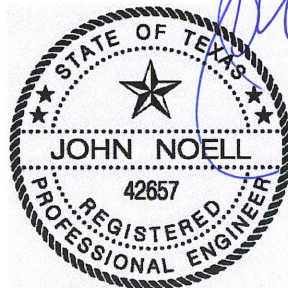# ADDENDUM TO

EROSION HAZARD ZONE
DELINEATION

AUSTIN OAKS PUD

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The purpose of this report is to provide additional calculations using the City of Austin Drainage Criteria Manual, Appendix E procedure to evaluate the potential for erosion on two stream reaches which affect the Austin Oaks development and to establish an erosion hazard zone. The report will supplement a prior report dated March 30, 2016 which contains the hydrologic and hydraulic modeling of the stream reaches based on site specific site investigation and data obtained from on-site topographic surveys.

The three reaches in question are first, the "Foster Branch Reach" (FBR) which extends from the culvert under MoPac (Loop 1) located on the south side of the intersection of Loop 1 and Spicewood Springs Road, extending upstream (westerly) to a culvert under Spicewood Springs Road. Second, the "Wood Hollow Reach" (WHR) extends from its junction with FBR upstream of the Culvert under Loop 1, upstream in a southwesterly direction approximately 220 feet to Executive Center Drive. The third reach continues from Executive center Drive upstream to Wood Hollow Drive. All three reaches are "developed" waterways, affected by adjacent development including the aforementioned public streets.

The channel in the Foster Branch reach is characterized by a stable rock (limestone) invert and stable vegetated sloping banks extending to Spicewood Springs Road on the north and to an existing parking lot on the south. This condition is illustrated in the images below.

The channel in the lower Wood Hollow reach is characterized by a stable rock (limestone) invert approximately 20 feet wide with steep banks constructed by placement of large boulders. This condition is illustrated in the images below.
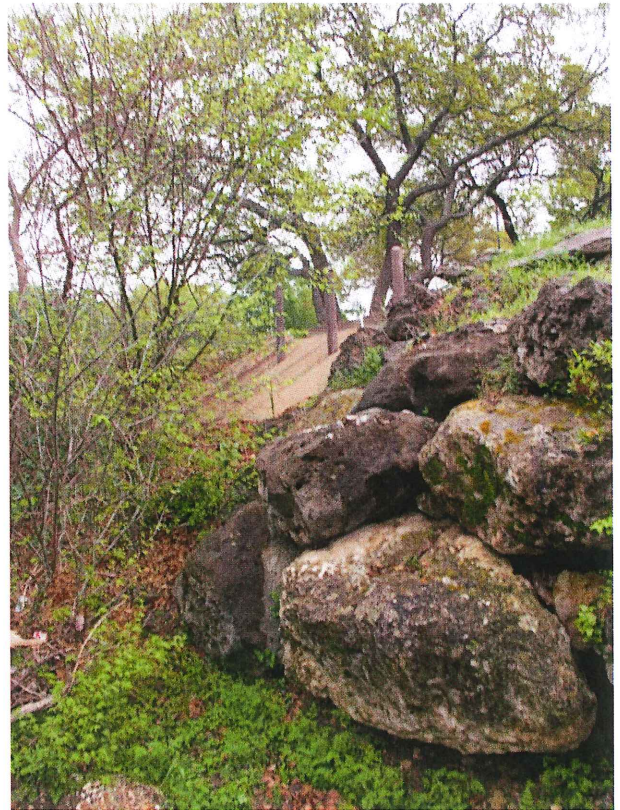
The channel in the upper WHR, upstream of Executive Center Drive, is characterized by a stable rock (limestone) invert and stable vegetated sloping banks extending to Wood Hollow Drive to the west and to the retaining structure for the existing development on the east.

Beginning at the MoPac culvert the total tributary area is 818.7 acres. Beginning at its downstream junction with FBR the WHR has a tributary area of 419.9 acres making the two contributing watersheds approximately equal. The watersheds are essentially fully developed as is illustrated on the attached drainage area map. The flow rates for flood events are moderated by regional detention in both watersheds in addition to channel storage created as a result of numerous street crossings where culverts are undersized. The flow rates were determined using the current City of Austin study extracted from the HMS file provided and are tabulated as follows:

Reach Location	Q_2	Q_{10}	Q_{25}	Q_{100}
Foster Branch Reach				
MoPac Culvert	1000	1660	1970	2680
SS Culvert	570	1050	1290	1920
Wood Hollow Reach				
Confluence	447	676	790	1294
Executive Center	447	676	790	1294
Wood Hollow	447	676	790	1294

A hydraulic analysis for the two reaches was performed using HMS and is attached to the original report. Frequent flood events are the primary mechanism of stream erosion and, thus, the two year flow event is of primary concern. Results for less frequent storms are also presented for reference. For ease of review flows and velocities are tabulated for the sections analyzed.

Evaluation of Erosion Hazard Zone in Appendix E is a catch-all planning approach which does not take into account the rock substrate which makes up the channel flowlines in the subject reaches. Accordingly the prescribed parameters in Appendix E were modified to account for the presence of rock in the channel flowlines and in the constructed banks in the middle reach.

The following is furnished as a commentary on the 7 steps in the Appendix E method:

Step 1 – The three channel reaches were selected as previously described to account for the variations in channel characteristics. The channel width was taken as the top width for the 2 year event as calculated in our hydraulic analysis, included in the initial report.

Step 2 – The valley and centerline lengths were measures and the sinuosity calculated; the channel being mostly straight. The numbers are all shown on the attached EHZ Analysis spreadsheet.

Step 3 – The top width for Q2 and the depth were determined from the hydraulic analysis and are shown on the attached EHZ Analysis spreadsheet.

Step 4 - The future incision depth was taken to be 1.0 for the exposed bedrock channel invert in the middle reach and 1.5 for the channel invert consisting of cemented rock rubble overlying bedrock in the upper and lower reaches. Again the numbers are shown on the attached EHZ Analysis spreadsheet.

Step 5 through 7 – The remaining geometry was calculated using a 3:1 bank slope to account for the more stable rock infused channel sides resulting in an EHZ as shown on the attached plan.
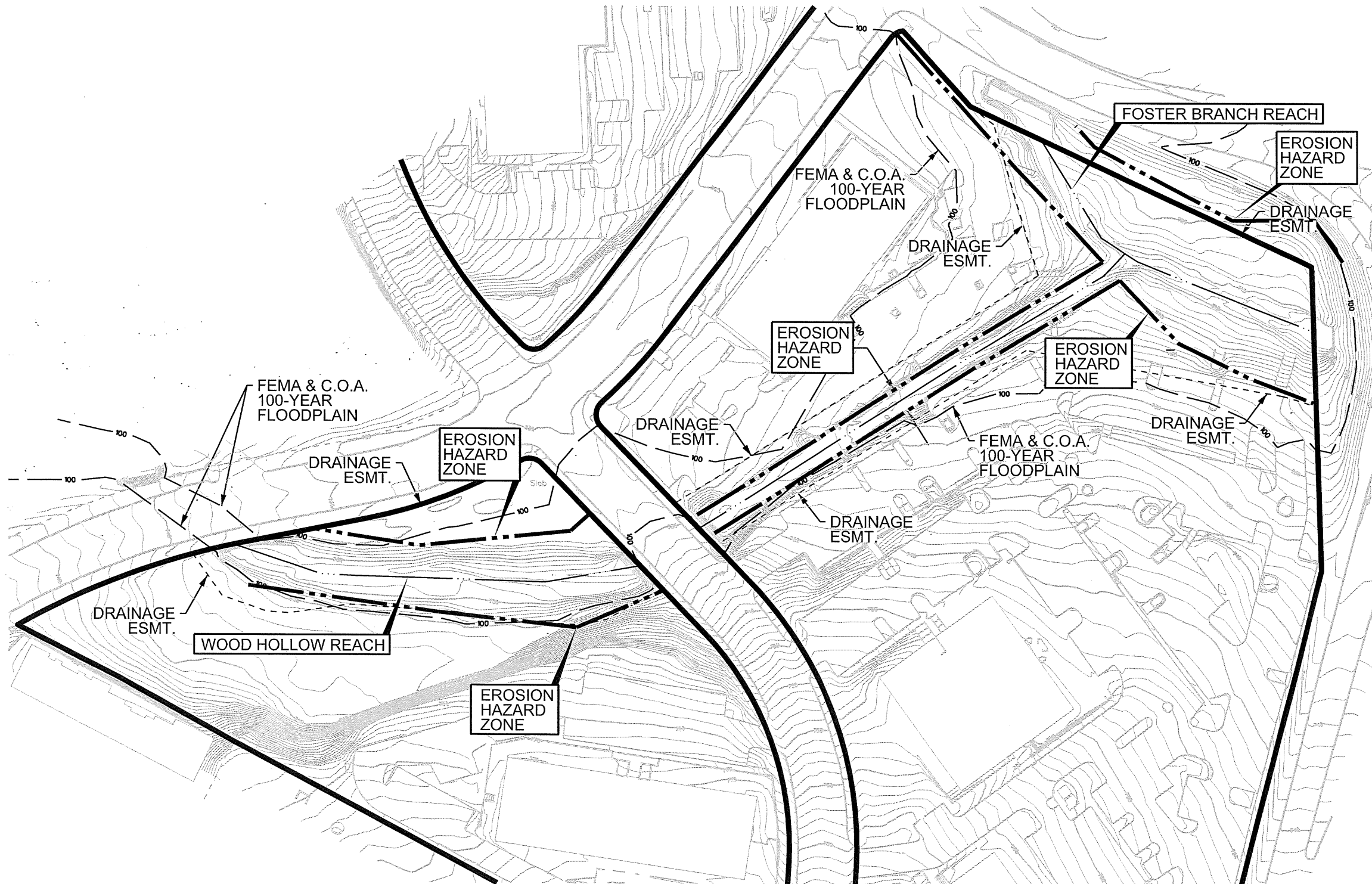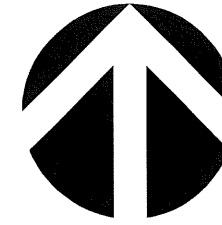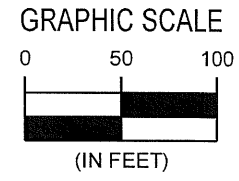
Austin Oaks (UDG 15-864)
Erosion Hazard Zone
Analysis

Stream:	Wood Hollow Tributary - U/S from Executive Center Drive to Wood Hollow Drive												
C_L = Channel Length (ft)	500		$D_i=1.5*D_{ex}$	D_{ex} has a multiplier of 1.5 for rock rubble over bedrock									
V_L = Valley Length (ft)	503		$D_i=1*D_{ex}$	D_{ex} has a multiplier of 1 for rock bedrock channel bottom									
P = CL/V_L Sinuosity	0.99			Note: 1.) Based on 2-Year (Bankful) Conditions) 2.)The reach has a **rock rubble** bottom channel									
Cross Section	Q Total	Min Ch El	W.S. Elev	Vel Chnl	W_{ex}=Top Width	D_{ex}	$D_i=1.5*D_{ex}$	B_{ult}	S_{left} - X:Y	$Width_{Left}$	S_{right} : X:Y	$Width_{Right}$	EHZ TW = B_{ult} + $Width_{Left}$ + $Width_{Right}$
	(cfs)	(ft)	(ft)	(ft/s)	(ft)	ft	ft	ft	ft/ft	ft	ft/ft	ft	ft
833	447	729.00	732.08	4.3	44	3	5	44	3:1*	14	3:1*	14	72
706	447	727.90	730.32	6.9	39	2	4	39	3:1*	11	3:1*	11	61
573	447	725.00	730.03	3.1	39	5	8	39	3:1*	23	3:1*	23	85
Average					40	4	5	40	-	16	-	16	73

Stream:	Wood Hollow Tributary - D/S from Executive Center Drive to Confluence with Fosters Branch												
C_L = Channel Length (ft)	460		$D_i=1.5*D_{ex}$	D_{ex} has a multiplier of 1.5 for rock rubble over bedrock									
V_L = Valley Length (ft)	451		$D_i=1*D_{ex}$	D_{ex} has a multiplier of 1 for rock bedrock channel bottom									
P = CL/V_L Sinuosity	1.02			Note: 1.) Based on 2-Year (Bankful) Conditions) 2.)The reach has a **rock** bottom channel									
Cross Section	Q Total	Min Ch El	W.S. Elev	Vel Chnl	W_{ex}=Top Width	D_{ex}	$D_i=1*D_{ex}$	B_{ult}	S_{left} - X:Y	$Width_{Left}$	S_{right} : X:Y	$Width_{Right}$	EHZ TW = B_{ult} + $Width_{Left}$ + $Width_{Right}$
	(cfs)	(ft)	(ft)	(ft/s)	(ft)	ft	ft	ft	ft/ft	ft	ft/ft	ft	ft
351	447	719.00	722.60	6.2	20	4	4	20	0	0	0	0	20
165	447	717.00	719.77	9.5	17	3	3	17	0	0	0	0	17
Average					19	3	3	19	-	-	-	-	19

Stream:	Fosters Branch -from Spicewood Springs Road to Mopac												
C_L = Channel Length (ft)	350		$D_i=1.5*D_{ex}$	D_{ex} has a multiplier of 1.5 for rock rubble over bedrock									
V_L = Valley Length (ft)	352		$D_i=1*D_{ex}$	D_{ex} has a multiplier of 1 for rock bedrock channel bottom									
P = CL/V_L Sinuosity	0.99			Note: 1.) Based on 2-Year (Bankful) Conditions) 2.)The reach has a **rock rubble** bottom channel									
Cross Section	Q Total	Min Ch El	W.S. Elev	Vel Chnl	W_{ex}=Top Width	D_{ex}	$D_i=1.5*D_{ex}$	B_{ult}	S_{left} - X:Y	$Width_{Left}$	S_{right} : X:Y	$Width_{Right}$	EHZ TW = B_{ult} + $Width_{Left}$ + $Width_{Right}$
	(cfs)	(ft)	(ft)	(ft/s)	(ft)	ft	ft	ft	ft/ft	ft	ft/ft	ft	ft
2629	570	717.84	722.00	5.2	121	4	6	121	3:1*	19	3:1*	19	159
2577	570	717.21	720.79	8.2	40	4	5	40	3:1*	16	3:1*	16	72
2398	1000	713.27	718.73	6.3	66	5	8	66	3:1*	25	3:1*	25	116
2330	1000	711.97	718.83	4.0	90	7	10	90	3:1*	31	3:1*	31	152
2281	1000	710.93	718.60	4.7	58	8	12	58	3:1*	35	3:1*	35	128
Average					75	6	8	75	-	25	-	25	125

GRAPHIC SCALE

0   50   100

(IN FEET)

FOSTER BRANCH REACH

EROSION HAZARD ZONE

DRAINAGE ESMT.

FEMA & C.O.A. 100-YEAR FLOODPLAIN

DRAINAGE ESMT.

EROSION HAZARD ZONE

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DRAINAGE ESMT.

EROSION HAZARD ZONE

DRAINAGE ESMT.

WOOD HOLLOW REACH

EROSION HAZARD ZONE

AUSTIN OAKS PUD

EROSION HAZARD ZONE

UDG

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