MEMORANDUM

February 22, 2021

TO: Forrest Dykstra, Highlands Ranch Metropolitan Districts

Re: Highlands Ranch Metropolitan District Senior Center
Technical Analysis of Flood Issues

At the request of the Highlands Ranch Metropolitan District, Calibre Engineering provided an analysis of the proposed Senior Center with respect to its impact on local and regional flooding. The purpose of this memorandum is to summarize our approach to the analysis and its results.

The site is located just south of East Highlands Ranch Parkway and South Broadway intersection, just east of the Mountainview Christian Church

Specific questions to be answered included:

1. Will the construction of the Senior Center on this site increase the potential for erosion of the channel or the contribution of sediment to the channel?
2. Will the construction of the Senior Center on this site increase the probability or severity of minor or major flooding in Dad Clark Gulch?
3. Will the construction of the Senior Center raise flood levels in the areas downstream of the site?

Refer also to the attached graphics, Exhibit 1 and Exhibit 2 which show the proposed site and environs.

To answer these questions, we obtained the projected runoff rates for the 100-year storm in Dad Clark Gulch and estimated the increase in runoff expected to be generated by the Senior Center Development. We then compared expected increases in flood height and flood velocity before and after Senior Center construction. We also evaluated the impact of the Senior Center under the conditions that the culvert on Dad Clark Gulch at Broadway is entirely plugged (i.e., the culvert entrance has been blocked by debris).

Results of the calculations indicated that the rate of expected storm runoff in Dad Clark Gulch just downstream of the proposed Senior Center Site is 1347 cfs, given existing conditions within the overall basin. With the addition of the Senior Center, the flow rate would increase less than 0.4%, to 1352 cfs (see the attached “Flood Analysis for Senior Center”).

Calculating the increase in flooding depth due to this runoff increase yields an increase of less than one one-hundredth of an inch of depth, which is considered negligible. For comparison purposes FEMA would consider anything under 0.5’ as “No Rise”, therefore the projected rise from the Senior Center development is approximately 1/500th of this “No Rise” condition.

Likewise, under the conditions that the South Broadway culvert is plugged, we evaluated flood depths in Broadway and Highlands Ranch Parkway with and without the Senior Center in place. Results showed that the increase in flooding depth in South Broadway and Highlands Ranch Parkway would be 1/500th of what FEMA would consider a “No Rise” condition, or less than one one-hundredth of an inch, a negligible amount.

Expected increase in velocity in the channel, calculated to be less than .01 feet per second, likewise would be negligible. Since velocity, or other hydraulic parameters related to velocity, are the primary determining factors in channel erosion and channel sedimentation, no change in channel erosion or sedimentation is expected due runoff from a new Senior Center just upstream of Broadway.

Local erosion of the hillside adjacent to the channel during and after the construction of the Senior Center is a function of installing adequate erosion control measures. Douglas County has comprehensive standards governing construction sites and governing post construction erosion control. Based on these standards, the Highlands Ranch Metropolitan District and its contractors will be required to install erosion control measures that will minimize the amount of soil leaving the site. Erosion and sedimentation are therefore NOT expected to be approximately equal to the historic, pre-development conditions.

Our conclusions, given the above calculations and results, are that the construction of the Senior Center on the proposed site would not measurably increase flooding heights, runoff velocities, sedimentation, or erosion within Dad Clark Gulch or on any of the properties downstream of the site evaluated.

Sincerely,

FOR AND ON BEHALF OF

CALIBRE ENGINEERING, INC.

Gregory V. Murphy, P.E.

Cc: Alan Pagán-Rivera, Calibre Engineering Inc.

Enclosures:

1) Flood Analysis for Senior Center Exhibits

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone I*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

DAD CLARK GULCH FHAD
100-YR FLOODPLAIN EXHIBIT 1

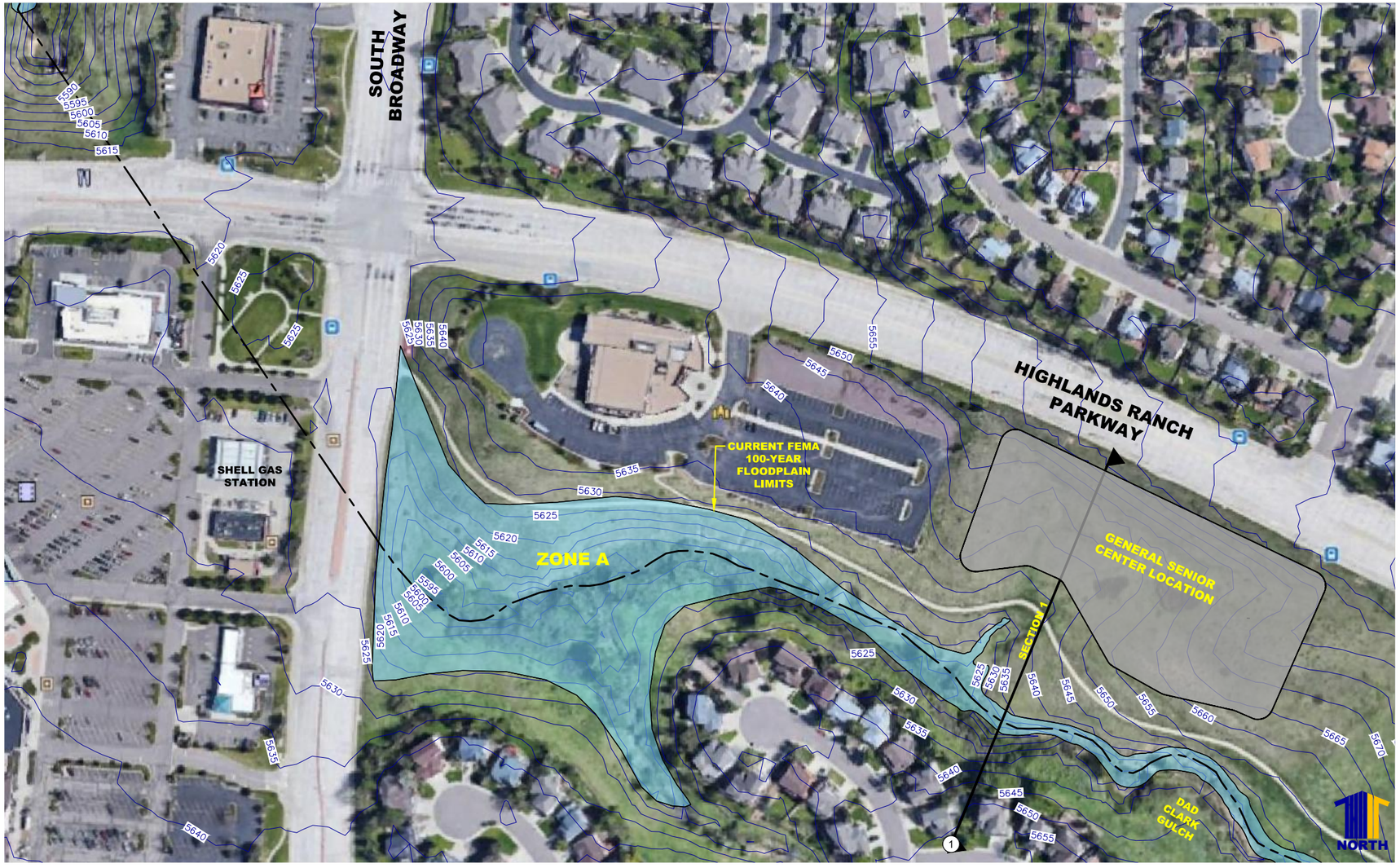
NORTH

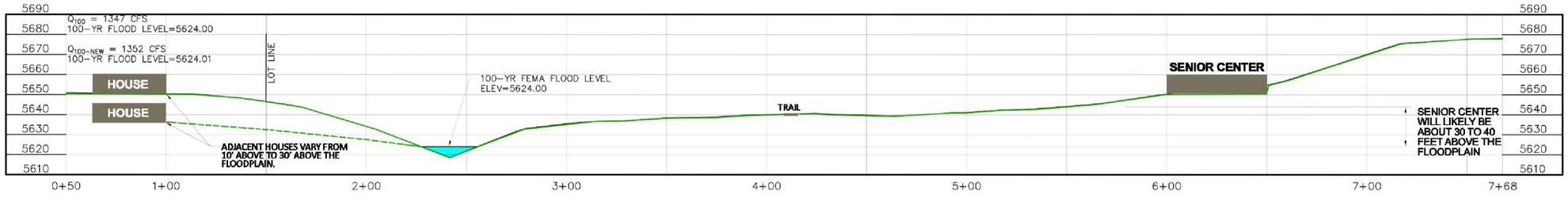
0 50 100 200
1 inch = 100 ft. Horizontal

Calibre Engineering, Inc.
9090 South Ridgeline Boulevard, Suite 105
Highlands Ranch, CO 80129 (303) 730-0434
www.calibre-engineering.com
Construction Management Civil Engineering Surveying

C:\USERS\APAGAN-RIVERA\DESKTOP\HRMD\DADCLARKEGULCH FLOODPLAIN.DWG
2/22/2021 11:07 AM
ALAN PAGAN-RIVERA

DAD CLARK GULCH FHAD
100-YR FLOODPLAIN EXHIBIT 2





NOTE: THIS SECTION IS ABOUT 1000' UPSTREAM OF THE BROADWAY CULVERT, SEE PLAN VIEW

SECTION 1

SCALE:
1" = 30' Horizontal
1" = 1' Vertical

ANALYSIS

1. THE SENIOR CENTER IS PROJECTED TO BE A MINIMUM OF 20' ABOVE THE 100-YEAR FLOODPLAIN, AND POSSIBLY AS MUCH AS AS 40' ABOVE THE FLOODPLAIN.

2 THE LIGHTER BLUE SHADED AREA WITH A BLACK OUTLINE TO THE LEFT INDICATES THE CURRENT FEMA 100-YEAR FLOOD LEVEL. NO OVERTOPPING OF SOUTH BROADWAY IS PROJECTED DURING THE 100-YEAR STORM. HOWEVER, CULVERT PLUGGING CAN OCCUR. IF PLUGGING DOES OCCUR, THE INCREASE IN OVERFLOW DEPTH IN SOUTH BROADWAY AND HIGHLANDS RANCH PKWY DUE TO THE ADDITION OF THE SENIOR CENTER WOULD BE LESS THAN $\frac{1}{100}$ OF AN INCH.

0 50 100 200
1 inch = 100 ft. Horizontal

Calibre Engineering, Inc.
9090 South Ridgeline Boulevard, Suite 105
Highlands Ranch, CO 80129 (303) 730-0434
www.calibre-engineering.com
Construction Management Civil Engineering Surveying

C:\USERS\APAGAN-RIVERA\DESKTOP\HRMD\DADCLARKEGULCH FLOODPLAIN.DWG
2/22/2021 11:07 AM
ALAN PAGAN-RIVERA