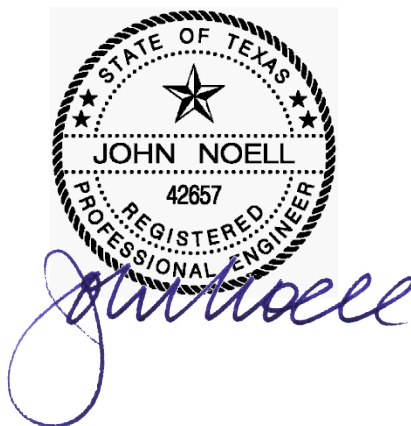


EROSION HAZARD ZONE DELINEATION AUSTIN OAKS PUD

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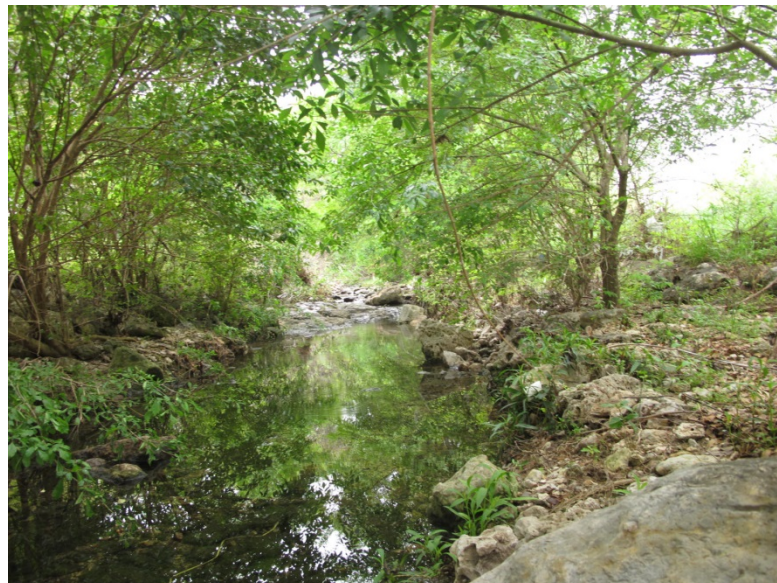
March 30, 2016



The purpose of this report is 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 include hydrologic and hydraulic modeling of the stream reaches based on site specific site investigation and data obtained from on-site topographic surveys.

The two 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 approximately 180 feet upstream (westerly) to a culvert under Spicewood Springs Road. Second, the “Wood Hollow Reach” (WHR) extends from its junction with FBR approximately 100 feet upstream of the Culvert under Loop 1, upstream in a southwesterly direction approximately 220 feet, crossing Executive Center Drive and then approximately 180 feet to Wood Hollow Drive. Both 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. 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 Zones is a risk based analysis of channel inverts and banks which may be susceptible to erosion. Channels may experience lateral migration, channel widening and deepening **depending on site specific circumstances**. Invert and bank erodibility, stream flow amount, frequency and velocity, bed alignment, manmade features and bank vegetation are primary factors.

A number of factors were analyzed in order to determine the proposed Erosion Hazard Zone (EHZ) for the two reaches, the adjustment factor method taken from the guidelines developed by JE Fuller. This method uses the 100 year flows as a baseline flood so it is used for the applicable factors in the analysis.

Site Characteristic <u>FBR</u>	Adjustment Factor
Channel Bend Factor - Bend angle < 5° (Reaches are relatively straight)	0.00
Channel Velocity Factor - Main Channel Velocity	0.10
Bankfull Width/Depth Ratio Factor - W/D = 10 - 40	0.02
Bank Materials Factor - Boulders, Clay	0.05
Bank Cementation Factor - High CaCO ₃ limestone soils	0.00
Bank Vegetation Density Factor - < 25% Soils Exposed on Bank	0.00
Bank Vegetation Type Factor - Most Stable	0.00
Bank Conditions Factor - 0-5% cutbanks, rock bottom	0.00
Flow Conditions Factor - Ephemeral Stream	0.05
Watershed Development Factor - Urbanized Watershed	0.10
Man-Made Disturbance Factor - Moderate Floodplain Activity (Stable 30+ years)	0.15
Vertical Channel Stability - No Significant Degradation/Aggradation Expected (Rock Base)	0.00
TOTAL	0.47

The Fuller method equation provides that the Erosion hazard Zone Setback for FBR=
 $Q_{100}^{0.5} (\text{Adjustment Factors}) = 2680^{0.5} (0.47) = 24.3'$

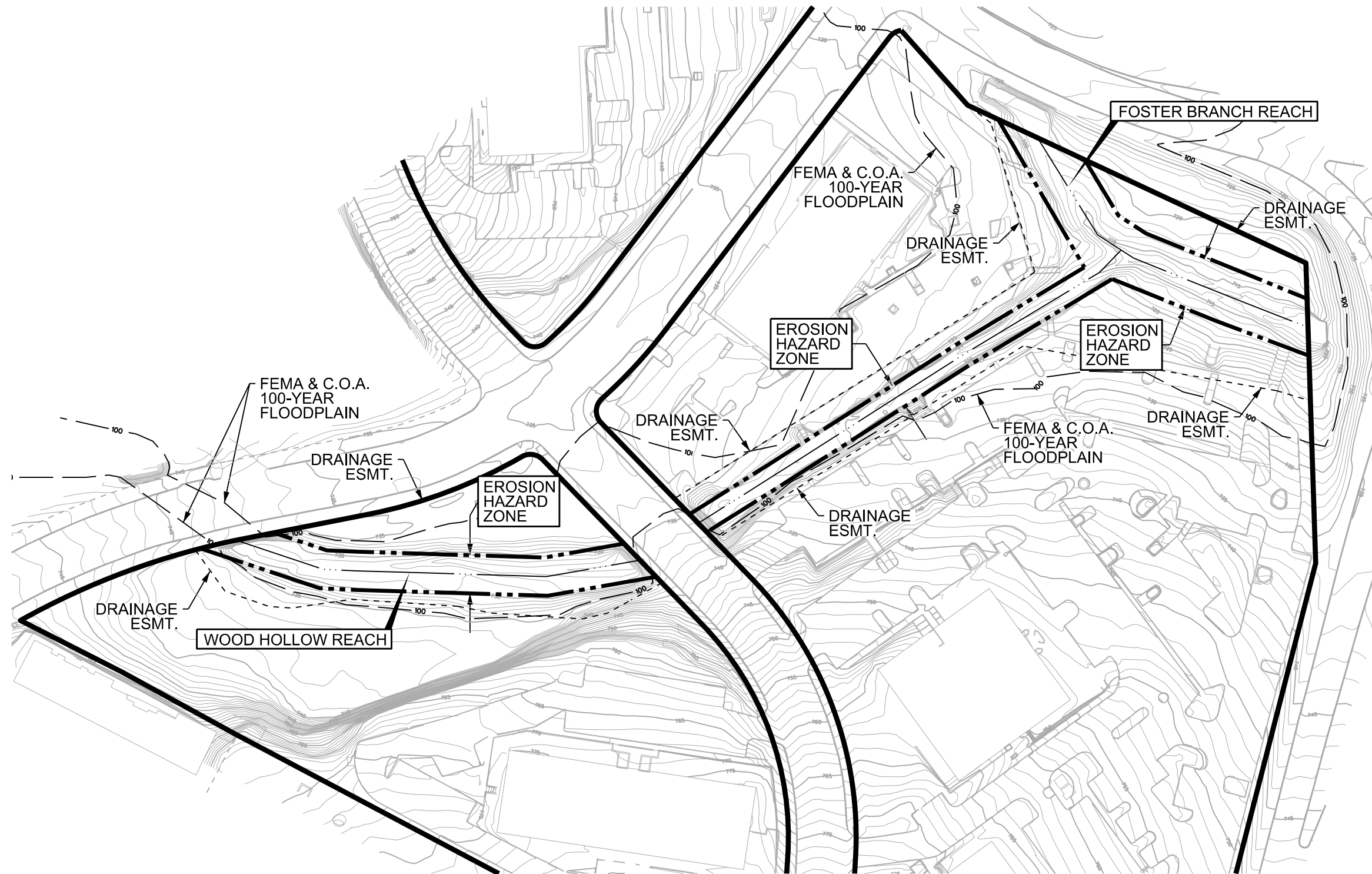
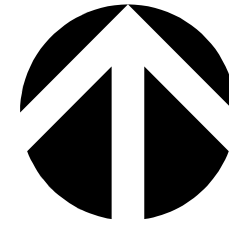
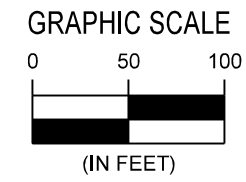
Site Characteristic <u>LOWER WHR</u>	Adjustment Factor
Channel Bend Factor - Bend angle < 5° (Reaches are relatively straight)	0.00
Channel Velocity Factor - Main Channel Velocity	0.00
Bankfull Width/Depth Ratio Factor - W/D = < 10	0.00
Bank Materials Factor - Boulders, Bedrock	0.00
Bank Cementation Factor - Rock	0.00
Bank Vegetation Density Factor - < 25% Soils Exposed on Bank	0.00
Bank Vegetation Type Factor - Most Stable (Albeit Not Relevant Due to Rock)	0.00
Bank Conditions Factor - 0-5% cutbanks, Rock bottom.	0.00
Flow Conditions Factor - Ephemeral Stream	0.05
Watershed Development Factor - Urbanized Watershed	0.10
Man-Made Disturbance Factor - Moderate Floodplain Activity (Stable 30+ years)	0.15
Vertical Channel Stability - No Significant Degradation/Aggradation Expected (Rock Base)	0.00
TOTAL	0.30

$$\text{Lower WHR Setback} = Q_{100}^{0.5} (\text{Adjustment Factors}) = 1294^{0.5} (0.30) = 10.8'$$

Site Characteristic <u>UPPER WHR</u>	Adjustment Factor
Channel Bend Factor - Bend angle < 5° (Reaches are relatively straight)	0.00
Channel Velocity Factor - Main Channel Velocity	0.10
Bankfull Width/Depth Ratio Factor - W/D = 10 - 40	0.02
Bank Materials Factor - Boulders, Clay	0.05
Bank Cementation Factor - High CaCO ₃ limestone soils	0.00
Bank Vegetation Density Factor - < 25% Soils Exposed on Bank	0.00
Bank Vegetation Type Factor - Most Stable	0.00
Bank Conditions Factor - 0-5% cutbanks, rock bottom	0.00
Flow Conditions Factor - Ephemeral Stream	0.05
Watershed Development Factor - Urbanized Watershed	0.10
Man-Made Disturbance Factor - Moderate Floodplain Activity (Stable 30+ years)	0.15
Vertical Channel Stability - No Significant Degradation/Aggradation Expected (Rock Base)	0.00
TOTAL	0.47

$$\text{Upper WHR Setback} = Q_{100}^{0.5} (\text{Adjustment Factors}) = 1294^{0.5} (0.47) = 16.9'$$

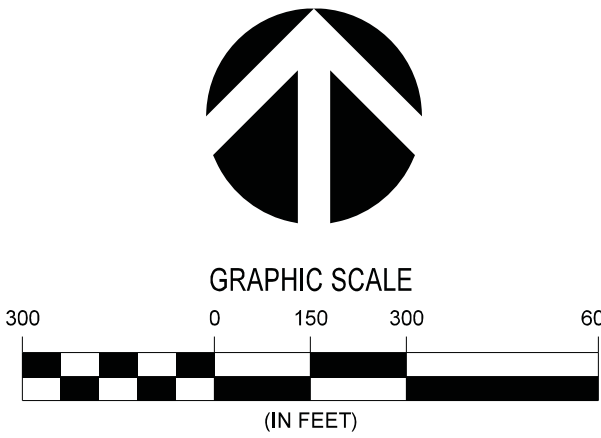
Erosion Hazard Zones are drawn on the attached existing site plan.

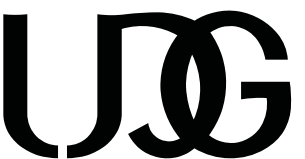


AUSTIN OAKS PUD

EROSION HAZARD ZONE

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AUSTIN OAKS PUD	DRAINAGE AREA MAP
UDG JOB NO. 15-864	