PACE
Advanced Water Engineering

**Technical Memorandum**

**Date:** May 18, 2021

**To:** Mike Green, Clark & Green Associates

**From:** Jenny Robinet, MS, PE, CFM,
Paige Brue, MS, PE

**Re:** El Camino Memorial Park – Secret Canyon Floodplain Analysis / CLOMR Requirements # B803

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## Project Description

The project is located within El Camino Memorial Park, in the City of San Diego, accessible through an entrance gate east of the intersection of Carrol Canyon Road and Pacific Heights Boulevard. The project involves extending an access road over a small canyon to expand the memorial park. The small canyon is referred to as Secret Canyon. Flows through Secret Canyon are tributary to Flanders Canyon Creek, which runs along the southeast edge of the memorial park. The confluence of Secret Canyon Creek with Flanders Canyon Creek is located approximately 200 feet downstream of the road extension crossing project.

## Current FEMA Floodplain Mapping

The FEMA floodplain in the Secret Canyon is currently mapped as Zone A on the FEMA Flood Insurance Rate Map (FIRM) Panel. According to *44 CFR § 64.3*, FEMA defines a Zone A as an "area of special flood hazard without water surface elevations determined." This means that FEMA delineated the floodplain based on approximate methods. PACE performed a detailed floodplain analysis, following FEMA guidelines, to determine a refined floodplain in the project area.

## Floodplain Analysis Procedure

To determine a refined floodplain, PACE completed a hydrologic analysis, in accordance with procedures outlined in the San Diego County Hydrology Manual, to determine 100-yr flowrates for Secret Canyon and Flanders Canyon. The flows were then used as input into a riverine model to establish a revised floodplain boundary.

### *Hydrologic Analysis*

Hydrologic modeling was performed using the National Resources Conservation Service (NRCS) Hydrologic Method, as described in Chapter 4 of the San Diego County Hydrology Manual. The method was used to develop a hydrograph of direct runoff from the drainage areas to establish a peak discharge. The NRCS Hydrologic Method establishes effective excess rainfall while also considering the time distribution of the rainfall, initial rainfall losses to the soil, and an infiltration rate that decreases as the storm progresses.

The method is divided into four steps:

1) Lag Time/Time to Peak Determination
2) Incremental Rainfall Distribution
3) Excess Rainfall Calculation
4) Direct Runoff Hydrograph Development

*Step 1: Lag Time/Time to Peak Determination*

Lag time was determined for each contributing watershed (see Exhibit 1) using the Army Corps of Engineers (ACOE) lag time equation, which is based on physical characteristics of the watershed as shown in the following empirical formula:

Corps $T_l$ (hours) = 24 ṅ ((L x Lc) / $s^{0.5}$) $^m$

where:
L = length to longest watercourse (miles)
$L_c$ = length along longest watercourse, measured upstream to a point opposite the watershed centroid (miles)
s = overall slope of drainage area between the headwaters and the collection point (feet per mile)
m = a constant determined by regional flood reconstitution studies (0.38 for San Diego County)
ṅ = the average of the Manning's n values of the watercourse and its tributaries

The lag time was then converted to a time to peak ($T_p$) for use in developing the hydrograph by applying the following equations:

$T_p$ = 0.862 x Corps $T_l$

*Step 2: Incremental Rainfall Distribution*

The rainfall distribution was established using incremental rainfall depths for specific durations. Each rainfall depth was applied to their associated distribution to create an incremental storm for a 24-hour computation period.

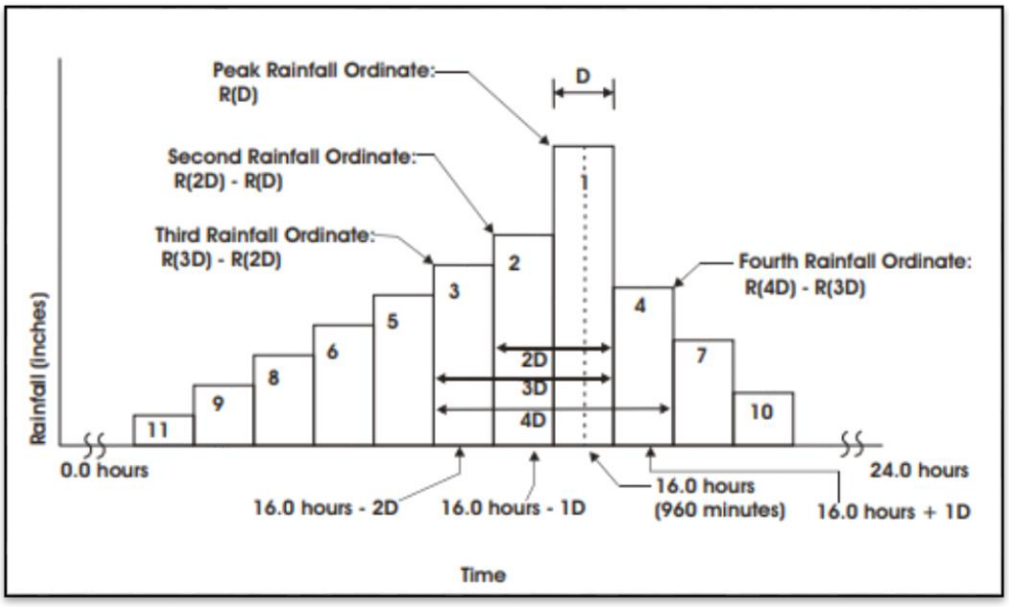


**Figure 1: Construction of Rainfall Distribution (Figure 4.9, San Diego County Hydrology Manual)**

*Step 3: Excess Rainfall Calculation*

Excess rainfall must be calculated to determine the amount of excess runoff that does not infiltrate into the soil. Excess rainfall was calculated by creating a cumulative rainfall series using the incremental rainfall ordinates. Each ordinate of the cumulative rainfall series was calculated using the following equation:

$Q_a = (P - I_a)^2 / (P - I_a) + S$
where:
$Q_a$= accumulated direct runoff (in)
P = accumulated rainfall (potential maximum runoff) (in)
$I_a$ = initial abstraction including surface storage, interception, evaporation, and infiltration prior to runoff (in)
S = potential maximum soil retention (in), based on the Curve Number, CN

It should be noted that the curve number is based on land use and hydrologic soil group (HSG). The watersheds were divided per land use and HSG to establish a weighted average curve number.

The equation above creates incremental amounts of excess rainfall from the cumulative series, which provides incremental amounts of direct runoff for establishing a direct runoff hydrograph.

*Step 4: Direct Runoff Hydrograph Development*

To develop the direct runoff hydrograph, a unit hydrograph was calculated using a dimensionless unit hydrograph (Table 4-7 in San Diego County Hydrology Manual), and applying the previously calculated time to peak and a unit discharge ($q_p$). The unit discharge was determined using the following equation:

$q_p = K_s A Q_a / T_p$

where:
$K_s$ = 484, a constant reflecting both the conversion of units and the shape of the hydrograph
$Q_a$ = 1 inch of effective runoff
A = watershed area (square miles)

After the unit hydrograph is set up, the unit hydrograph ordinates are multiplied by the incremental excess rainfall ordinates. Finally, the unit hydrograph was convoluted to establish a direct runoff hydrograph.

Final results were calculated for Secret Canyon as well as Flanders Canyon, since the crossing is located near the confluence of the two creeks. The calculated 100-year flowrates are provided in the table below:

| Secret Canyon Creek 100-year Flowrate | Flanders Canyon Creek 100-year Flowrate |
|---|---|
| 417 cfs | 2,857 cfs |

An additional analysis was performed to determine whether the land use change due to the project area grading changed the 100-year flow rates shown in the table above. The addition of the grading resulted in an insignificant change to the curve number designation, which resulted in a negligible (<0.01 cfs) change to the final calculated flowrates.

*Hydraulic Analysis*

Hydraulic modeling was performed using HEC-RAS Version 5.0.7, a computer modeling software program developed by the United States Army Corps of Engineers (USACE). The rigid boundary hydraulic model assumes that the channel bed does not fluctuate and develops a one-dimensional solution of the energy equation. To do this, energy losses are evaluated by friction through Manning's equation and contraction/expansion is based on the coefficient and change in velocity head.

The HEC-RAS model covers a reach of approximately 4,500 feet of Flanders Canyon Creek, and 1,500 feet of Secret Canyon Creek. The floodplain revision area is within the limits of study, extending approximately 2,800 feet of Flanders Canyon (to tie in to current FEMA floodplain), and 800 feet of Secret Canyon.

To prepare the model, channel topographic data (2014) was obtained from the web-based SanGIS Regional Data Warehouse, and cross sections were cut with a spacing of approximately 100 feet, except in areas where crossings or constrictions were located. Appropriate Manning's coefficients and peak discharges from the hydrologic analysis were applied to the study reach for the analysis. Normal depth boundary conditions were then entered to initiate hydraulic calculations.

The resulting water surface elevations from the model were applied to the channel geometric data using GIS floodplain delineation tools to establish the refined 100-year floodplain. The final 100-year floodplain is shown in Exhibit 2.

## FEMA CLOMR Requirements

FEMA has specific requirements for floodplain mapping, depending on the Special Flood Hazard Area designation in which the project is located. The El Camino Memorial Park Secret Canyon project is located in Zone A, which has floodplain management requirements that fall under *44 CFR § 60.3 (b)*. Under this subsection, FEMA requires any new or substantially improved development be made reasonably safe from flooding, and that any available water surface elevation data be obtained to assist with establishing at minimum bottom floor or flood-proofing elevations for a new or substantially improved development.

Subsection b does not specify the requirement to adhere to *44 CFR § 60.3 (c)(13) or 44 CFR § 60.3 (d)(4)* – which are the only two sections under *44 CFR § 60.3* which state that the community must first apply for a conditional FIRM revision (CLOMR) approval. Subparts c and d of *44 CFR § 60.3* are applicable to projects within floodplains that have base flood elevations established, which is not the case for the El Camino Memorial Park Secret Canyon project.

As described in the hydrology section, the flowrate does not change as a result of the project. Therefore, any project impact to the floodplain would be confined to the location of the extension road crossing over Secret Canyon, specifically as a result of the supports for the crossing. The current supports are shown to be just within the revised 100-year floodplain. According to our research, even if the project were in a Special Flood Hazard Area with base flood elevations established, a CLOMR is not required when the 100-year water surface elevation increases by less than 1-ft. (Source: *44 CFR § 60.3 (c)(13) and 44 CFR § 65.12*) Since the supports for the crossing would likely result in an increase in water surface elevation that is much less than 1-ft, a CLOMR would not have been required by FEMA if the project were in a Special Flood Hazard Area with base flood elevations established.

Moving the supports out of the floodplain does not seem necessary; however, if this option were pursued, an additional floodplain delineation is provided (see Exhibit 3) that is expanded to incorporate a 1-ft of freeboard buffer. One foot is the freeboard amount recommended by the County of San Diego in their floodplain management plan as a prevention and protection measure for new or substantially improved buildings in flood prone areas. This typically applies to establishing bottom floor or lot elevations of new or substantially improved development / buildings, but could also be used to establish a floodplain buffer area.

However, due to the specific special hazard floodplain in this area (Zone A), the allowable change by FEMA (1-ft), and the expected impact of the supports on the water surface elevation of the revised floodplain (minimal), a CLOMR is not expected to be required by FEMA.

It should be noted that it can be common practice to submit a CLOMR for a project that may impact a floodplain, depending on the extents of the impact and the project development. But technically for the case of the El Camino Memorial Park Secret Canyon project, a CLOMR is not a requirement per FEMA's federal regulations as described above.

There are requirements that still apply to the El Camino Memorial Park Secret Canyon project. They can be found in *44 CFR § 60.3 (a)(3)* which ensures that a structure or building within a flood-prone area is protected from flood damages where applicable, stated as follows:

> ***(3)*** *Review all permit applications to determine whether proposed* ***building*** *sites will be reasonably safe from flooding. If a proposed* ***building*** *site is in a* ***flood****-prone area, all new construction and* ***substantial improvements*** *shall (i) be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the* ***structure*** *resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, (ii) be constructed with materials resistant to* ***flood*** *damage, (iii) be constructed by methods and practices that minimize* ***flood*** *damages, and (iv) be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.*

In addition to the structural requirements above, it is recommended that a fluvial study be performed to determine the depths the supports should be installed to avoid undermining by scour or erosive forces.

## References

City of San Diego. (June 2007). "Flood Mitigation Plan."

County of San Diego. (August 2007). "Floodplain Management Plan."

County of San Diego Department of Public Works, Flood Control Section. (June 2003). "San Diego County Hydrology Manual."

Federal Register. (2020). "Code of Federal Regulations – Title 44 Emergency Management and Assistance – Chapter 1 Federal Emergency Management Agency, Department of Homeland Security – Subchapter B Insurance and Hazard Mitigation – Part 60 Criteria for Land Management and Use – Subpart A Requirements for Flood Plain Management Regulations". Accessed through the Cornell Law School Legal Information Institute [LII] Website: https://www.law.cornell.edu/cfr/text/44/part-60/subpart-A

Federal Register. (2020). "Code of Federal Regulations – Title 44 Emergency Management and Assistance – Chapter 1 Federal Emergency Management Agency, Department of Homeland Security – Subchapter B Insurance and Hazard Mitigation – Part 64 Communities Eligible for the sale of Insurance". Accessed through the Cornell Law School Legal Information Institute [LII] Website: https://www.law.cornell.edu/cfr/text/44/part-64

Federal Register. (2020). "Code of Federal Regulations – Title 44 Emergency Management and Assistance – Chapter 1 Federal Emergency Management Agency, Department of Homeland Security – Subchapter B Insurance and Hazard Mitigation – Part 65 Identification and Mapping of Special Hazard Areas". Accessed through the Cornell Law School Legal Information Institute [LII] Website: https://www.law.cornell.edu/cfr/text/44/part-65

Legend

Stream Centerlines

Drainage Areas

Secret Canyon (197 AC)

Flanders Canyon (1447 AC)

Mira Mesa

Flanders Canyon

Secret Canyon

Mira Mesa Park

Mira Mesa Vernal Pool Openspace

Jonas Salk Elementary

Mason Elementary

Mira Mesa High

Challenger Middle

Hage Elementary

Hourglass Field Community Park

Miramar

Esri Community Maps Contributors, SanGIS, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, Bureau of Land Management, FPA, NPS, US Census Bureau, USDA, Maxar

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# EL CAMINO MEMORIAL PARK
# SECRET CANYON FLOODPLAIN ANALYSIS

## WATERSHED MAP

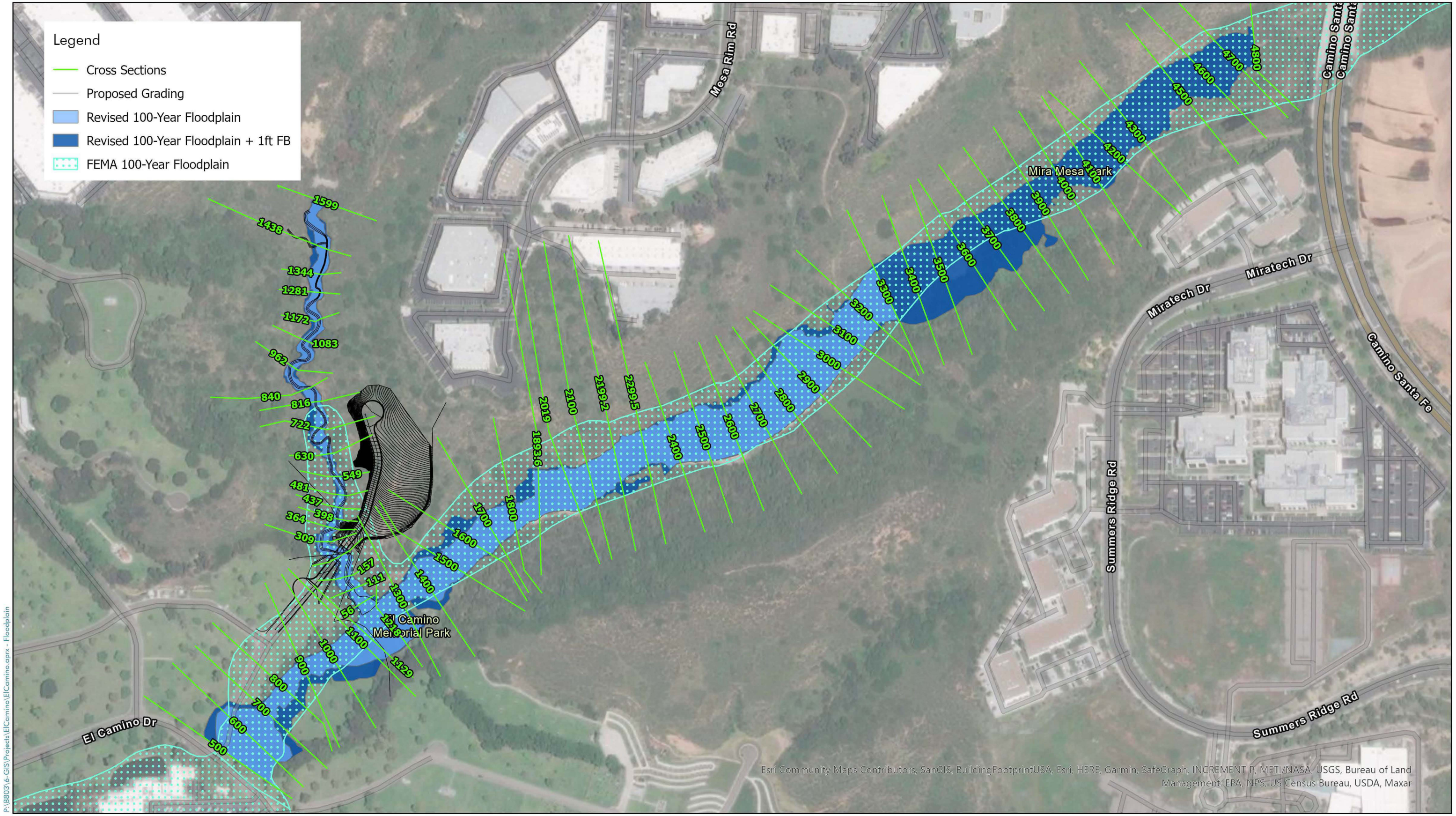
PACE Advanced Water Engineering

0 750 1,500 3,000 Feet

Date: 5/13/2021

Job Number: B803

Exhibit 1

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# EL CAMINO MEMORIAL PARK
# SECRET CANYON FLOODPLAIN ANALYSIS

## REGIONAL FLOODPLAIN WORKMAP

PACE Advanced Water Engineering

0 150 300 600 Feet

Date: 5/13/2021

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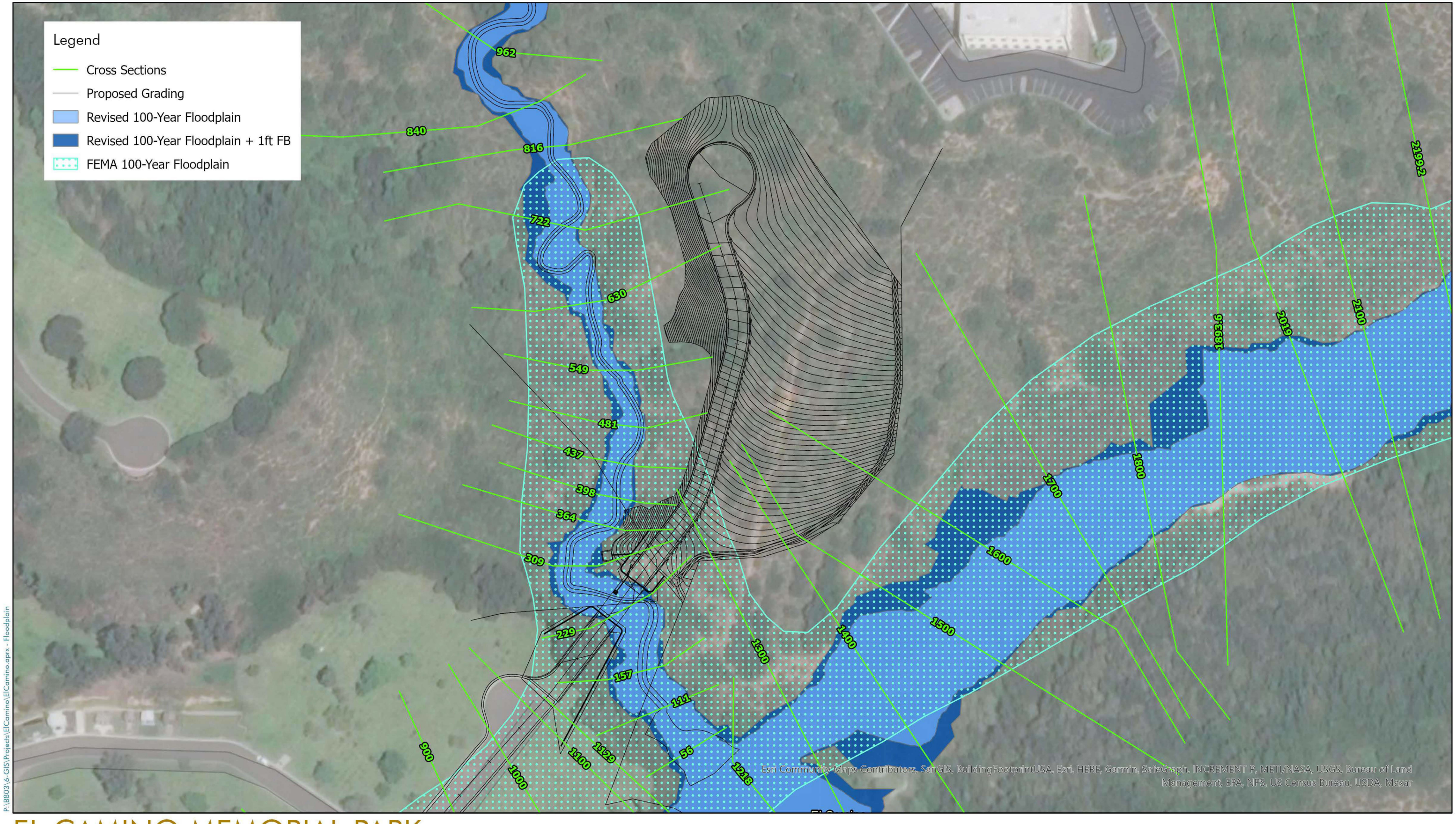
Exhibit 2

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# EL CAMINO MEMORIAL PARK
# SECRET CANYON FLOODPLAIN ANALYSIS

## PROJECT AREA
## FLOODPLAIN WORKMAP

PACE Advanced Water Engineering

0 50 100 200 Feet

Date: 5/13/2021

Job Number: B803

Exhibit 3