

## MEMORANDUM

**Date:** November 23, 2020 **BKF Job Number:** 20190112

**Deliver To:** Carolyn Neer, David J. Powers & Associate, Inc.

**From:** Lokelani Yee, BKF Engineers  
Caleb Beck, BKF Engineers

**Subject:** 2535 Pulgas Avenue – Flood Displacement Memorandum

### Purpose

The purpose of this memorandum is to review the FEMA designated flood elevation for the 2535 Pulgas Avenue site and determine if development of the project could potentially displace flood water onto adjacent areas currently not included in the 100 year flood zone or potentially increase the depth of flooding in the current flood zone that would negatively impact neighboring properties.

### Background

2535 Pulgas Avenue encompasses approximately 3.86 acres in East Palo Alto, situated between Roto-Rooter Plumbing & Water Cleanup, Pitcher Drilling, and Palo Alto Plumbing Heating & Air. The site is currently occupied by Touchatt Trucking Company and includes paved parking areas and two existing single-story buildings. All existing conditions are to be demolished. The proposed development includes a parking lot and a 109,289 sf 4-story office building (Project). The northeast portion of the site is currently included in the Special Flood Hazard Area (SFHA) Zone AE as shown on the FEMA Flood Insurance Rate Map (FIRM) Community Panel Number 060708 0307 F, revised April 5, 2019. The zone designated AE means the area is inundated by the base flood with base flood elevations determined. The Base Flood Elevation (BFE) for the area is defined as elevation 11.0 (Datum NAVD 1988). The zone designation of AE also means that the area is not tidally influenced and does not consider the effects of either wave height or run-up. This is appropriate for the area due to the extent of levee protected marsh between the Bay and the project that attenuate waves from the Bay. The Flood Insurance Study (FIS) for San Mateo County and Incorporated Areas completed by FEMA July 16, 2015 provides more detailed information and analysis to support the BFE and flood zone designation.

Review of the FIS also indicates that flooding in this area of East Palo Alto is tidally influenced from San Francisco Bay because of an incomplete system of levees built along the bay that include numerous low points and openings that allow tides to overtop or bypass the levees. Levees in the project vicinity are shown on **Exhibit 1: Existing Levees**. This system of levees is not recognized or certified by FEMA and the SFHA is mapped as if they do not exist. The flood elevation of 11.0 identified in the FIS is the maximum, 100-year still water elevation in the Bay and does not have an upstream, stormwater runoff hydrologic or hydraulic component. This is illustrated on the FIRM by a large area of flooding that extends along a significant portion of the Peninsula shoreline with a consistent elevation.

As part of the site development process, the portion of the property within the SFHA will be raised by placing approximately 2 feet of fill across the project site. It has not yet been determined if the development team will apply for a Letter of Map Revision – Fill (LOMR-F) for the site with the City and FEMA to document removal of the portion of the property this is within the SFHA. Until FEMA issues the LOMR-F, the City will continue its oversight of the potential for flood displacement on neighboring properties.

## **Analysis**

To determine if raising the project site would impact either the extent or depth of flooding, we first need to understand the cause of flooding in the area. Based on review of the FIS, it is understood that flooding in this area is tidal and directly connected to the static elevation of the Bay. Calculations of the flood elevation are based only on the historic data for tide gauging stations in San Francisco Bay. FEMA determined the extent of flooding shown on the FIRM by applying this elevation to topographic maps. Because there are existing levees that are not recognized by FEMA, the actual extent of flooding during a specific event may not include the entire SFHA. Predicting flood patterns and flood volumes in the SFHA is difficult since the flood patterns are dependent on the number and location of levee failures or overtoppings.

In general, flooding in the vicinity of the project site occurs when a levee is breached or overtopped. When this happens, Bay water flows to the low points behind the levees and continues to pond behind the levee until the tide recedes. When the tide recedes, flood water flows back to the Bay down to the elevation of the remaining portion of the overtopped or breached levee. The remainder of the water impounded behind the levee makes its way to the storm drain at the north termination of Pulgas Ave or infiltrates in low lying, undeveloped areas near the levee.

We reviewed the site topography based on an aerial topographic survey prepared for the project. The existing project site is surrounded by several features that partially protect it from the 100-year tidal flooding event. These include the levees along the Bay and marsh land, the large bermed land that spans from the terminations of Demeter Street and Pulgas Ave, and Tara Street which all are largely at or above the BFE of 11.0. These are all significant facilities that will impede the flow of tidal flood water from the Bay. In order for the project site to flood, tidal flood water would have to pond within the low lying undeveloped areas near the levee and eventually flow onto the Pulgas Ave and Demeter Street properties north of the project site to flood the portion of the existing project site that is within the SFHA; as shown on **Exhibit 2: Existing Storage**.

The limits of the SFHA terminate on the project site. As a result, flood water flow is generally only in the north direction in relation to the project site.

To determine if raising the project site by placing approximately 2 feet of fill material would have a negative effect that may impact the extent or elevation of flooding on adjacent properties, we reviewed the site topography along with the existing drainage pattern and SFHA extents. Based on the existing site topography, placing fill to raise the entirety of the site above elevation 11.0 would eliminate approximately 3,360 CY of existing available floodwater storage; as shown on **Exhibit 3: Proposed Storage**. Removal of this available storage volume could decrease the duration of tidally induced flooding

in low laying areas of adjacent properties. Because the tidal flooding results from a specific water elevation in the Bay, the extent and depth of flooding would not change. Since the existing extents of the SFHA terminate on the project site, in the proposed condition, when the tidal flood water recedes the water will flow north across the Demeter Street and Pulgas Ave properties similar to the existing condition and will not be impeded by the development.

To put this change in flooding duration in perspective, we calculated the volume of tidal flood water in the general flood study area identified to be approximately 3,260,700 SF with 156,400 CY of storage volume available; as shown on **Exhibit 4: Flood Analysis Area**. The proposed change in earthwork on the site could decrease this detained volume and potential flood duration by approximately 2.1 percent. The actual volume of tidal flood water remaining after a flood event would be dependent on the elevation of the levee breach or overtopping.

## **Conclusion**

Because flooding in the project vicinity is tidally influenced, earthwork fill to remove the northeast portion of the site from the SFHA will not displace flood water and will not increase the extent or depth of flooding on adjacent properties that could cause an adverse impact. Proposed grading on the site will decrease the available storage volume in the flood area by approximately 2.1 percent and could have a proportionate decrease in the duration of flooding which would not negatively impact adjacent properties.

## **Attachments:**

**Exhibit 1: Existing Levees**

**Exhibit 2: Existing Storage**

**Exhibit 3: Proposed Storage**

**Exhibit 4: Flood Analysis Area**



1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

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Date	No.	Revisions
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Design		
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Approved		
Job No. J09_10		

**2535 PULGAS AVE FLOOD DISPLACEMENT  
EXISTING LEVEES**

CALIFORNIA

COUNTY OF SAN MATEO

CITY OF EAST PALO ALTO



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REDWOOD CITY, CA 94065  
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DRAWING NAME: \\BKF-rs\dat\2019\190112\_Project\_Thunder\ENG\EXHIBITS\Flood Displacement\EXTHAER\AL.dwg  
PLOT DATE: 11-23-20 PLOTTED BY: bck

**LEGEND**



ELEVATION 11.0 & UNDER



PROPERTY LINE

**DEMETER STREET**

**2535  
PULGAS AVE**

**PULGAS AVE**

**TARA STREET**

**100 YEAR TIDE  
INCOMING/RECEDING  
FLOW PATH**

**SAN FRANCISCO BAY**

GRAPHIC SCALE



**BKF100**  
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**2535 PULGAS AVE FLOOD DISPLACEMENT  
EXISTING STORAGE**

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**EXHIBIT  
2**



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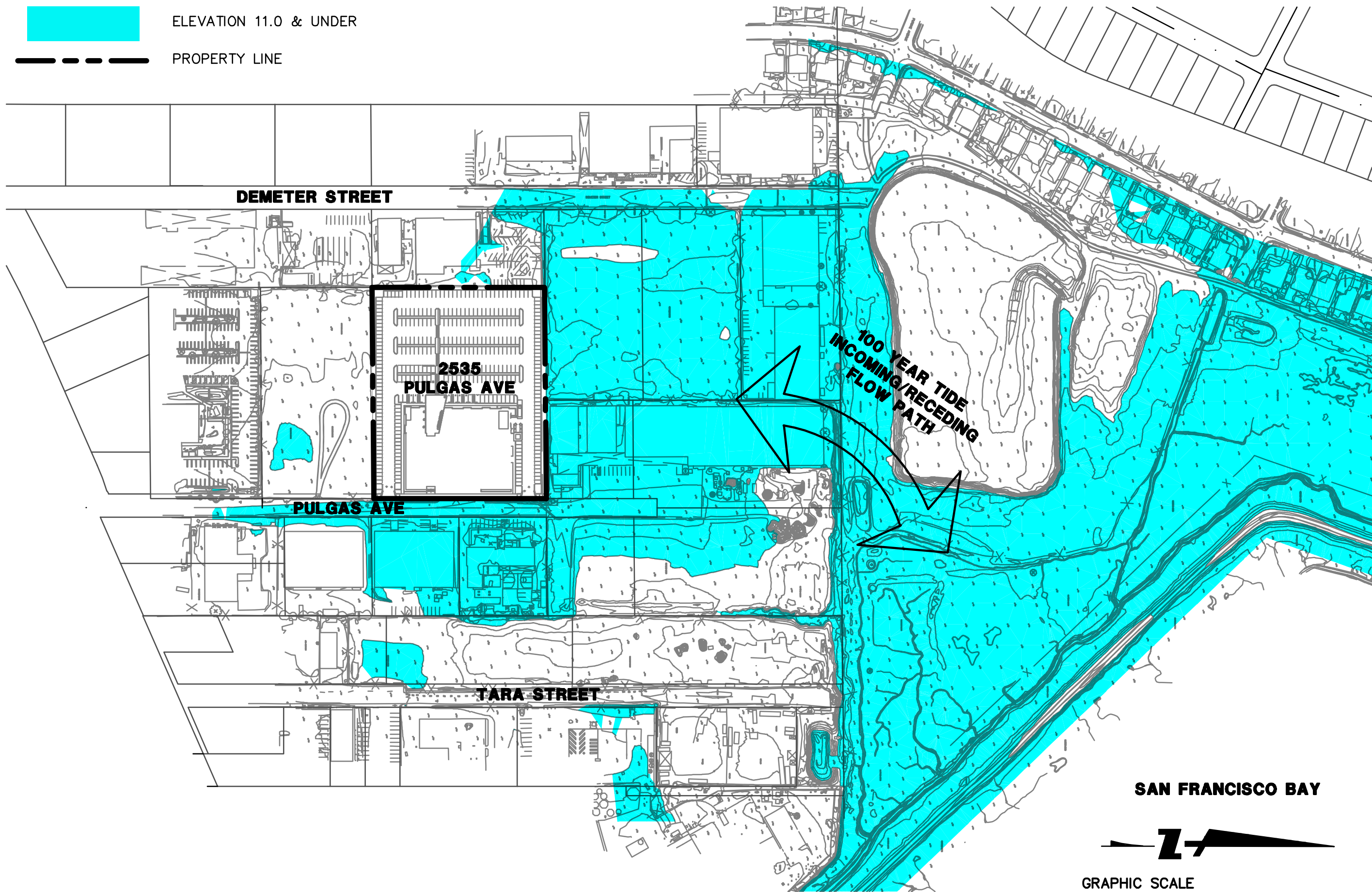
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ELEVATION 11.0 & UNDER



PROPERTY LINE



**SAN FRANCISCO BAY**



GRAPHIC SCALE



200 0 200 400



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**2535 PULGAS AVE FLOOD DISPLACEMENT  
PROPOSED STORAGE**

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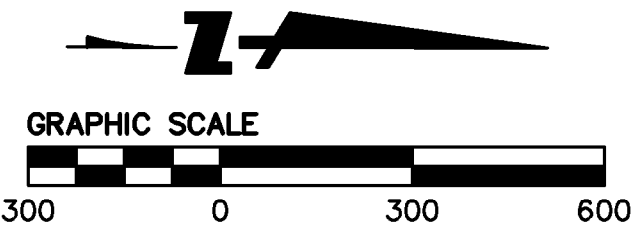
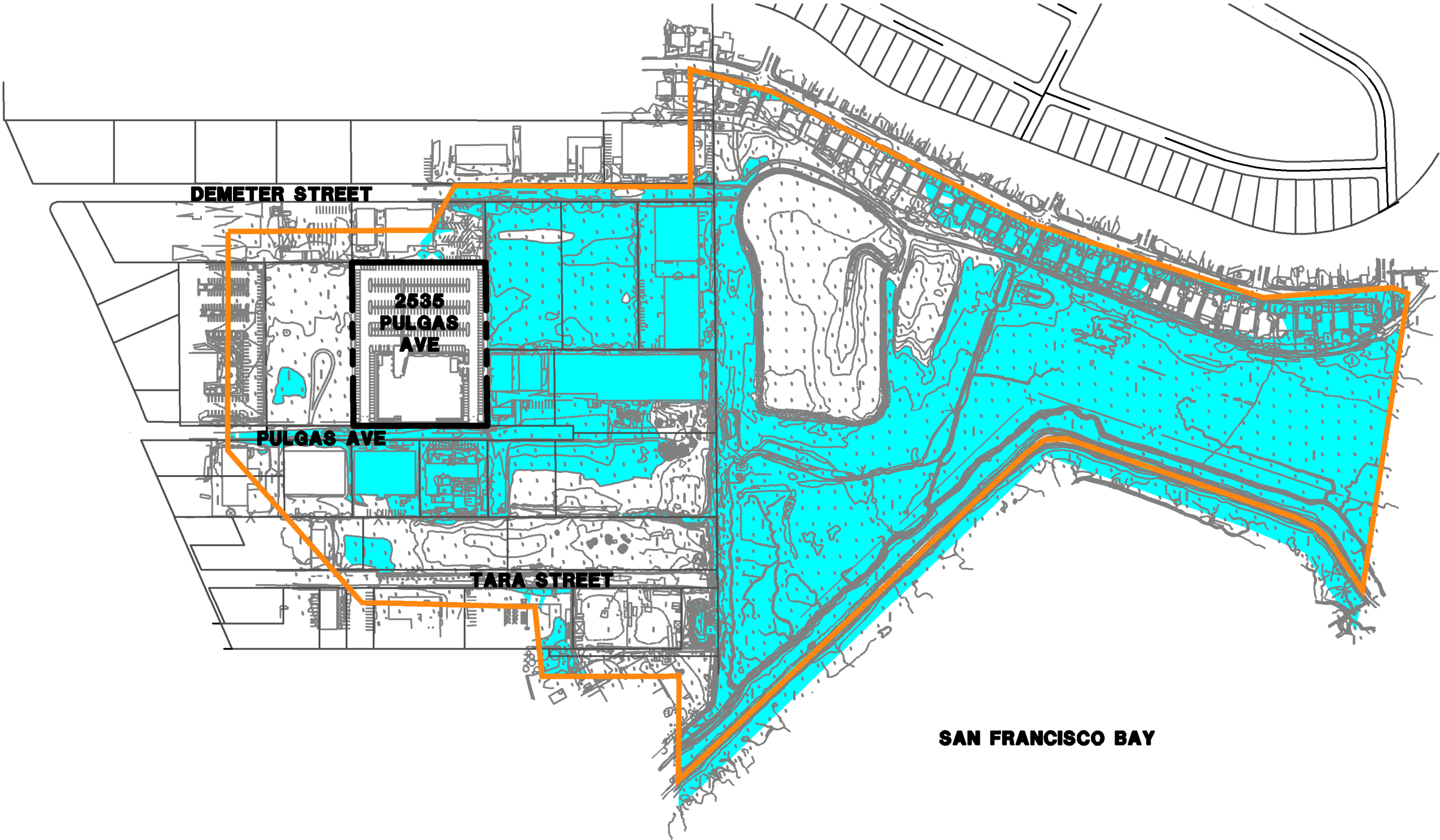
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**EXHIBIT**  
**3**

**LEGEND**

- ELEVATION 11.0 & UNDER
- PROPERTY LINE
- FLOOD ANALYSIS AREA

TOTAL AREA: 3,260,700 SF  
EXISTING STORAGE: 156,440 CY  
PROPOSED STORAGE: 153,080 CY  
  
FLOOD REDUCTION = 2.1%



DRAWING NAME: \\BKF-101\dat\2019\190112\_Project\_Thunder\ENG\EXHIBITS\Flood Displacement\EXTHAERIAL.dwg  
PLOT DATE: 11-23-20  
PLOTTED BY: beek



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**2535 PULGAS AVE FLOOD DISPLACEMENT  
FLOOD ANALYSIS AREA**

CITY OF EAST PALO ALTO      COUNTY OF SAN MATEO      CALIFORNIA

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