSHTS
Drawing File Name:	PONDS.DWG
Acad. Ver. 2006	Scale: 1"=200' Units: Feet

Index of Revisions

Profiles

URS

Designed by: KAP
Detailed by: DRM
Checked by: JAJ

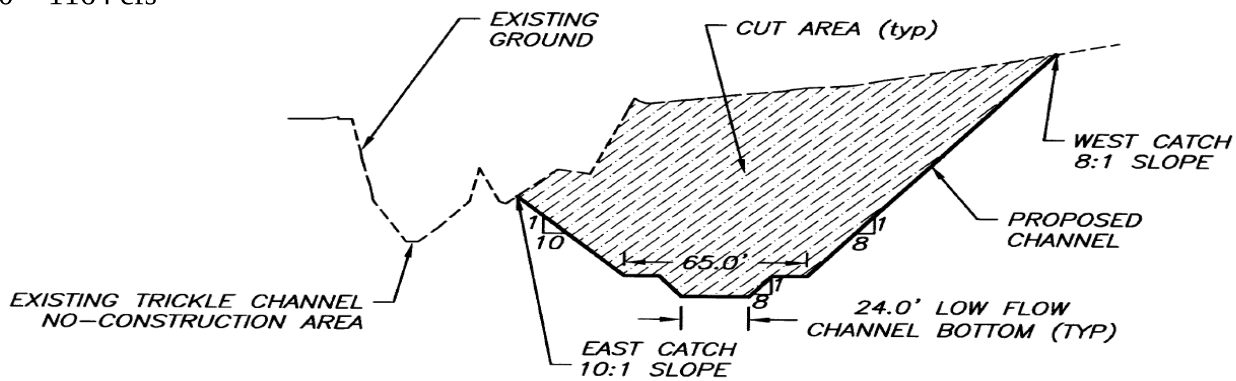
Structure Numbers

HAEGLER RANCH DRAINAGE BASIN

Sheet Number SR02

Eastonville Channel Capacity (depth = 2.5 ft)

Q100 = 1164 cfs



TYPICAL
CHANNEL DETAIL SECTION

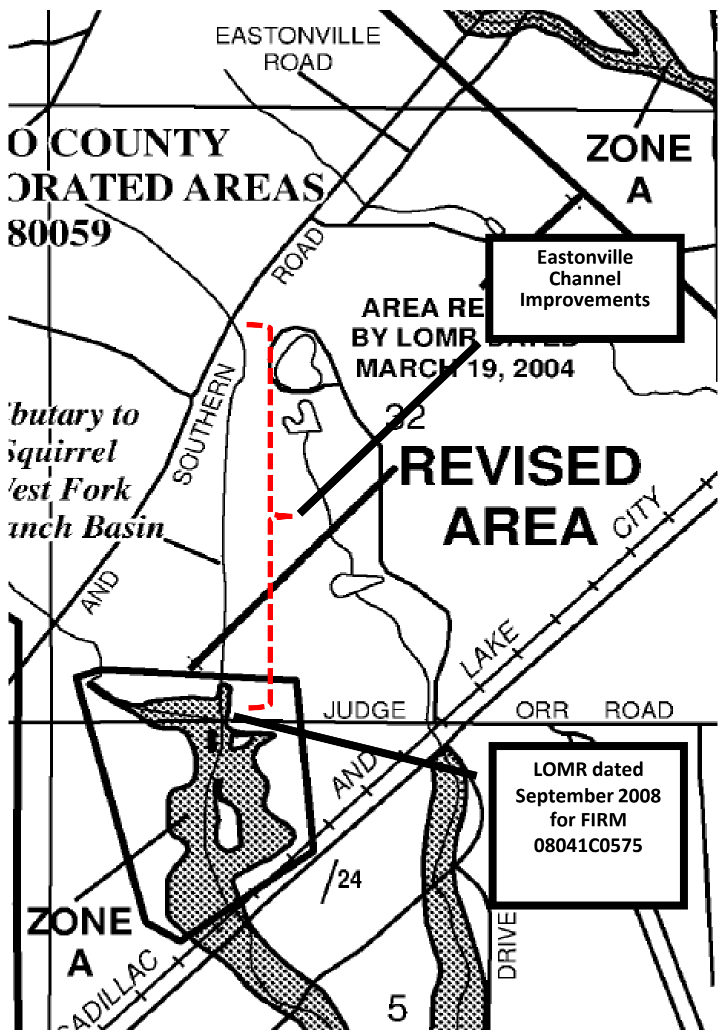
Low Flow Channel	
Z_1:1 (side slopes, ft)	8
Z_2:1 (side slopes, ft)	8
w (bottom width, ft)	24
d (depth, ft)	1
Area (sqft)	***40.00***
Wetted Perimeter (ft)	***40.12***

Above Low Flow Channel	
Z_1:1 (side slopes, ft)	10
Z_2:1 (side slopes, ft)	8
w (bottom width, ft)	65
d (depth, ft)	1.5
Area (sqft)	***124.50***
Wetted Perimeter (ft)	***83.25***

Area = 40.00 + 124.50 = 164.50 sqft
Wetted Perimeter = 40.12 + 83.25 - 40.00 = 83.37 ft

Channel at 2.5 ft deep	
n (mannings)	0.033
s (channel slope, ft/ft)	0.01
Area (sqft)	***164.50***
Wetted Perimeter (ft)	***83.37***
Velocity (fps)	***7.1***
Q (cfs)	***1171.1***

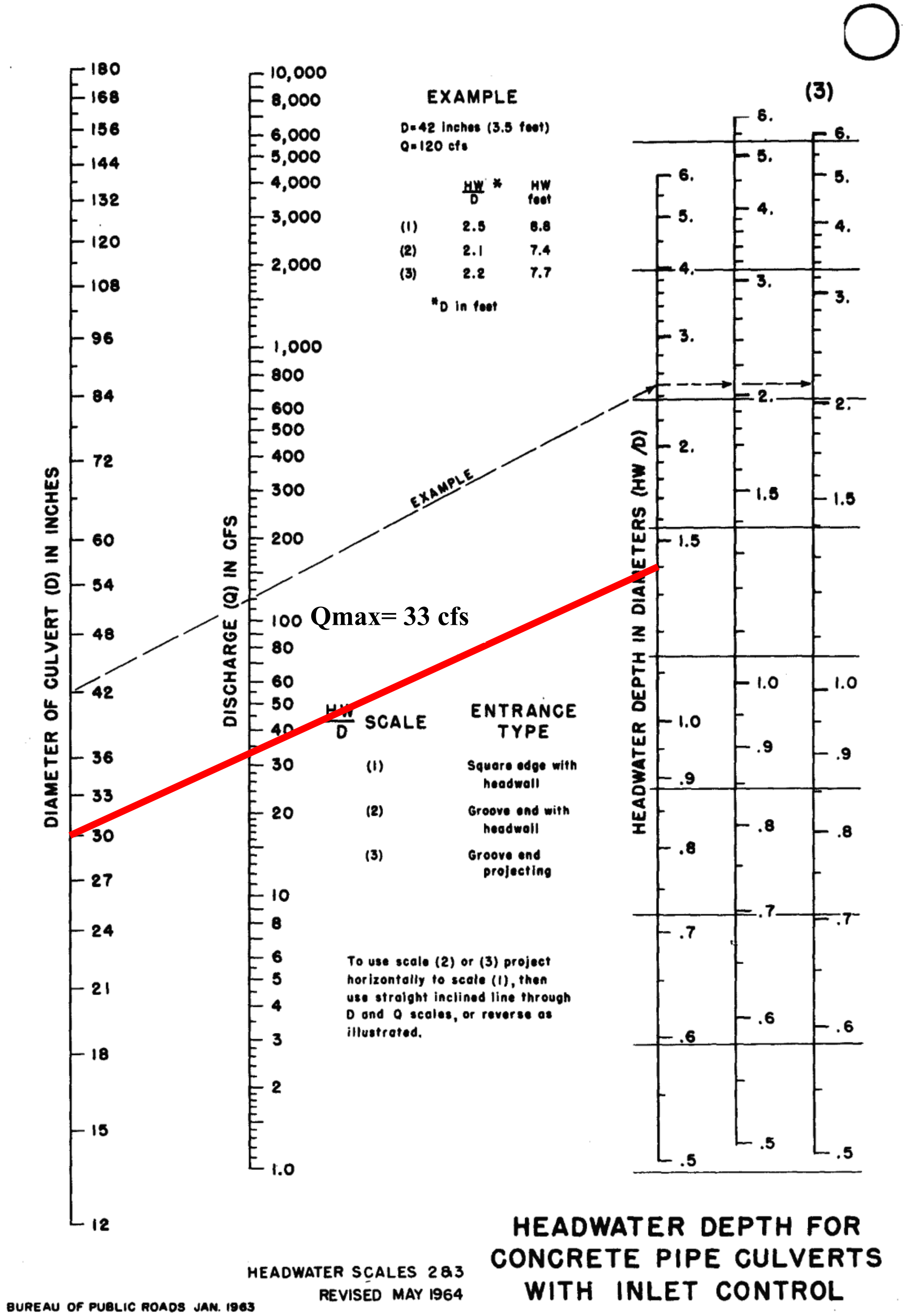
> 1164 cfs




Meadowlake Ranch
Pond / Wetland Area
Eastonville Rd
Snaffle Bit Rd
Motley Rd
Eastonville Rd
Judge Orr Rd
Judge Orr Rd
Judge Orr Rd
Judge Orr Rd
Judge Orr Rd
Hwy 24
Hwy 24
24
24
Google
Reptile Food & More
Imagery ©2018 Google, Map data ©2018 Google
United States
Terms

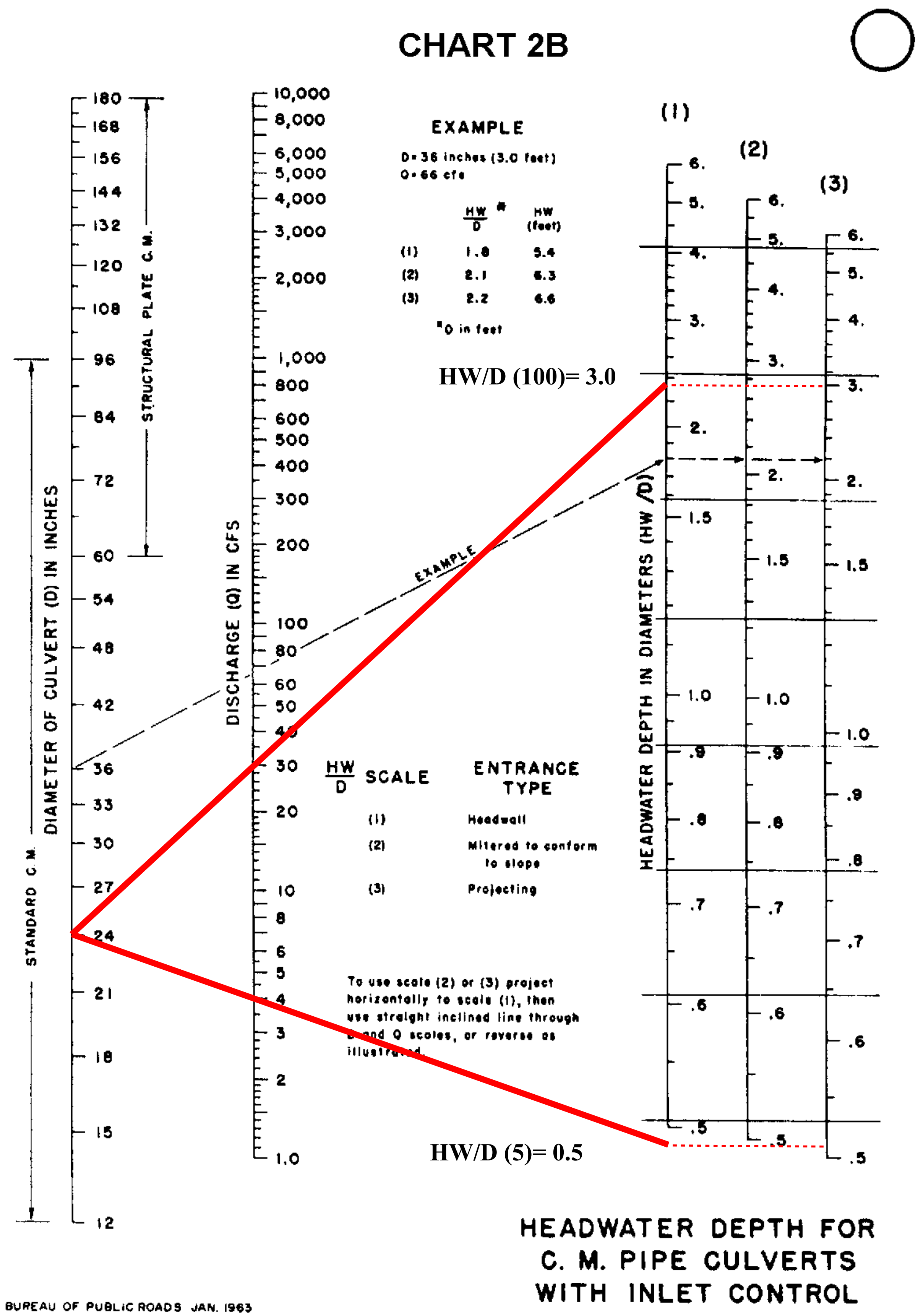
Single 30" Pipe Culvert under Bandanero Drive (Basin OS-2)
Square Edge with Headwall
Maximum allowable HW/D = 1.4

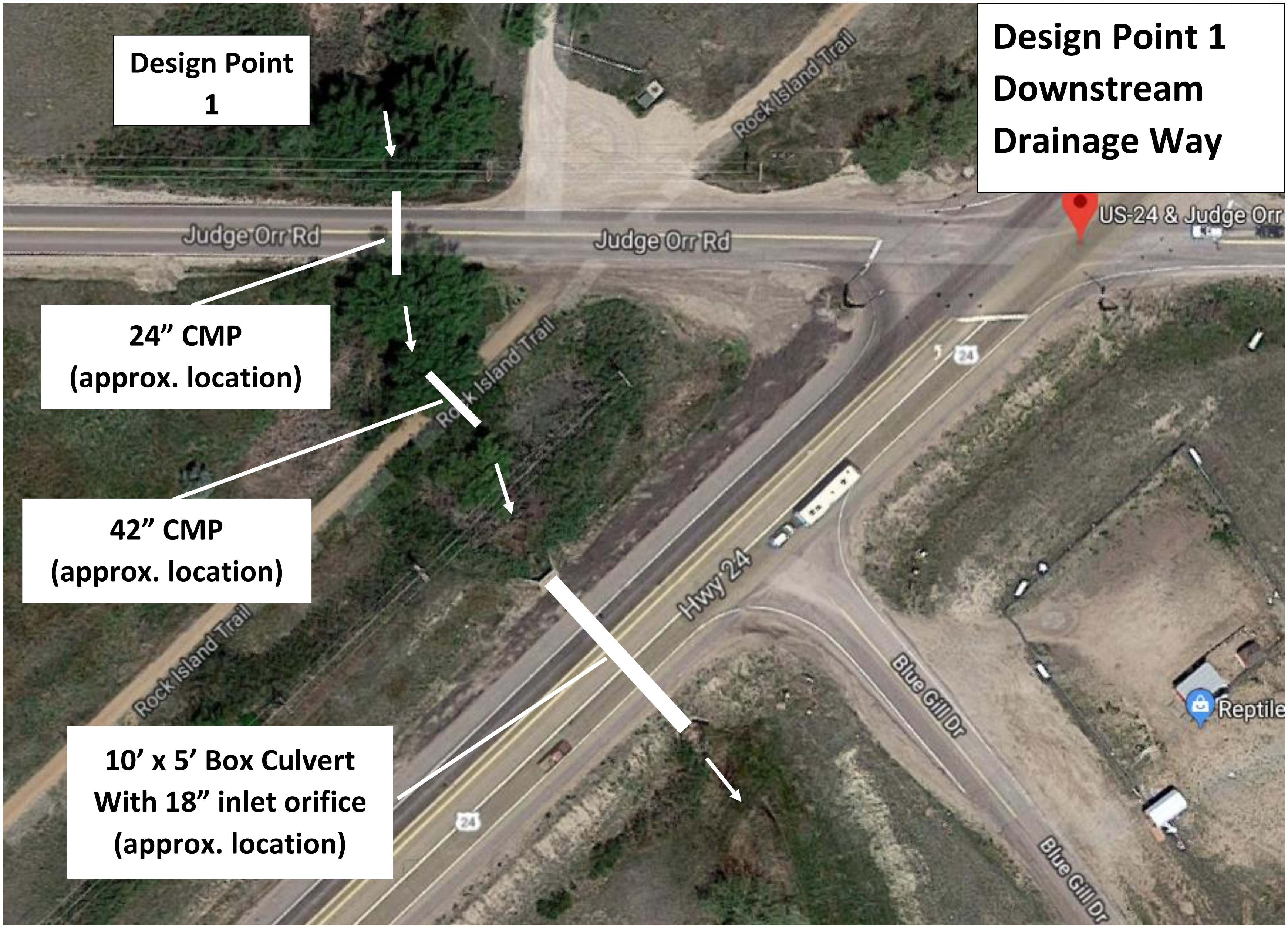
CHART 1B



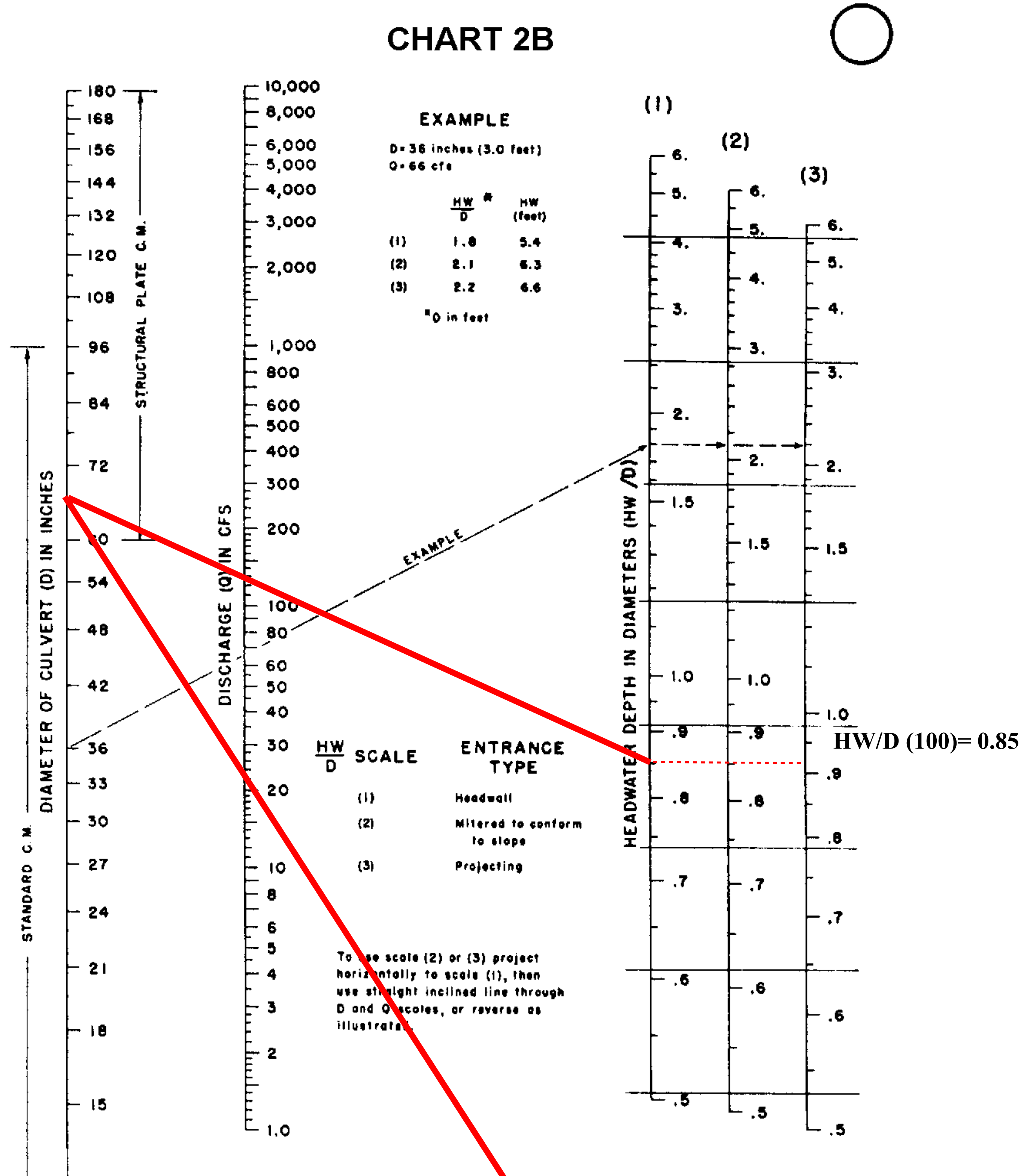
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

Single 24" Pipe Culvert under Judge Orr Road (Design Point 1)
Q5= 4.0 cfs, Q100= 29.1 cfs
Projecting End




Design Point 1 Downstream Drainage Way
Design Point 1
24" CMP (approx. location)
42" CMP (approx. location)
10' x 5' Box Culvert With 18" inlet orifice (approx. location)
Judge Orr Rd
Judge Orr Rd
US-24 & Judge Orr
Rock Island Trail
Rock Island Trail
Rock Island Trail
Hwy 24
Blue Gill Dr
Blue Gill Dr
Reptile

Dual 66" Pipe Culverts under Highway 24 (Design Point 3)
Total Flow: Q5= 41.1 cfs, Q100= 247.0 cfs
(Q5= 20.6 cfs per culvert, Q100= 123.5 cfs per barrel)



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

HYDROLOGIC/DETENTION CALCULATIONS

DRAINAGE CALCULATIONS SUMMARY TABLE 1
Meadowlake Ranch

Rainfall/Runoff - SCS METHOD

Basin Parameters and Results - Existing Conditions

Basin Name	Area		CN	% Imp.	T_c		T_{lag}		Q5	Q100
	acres	sq mi	weighted values		hr	min	hr	min	cfs	cfs
EX-1	55.7	0.087	61	0	1.06	64	0.64	38	4.0	29.1
EX-2	24.0	0.038	62	0	0.88	53	0.53	32	2.3	15.5
EX-3	168.9	0.264	61	0	0.86	52	0.52	31	13.6	102.1
OS-1	118.3	0.185	62	2	0.35	21	0.21	13	24.4	144.2
OS-2	13.2	0.021	65	12	0.32	19	0.19	11	7.3	24.3

Basin Parameters and Results - Proposed Conditions

Basin Name	Area		CN	% Imp.	T_c		T_{lag}		Q5	Q100
	acres	sq mi	weighted values		hr	min	hr	min	cfs	cfs
PR-1	77.9	0.122	77	44	0.42	25	0.25	15	114.4	234.2
PR-2	206.9	0.323	74	36	0.46	28	0.27	16	253.6	553.8
OS-1	118.3	0.185	62	2	0.35	21	0.21	13	24.4	144.2
OS-2	13.2	0.021	65	12	0.32	19	0.19	11	7.3	24.3

DRAINAGE CALCULATIONS SUMMARY TABLE 2
Meadowlake Ranch

Reach Routing Paramters - MUSKINGUM-CUNGE METHOD

Reach Name	length	Slope	Mannings n	Bottom Width	Side Slopes	Description
	ft	ft/ft		ft	Z:1	
Thru EX-3	2850	0.0168	0.025	0	30	existing grassy swale
Thru PR-2	2155	0.016	0.025	10	4	proposed trapezoidal channel

Reach Routing Results - Existing Conditions

Design Point	Area	Q5	Q100	Notes
	sq mi	cfs	cfs	
1	0.087	4.0	29.1	No routing - Basin EX-1 only
2	0.038	2.3	15.5	No routing - Basin EX-2 only
3	0.470	41.1	247.0	Basins OS-1, OS-2 & EX-3

Reach Routing Results - Proposed Conditions

Design Point	Area	Q5	Q100	Notes
	sq mi	cfs	cfs	
1	0.122	114.4	234.2	No routing - Basin PR-1 only
2	--	--	--	Area included in PR-2
3	0.526	275.5	714.3	Basins OS-1, OS-2 & PR-2

SCS METHOD - CN & Percent Impervious
Meadowlake Ranch

BASIN	TOTAL (Acres)	TOTAL (sq mi)	WEIGHTED CN	UNDEVELOPED AREA (Acres)	UNDEVELOPED CN	COMMERCIAL AREA (Acres)	COMMERCIAL CN	RANCH or INDUSTRIAL AREA (Acres)	RANCH or INDUSTRIAL CN	URBAN RES. AREA (Acres)	URBAN RES. CN	RURAL RES. AREA (Acres)	RURAL RES. CN	NOTES
EX-1	55.7	0.087	61	55.7	61									
EX-2	24.0	0.038	62	23.0	61			1.0	74					Ranch
EX-3	168.9	0.264	61	168.9	61									
PR-1	77.9	0.122	77			19.4	92			58.5	72			
PR-2	206.9	0.323	74			7.1	92	62.7	88	42.2	72	94.9	65	Industrial
OS-1*	118.3	0.185	62	99.0	61							19.3	65	
OS-2*	13.2	0.021	65									13.2	65.00	

BASIN	TOTAL (Acres)	TOTAL (sq mi)	WEIGHTED % Imp	UNDEVELOPED AREA (Acres)	UNDEVELOPED % Imp	COMMERCIAL AREA (Acres)	COMMERCIAL % Imp	RANCH or INDUSTRIAL AREA (Acres)	RANCH or INDUSTRIAL % Imp	URBAN RES. AREA (Acres)	URBAN RES. % Imp	RURAL RES. AREA (Acres)	RURAL RES. % Imp	NOTES
EX-1	55.7	0.087	0	55.7	0									
EX-2	24.0	0.038	0	24.0	0									
EX-3	168.9	0.264	0	168.9	0									
PR-1	77.9	0.122	44			19.4	85			58.5	30			
PR-2	206.9	0.323	36			7.1	85	62.7	72	42.2	30	94.9	12	Industrial
OS-1*	118.3	0.185	2	99.0	0							19.3	12	
OS-2*	13.2	0.021	12									13.2	12	

* Basin areas and CNs are from the MDDP Four Way Ranch and the FDR for 4 Way Ranch Filing No. 1

SCS METHOD - Time of Concentration
Meadowlake Ranch

BASIN: EX-1

T_c		T_{lag}	
(hr)	*(min)*	*(hr)*	*(min)*
1.06	64	*0.64*	*38*

OVERLAND FLOW					
n	**P_2**	**Length**	**Height**	**Slope**	**T_i**
	(in)	*(ft)*	*(ft)*	*(ft/ft)*	*(hr)*
n from Table 6-11: dense grasses					
0.24	1.19	300	7.0	0.023	0.88

SHALLOW CONC. FLOW			
Length	**Slope**	**Velocity**	**T_t**
(ft)	*(%)*	*(fps)*	*(hr)*
Velocity from Fig. 6.25: Grassed Waterway			
970	1.9%	2.7	0.10

CONCENTRATED FLOW		
Length	**Velocity**	**T_t**
(ft)	*(fps)*	*(hr)*
Velocity from Mannings Equation		
1260	4.6	0.08

Mannings Equation			
Open Channel			
z:1 (side slopes, ft)	50	**Mannings Equation**	
w (bottom width, ft)	0	**Pipe Flowing 1/2 Full**	
d (depth, ft)	1	d (diameter, in)	
n (roughness coef.)	0.025	n (mannings)	
s (channel slope, ft/ft)	0.015	s (pipe slope, ft/ft)	
Area (sqft)	***50.00***	***Area (sqft)***	***0.00***
Wetted Perimeter (ft)	***100.02***	***Wetted Perimeter (ft)***	***0.00***
Velocity (fps)	***4.6***	***Velocity (fps)***	***#DIV/0!***

SCS METHOD - Time of Concentration
Meadowlake Ranch

BASIN: EX-2

T_c		T_{lag}	
(hr)	*(min)*	*(hr)*	*(min)*
0.88	53	*0.53*	*32*

OVERLAND FLOW					
n	**P_2**	**Length**	**Height**	**Slope**	**T_i**
	(in)	*(ft)*	*(ft)*	*(ft/ft)*	*(hr)*
n from Table 6-11: dense grasses					
0.24	1.19	300	9.0	0.030	0.80

SHALLOW CONC. FLOW			
Length	**Slope**	**Velocity**	**T_t**
(ft)	*(%)*	*(fps)*	*(hr)*
Velocity from Fig. 6.25: Grassed Waterway			
520	3.3%	2.8	0.05

CONCENTRATED FLOW		
Length	**Velocity**	**T_t**
(ft)	*(fps)*	*(hr)*
Velocity from Mannings Equation		
610	5.9	0.03

Mannings Equation Open Channel		**Mannings Equation Pipe Flowing 1/2 Full**	
z:1 (side slopes, ft)	50	d (diameter, in)	
w (bottom width, ft)	0	n (mannings)	
d (depth, ft)	1	s (pipe slope, ft/ft)	
n (roughness coef.)	0.025		
s (channel slope, ft/ft)	0.025		
Area (sqft)	***50.00***	***Area (sqft)***	***0.00***
Wetted Perimeter (ft)	***100.02***	***Wetted Perimeter (ft)***	***0.00***
Velocity (fps)	***5.9***	***Velocity (fps)***	***#DIV/0!***

SCS METHOD - Time of Concentration
Meadowlake Ranch

BASIN: EX-3

T_c		T_{lag}	
(hr)	*(min)*	*(hr)*	*(min)*
0.86	52	*0.52*	*31*

OVERLAND FLOW					
n	P_2	**Length**	**Height**	**Slope**	T_i
	(in)	*(ft)*	*(ft)*	*(ft/ft)*	*(hr)*
n from Table 6-11: dense grasses					
0.24	1.19	300	20.0	0.067	0.58

SHALLOW CONC. FLOW			
Length	**Slope**	**Velocity**	T_t
(ft)	*(%)*	*(fps)*	*(hr)*
Velocity from Fig. 6.25: Grassed Waterway			
1720	2.6%	2.4	0.20

CONCENTRATED FLOW		
Length	**Velocity**	T_t
(ft)	*(fps)*	*(hr)*
Velocity from Mannings Equation		
1260	4.3	0.08

Mannings Equation	
Open Channel	
z:1 (side slopes, ft)	30
w (bottom width, ft)	0
d (depth, ft)	1
n (roughness coef.)	0.025
s (channel slope, ft/ft)	0.013
Area (sqft)	***30.00***
Wetted Perimeter (ft)	***60.03***
Velocity (fps)	***4.3***

Mannings Equation	
Pipe Flowing 1/2 Full	
d (diameter, in)	
n (mannings)	
s (pipe slope, ft/ft)	
Area (sqft)	***0.00***
Wetted Perimeter (ft)	***0.00***
Velocity (fps)	***#DIV/0!***

SCS METHOD - Time of Concentration
Meadowlake Ranch

BASIN: PR-1

T_c		T_{lag}	
(hr)	*(min)*	*(hr)*	*(min)*
0.42	25	*0.25*	*15*

OVERLAND FLOW					
n	P_2	**Length**	**Height**	**Slope**	T_i
	(in)	*(ft)*	*(ft)*	*(ft/ft)*	*(hr)*
n from Table 6-11: short prairie grass					
0.15	1.19	100	2.0	0.020	0.27

SHALLOW CONC. FLOW			
Length	**Slope**	**Velocity**	T_t
(ft)	*(%)*	*(fps)*	*(hr)*
Velocity from Fig. 6.25: Paved Area			
500	2.0%	2.8	0.05

CONCENTRATED FLOW		
Length	**Velocity**	T_t
(ft)	*(fps)*	*(hr)*
Velocity from Mannings Equation		
4100	11.0	0.10

Mannings Equation	
Open Channel	
z:1 (side slopes, ft)	
w (bottom width, ft)	
d (depth, ft)	
n (roughness coef.)	0.025
s (channel slope, ft/ft)	
Area (sqft)	***0.00***
Wetted Perimeter (ft)	***0.00***
Velocity (fps)	***#DIV/0!***

Mannings Equation	
Pipe Flowing 1/2 Full	
d (diameter, in)	36
n (mannings)	0.013
s (pipe slope, ft/ft)	0.014
Area (sqft)	***3.53***
Wetted Perimeter (ft)	***4.71***
Velocity (fps)	***11.2***

SCS METHOD - Time of Concentration
Meadowlake Ranch

BASIN: PR-2

T_c		T_{lag}	
(hr)	*(min)*	*(hr)*	*(min)*
0.46	27	*0.27*	*16*

OVERLAND FLOW					
n	**P_2**	**Length**	**Height**	**Slope**	**T_i**
	(in)	*(ft)*	*(ft)*	*(ft/ft)*	*(hr)*
n from Table 6-11: short prairie grass					
0.15	1.19	100	4.0	0.040	0.20

SHALLOW CONC. FLOW			
Length	**Slope**	**Velocity**	**T_t**
(ft)	*(%)*	*(fps)*	*(hr)*
Velocity from Fig. 6.25: Grassed Waterway			
1425	2.8%	2.5	0.16

CONCENTRATED FLOW		
Length	**Velocity**	**T_t**
(ft)	*(fps)*	*(hr)*
Velocity from Mannings Equation		
2155	6.3	0.10

Mannings Equation	
Open Channel	
z:1 (side slopes, ft)	4
w (bottom width, ft)	10
d (depth, ft)	1
n (roughness coef.)	0.025
s (channel slope, ft/ft)	0.016
Area (sqft)	***14.00***
Wetted Perimeter (ft)	***18.25***
Velocity (fps)	***6.3***

Mannings Equation	
Pipe Flowing 1/2 Full	
d (diameter, in)	
n (mannings)	
s (pipe slope, ft/ft)	
Area (sqft)	***0.00***
Wetted Perimeter (ft)	***0.00***
Velocity (fps)	***#DIV/0!***

SCS METHOD - Time of Concentration

BASIN: OS-1*

T_c		T_{lag}	
(hr)	*(min)*	*(hr)*	*(min)*
0.35	21	*0.21*	*13*

* values for T_c and T_{lag} are from the MDDP for Four Way Ranch

SCS METHOD - Time of Concentration
Meadowlake Ranch

BASIN: OS-2 derived from FDR for 4 Way Ranch Filing No. 1

T_c		T_{lag}	
(hr)	*(min)*	*(hr)*	*(min)*
0.32	19	*0.19*	*12*

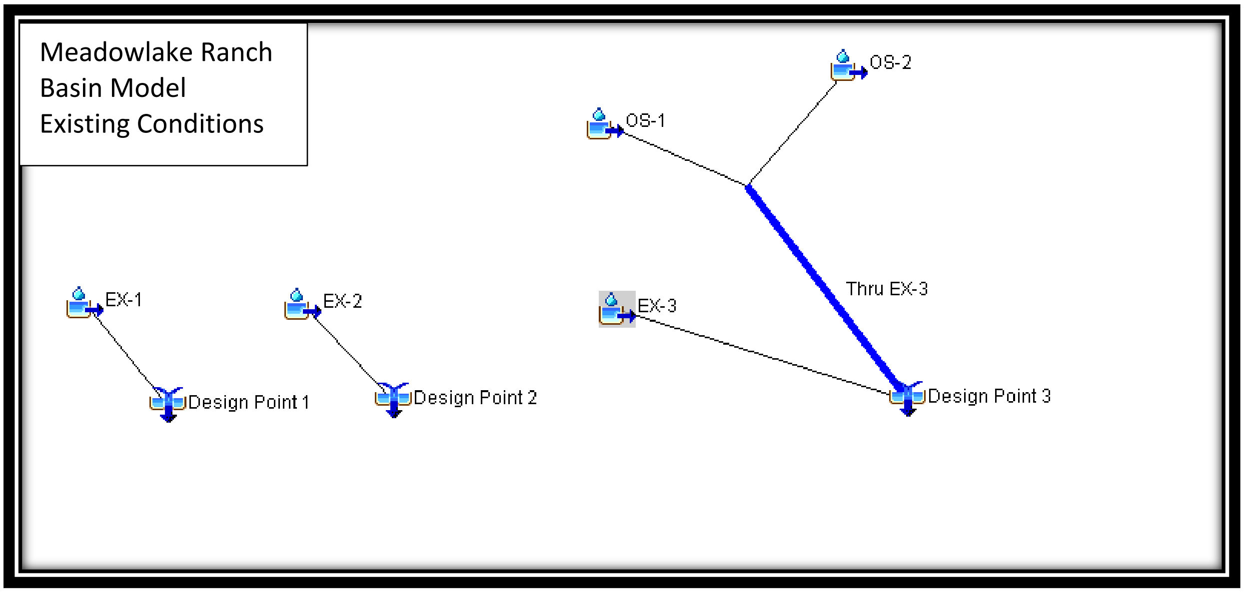
OVERLAND FLOW					
n	**P_2**	**Length**	**Height**	**Slope**	**T_i**
	(in)	*(ft)*	*(ft)*	*(ft/ft)*	*(hr)*
n from Table 6-11: short prairie grass					
0.15	1.19	130	8.0	0.062	0.21

SHALLOW CONC. FLOW			
Length	**Slope**	**Velocity**	**T_t**
(ft)	*(%)*	*(fps)*	*(hr)*
Velocity from Fig. 6.25: Paved Area			
470	2.6%	2.4	0.05

CONCENTRATED FLOW		
Length	**Velocity**	**T_t**
(ft)	*(fps)*	*(hr)*
Velocity from Mannings Equation		
900	4.5	0.06

Mannings Equation	
Open Channel	
z:1 (side slopes, ft)	4
w (bottom width, ft)	0
d (depth, ft)	1
n (roughness coef.)	0.025
s (channel slope, ft/ft)	0.015
Area (sqft)	***4.00***
Wetted Perimeter (ft)	***8.25***
Velocity (fps)	***4.5***

Mannings Equation	
Pipe Flowing 1/2 Full	
d (diameter, in)	
n (mannings)	
s (pipe slope, ft/ft)	
Area (sqft)	***0.00***
Wetted Perimeter (ft)	***0.00***
Velocity (fps)	***#DIV/0!***



Global Summary Results for Run "Existing 5yr"

Project: 1822.00 Meadowlake Ranch   Simulation Run: Existing 5yr

Start of Run: 01Jul2018, 12:00   Basin Model: Meadowlake Ranch Existing
End of Run: 03Jul2018, 12:00   Meteorologic Model: El Paso Cnty 5
Compute Time: 23Jul2018, 10:50:08   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: (•) IN ( ) AC-FT   Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Design Point 1	0.087	4.0	02Jul2018, 00:46	0.26
Design Point 2	0.038	2.3	02Jul2018, 00:36	0.29
Design Point 3	0.470	41.1	02Jul2018, 00:20	0.31
EX-1	0.087	4.0	02Jul2018, 00:46	0.26
EX-2	0.038	2.3	02Jul2018, 00:36	0.29
EX-3	0.264	13.6	02Jul2018, 00:36	0.26
OS-1	0.185	24.4	02Jul2018, 00:10	0.33
OS-2	0.021	7.3	02Jul2018, 00:06	0.65
Thru EX-3	0.206	31.0	02Jul2018, 00:20	0.37

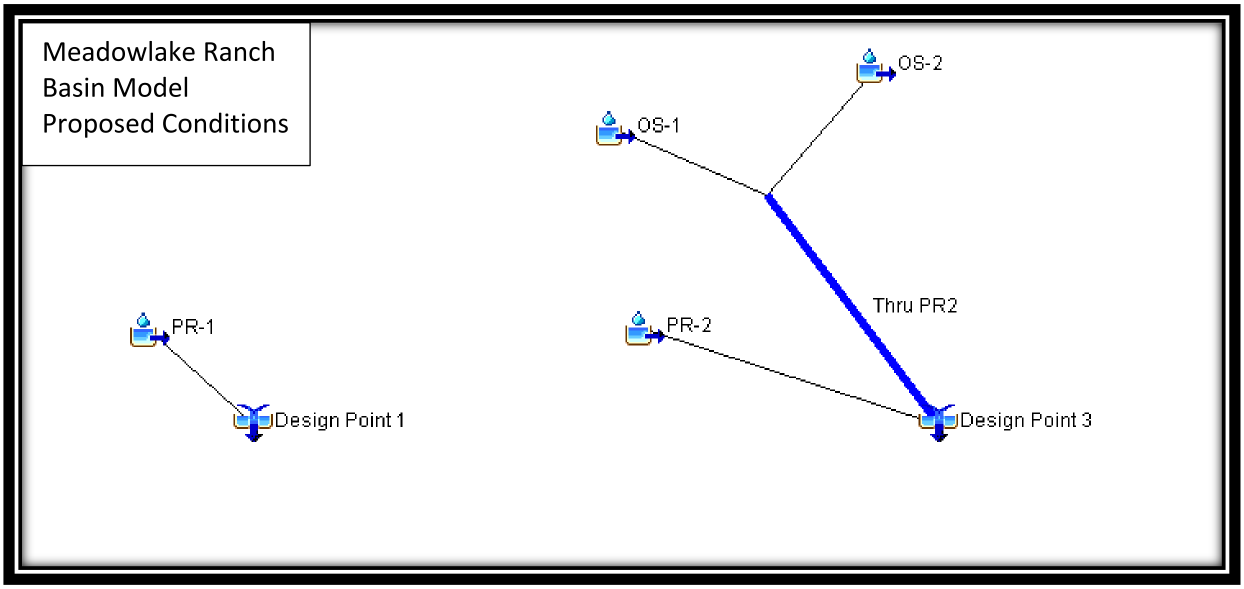
Global Summary Results for Run "Existing 100yr"

Project: 1822.00 Meadowlake Ranch   Simulation Run: Existing 100yr

Start of Run: 01Jul2018, 12:00   Basin Model: Meadowlake Ranch Existing
End of Run: 03Jul2018, 12:00   Meteorologic Model: El Paso Cnty 100
Compute Time: 23Jul2018, 10:52:14   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: (•) IN ( ) AC-FT   Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Design Point 1	0.087	29.1	02Jul2018, 00:36	1.14
Design Point 2	0.038	15.5	02Jul2018, 00:28	1.20
Design Point 3	0.470	247.0	02Jul2018, 00:16	1.22
EX-1	0.087	29.1	02Jul2018, 00:36	1.14
EX-2	0.038	15.5	02Jul2018, 00:28	1.20
EX-3	0.264	102.1	02Jul2018, 00:28	1.14
OS-1	0.185	144.2	02Jul2018, 00:08	1.27
OS-2	0.021	24.3	02Jul2018, 00:06	1.78
Thru EX-3	0.206	167.3	02Jul2018, 00:14	1.32



Global Summary Results for Run "Proposed 5yr"

Project: 1822.00 Meadowlake Ranch   Simulation Run: Proposed 5yr

Start of Run: 01Jul2018, 12:00   Basin Model: Meadowlake Ranch Developed
End of Run: 03Jul2018, 12:00   Meteorologic Model: El Paso Cnty 5
Compute Time: 23Jul2018, 10:57:44   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN AC-FT   Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Design Point 1	0.122	114.4	02Jul2018, 00:08	1.67
Design Point 3	0.526	275.5	02Jul2018, 00:08	1.02
OS-1	0.185	24.4	02Jul2018, 00:10	0.33
OS-2	0.021	7.3	02Jul2018, 00:06	0.65
PR-1	0.122	114.4	02Jul2018, 00:08	1.67
PR-2	0.320	253.6	02Jul2018, 00:08	1.44
Thru PR2	0.206	31.1	02Jul2018, 00:14	0.37

Global Summary Results for Run "Proposed 100yr"

Project: 1822.00 Meadowlake Ranch   Simulation Run: Proposed 100yr

Start of Run: 01Jul2018, 12:00   Basin Model: Meadowlake Ranch Developed
End of Run: 03Jul2018, 12:00   Meteorologic Model: El Paso Cnty 100
Compute Time: 23Jul2018, 10:57:51   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN AC-FT   Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Design Point 1	0.122	234.2	02Jul2018, 00:08	3.31
Design Point 3	0.526	714.3	02Jul2018, 00:08	2.32
OS-1	0.185	144.2	02Jul2018, 00:08	1.27
OS-2	0.021	24.3	02Jul2018, 00:06	1.78
PR-1	0.122	234.2	02Jul2018, 00:08	3.31
PR-2	0.320	553.8	02Jul2018, 00:08	2.97
Thru PR2	0.206	167.2	02Jul2018, 00:10	1.32

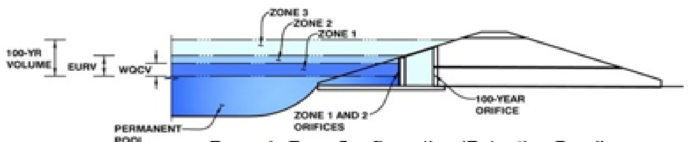
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Clear Workbook

Project: 1822.00 Meadowlake Ranch

Basin ID: Pond-1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Extended Detention Basin (EDB)	EDB			
Watershed Area =	77.90	acres		
Watershed Length =	4,700	ft		
Watershed Slope =	0.014	ft/ft		
Watershed Imperviousness =	46.00%	percent		
Percentage Hydrologic Soil Group A =	100.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	1.270	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	4.036	acre-feet		
2-yr Runoff Volume (P1 = 1.03 in.) =	2.377	acre-feet	1.03	inches
5-yr Runoff Volume (P1 = 1.32 in.) =	3.184	acre-feet	1.32	inches
10-yr Runoff Volume (P1 = 1.59 in.) =	4.064	acre-feet	1.59	inches
25-yr Runoff Volume (P1 = 2.01 in.) =	5.651	acre-feet	2.01	inches
50-yr Runoff Volume (P1 = 2.38 in.) =	7.535	acre-feet	2.38	inches
100-yr Runoff Volume (P1 = 2.77 in.) =	9.801	acre-feet	2.77	inches
500-yr Runoff Volume (P1 = 3.85 in.) =	16.027	acre-feet	3.85	inches
Approximate 2-yr Detention Volume =	2.239	acre-feet		
Approximate 5-yr Detention Volume =	3.002	acre-feet		
Approximate 10-yr Detention Volume =	3.798	acre-feet		
Approximate 25-yr Detention Volume =	5.166	acre-feet		
Approximate 50-yr Detention Volume =	6.097	acre-feet		
Approximate 100-yr Detention Volume =	7.215	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV)	1.270	acre-feet
Zone 2 Volume (EURV - Zone 1)	2.767	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2)	3.179	acre-feet
Total Detention Basin Volume =	7.215	acre-feet
Initial Surcharge Volume (ISV) =	user	[illegible]

Depth Increment = 0.5 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	61,250	1.406		
	--	0.50	--	--	--	63,366	1.455	30,521	0.701
	--	1.00	--	--	--	65,514	1.504	62,719	1.440
	--	1.50	--	--	--	67,694	1.554	95,999	2.204
	--	2.00	--	--	--	69,906	1.605	130,377	2.993
	--	2.50	--	--	--	72,150	1.656	166,590	3.824
	--	3.00	--	--	--	74,426	1.709	203,234	4.666
	--	3.50	--	--	--	76,734	1.762	241,024	5.533
	--	4.00	--	--	--	79,074	1.815	279,976	6.427
	--	4.50	--	--	--	81,446	1.870	320,106	7.349
	--	5.00	--	--	--	83,850	1.925	361,430	8.297
	--	5.50	--	--	--	86,286	1.981	403,964	9.274
	--	6.00	--	--	--	88,754	2.038	447,724	10.278
	--	6.50	--	--	--	91,254	2.095	492,726	11.311
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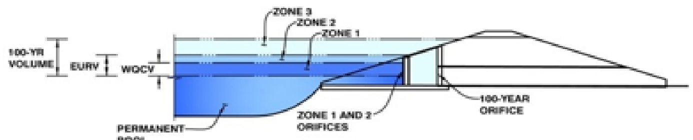
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Clear Workbook

Project: 1822.00 Meadolake Ranch

Basin ID: Pond-2 Detention for Basin PR-2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Extended Detention Basin (EDB)	EDB	
Watershed Area =	206.90	acres
Watershed Length =	3,620	ft
Watershed Slope =	0.027	ft/ft
Watershed Imperviousness =	36.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

			Optional User Override 1-hr Precipitation	
Water Quality Capture Volume (WQCV) =	2.914	acre-feet		
Excess Urban Runoff Volume (EURV) =	7.756	acre-feet		
2-yr Runoff Volume (P1 = 1.03 in.) =	5.240	acre-feet	1.03	inches
5-yr Runoff Volume (P1 = 1.32 in.) =	7.472	acre-feet	1.32	inches
10-yr Runoff Volume (P1 = 1.59 in.) =	11.238	acre-feet	1.59	inches
25-yr Runoff Volume (P1 = 2.01 in.) =	19.413	acre-feet	2.01	inches
50-yr Runoff Volume (P1 = 2.38 in.) =	25.330	acre-feet	2.38	inches
100-yr Runoff Volume (P1 = 2.77 in.) =	32.988	acre-feet	2.77	inches
500-yr Runoff Volume (P1 = 3.85 in.) =	51.745	acre-feet	3.85	inches
Approximate 2-yr Detention Volume =	4.895	acre-feet		
Approximate 5-yr Detention Volume =	7.013	acre-feet		
Approximate 10-yr Detention Volume =	10.165	acre-feet		
Approximate 25-yr Detention Volume =	12.728	acre-feet		
Approximate 50-yr Detention Volume =	14.080	acre-feet		
Approximate 100-yr Detention Volume =	16.963	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV)	2.914	acre-feet
Zone 2 Volume (EURV - Zone 1)	4.842	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2)	9.207	acre-feet
Total Detention Basin Volume =	16.963	acre-feet
Initial Surcharge Volume (ISV) =		...

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool									

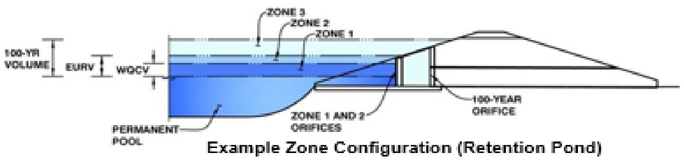
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Clear Workbook

Project: 1822.00 Meadowlake Ranch

Basin ID: Pond-2 WQ for Offsite Basins (OS-1 and OS-2) and Detention for Basin PR-2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Extended Detention Basin (EDB)	EDB			
Watershed Area =	338.70	acres		
Watershed Length =	7,685	ft		
Watershed Slope =	0.018	ft/ft		
Watershed Imperviousness =	22.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	3.491	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	7.460	acre-feet		
2-yr Runoff Volume (P1 = 1.03 in.) =	4.799	acre-feet	1.03	inches
5-yr Runoff Volume (P1 = 1.32 in.) =	7.123	acre-feet	1.32	inches
10-yr Runoff Volume (P1 = 1.59 in.) =	12.289	acre-feet	1.59	inches
25-yr Runoff Volume (P1 = 2.01 in.) =	25.775	acre-feet	2.01	inches
50-yr Runoff Volume (P1 = 2.38 in.) =	35.372	acre-feet	2.38	inches
100-yr Runoff Volume (P1 = 2.77 in.) =	47.961	acre-feet	2.77	inches
500-yr Runoff Volume (P1 = 3.85 in.) =	78.135	acre-feet	3.85	inches
Approximate 2-yr Detention Volume =	4.473	acre-feet		
Approximate 5-yr Detention Volume =	6.679	acre-feet		
Approximate 10-yr Detention Volume =	10.855	acre-feet		
Approximate 25-yr Detention Volume =	14.622	acre-feet		
Approximate 50-yr Detention Volume =	16.254	acre-feet		
Approximate 100-yr Detention Volume =	20.586	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV)	3.491	acre-feet
Zone 2 Volume (EURV - Zone 1)	3.968	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2)	9.207	acre-feet
Total Detention Basin Volume =	16.667	acre-feet
Initial Surcharge Volume (ISV) =	user	

Total detention volume is less than 100-year volume.

Depth Increment = 0.5 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	151,250	3.472		
	--	0.50	--	--	--	154,566	3.548	74,909	1.720
	--	1.00	--	--	--	157,914	3.625	152,995	3.512
	--	1.50	--	--	--	161,294	3.703	232,763	5.344
	--	2.00	--	--	--	164,706	3.781	314,229	7.214
	--	2.50	--	--	--	168,150	3.860	399,090	9.162
	--	3.00	--	--	--	171,626	3.940	484,034	11.112
	--	3.50	--	--	--	175,134	4.021	570,724	13.102
	--	4.00	--	--	--	178,674	4.102	659,176	15.133
	--	4.50	--	--	--	182,246	4.184	749,406	17.204
	--	5.00	--	--	--	185,850	4.267	841,430	19.317
	--	5.50	--	--	--	189,486	4.350	935,264	21.471
	--	6.00	--	--	--	193,154	4.434	1,030,924	23.667
	--	6.50	--	--	--	196,854	4.519	1,128,426	25.905
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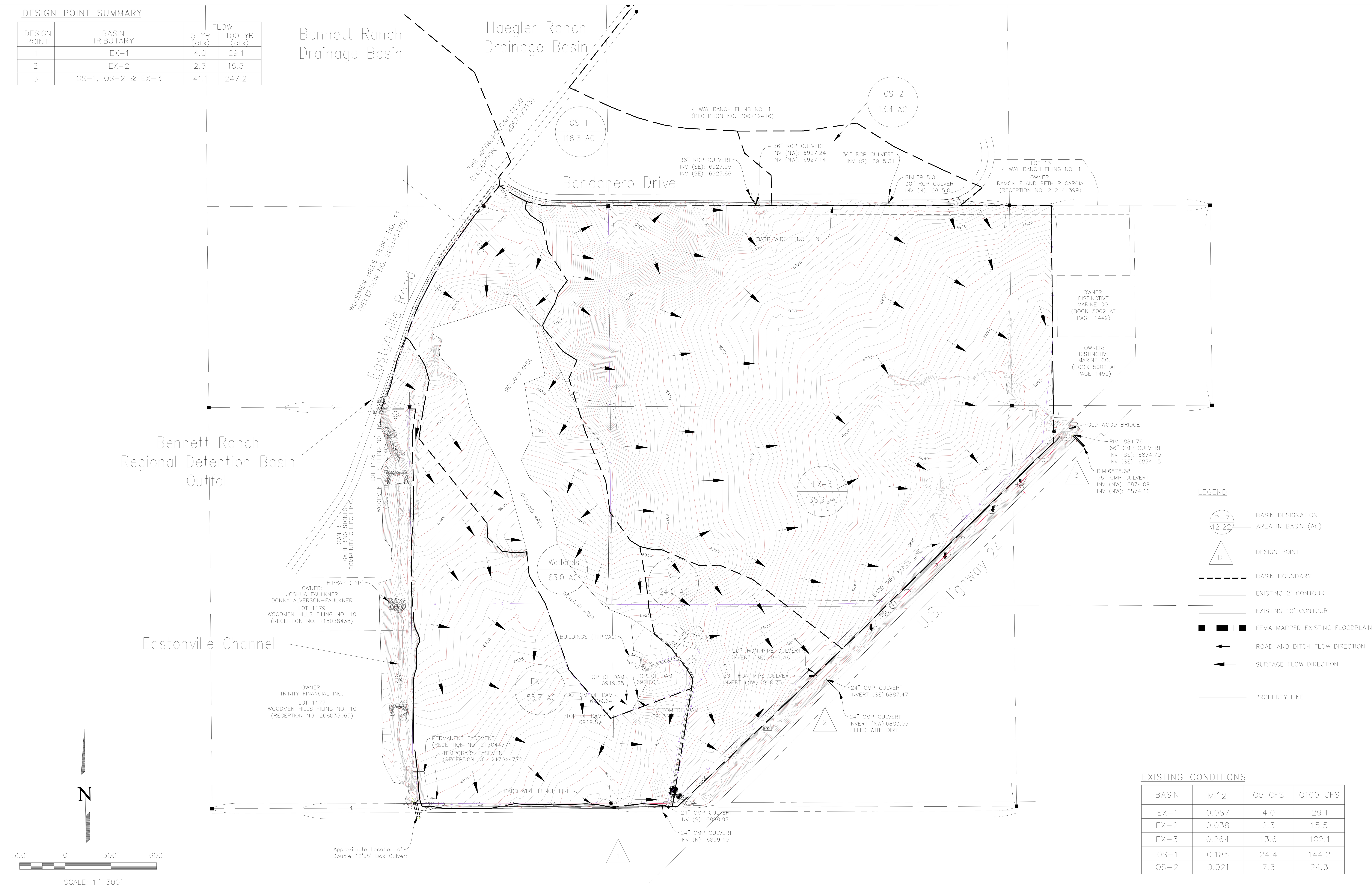
DRAINAGE AREA MAPS

DESIGN POINT SUMMARY

DESIGN POINT	BASIN TRIBUTARY	FLOW 5 YR (cfs)	FLOW 100 YR (cfs)
1	EX-1	4.0	29.1
2	EX-2	2.3	15.5
3	OS-1, OS-2 & EX-3	41.1	247.2



EXISTING CONDITIONS

BASIN	MI^2	Q5 CFS	Q100 CFS
EX-1	0.087	4.0	29.1
EX-2	0.038	2.3	15.5
EX-3	0.264	13.6	102.1
OS-1	0.185	24.4	144.2
OS-2	0.021	7.3	24.3

See comment on page 8 of the report to address the 63 acres.

See Sheet 2 for Design Point detail.

REVISIONS: NO. | DESCRIPTION | DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

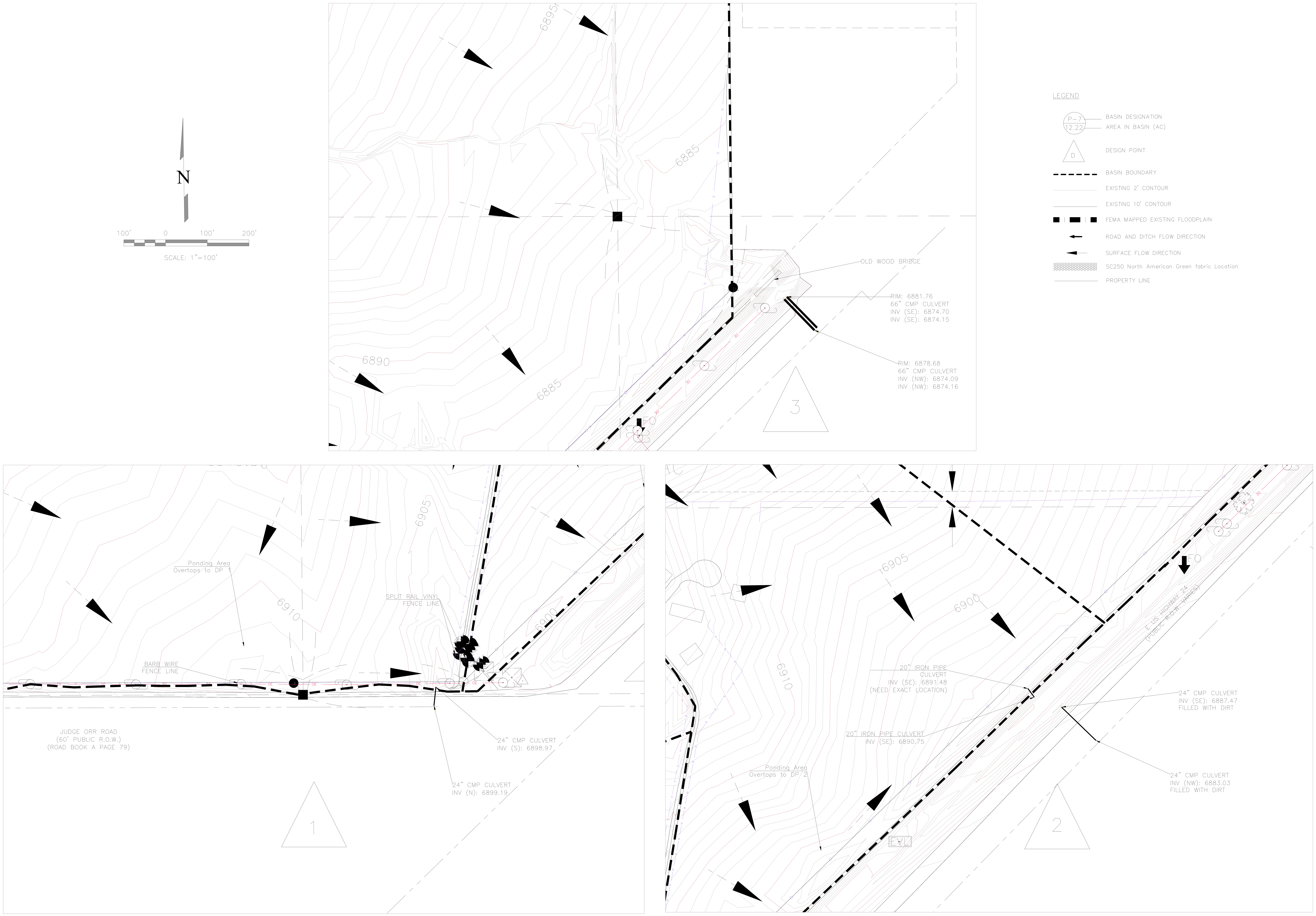
PREPARED FOR:
DAN FERGUSON
ATTN: DAN FERGUSON
13202 JUDGE ORR ROAD
PEYTON CO 80831-8401

Terra Nova Engineering, Inc.
"Creative Civil Engineering Solutions"
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

MEADOWLAKE MDDP

EXISTING DRAINAGE PLAN

DESIGNED BY DWD
DRAWN BY DWD
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE N/A
JOB NO. 1822.00
DATE ISSUED 11/14/18
SHEET NO. 1 OF 3



REVISIONS		
NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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FAX: 719-635-6426
www.tnesinc.com

MEADOWLAKE MDDP

EXISTING DRAINAGE PLAN
DETAILED

DESIGNED BY DWD
DRAWN BY DWD
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE N/A
JOB NO. 1822.00
DATE ISSUED 11/14/18
SHEET NO. 2 OF 3

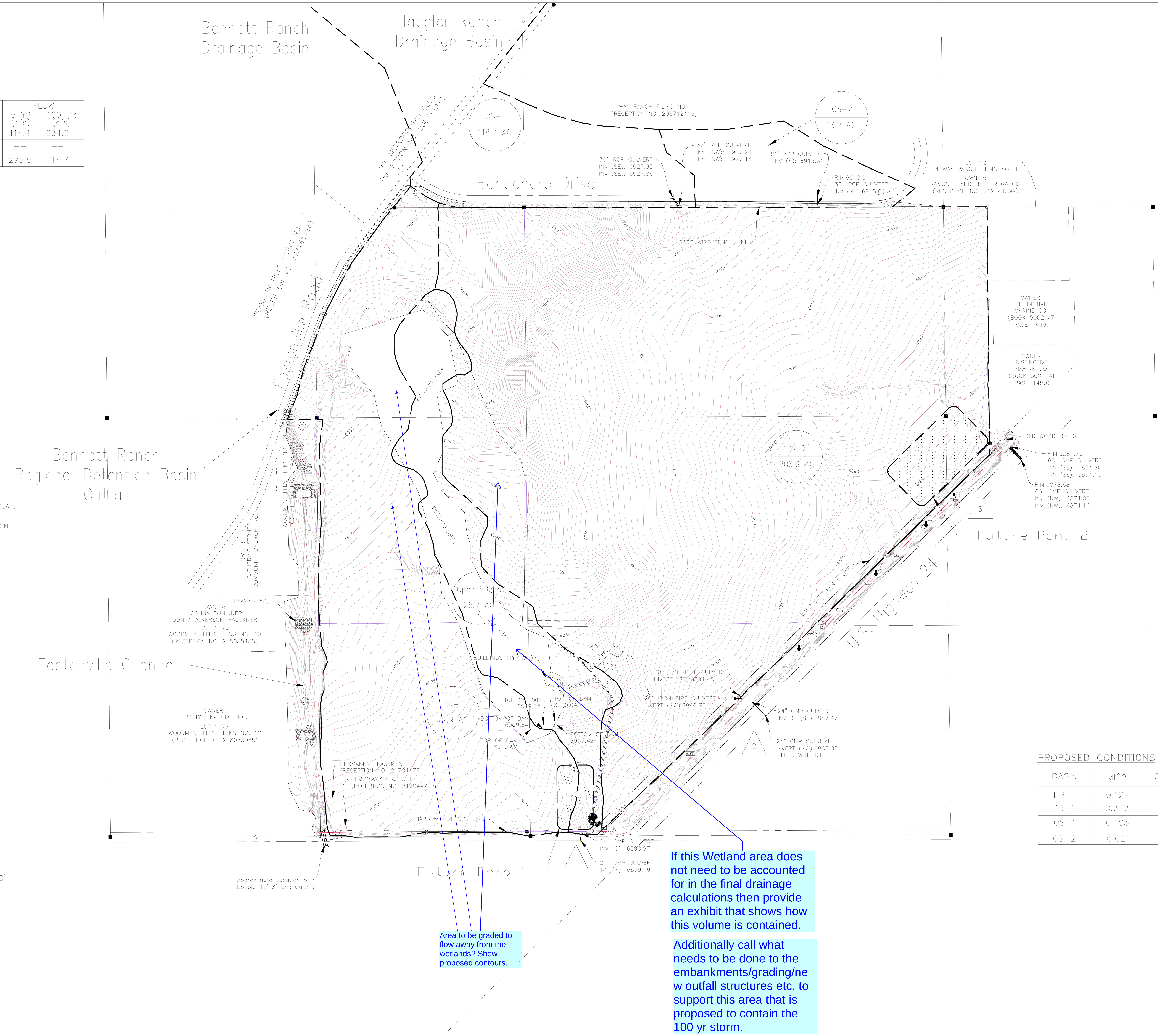
N:\jobs\1822.00\drawings\mddp\182200 mddp.dwg, 11/16/2018 1:15:14 PM, DWG To PDF.pc3

DESIGN POINT SUMMARY

DESIGN POINT	BASIN TRIBUTARY	FLOW 5 YR (cfs)	FLOW 100 YR (cfs)
1	PR-1	114.4	234.2
2	--	--	--
3	OS-1, OS-2 & PR-3	275.5	714.7

LEGEND

- BASIN DESIGNATION / AREA IN BASIN (AC)
- DESIGN POINT
- BASIN BOUNDARY
- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- FEMA MAPPED EXISTING FLOODPLAIN
- ROAD AND DITCH FLOW DIRECTION
- PROPERTY LINE



Area to be graded to flow away from the wetlands? Show proposed contours.

If this Wetland area does not need to be accounted for in the final drainage calculations then provide an exhibit that shows how this volume is contained.

Additionally call what needs to be done to the embankments/grading/new outfall structures etc. to support this area that is proposed to contain the 100 yr storm.

PROPOSED CONDITIONS

BASIN	MI^2	Q5 CFS	Q100 CFS
PR-1	0.122	114.4	234.2
PR-2	0.323	253.6	553.8
OS-1	0.185	24.4	144.2
OS-2	0.021	7.3	24.3

REVISIONS: NO. | DESCRIPTION | DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
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ATTN: DAN FERGUSON
13202 JUDGE ORR ROAD
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OFFICE: 719-635-6422
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MEADOWLAKE MDDP

PROPOSED DRAINAGE PLAN

DESIGNED BY DWD
DRAWN BY DWD
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE N/A
JOB NO. 1822.00
DATE ISSUED 7/24/18
SHEET NO. 2 OF 2

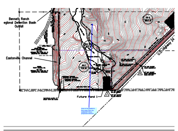
Markup Summary

Steve Kuehster (16)

Subject: text box
Page Label: 4
Author: Steve Kuehster
Date: 2/11/2019 10:57:43 AM
Color:

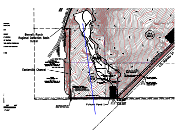
Include acreage of the overall site included in the sketch plan

---



Subject: arrow & box
Page Label: [1] PR-DR
Author: Steve Kuehster
Date: 2/11/2019 11:16:58 AM
Color:

Area to be graded to flow away from the wetlands? Show proposed contours.



Subject: Arrow
Page Label: [1] PR-DR
Author: Steve Kuehster
Date: 2/11/2019 11:17:11 AM
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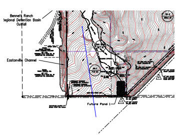


Subject: Arrow
Page Label: [1] PR-DR
Author: Steve Kuehster
Date: 2/11/2019 11:17:30 AM
Color:

Subject: text box
Page Label: 7
Author: Steve Kuehster
Date: 2/11/2019 11:41:09 AM
Color:

Please account for the 63 acres as shown on the existing drainage plan as "wetland area"; there is not enough information included in this MDDP to support that both the 5 yr and 100 yr storms completely infiltrate for this area.

Subject: text box
Page Label: [1] EX-DR
Author: Steve Kuehster
Date: 2/11/2019 11:47:16 AM
Color:

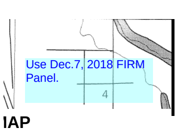
See comment on page 8 of the report to address the 63 acres.

Subject: text box
Page Label: 10
Author: Steve Kuehster
Date: 2/11/2019 12:05:57 PM
Color:

Please also comment on the 24 inch storm sewer under Judge Orr.   either indicate there will be over detention to address it or that it will be up graded.

Subject: text box
Page Label: 11
Author: Steve Kuehster
Date: 2/11/2019 12:10:08 PM
Color:

Please state: "The existing dual 60 inch culverts under Highway 24 have capacity for these proposed flows."



Subject: text box
Page Label: 21
Author: Steve Kuehster
Date: 2/11/2019 12:37:30 PM
Color:

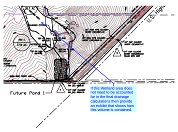
Use Dec.7, 2018 FIRM Panel.

Subject: text box
Page Label: 11
Author: Steve Kuehster
Date: 2/11/2019 12:59:38 PM
Color:

Please call out how the proposed pond 2 design includes the detention requirements of the regional pond SR - 02 per the Haeglar Ranch DBPS.

Subject: text box
Page Label: 5
Author: Steve Kuehster
Date: 2/11/2019 8:53:15 AM
Color:

The 24 inch pipe is evaluated for ? and shown on page?



Subject: arrow & box
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Author: Steve Kuehster
Date: 2/12/2019 8:35:21 AM
Color:

If this Wetland area does not need to be accounted for in the final drainage calculations then provide an exhibit that shows how this volume is contained.

Subject: text box
Page Label: [1] PR-DR
Author: Steve Kuehster
Date: 2/12/2019 9:11:19 AM
Color:

Additionally call what needs to be done to the embankments/grading/new outfall structures etc. to support this area that is proposed to contain the 100 yr storm.

Subject: text box
Page Label: 6
Author: Steve Kuehster
Date: 2/12/2019 9:22:40 AM
Color:

Call out who is responsible for improvements to this "natural" trapezoidal channel. Would Meadowlake Ranch be responsible for a some of these improvements as they develop next to this channel?

Subject: Arrow
Page Label: 6
Author: Steve Kuehster
Date: 2/12/2019 9:24:37 AM
Color:

Subject: text box
Page Label: 5
Author: Steve Kuehster
Date: 2/12/2019 9:27:02 AM
Color:

See comment on proposed drainage map. concerning the isolated Wetland area.