



**CITY OF BOULDER
CITY COUNCIL AGENDA ITEM**

MEETING DATE: February 19, 2019

AGENDA TITLE: Call-Up Item: Floodplain Development Permit (LUR2017-00045) for replacement of a fence within the conveyance zone, high hazard zone of Gregory Creek. The call up period expires on **February 19, 2019.**

PRESENTER/S

Jane S. Brautigam, City Manager
Mary Ann Weideman, Interim Director of Public Works
Edward Stafford, Development Review Manager – Public Works
Christin Shepherd, Senior Civil Engineer – Floodplain and Wetland
Alysha Geiger, Civil Engineer I

EXECUTIVE SUMMARY

On January 17, 2019, the Planning Board voted 6-0, to approve a Floodplain Development Permit (LUR2017-00045) for replacement of a fence within the conveyance and high hazard zones of Gregory Creek. The project includes the removal and replacement of an existing fence that is located along the east side of the property, adjacent to Gregory Canyon Creek, and a portion of fence south of the main structure. The replacement fence is located in the conveyance and high hazard zones of Gregory Canyon Creek and will replace an existing fence that was deteriorated. In addition to background information about the proposed project and permit process, this Information Packet item includes the following attachments:

- **Attachment A** contains the Floodplain Development Permit.
- **Attachment B** contains the Floodplain Development Report.
- **Attachment C** contains the Criteria of Consideration for Floodplain Development Permit.

- **Attachment D** contains the draft minutes from the Jan. 17, 2019 Planning Board hearing

The Planning Board's approval is subject to a 30-day call-up period by City Council which expires on **Feb. 19, 2019** (the end of the call up period falls on a weekend and the following Monday is a holiday, so it is extended to the following Tuesday). City Council is scheduled to consider this application for call-up at its **Feb. 19, 2019** public meeting.

The staff memorandum to Planning Board and other related background materials are available on the [city website](#).

BACKGROUND

Existing Site/Site Context:

As depicted in **Figure 1** below, 816 Arapahoe Avenue is located south of Arapahoe Avenue, west of 9th Street and Gregory Creek runs through the south east portion of the property.

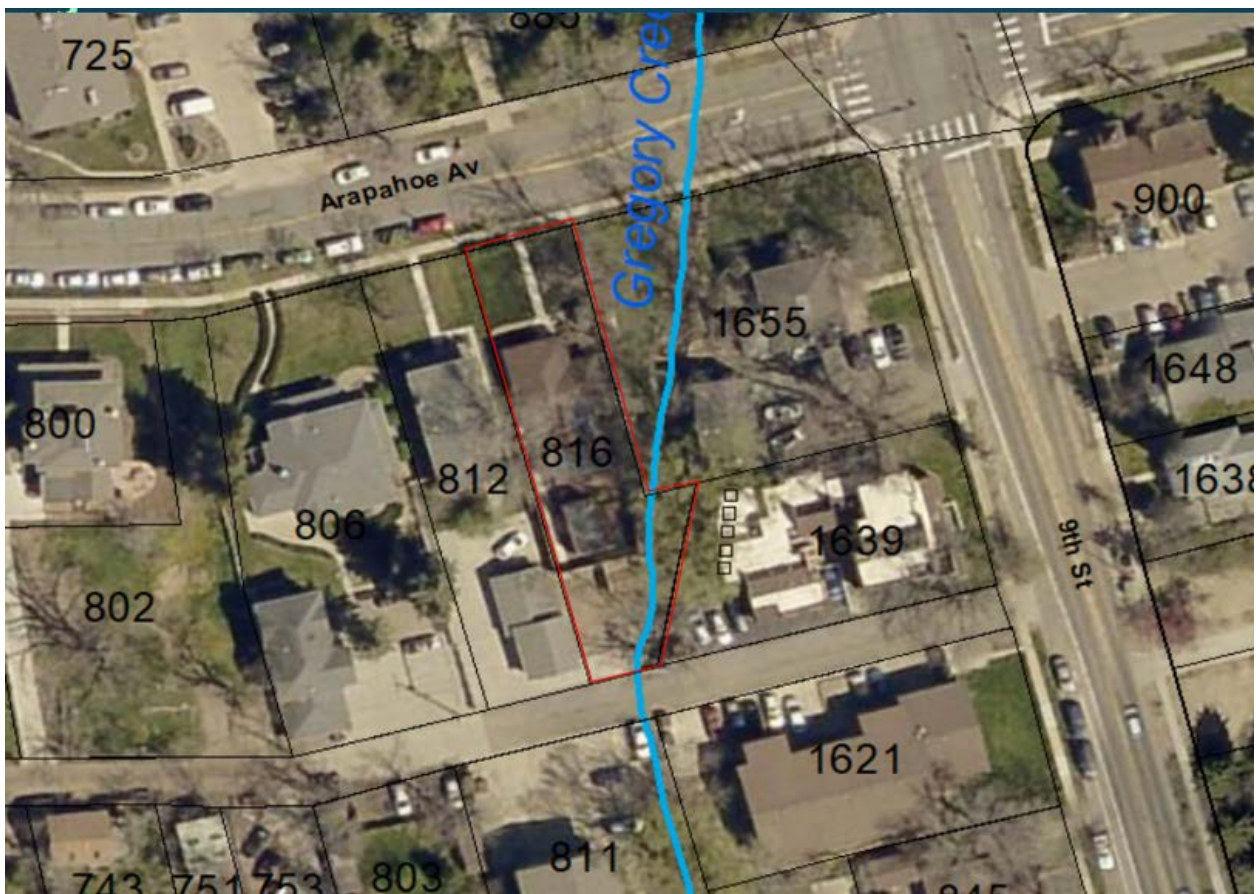


Figure 1: Vicinity Map

Project Description:

The project includes the removal and replacement of an existing fence that is located along the east side of the property, adjacent to Gregory Canyon Creek, and a portion south of the structure. The replacement fence is located in the conveyance and high hazard zones of Gregory Canyon Creek. The fence is to replace an existing fence that was deteriorated.

Permit Process:

The project is located within the flood conveyance and high hazard zones of Gregory Canyon Creek. The property owner applied for a Floodplain Development Permit (**Attachment B**) on June 16, 2017. The Floodplain Development Permit was approved by Public Works staff on October 30, 2018. The staff level decisions associated with the Floodplain Development Permit is subject to call-up by the Planning Board or by the public within 14 days of staff's decision. A member of the Planning Board called up the staff level decision on November 15, 2018. Staff then presented the permits at the Jan. 17, 2019 Planning Board meeting. The board voted 6-0 to approve the permit. The Planning Board decision is subject to City Council call-up within 30-days.

ANALYSIS

Staff identified the following key project issues:

- 1. Is the proposed Floodplain Development Permit consistent with the Floodplain Development Permit criteria set forth in [Section 9-3-3](#), [9-3-4](#), [9-3-5](#), and [9-3-6](#) B.R.C. 1981?**

In reviewing a Floodplain Development Permit for projects within the flood conveyance zone and high hazard zone, the criteria of [Section 9-3-6](#) "Floodplain Development Permits", [Section 9-3-3](#) "Regulations Governing the One Hundred-Year Floodplain", [Section 9-3-4](#) "Regulations Governing the Conveyance Zone" and [Section 9-3-5](#) "Regulations Governing the High Hazard Zone" B.R.C. are considered.

Please refer to the staff analysis of the Floodplain Development Permit Criteria (**Attachment C**) for a full discussion of the above key issues.

The city's [Flood Mitigation Plan for Gregory Canyon Creek](#) includes habitat improvements, culvert and channel improvements, a pedestrian bridge at Pennsylvania Ave, sediment traps, roadway improvements and other features. The Flood Mitigation Plan was accepted by City Council in December 2015. City staff worked closely with the property owners along Gregory Canyon Creek on the development of the plan. Attachment E provides more detail on what mitigation has been proposed for this area of Gregory Creek. Capital improvement funds were allocated in 2018 for the design of culvert and channel improvements from Arapahoe Ave to Pennsylvania Ave. The city is partnering with the Urban Drainage and Flood Control District on this project. An engineering consulting firm will be selected to help with the design and analysis.

In accordance with [Section 11-5-3\(f\)](#):

Easement Requirements: No owner of a parcel of land through which a natural drainage way flows as shown on the master drainage plan shall obtain a building permit to develop the property, unless the person first grants to the city at no charge a permanent easement to construct, maintain or reconstruct the channel along the drainage way.

A flood control easement is not required as a part of this project since a building permit is not required for the replacement of the fence.

PLANNING BOARD ACTION:

On Jan. 17, 2019, the Planning Board voted 6-0 to approve the Floodplain Development Permit (LUR2017-00045).

Please see **Attachment D** for the meeting minutes from the Jan. 17, 2019 Planning Board meeting, **Attachment A** for the Floodplain Development Permit.

PUBLIC COMMENT AND PROCESS:

Published notice of the Planning Board hearing was provided not less than ten days prior to the hearing. All notice requirements of [Section 9-4-3](#), B.R.C. 1981 have been met. Public comments regarding the Floodplain Development Permit may also be received through public hearing. No public comment was provided during the November 15, 2018 Planning Board meeting or the January 17, 2019 Planning Board meeting.

NEXT STEPS

The Planning Board decision is subject to City Council call-up within 30-days. The Floodplain Development Permit request is scheduled as an informational call-up item for the **Feb. 19, 2019** City Council meeting. **The call up period expires on Feb. 19, 2019.**

ATTACHMENTS

- A. Floodplain Development Permit.
- B. Floodplain Development Report.
- C. Criteria of Consideration for Floodplain Development Permit.
- D. Draft Minutes from the Jan. 17, 2019 Planning Board hearing



City of Boulder Planning & Development Services

Floodplain Development Permit

Date Issued:

Expiration Date:

(Pursuant to Subsection 9-3-6(e), B.R.C. 1981)

Permit Number:

LUR2017-00045

Contact Information:

DONALD ASH, SCOTT, COX & ASSOCIATES
1530 55TH
BOULDER, CO 80303
(303) 444-3051

Project Information

Location:

816 ARAPAHOE AV

Legal Description:

W 45 FT OF E 175 FT OF LOT 1 & THAT PT LOT 10 LYING S OF W 45 FT OF E 175 FT OF LOT 1 NWLY OF GREGORY CREEK BLK 11 SMITHS TO WEST BOULDER

Description of Work:

JIMENEZ RESIDENCE SITE IMPROVEMENTS -- FLOODPLAIN REVIEW W/OUT ANALYSIS for a fence and a shed located within the regulatory conveyance zone.

Type of Floodplain Permit:

Floodplain Review Without Analysis

Creek Name(s):

Gregory

Flood Protection Elevation:

0

Conditions of Approval

Flood Vents

Provide flood openings that automatically equalize the hydrostatic flood forces in accordance with section 9-3-3(a)(11)(B) of the BRC, and the floodplain development permit that was issued for this project.

Improvements per Submitted Plan

Improvements shall be constructed in accordance with the plans submitted as part of the permit application.

Fence and Shed Must be Anchored

The fence and shed shall be securely anchored to resist damage and washing away as debris during flooding events.

Site Inspection Required

The applicant shall obtain a site inspection and approval from the City of Boulder Floodplain and Wetlands Administrator prior to final building inspection.

No change to Grade Permitted

Construction activities must not change existing grades.

Floodplain Development Permit

Engineer's Certification

Certification by a Colorado Registered Professional Engineer that the development has been completed in compliance with the approved permit application and that all conditions have been fulfilled must be submitted to the City of Boulder prior to scheduling the final flood inspection. A Letter of Completion will not be issued for any structure where this provision has not been satisfied.

Inspections

To request an inspection, visit <https://energovcss.bouldercolorado.gov>. Log into your account and find the case number under "My Permits". Inspections can be requested from within the permit. For inspection scheduling related questions, call 303-441-4088.

Engineers Certification

Final Floodplain



SCOTT, COX & ASSOCIATES, INC.

consulting engineers • surveyors

June 19, 2017

Mr. Jose L. Jimenez
816 Arapahoe Avenue
Boulder, CO 80301

Reference: Floodplain Development Permit
816 Arapahoe Avenue – Boulder, Colorado
Scott, Cox & Associates Inc. Project No. 17324

Dear Mr. Jimenez:

Scott, Cox & Associates, Inc. (SCA) has reviewed the floodplain development permit requirements for the site improvements located at 816 Arapahoe Avenue, in Boulder, Colorado. This letter has been prepared based on our site meeting on January 27, 2017 and the Notice and Order issued by the City of Boulder dated September 1, 2016.

The work for the site included the removal and replacement of an existing fence that was located along the east side of the site, adjacent to Gregory Canyon Creek. The work also included the construction of a storage shed located at the north east corner of the existing residence.

Based on the FEMA Flood Insurance Rate Map (FIRM) - Map Number 08013C0393 J dated December 18, 2012, the entire site is located within Zone AE "Areas Inundated by the 100-year Flood". Furthermore, the City of Boulder's High Hazard and Conveyance Zone Mapping show that portions of the site are located within the High Hazard and Conveyance Zones. Copies of the relevant FEMA Firm and the City's High Hazard/Conveyance Zone Maps have been attached to this letter.

The exterior site improvements included a new fence and storage shed. The fence was constructed to replace an existing fence that was deteriorated. The shed will be designed with flood vents to allow for the passage of flood waters. The fence and shed will be designed to resist the associated flood forces.

In addition to the floodplain considerations, the building and site improvements are subject to the conveyance zone regulations.

The fence has been built to replace an existing deteriorated fence. The fence has been designed to be parallel to the direction of flow. This will allow the conveyance flow to continue through the site unimpeded. Therefore, the

Mr. Jose L. Jimenez

June 19, 2017

Page 2 of 3

replacement fence will not decrease the conveyance capacity of Gregory Canyon Creek adjacent to the site.

The new storage shed is located adjacent to the existing residential structure, at the northeast corner of the site. The National Flood Insurance Program allows for minor improvements to be located within the conveyance shadow of the existing buildings. This flood shadow is defined as being the upstream shadow of the building at a 1:1 ratio and the downstream shadow at a 4:1 shadow. The site plan shows the limits of the conveyance shadow.

We have reviewed the site plans, the regulatory floodplain model and the historical topographic information for the site. The storage shed is located within the conveyance shadow and is in a hydraulically ineffective flow area. Building improvements on both the left and right overbank areas adjacent to the site generally prohibit conveyance in the upland areas.

There is a section of fence along the south side of the site that runs east-west and perpendicular to the direction of flow. This fence is, for the most part, located outside of the conveyance zone and within the upstream shadow of the garage and studio structures. The eastern half of the fence is located within the conveyance zone but is generally in a hydraulically ineffective flow area. We feel that the fence will not negatively affect the floodway. In order to increase conveyance, if required, this section of fence could be designed with openings at the bottom or a break away panel that would allow floodwaters to pass underneath of the fence. We could explore this option with Staff should the situation arise.

In conclusion, we feel that the minor work that was completed at the site will not alter the alignment or elevations of the flood channel, and will therefore not impact upstream or downstream properties. Therefore, there is no measurable decrease in the flood conveyance capacity of the Gregory Canyon Creek floodway at the site and will not result in a rise in the elevation of the 100-year flood.

Mr. Jose L. Jimenez
June 19, 2017
Page 3 of 3

Should you have any questions or comments, kindly give us a call.

Sincerely,

SCOTT, COX & ASSOCIATES, INC.



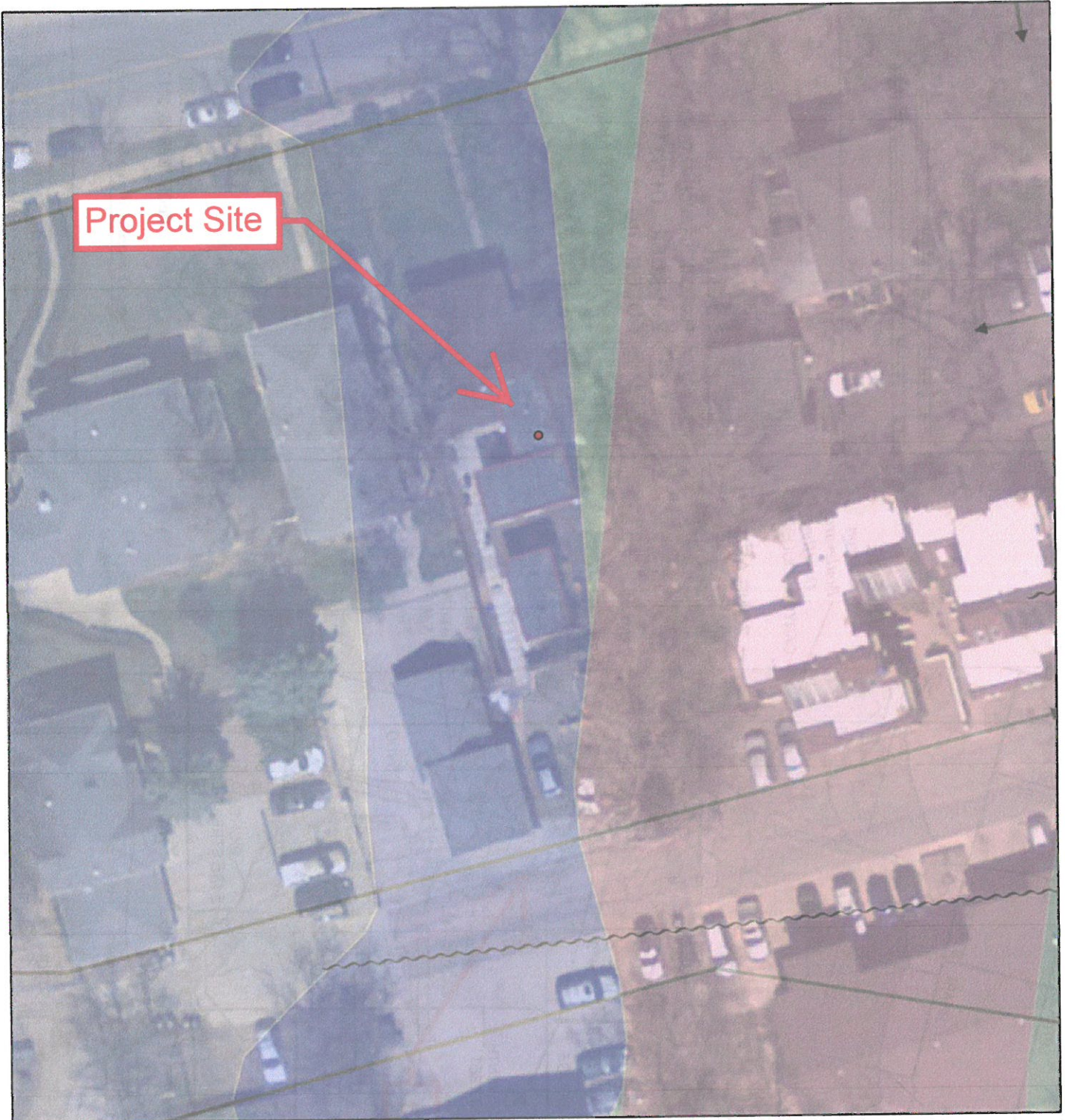
Donald P. Ash, P.E.
Chief Civil Engineer










Enclosures: Floodplain Development Application Form
FEMA FIRM Map Number 08013C0393 J dated December 18, 2012
City of Boulder GIS Flood Mapping
Floodplain Development Permit Site Plan
Response to the City's 15 Floodplain Impact Factors

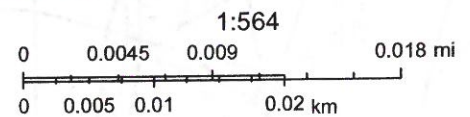


816 Arapahoe Avenue

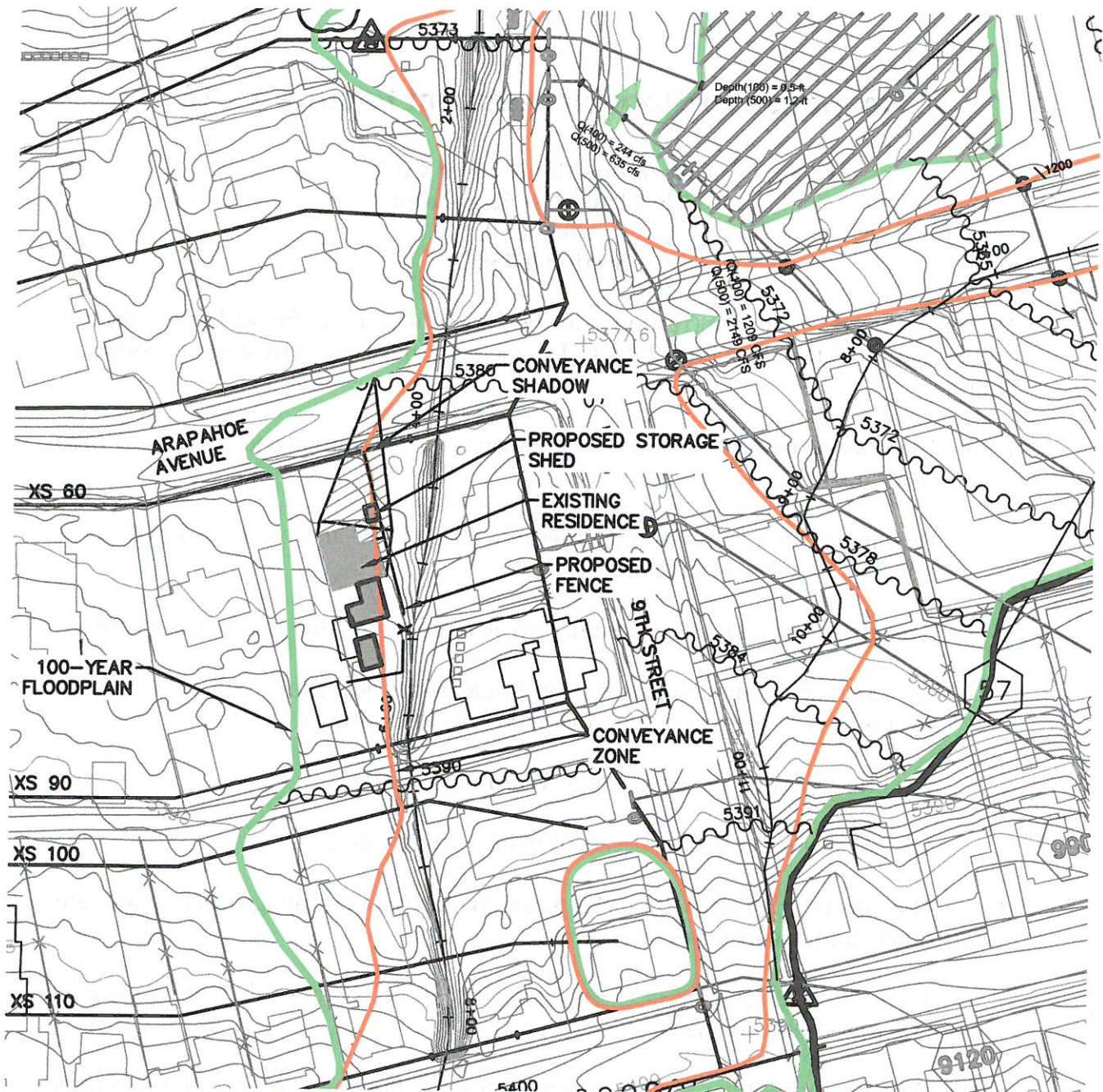


June 14, 2017

- | | | | |
|---|-----------------------|---|--------------------|
|  | City Limits |  | FEMA 100 Year Zone |
|  | FEMA BFE |  | FEMA 500 Year Zone |
|  | FEMA Cross Sections | | |
|  | City High Hazard Zone | | |
|  | City Conveyance Zone | | |

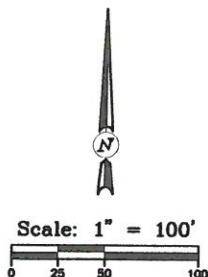


City of Boulder, Colorado
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors



1 SITE PLAN

SCALE: 1" = 100'



**816 ARAPAHOE AVENUE
BOULDER, COLORADO**



SCOTT, COX & ASSOCIATES, INC.
consulting engineers • surveyors
1530 55th Street • Boulder, Colorado 80303
(303) 444 - 3051

6/15/17

JOB NO. 17324

DRAWING NO. 17324-1

Response to Floodplain Impact Factors 1 - 15

**City of Boulder Revised Code
Title 9 Land Use Regulations
Chapter 9
Section 9-3-6(C)**

The following is a line item response to the City's fifteen (15) Flood Impact Factors outlined in the B.R.C. Section 9-3-6(C). The factors are listed below with responses in italics.

1. The effects upon the efficiency or capacity of the conveyance zone and high hazard zone;

The efficiency or capacity of the conveyance zone and the high hazard zone will not be reduced by the proposed improvements.
2. The effects upon lands upstream, downstream, and in the immediate vicinity;

The lands upstream, downstream, and in the immediate vicinity will not be affected because the 100-year water surface elevations will not increase.
3. The effects upon the one hundred year flood profile;

The 100-year water surface elevations in the vicinity will not change.
4. The effects upon any tributaries to the main stream, drainage ditches, and any other drainage facilities or systems;

There will be no significant effects on any tributaries, drainage ditches, or any other drainage facilities or systems.
5. Whether additional public expenditures for flood protection or prevention will be required;

No additional public expenditures for flood protection or prevention will be required.
6. Whether the proposed use is for human occupancy;

The proposed structures are not for human occupancy.

7. The potential danger to persons upstream, downstream, and in the immediate vicinity;

The proposed improvements will not increase the likelihood of materials being swept downstream. The potential danger to persons in the project vicinity will not increase.

8. Whether any proposed changes in a watercourse will have an adverse environmental effect on the watercourse, including, without limitation, stream banks and streamside trees and vegetation;

The project will not create any changes in the watercourse and therefore will have no environmental impact on the watercourse. The stream banks, and streamside trees and vegetation will not be affected by the proposed improvements.

9. Whether any proposed water supply and sanitation systems and other utility systems can prevent disease, contamination, and unsanitary or hazardous conditions during a flood;

There are not utilities planning for this project.

10. Whether any proposed facility and its contents will be susceptible to flood damage and the effect of such damage;

The proposed structures will not be susceptible to flood damage.

11. The relationship of the proposed development to the Boulder Valley Comprehensive Plan and any applicable floodplain management programs;

The proposed project does not conflict with the Boulder Valley Comprehensive Plan.

12. Whether safe access is available to the property in times of flood for ordinary and emergency vehicles;

The safety of access to the property in times of flooding will be unaffected by the proposed improvements.

13. Whether the applicant will provide flood warning systems to notify floodplain occupants of impending floods;

The applicant has no plans to install a flood warning system.

14. Whether the cumulative effect of the proposed development with other existing and anticipated uses will increase flood heights; and

The 100-year flood heights will not be raised.

15. Whether the expected heights, velocities, duration, rate of rise, and sediment transport of the floodwaters expected at the site will adversely affect the development or surrounding property.

The surrounding property will be unaffected by the proposed improvements because the proposed improvements will not measurably effect flood heights.



SCOTT, COX & ASSOCIATES, INC.

consulting engineers • surveyors

September 27, 2018

Ms. Alysha Geiger
City of Boulder
1739 Broadway, Third Floor
P.O. Box 791
Boulder, CO 80306

Reference: Floodplain Development Permit – Comment Response Letter
Jimenez Residence Site Improvements – LUR2017-00045
816 Arapahoe Avenue – Boulder, Colorado
Scott, Cox & Associates Project No. 17325

Dear Ms. Geiger:

The following is a line item response to the City of Boulder's review comments dated July 7, 2018 for the above referenced project. The comments are listed below with responses in italics. Please let us know if you have any questions or need any further clarification regarding these issues.

II. CITY REQUIREMENTS

Fees

A resubmittal fee of \$175 will be required prior to review of the revised application materials.

The resubmittal fee has been included with this resubmittal.

Flood Control Alysha Geiger, 303-441-4053

1. Please provide details showing how fence and shed will be properly anchored to prevent flotation, collapse, or lateral movement and be capable of resisting hydrostatic and hydrodynamic loads, section 9-3-3(a)(2)(B) of the Boulder Revised Code, 1981.

The flood loadings have been calculated for both the shed and the fence. The associated details, with supporting engineering calculations, have been included with this resubmittal.

2. In accordance with section 9-3-3(a)(18)(B), B.R.C., at least one square inch of opening is required for every square foot of enclosed space for the shed. The bottom of each flood opening is to be located no higher than 1 foot above the higher of the final interior or exterior grades under the opening, refer to FEMA's Technical Bulletin 1 for guidance. Provide design sheets for the

Ms. Alysha Geiger
City of Boulder
September 27, 2018
Page 2 of 3

shed and show the location and sizes of the flood openings on the building drawings, including the elevation of the openings to verify that they are located below the flood protection elevation and no more than one foot above grade.

The required flood openings have been shown on the attached building elevations.

3. On the south side of the site there is part of the fence that is perpendicular to flow in the conveyance zone. Please provide a fence design that allows flood waters, to a depth of at least the base flood elevation, to pass through.

We have included a proposed fence design that allows flood waters to pass through. A hinged panel system has been designed, which will float with the rising flood waters. This will allow water to pass underneath of the fence to a depth at the base flood elevation.

4. This floodplain development permit cannot be approved until a site plan is provided that complies with the Zoning comment below.

The BOZA Setback Variance has been approved.

Zoning Robbie Wyler, 303-441-3130

1. Provide a site plan showing compliance with CPL2016-00849 including but not limited to ensuring the shed meets required setbacks for accessory structures in the RMX-1 zoning district and the fence fully meets BRC Section 9-9-15 "Fence & Wall" standards. Dimension all setbacks on the site plan.

The BOZA Setback Variance has been approved. The Site Plan has been updated to show the required setbacks and maintenance easement on the adjacent property.

Ms. Alysha Geiger
City of Boulder
September 27, 2018
Page 3 of 3

Should you have any questions or comments regarding this letter, kindly give us a call.

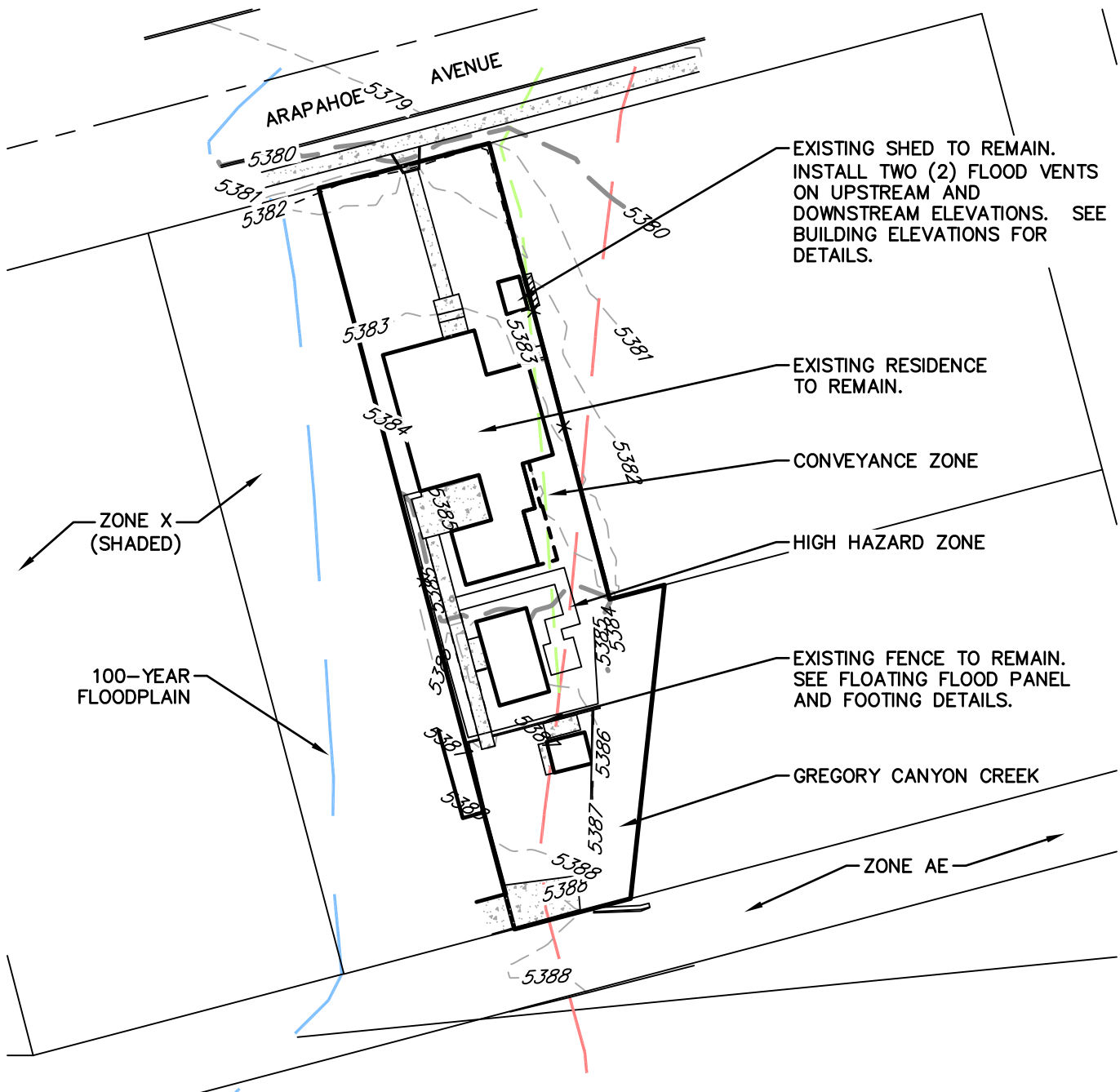
Sincerely,

SCOTT, COX & ASSOCIATES, INC.

A handwritten signature in black ink, appearing to read 'Donald P. Ash', with a large, sweeping loop at the end.

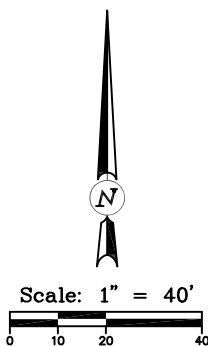
Donald P. Ash, P.E.
Chief Civil Engineer

Enclosures: FDP Site Plan and Details
Pivoting Fence Details
Flood Loading Calculations
Fence Loading Calculations
Shed Loading Calculations



1 SITE PLAN

SCALE: 1" = 40'



**816 ARAPAHOE AVENUE
BOULDER, COLORADO**

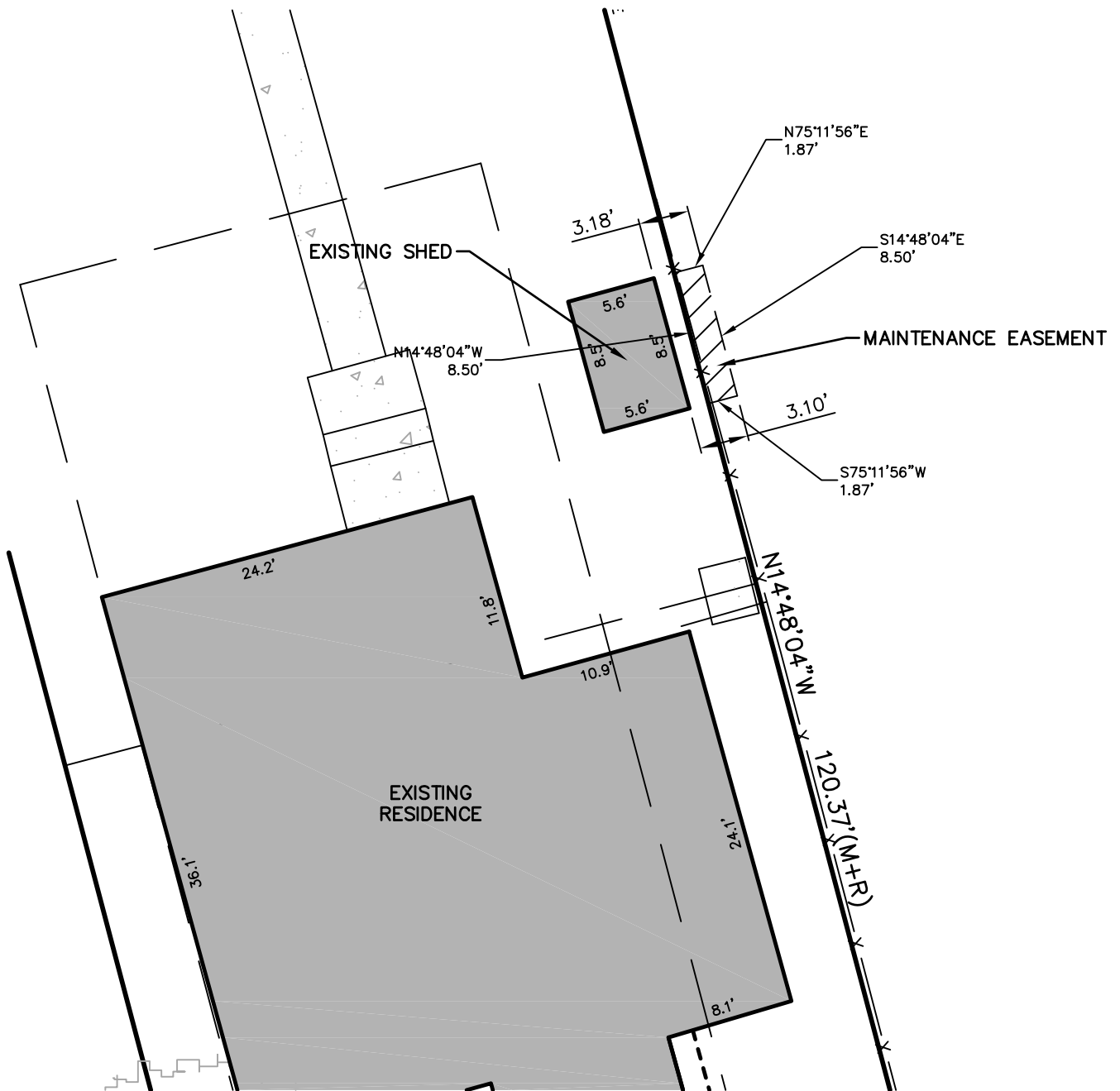


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9/28/18

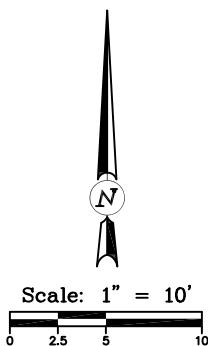
JOB NO. 17325

DRAWING NO. 17325A-1



1 SHED DETAIL

SCALE: 1" = 10'



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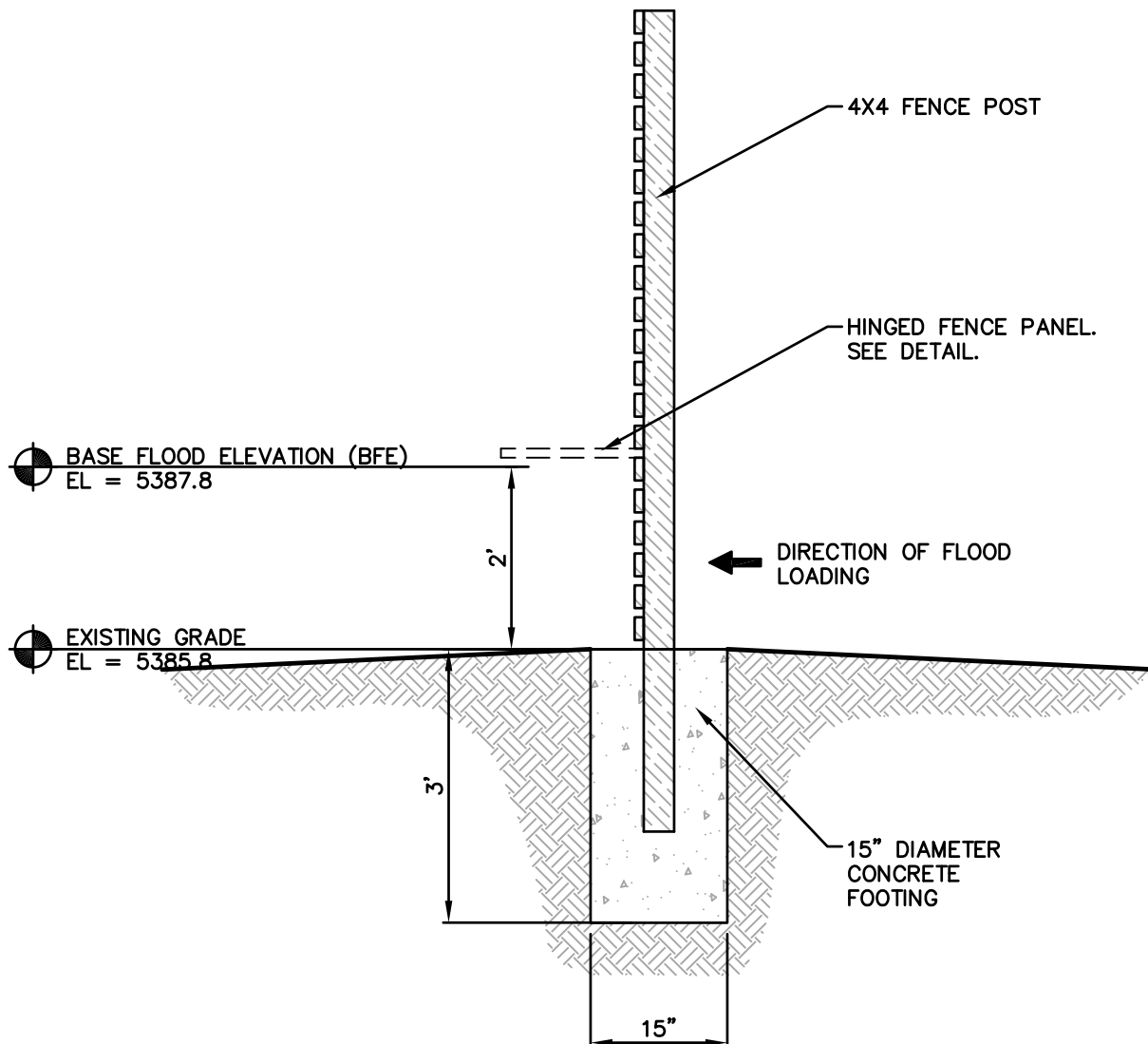


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JOB NO. 17325

DRAWING NO. 17325A-1



1 FENCE POST DETAIL

SCALE: 1/2" = 1' - 0"

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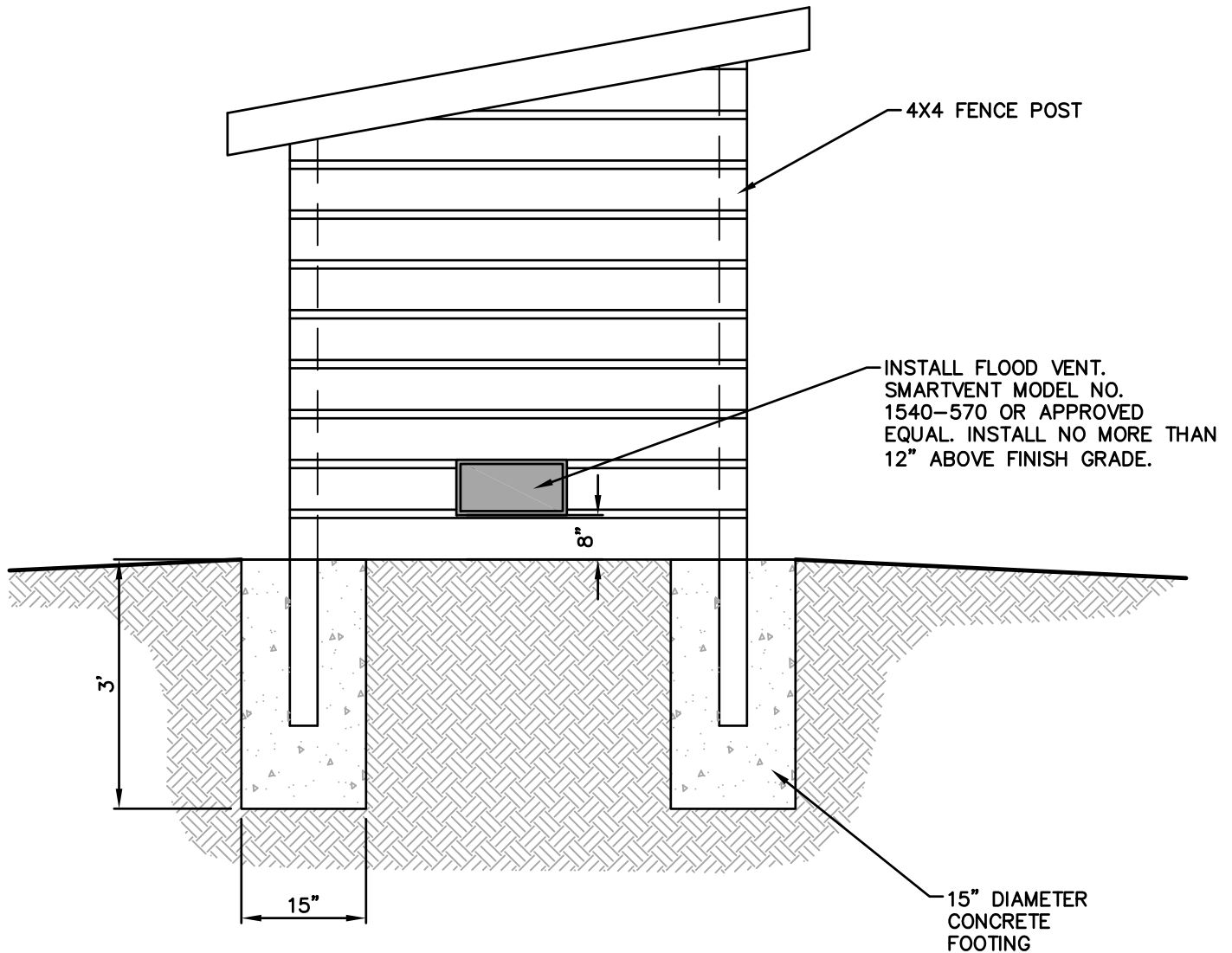


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DRAWING NO. 17325A-1



1 NORTH ELEVATION

SCALE: 1/2" = 1' - 0"

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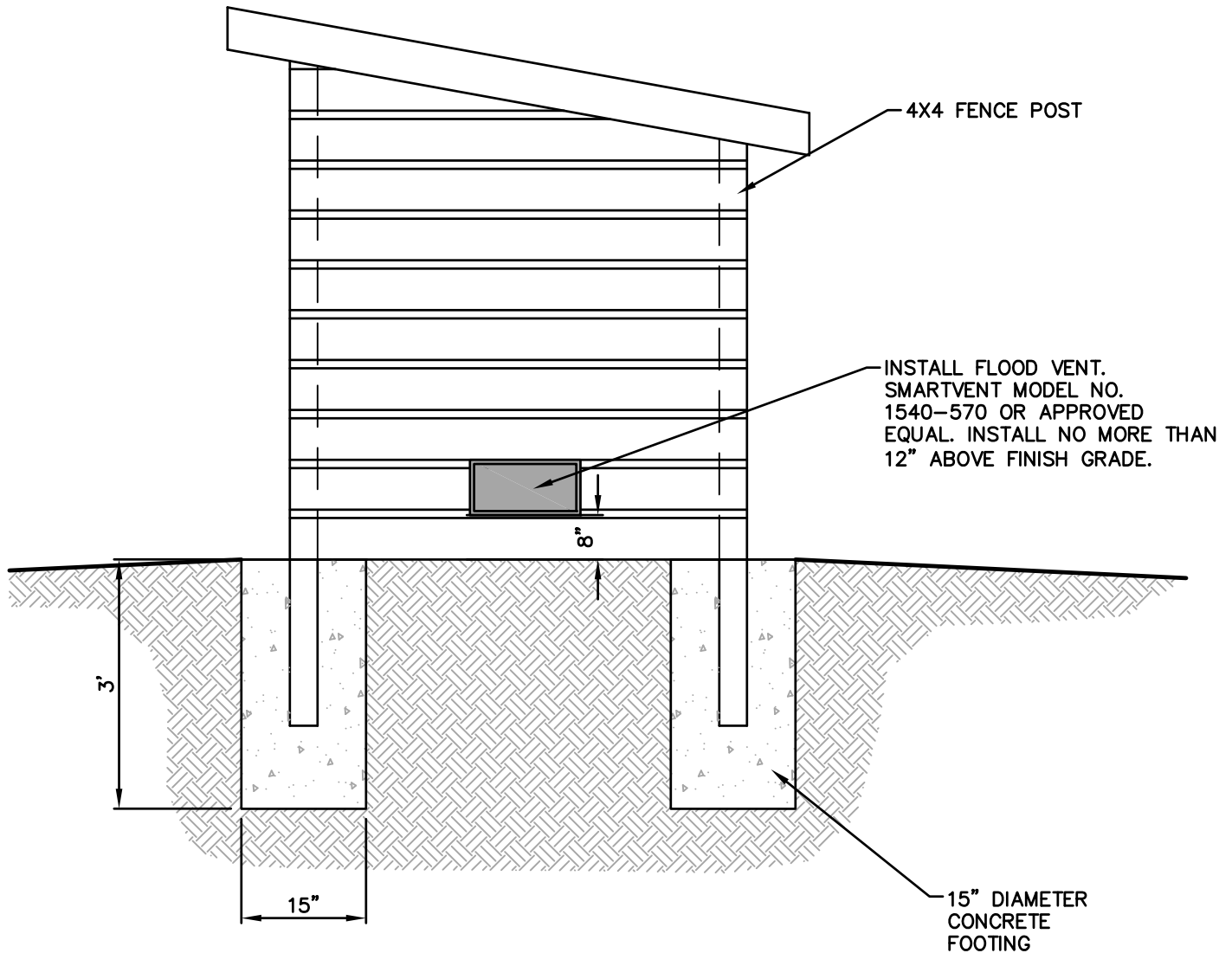


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DRAWING NO. 17325A-1



SOUTH ELEVATION

1

SCALE: 1/2" = 1' - 0"

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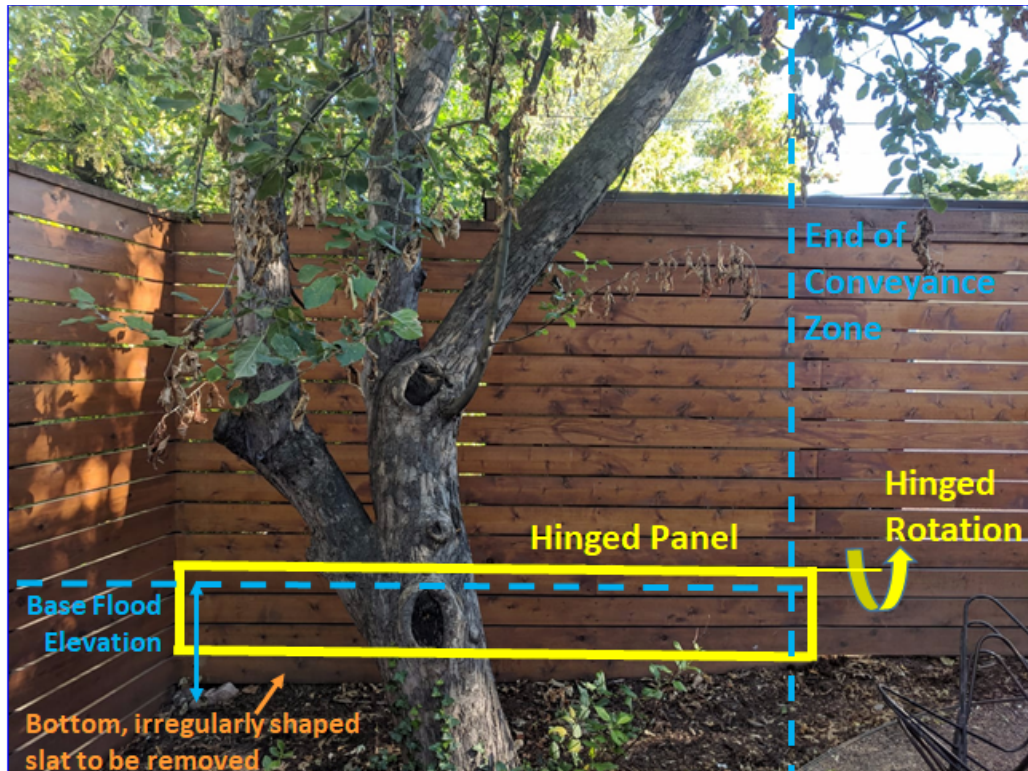
JOB NO. 17325

DRAWING NO. 17325A-1

Design of a flotation system for the part of the fence that is perpendicular to the flow of water within the conveyance zone at 816 Arapahoe.

To meet the requirement of allowing unrestricted flow of flood waters in the conveyance zone up to the base flood elevation, the fence will be modified as shown in the figure below:

- A hinged panel will be installed over the height of 3 fence slats, and will be fitted with marine-grade foam for buoyancy (further details below). The panel will rotate out of the way in case of flood, allowing flood waters to pass.
- The bottom, irregular slat will be removed

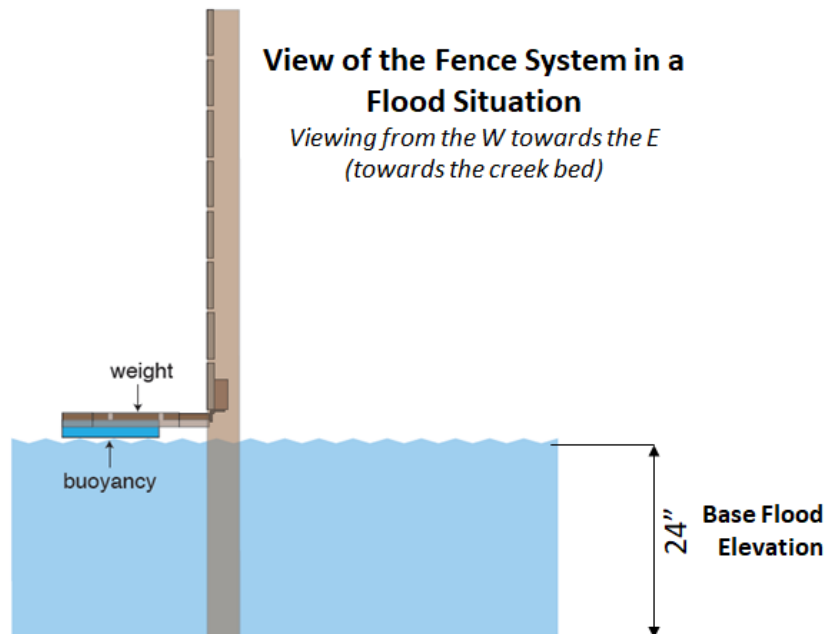
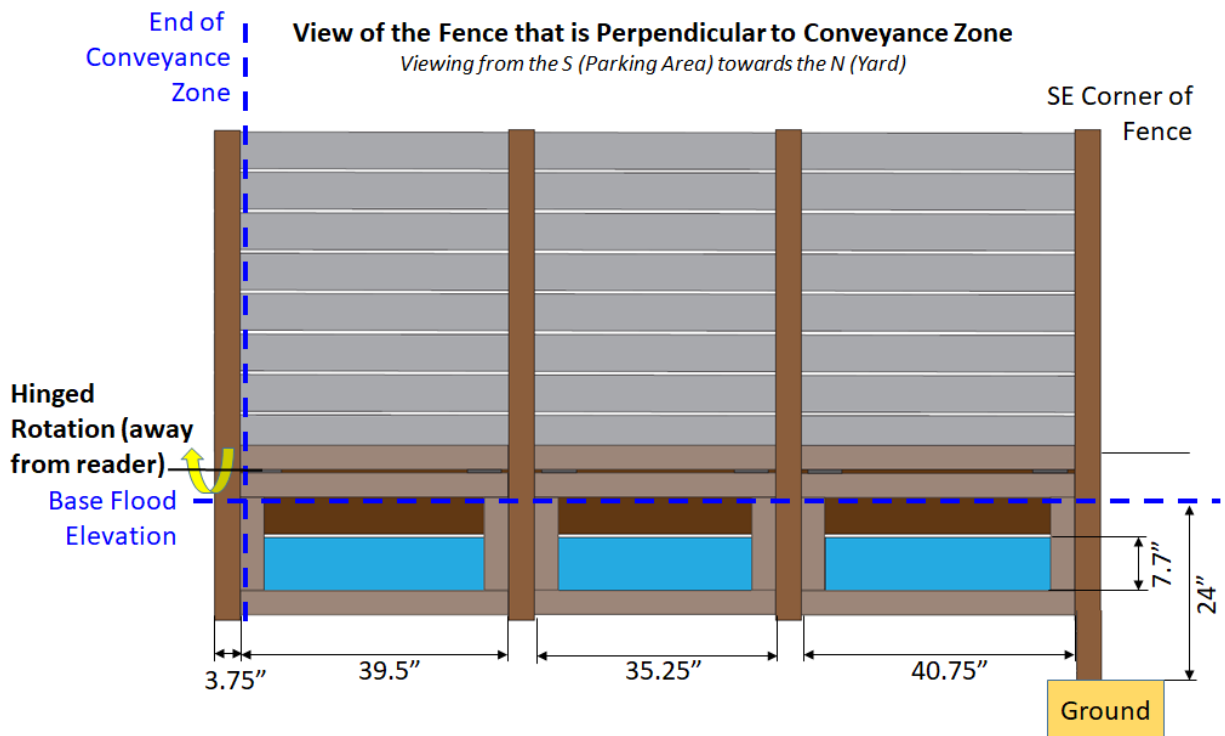


Basic design parameters:

- The height of the base flood elevation above the ground elevation is 2 ft at the SE corner and less towards the West (5387.8 ft for BFE at that point, vs. 5385.8 ft for the ground elevation). Therefore we take 2 ft as the design height. This corresponds to less than the height of the first 4 horizontal cedar fence slats (2ft 4"). We therefore take 4 slats as the design opening. The bottom slat is irregular and will be removed. The other 3 slats will hinge away per the design below.
- The length of fence that needs to be modified so that it can pivot and float above the flood water is 10 ft 4.8", as measured from the location of the fence and the conveyance zone on the survey of the property (submitted with this flood permit application). This corresponds to a bit less than the space between 4 existing posts, which is 10 ft 10.5".

Description of the System Design

The design for the system is shown below. Hinges will be mounted on a newly constructed frame (light brown in drawing below) from the same kiln-dried western red cedar material as the fence, and will support the horizontal fence slats (dark brown). The hinges will allow the fence to open in case of flood water flow. Marine-grade extruded polystyrene (EPS) foam (blue) will be attached to the bottom part, to provide buoyancy for the system to float on top of the flood waters.



Calculation of the weight of wood to be lifted:

- Wood volume
 - Fence slats: 128.6" long x 5.375" tall x 0.75" thick x 3 slats = 1556 in³ = 0.90 ft³
 - Support structure: 334" long x 3.5 thick x 1.75 deep = 1415 in³ = 0.82 ft³
 - Total wood volume: 1.72 ft³
- Wood density of 23 lb/ft³ for kiln-dried western red cedar from https://www.engineeringtoolbox.com/weight-wood-d_821.html
- Wood weight: 1.72 ft³ x 23 lb/ft³ = 39.5 lbs

Calculation of the buoyancy provided by the foam

- Foam volume: 115.5" long x 7.7" high x 2" thick = 1779 in³ = 1.03 ft³
- Buoyancy of foam per unit volume = 60 lb/ft³, from <http://www.harborfoam.com/floatation.php>
- Total buoyancy provided by the foam = 1.03 ft³ x 60 lb/ft³ = 62 lbs
 - Thus the buoyancy of the foam is 1.56 times the weight of the wood to be supported, and the system will float on the flood waters as needed.

Hinges to be used

We will use six (6) hinges (4.5 in. x 4.5 in. Full Mortise Heavy Weight Ball Bearing Steel Hinges) that are strong enough to resist the forces acting on the panels during a flood.

<https://www.homedepot.com/p/GLOBAL-DOOR-CONTROLS-4-5-in-x-4-5-in-Full-Mortise-Heavy-Weight-Ball-Bearing-Steel-Hinge-Satin-Chrome-CPH4545BB-26D/306352802>

SCOTT, COX & ASSOCIATES, INC.
consulting engineers - surveyors

Project No.: **17325**
Date: **10/1/2018**
By: **Dash**

HYDRAULIC FLOOD LOADINGS

Per FEMA Technical Bulletin 3-93

| <u>Hydrodynamic Loading</u> | | | |
|---|----------------------------|----------------|--|
| Drag Coefficient (Cd) = | 1.25 | | |
| Mass density of water (m) = | 1.94 slugs/ft ³ | | |
| Velocity of the water (V) = | 4 ft/s | (Conservative) | |
| Water Surface Elevation (WSEL) = | 5387.80 ft | | |
| Base Flood Elevation (BFE) = | 5387.80 ft | | |
| Existing Grade Elevation (EG) = | 5385.80 ft | | |
| Area of Vertical Surface (A) = | 2.00 ft ² | | |
| $F_h = C_d m \frac{1}{2} V^2 A_v =$ | <u>39</u> lbs/LF | @ 1/3 H | |
| <u>Hydrostatic Loading</u> | | | |
| Specific Weight of Water (w) = | 62.4 pcf | | |
| Water Surface Elevation (WSEL) = | n/a ft | | |
| Base Flood Elevation (BFE) = | n/a ft | | |
| Existing Grade Elevation (EG) = | n/a ft | | |
| Height (H) = | n/a ft | | |
| Equivalent Soil Pressure for Saturated Backfill (S) = | 82 pcf | | |
| Depth of Saturated Soil (D) = | 0 ft | | |
| $F_h = \frac{1}{2} w H^2 =$ | <u>0</u> lbs | @ H | |
| $F_{sat} = \frac{1}{2} S D^2 + F_h =$ | <u>0</u> lbs | @ H | |
| <u>Normal Impact Loading</u> | | | |
| Weight of the Object (W) = | 1,000 lbs | | |
| Velocity of the water (V) = | 4 ft/s | (Conservative) | |
| Acceleration due to gravity (g) = | 32.2 ft/s ² | | |
| Duration of Impact (t) = | 1 sec | | |
| $F_i = WV/(gt) =$ | <u>124</u> lbs | @ H | |
| <u>Special Impact Force</u> | | | |
| $F_h =$ | <u>100</u> plf | @ H | |
| <u>Saturated Soil Pressure</u> | | | |
| Per FEMA 259 Section 4.1.2.4 | | | |
| Equivalent Soil Pressure for Saturated Backfill (S) = | 82 pcf | | |

SCOTT, COX & ASSOCIATES, INC.
consulting engineers - surveyors

PROJECT #: 17325
DATE: 10/1/2018
BY: DPA

FENCE POST FOOTING - DESIGN FOR HYDRODYNAMIC FLOOD LOAD

Per 2012 IBC Eq 18-1 and FEMA Technical Bulletin 3-93

$$D = 0.5A * \{ 1 + [(4.36 * H) / A]^{1/2} \}$$

Where:

$$A = 2.34P/S_1 b$$

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet.

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet from ground surface to point of application of "P."

P = Applied lateral force in pounds.

S₁ = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf).

| | | |
|------------------|----------------|--|
| W = | 3.5 ft | (Post Spacing) |
| F _h = | 39 plf | (Hydrodynamic Flood Loading) |
| P = | 137 lbs | |
| S ₁ = | 400 psf | |
| b = | 1.25 ft | |
| A = | 0.64 | |
| H = | 2 ft | |
| h = | 0.66 ft | |
| <u>D =</u> | <u>1.00 ft</u> | <u>Minimum embedment depth</u> <u><3.0 ft OK</u> |

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PROJECT #: 17325
DATE: 10/1/2018
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FENCE POST FOOTING - DESIGN FOR IMPACT FLOOD LOAD

Per 2012 IBC Eq 18-1 and FEMA Technical Bulletin 3-93

$$D = 0.5A * \{ 1 + [(4.36 * H) / A]^{1/2} \}$$

Where:

$$A = 2.34P/S_1 b$$

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet.

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet from ground surface to point of application of "P."

P = Applied lateral force in pounds.

S₁ = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf).

$$P = 125 \text{ lbs} \quad (\text{Impact Flood Loading})$$

$$S_1 = 400 \text{ psf}$$

$$b = 1.25 \text{ ft}$$

$$A = 0.59$$

$$H = 2 \text{ ft}$$

$$h = 2 \text{ ft}$$

$$D = 1.42 \text{ ft}$$

Minimum embedment depth
<3.0 ft OK

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BY: DPA

FENCE POST BENDING - DESIGN FOR IMPACT FLOOD LOAD

$$M = P H$$

Where:

| | | |
|--------------------|------------|----------------------------|
| P = | 125 lbs | (Impact Flood Loading) |
| H = | 2 ft | (Height of Impact) |
| M = | 250 ft-lbs | (Maximum Moment) |
| $\sigma_{allow} =$ | 1,200 psi | (Allowable Bending Stress) |

$$\sigma_b = M / S$$

$$S = d^3 / 6$$

| | | |
|-----|----------------------|------------------------------|
| d = | 3.5 in ³ | (Width of 4x4) |
| S = | 7.15 in ³ | (Section Modulus - 4x4 Post) |

| | | |
|--------------|-----------|--|
| $\sigma_b =$ | 34.99 psi | <u>Maximum bending stress</u> <u><allowable stress 1,200 psi. Therefore, OK.</u> |
|--------------|-----------|--|

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consulting engineers - surveyors

PROJECT #: 17325
DATE: 10/1/2018
BY: DPA

SHED POST FOOTING - DESIGN FOR HYDRODYNAMIC FLOOD LOAD

Per 2012 IBC Eq 18-1 and FEMA Technical Bulletin 3-93

$$D = 0.5A * \{ 1 + [(4.36 * H) / A]^{1/2} \}$$

Where:

$$A = 2.34P/S_1 b$$

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet.

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet from ground surface to point of application of "P."

P = Applied lateral force in pounds.

S₁ = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf).

| | | |
|------------------|----------------|--|
| W = | 2.8 ft | (Post Spacing) |
| F _h = | 39 plf | (Hydrodynamic Flood Loading) |
| P = | 109 lbs | |
| S ₁ = | 400 psf | |
| b = | 1.25 ft | |
| A = | 0.51 | |
| H = | 2 ft | |
| h = | 0.66 ft | |
| <u>D =</u> | <u>0.86 ft</u> | <u>Minimum embedment depth</u> <u><3.0 ft OK</u> |

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SHED POST FOOTING - DESIGN FOR IMPACT FLOOD LOAD

Per 2012 IBC Eq 18-1 and FEMA Technical Bulletin 3-93

$$D = 0.5A * \{ 1 + [(4.36 * H) / A]^{1/2} \}$$

Where:

$$A = 2.34P/S_1 b$$

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet.

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet from ground surface to point of application of "P."

P = Applied lateral force in pounds.

S₁ = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf).

$$P = 125 \text{ lbs} \quad (\text{Impact Flood Loading})$$

$$S_1 = 400 \text{ psf}$$

$$b = 1.25 \text{ ft}$$

$$A = 0.59$$

$$H = 1.5 \text{ ft}$$

$$h = 1.5 \text{ ft}$$

$$D = 1.27 \text{ ft}$$

Minimum embedment depth
<3.0 ft OK

SCOTT, COX & ASSOCIATES, INC.
consulting engineers - surveyors

PROJECT #: 17325
DATE: 10/1/2018
BY: DPA

SHED POST BENDING - DESIGN FOR IMPACT FLOOD LOAD

$$M = P H$$

Where:

P = 125 lbs (Impact Flood Loading)

H = 1.5 ft (Height of Impact)

M = 188 ft-lbs (Maximum Moment)

$\sigma_{allow} = 1,200$ psi (Allowable Bending Stress)

$$\sigma_b = M / S$$

$$S = d^3 / 6$$

d = 3.5 in³ (Width of 4x4)

S = 7.15 in³ (Section Modulus - 4x4 Post)

$\sigma_b = 26.24$ psi **Maximum bending stress**
<allowable stress 1,200 psi. Therefore, OK.

The application has to meet the intent of the floodplain regulations prescribed by [Section 9-3-2\(a\), B.R.C. 1981](#):

Legislative Intent: The purpose of this chapter is to regulate certain areas of the city subject to flooding in order to protect the public health, safety, and welfare by:

1. Restricting or prohibiting certain uses that are hazardous to life or property in time of flood;
2. Restricting the location of structures intended for human occupancy and regulating the manner in which such structures may be built in order to minimize danger to human life within and around such structures;
3. Requiring that those structures allowed in the floodplain be expanded or enlarged, and equipment and fixtures be installed or replaced, in a manner designed to prevent their being washed away and to assure their protection from severe damage;
4. Regulating the method of construction and replacement of water supply and sanitation systems in order to prevent disease, contamination, and unsanitary conditions;
5. Maintaining for public inspection available maps delineating areas subject to such provisions in order to protect individuals from purchasing or using lands for purposes that are not suitable;
6. Protecting and preserving the water-carrying and water-retention characteristics and capacities of watercourses used for conveying and retaining floodwaters; and
7. Obtaining and maintaining the benefits to the community of participating in the National Flood Insurance Program.

In considering whether the intent prescribed by Section 9-3-2(a), B.R.C. 1981, has been met, the following factors are considered:

Section 9-3-6 "Floodplain Development Permits" Criteria:

1. **The effects upon the efficiency or capacity of the conveyance zone and high hazard zone;**
The efficiency or capacity of the conveyance zone and the high hazard zone will not be reduced by the proposed improvements. The fence along the east side of the property is parallel to the direction of flow which will allow the conveyance flow to continue through the site unimpeded. The portion of the fence south of the structure is perpendicular to the direction of flow but has been designed to allow 100-year flood water pass underneath the fence.
2. **The effects upon lands upstream, downstream, and in the immediate vicinity;**
The lands upstream, downstream, and in the immediate vicinity will not be affected because the 100-year water surface elevations will not increase.
3. **The effects upon the one hundred-year flood profile;**
The 100-year water surface elevations in the vicinity will not change.

4. **The effects upon any tributaries to the main stream, drainage ditches, and any other drainage facilities or systems;**
There will be no significant effects on any tributaries, drainage ditches, or other drainage facilities or systems.
5. **Whether additional public expenditures for flood protection or prevention will be required;**
No additional public expenditures for flood protection or prevention will be required.
6. **Whether the proposed use is for human occupancy;**
The project does not propose any new structures intended for human occupancy.
7. **The potential danger to persons upstream, downstream, and in the immediate vicinity;**
The proposed improvements will not increase the likelihood of materials being swept downstream. The fence has been designed to withstand flood forces. The potential danger to persons in the project vicinity will not increase.
8. **Whether any proposed changes in a watercourse will have an adverse environmental effect on the watercourse, including, without limitation, stream banks and streamside trees and vegetation;**
The project will not create any changes in the watercourse and therefore will have no environmental impact on the watercourse. The stream banks, and streamside trees and vegetation will not be affected by the proposed improvements.
9. **Whether any proposed water supply and sanitation systems and other utility systems can prevent disease, contamination, and unsanitary or hazardous conditions during a flood;**
There are no utilities planned for this project.
10. **Whether any proposed facility and its contents will be susceptible to flood damage and the effect of such damage;**
The fence is located within the conveyance and high hazard zones of Gregory Creek. This area is intended to convey flows in the event of a flood. The fence has been designed to pass flood waters during a flood event and anchored to withstand flood forces.
11. **The relationship of the proposed development to the Boulder Valley Comprehensive Plan and any applicable floodplain management programs;**
The proposed project does not conflict with the Boulder Valley Comprehensive Plan.
12. **Whether safe access is available to the property in times of flood for ordinary and emergency vehicles;**
The safety of access to the property in times of flooding will be unaffected by the proposed improvements.
13. **Whether the applicant will provide flood warning systems to notify floodplain occupants of impending floods;**
No additional warning systems have been proposed and no additional occupants have been added to the floodplain by this project.

14. Whether the cumulative effect of the proposed development with other existing and anticipated uses will increase flood heights; and

The 100-year flood heights will not increase.

15. Whether the expected heights, velocities, duration, rate of rise, and sediment transport of the floodwaters expected at the site will adversely affect the development or surrounding property.

The surrounding properties will be unaffected by the proposed improvements because the proposed improvements will not measurably effect flood heights, velocities, duration, rate of rise and sediment transport.

Considering the above findings, staff finds that the project overall meets the intent of the floodplain regulations prescribed by [Section 9-3-2\(a\)](#), B.R.C. 1981.

Section 9-3-3 "Regulations Governing the One Hundred-Year Floodplain" Criteria:

1. Floodplain Development Permit: Except as specified in [Subsection 9-3-6\(a\)](#), "Activities Exempt from Floodplain Development Permit Requirement," B.R.C. 1981, no development in the one hundred-year floodplain may occur prior to the issuance of a floodplain development permit pursuant to [Section 9-3-6](#), "Floodplain Development Permits," B.R.C. 1981.

The applicant has applied for a Floodplain Development Permit (LUR2017-00045).

2. Anchoring:

- A. All new construction and substantial improvements or substantial modifications shall be anchored to prevent flotation, collapse, or lateral movement of the structure and be capable of resisting the hydrostatic and hydrodynamic loads.

The project has not proposed any new construction, substantial improvements or substantial modifications to existing structures. All proposed improvements have been designed to be anchored to prevent flotation, collapse, or lateral movement of the structure and be capable of resisting the hydrostatic and hydrodynamic loads.

- B. All manufactured homes must be elevated and anchored to resist flotation, collapse, or lateral movement and capable of resisting the hydrostatic and hydrodynamic loads. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties connecting to permanent ground anchors, in addition to any anchoring requirements for resisting wind forces and any tie-down requirements of Chapter 10-12, "Mobile Homes," B.R.C. 1981.

Requirements shall include, without limitation, the following:

- i. Over-the-top ties shall be provided at each of the four corners of the manufactured homes. For manufactured homes fifty feet or longer, two additional ties per side are required at intermediate locations. For manufactured homes less than fifty feet long, one additional tie per side is required;

- ii. Frame ties shall be provided at each of the four corners of the manufactured homes. For manufactured homes fifty feet or longer, five additional ties per side are required at intermediate points. For manufactured homes less than fifty feet long, four additional ties per side are required;
- iii. All components of the anchoring system shall be capable of carrying a force of four thousand eight hundred pounds; and
- iv. Any additions to manufactured homes shall be similarly anchored.

Not Applicable - The project has not proposed the placement of manufactured homes.

3. Construction Materials and Methods:

- A. All new construction, substantial improvements, and substantial modifications shall be constructed with materials and utility equipment resistant to flood damage as outlined in the most current FEMA Technical Document on Flood-Resistant Materials Requirements.

The replacement fence is in compliance with the requirements most current FEMA Technical Document on Flood Resistant Materials.

- B. All new construction, substantial improvements, and substantial modifications shall be constructed using methods and practices that minimize flood damage.

The replacement will be constructed using methods and practices that minimize flood damage.

- C. All new construction, substantial improvements, and substantial modifications shall be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and located (by elevating or floodproofing the components) so as to prevent water from entering or accumulating within the components during flooding conditions.

No new equipment has been proposed.

4. Utilities:

- A. All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the systems.
- B. All new and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the systems and discharge from the systems into floodwaters.
- C. On-site waste disposal systems shall be located to avoid impairment or contamination during flooding.

No new water supply systems have been proposed. No sanitation systems have been proposed.

5. Subdivision Proposals:

- A. All subdivision proposals shall demonstrate efforts to minimize flood damage.
- B. All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage.
- C. All subdivision proposals shall have adequate drainage provided to reduce exposure to flood damage.
- D. Base flood elevation data shall be provided for subdivision proposals and other proposed development.
- E. No subdivision proposal shall create a lot which is unbuildable pursuant to this section.

The project has not proposed a subdivision.

6. Floodproofing: Whenever this section requires a building or structure to be floodproofed, the standards in [Subsection 9-3-2\(h\)](#), "Floodproofing," B.R.C. 1981, shall be met.

The project has not proposed any new floodproofed buildings or structures.

7. Hazardous Substances: No person shall store a hazardous substance at or below the flood protection elevation for the area of the floodplain in which it is located, except for the storage of fuel in existing and replacement underground tanks in existing fueling service stations and service garages, which tanks are designed to prevent infiltration and discharge into floodwaters and which are adequately anchored and shielded against rupture. For purposes of this paragraph, *existing* means in place and in use on January 1, 1989.

The project has not proposed the storage of hazardous materials.

8. Automobile Parking: Notwithstanding other provisions of this title, no person shall establish an area for automobile parking in any portion of the floodplain where flood depths exceed eighteen inches.

No new automobile parking been proposed.

9. Flood Warning System: No owner of a hotel, a motel, a dormitory, a rooming house, a hostel, a school, a bed and breakfast, a daycare center, a group home, or a residential or congregate care facility located in the Boulder Creek one hundred-year floodplain shall fail to provide a flood warning system approved by the city manager that is connected to a point of central communication in the building with twenty-four-hour monitoring. No such person shall fail to maintain such a flood warning system.

The project is not located in the one hundred year floodplain of Boulder Creek. The project has not proposed a hotel, motel, dormitory, rooming house, hostel, school, bed and breakfast, daycare center, group home, or residential or congregate care facility.

10. **Rental Property:** No owner of property that is located in a one hundred-year floodplain and subject to a city rental license under Chapter 10-3, "Rental Licenses," B.R.C. 1981, shall fail to post on the exterior of the premises at the entrance a sign approved by the city manager stating that the property is subject to flood hazard and containing such further information and posted at such other locations inside the building as the city manager may require.

The project has not proposed a rental property.

11. **Manufactured Housing:** All manufactured homes placed in the city after July 1, 1989, and all manufactured homes which are substantially improved or substantially modified shall be elevated on a permanent foundation so that the lowest floor of the manufactured home is at or above the flood protection elevation and is securely anchored to an adequately anchored foundation system, and shall meet the anchorage and tie-down requirements of Paragraph (a)(2) of this section.

No manufactured homes are proposed.

12. **Recreational Vehicles:** In order to reduce debris and hazard potential, recreational vehicles shall either: a) be in the one hundred-year floodplain for fewer than one hundred eighty consecutive days, b) be fully licensed and ready for highway use, or c) meet the permit requirements and elevation and anchoring requirements for manufactured homes.

The project has not proposed recreational vehicles.

13. **Structure Orientation:** In order to minimize the obstruction to flow caused by buildings, to the extent consistent with other city policies regarding solar access, new structures shall be placed with their longitudinal axes parallel to the predicted direction of flow of floodwaters or be placed so that their longitudinal axes are on lines parallel to those of adjoining structures.

[Section 9-16](#) "Definitions" B.R.C. defines a structure as *a building or other roofed construction, a basement, a wall, a fence, a manufactured home, or a storage tank. (Floodplain)*

All structures within the proposed project have been oriented to minimize the obstruction of flow.

14. **Existing Uses:** The use of any land or structure that was lawful before the application of this section or any amendment thereto but that does not conform to the requirements of this section may be continued subject to the requirements of this section. If such a use not conforming to the requirements of this section is discontinued for twelve consecutive months, no person shall use the land or structure thereafter unless such use conforms to the requirements of this section.

Residential uses are allowable within the zone.

15. **New Uses:** All uses allowed by the underlying zoning district may be established, subject to the requirements of this section, except for the outdoor or uncontained storage of moveable objects below the flood protection elevation.

Residential recreation uses are allowable within the zone.

16. **Existing Structures:** Any structure in existence before the enactment of this section or any amendment thereto that does not conform to the requirements of this section may remain or may undergo rehabilitation subject to the requirements of this section.

Further, any such structure may be otherwise improved as follows:

- A. Any person making an expansion or an enlargement to an existing residential structure shall elevate the lowest floor, including the basement, of the expanded or enlarged portion to or above the flood protection elevation.
- B. Any person making an expansion or an enlargement to an existing nonresidential structure shall floodproof or elevate the lowest floor, including the basement, of the expanded or enlarged portion to or above the flood protection elevation except that any lodging units within the expanded or enlarged portion of such structure shall be elevated to or above the flood protection elevation.
- C. Any person making an expansion or an enlargement to an existing mixed-use structure shall floodproof or elevate the lowest floor, including the basement, of the expanded or enlarged portion to or above the flood protection elevation and shall elevate the residential lodging units within the expanded or enlarged portion to or above the flood protection elevation.
- D. Any person making a substantial modification or a substantial improvement to any existing nonresidential structure shall floodproof or elevate the lowest floor, including the basement, of the entire structure to or above the flood protection elevation except that any lodging units within the expanded or enlarged portion of such structure shall be elevated to or above the flood protection elevation.
- E. Any person making a substantial modification or a substantial improvement to any existing residential structure shall elevate the lowest floor, including the basement, of the entire residential structure to or above the flood protection elevation.
- F. Any person making a substantial modification or a substantial improvement to an existing mixed-use structure shall floodproof or elevate the lowest floor, including the basement, of the entire structure and shall elevate all residential and lodging units within the structure to or above the flood protection elevation.

The project has not proposed modifications to any existing structures that are residential structures, nonresidential structures, or mixed-use structures as defined in the Boulder Revised Code.

17. **New Structures:** Construction of new structures shall meet the following requirements:

- A. Any person constructing a new residential structure shall elevate the lowest floor, including the basement, to or above the flood protection elevation;

- B. Any person constructing a new mixed-use structure shall floodproof or elevate the lowest floor, including the basement, of the entire structure, and shall elevate all residential and lodging units within the structure to or above the flood protection elevation;
- C. Any person constructing a new nonresidential structure shall elevate all lodging units within the structure to or above the flood protection elevation and shall floodproof in a manner requiring no human intervention or elevate the lowest floor, including the basement, to or above the flood protection elevation with the following exceptions:
 - i. Open air carwashes;
 - ii. Unheated pavilions;
 - iii. Unfinished or flood-resistant building entryways or access areas;
 - iv. Garden storage sheds;
 - v. Sidewalks, paving, or asphalt, concrete, or stone flatwork;
 - vi. Fences; and
 - vii. Poles, lines, cables, or other transmission or distribution facilities of public utilities.
- D. Any person constructing a new structure on a property removed from the one hundred-year floodplain through a FEMA Letter of Map Revision Based on Fill (LOMR-F) shall protect the lowest floor, including the basement, to or above the flood protection elevation that existed before placement of fill, as follows:
 - i. Residential structures: by elevating the structure; or
 - ii. Nonresidential structures: by elevating or floodproofing the structure.Solely for the purposes of this Subparagraph (D), previously designated floodplain areas that have been removed from the one hundred-year floodplain through a LOMR-F shall be considered to be within the floodplain. No person shall construct a new structure subject to this Subparagraph (D) prior to the issuance of a floodplain development permit pursuant to [Section 9-3-6](#), "Floodplain Development Permits," B.R.C. 1981.

The project has not proposed any new structures that are residential structures, nonresidential structures, or mixed-use structures as defined in the Boulder Revised Code. The property has not been removed from the 100-year floodplain through a FEMA LOMR-F.

- 18. Enclosures: Enclosures below the lowest floor that are unfinished or flood resistant, usable solely for parking of vehicles, crawl spaces, building access or storage, in an area that is not a basement, and that are not floodproofed as set forth in this section shall meet the following requirements:
 - A. Compliance with the provisions of Paragraphs (a)(2), (a)(3), and (a)(4) of this section; and
 - B. Design and construction that automatically equalizes hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters.
 - i. Designs for meeting this requirement shall meet or exceed the following minimum criteria: a minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with

- screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.
 - ii. Any designs not in conformance with Subparagraph (B)i. above shall be certified by a registered professional engineer or licensed architect and shall conform with the most current FEMA Technical Bulletin on Openings in Foundation Walls.
- C. Fully enclosed areas below the lowest floor subject to this provision include the following:
- i. Residential garages placed at or above grade;
 - ii. Enclosures or vestibules that are attached to structures and that are utilized for storage or entryways;
 - iii. Crawl spaces; and
 - iv. Outdoor pavilions and patio enclosures with removable walls not located in the high hazard zone.

The project has not proposed any enclosures.

19. Below Grade Crawl Space Construction: New construction, expansion or enlargement, substantial improvement and substantial modification of any below grade crawl space shall meet the following requirements:
- A. Interior grade elevation that is below the base flood elevation shall be no lower than two feet below the lowest adjacent grade;
 - B. The height of the below grade crawl space measured from the interior grade of the crawl space to the top of the foundation wall shall not exceed four feet at any point;
 - C. Adequate drainage systems shall allow floodwaters to drain from the interior area of the crawl space following a flood; and
 - D. The provisions of Paragraphs (a)(2), (a)(3), (a)(4), and (a)(18) of this section shall be complied with.

The project has not proposed below grade crawl space construction.

20. Critical Facilities and Lodging Facilities: The requirements of [Subsection 9-3-2\(i\)](#), "Standards for Critical Facilities and Lodging Facilities in the Five Hundred-Year Floodplain," B.R.C. 1981, apply to critical facilities and lodging facilities in the one hundred-year floodplain. Where a conflict exists between the requirements of this section and the provision of [Subsection 9-3-2\(i\)](#), the most restrictive requirements apply.

[Section 9-16](#) "Definitions" B.R.C. defines a critical facility as *any structure or related infrastructure, the loss of which may result in severe hazards to public health and safety or may interrupt essential services and operations for the community at any time before, during, and after a flood. Critical facilities are classified as follows: (1) essential services facility, (2) hazardous material facility, and (3) at-risk population facility. (Floodplain)*

The project has not proposed any critical or lodging facilities.

Section 9-3-4 "Regulations Governing the Conveyance Zone" Criteria:

- a. The provisions of [Section 9-3-3](#), "Regulations Governing the One Hundred-Year Floodplain," B.R.C. 1981.

The criteria of [Section 9-3-3](#) have been addressed above.

- b. The provisions of [Section 9-3-5](#), "Regulations Governing the High Hazard Zone," B.R.C. 1981, if the land is also located in the high hazard zone.

The criteria of [Section 9-3-5](#) "Regulations Governing the High Hazard Zone," B.R.C. 1981 have been provided below.

- c. All uses allowed under the provisions of [Section 9-3-3](#), "Regulations Governing the One Hundred-Year Floodplain," B.R.C. 1981, if they are not prohibited by the underlying zoning district or any ordinance of this city, may be established, except that no person shall establish or change any use that results in any rise in the elevation of the one hundred-year flood.

The construction of a fence is allowable within the zone. The criteria discussed above has confirmed that the project will not result in any rise in the elevation of the one hundred-year flood profile as compared to the existing conditions.

- d. All structures allowed under [Section 9-3-3](#), "Regulations Governing the One Hundred-Year Floodplain," B.R.C. 1981, may be established except that no person shall:

1. No person shall place any structure in the conveyance zone that will result in any rise in the elevation of the one hundred-year flood.

The criteria discussed above has confirmed that the project will not result in any rise in the elevation of the one hundred-year flood profile as compared to the existing conditions.

2. No person shall place any obstruction in the conveyance zone, except a device reasonably necessary for flood management if the device is designed and constructed to minimize the potential hazards to life and property.

[Section 9-16](#) "Definitions" B.R.C. defines an obstruction as *any item or material not constituting a moveable object in, along, across, or projecting into the floodplain that might impede, retard, or change the direction of a flow of water, either by itself or by catching or collecting debris carried by such water, in a way that the city manager determines would increase the flood hazard to adjacent properties. (Floodplain)*

The replacement fence has been designed to be parallel to the direction of conveyance flow. The portion of the replacement fence that is perpendicular to the conveyance flow has been designed to allow flood waters to pass underneath the fence. The replacement fence will have

no increase in the elevation of the one hundred-year flood profile, therefore there will be no increase in the flood hazard to adjacent properties as compared to the existing conditions.

- e. **No person shall carry out any other development that results in any rise in the elevation of the one hundred-year flood.**

The criteria discussed above has confirmed that the project will not result in any rise in the elevation of the one hundred-year flood as compared to the existing conditions.

- f. **Localized rises within flood channels or on a specific parcel that is being developed are permissible if there is no adverse impact on nearby properties and there is no increase in the average water surface elevations along the cross sections of the floodplain.**

The criteria discussed above has confirmed that the project will not result in any rise in the elevation of the one hundred-year flood as compared to the existing conditions

- g. **Localized rises on land owned or controlled by a government or government subdivision or agency, or within public drainage or flood control easements, are permissible if the following requirements have been satisfied:**

1. The applicant has necessary property interests or permission to use land to allow the increase in any water surface elevation or there is no adverse impact to such land;
2. There are no insurable structures under the FEMA National Flood Insurance Program affected by the localized rise;
3. The applicant minimizes the amount of the localized rise in a flood elevation; and
4. The applicant complies with all necessary FEMA requirements, including, without limitation, obtaining a Conditional Letter of Map Revision (CLOMR) prior to development and a Letter of Map Revision (LOMR) upon completion of a project causing a localized rise in flood elevation.

The criteria discussed above has confirmed that the project will not result in any rise in the elevation of the one hundred-year flood as compared to the existing conditions

Section 9-3-5 "Regulations Governing the High Hazard Zone" Criteria:

- a. The provisions of [Section 9-3-3](#), "Regulations Governing the One Hundred-Year Floodplain," B.R.C. 1981.

The criteria of [Section 9-3-3](#) have been addressed above.

- b. The provisions of [Section 9-3-4](#), "Regulations Governing the Conveyance Zone," B.R.C. 1981, if the land is also located in the conveyance zone.

The criteria of [Section 9-3-4](#) have been addressed above.

- c. All uses allowed under the provisions of [Section 9-3-3](#), "Regulations Governing the One Hundred-Year Floodplain," B.R.C. 1981, if they are not prohibited by the underlying zoning district or any other ordinance of the city, may be established, except that no person shall:

1. Change the use of an existing structure intended for human occupancy from a nonresidential use to a residential use or use as a school, daycare center, group home, residential care facility, or congregate care facility.

No change of use of existing structures has been proposed.

2. Establish any new parking lot for motor vehicles.

No new parking lots have been proposed.

3. Establish any campground.

No campgrounds have been proposed.

- d. All structures allowed under the provisions of [Section 9-3-3](#), "Regulations Governing the One Hundred-Year Floodplain," B.R.C. 1981, may be established, except that no person shall:

1. Construct or place any new structure intended for human occupancy.

[Section 9-16](#) "Definitions" B.R.C. defines intended for human occupancy as *capable of and likely to be used for residential habitation, or for commercial, industrial, or governmental occupation by persons on a regular basis. (Floodplain)*

No new structures intended for human occupancy have been proposed.

2. No person shall expand, enlarge, or make a substantial modification or substantial improvement to any existing structure intended for human occupancy in the high hazard zone.

The project has not proposed any modifications to any existing structures intended for human occupancy.

- e. Unconditioned, unenclosed building elements such as balconies, awnings, and roof overhangs may extend up to four feet into the high hazard zone if completely located above the flood protection elevation and the remainder of the structure complies with this chapter.

No balconies, awning, or roof overhangs have been proposed.

**CITY OF BOULDER
PLANNING BOARD ACTION MINUTES
January 17, 2019
1777 Broadway, Council Chambers**

A permanent set of these minutes and a tape recording (maintained for a period of seven years) are retained in Central Records (telephone: 303-441-3043). Minutes and streaming audio are also available on the web at: <http://www.bouldercolorado.gov/>

PLANNING BOARD MEMBERS PRESENT:

Liz Payton, Chair
Bryan Bowen, Vice Chair
John Gerstle
Crystal Gray
Peter Vitale
Harmon Zuckerman

PLANNING BOARD MEMBERS ABSENT:

David Ensign

STAFF PRESENT:

Edward Stafford, Development Review Manager, Public Works
Hella Pannewig, Assistant City Attorney
Cindy Spence, Administrative Specialist III
Alysha Geiger, Civil Engineer I
Christin Shepherd, Flood & Wetland Administrator
Chris Meschuk, Assistant City Manager / Interim Director of Planning Director
Kathleen King, Senior Planner

1. CALL TO ORDER

Chair, **L. Payton**, declared a quorum at 6:05 p.m. and the following business was conducted.

2. APPROVAL OF MINUTES

On a motion by **C. Gray** and seconded by **J. Gerstle** the Planning Board voted 6-0 (**D. Ensign** absent) to approve the December 6, 2018 minutes as amended.

3. PUBLIC PARTICIPATION

No one spoke.

4. DISCUSSION OF DISPOSITIONS, PLANNING BOARD CALL-UPS / CONTINUATIONS

- A. CALL UP ITEM:** Standard Wetland Permit (LUR2018-00004); Repair of the White Rocks Bridge and bank restoration at Boulder Creek from damage that occurred during the high flows experienced in 2015. This decision may be called up before Planning Board on or before January 18, 2019.

- B. CALL UP ITEM:** 1405 Bellevue Avenue (Kings Gulch); Floodplain Map Revision (FLD2018-00097); Revision to the 100-year floodplain and conveyance zone of Kings Gulch in the area of 1405 Bellevue Avenue. This decision may be called up before Planning Board on or before January 18, 2019.

None of the items were called up.

5. PUBLIC HEARING ITEMS

- A. AGENDA TITLE:** Public hearing and consideration of a Floodplain Development Permit (LUR2017-00045) for the replacement of a fence located at 816 Arapahoe Avenue within the conveyance and high hazard zones of Gregory Creek.

Board members were asked to reveal any ex-parte contacts they may have had on this item.

- **C. Gray, H. Zuckerman, J. Gerstle and P. Vitale** disclosed they had conducted site visits. In addition, they stated they had business relationships with Scott Cox & Associates, Inc., the applicant, in the past but it would not influence their decisions tonight. **B. Bowen** and **L. Payton** had no ex-parte contacts to disclose.

Staff Presentation:

E. Stafford introduced the item.

A. Geiger presented the item to the board.

Board Questions:

A. Geiger and **E. Stafford** answered questions from the board.

Applicant Presentation:

Don Ash, with Scott, Cox & Associates, Inc., and **Jose Jimenez**, the owner, presented the item to the board.

Board Questions:

Don Ash, representing the applicant, and **Jose Jimenez**, the owner, answered questions from the board.

Public Hearing:

No one spoke.

Board Comments:

Key Issue: Is the proposed Floodplain Development Permit consistent with the Floodplain Development Permit criteria set forth in Section 9-3-3, 9-3-4, 9-3-5, and 9-3-6 B.R.C. 1981?

- **B. Bowen** agreed with staff's recommendations.
- **L. Payton** said that she does not disagree with the staff's recommendations, however she did not see the preservation of the floodplain addressed within the current floodplain regulations and wondered if this would be updated to include large projects and the additions of impervious surfaces.

- **J. Gerstle** said the staff had made reasonable conclusions. He added that the board could approve the item with conditions such as granting an easement for flood management along the channel in the future. He suggested the board do this.
- **H. Zuckerman** said he would not be comfortable with a condition granting an easement “sometime in the future” without a specific proposed easement in front of the board.
- **J. Gerstle** stated that he understood that if the floodplain regulations are satisfied, then the board would not have a basis for added conditions. However, he would like to retain the maximum option for the city to develop a reasonable floodplain management program. It does not seem reasonable to move forward in this area with current floodplain regulations that seem outdated. He would like to retain maximum room for the city to develop and implement a plan. He would like to approve the application while retaining the city’s options.
- **P. Vitale** agreed with **J. Gerstle’s** comments however, there is no mechanism to tie this to the criteria, therefore it cannot be discussed.
- **L. Payton** said the larger issue may be with the development codes within planning and floodplain management and floodplain mitigation. She questioned if what would be done on this parcel would meet resilience goals. She said it appears they are not integrated. She would like to make a recommendation to the city to integrate the resilience efforts with our planning efforts and our utilities stormwater efforts.
- **B. Bowen** added that in defense of staff, they do a lot of that which the board may not witness.
- **C. Gray** questioned if there was an initiative to integrate resilience and floodplain management in a work plan or to update the floodplain regulations.
- **J. Gerstle** said the proposal does meet the existing criteria and rules, however, he said the board should recommend to city staff and City Council to review criteria and consider how that criteria are put into effect and enforced. In his opinion, it would not be unreasonable to put a condition in place such as when an easement would be desired by the city, that it should be done by the applicant, however the board has been advised that it cannot. He recommended the city be proactive in determining on what sort of easements it wants so it can start asking for them.

Motion:

On a motion by **J. Gerstle** seconded by **B. Bowen** the Planning Board voted 6-0 (**D. Ensign** absent) to approve the Floodplain Development Permit # LUR2017-00045 attached to this memorandum as Attachment B, subject to the conditions of approval shown on such permit, with the following update to the Flood Vents condition to read:

Provide flood openings that automatically equalize the hydrostatic flood forces in accordance with section 9-3-3(a)(18)(B) of the BRC, and the floodplain development permit that was issued for this project.

and adopt this memorandum as findings of fact.

J. Gerstle made a motion, seconded by **L. Payton**, to recommend to City Council that the floodplain development regulations be reviewed and that the city move ahead as expeditiously as possible to determine appropriate easements for floodplain management throughout the city and that enforcement of the new regulations be done with a view towards ensuring the future options of the city for flood management. Voted 3-3 (**B. Bowen, H. Zuckerman** and **P. Vitale** opposed). Motion Failed.

6. MATTERS FROM THE PLANNING BOARD, PLANNING DIRECTOR, AND CITY ATTORNEY

A. AGENDA TITLE: CU South Annexation Update

L. Payton recused herself.

Staff Presentation:

E. Stafford presented the item to the board.

Board Questions:

E. Stafford answered questions from the board.

L. Payton rejoined the meeting.

B. AGENDA TITLE: Discussion and Direction on the Subcommunity Planning Program

Staff Presentation:

K. King presented the item to the board.

Board Comments:

Key Issue: Scope & Community Engagement

- **L. Payton** said it should be made clear to the public that the plan will be invoked when projects are reviewed and that projects will need to comply with the plan.
- **C. Gray** was pleased that staff had broadened the groups under “Collaborate”. Regarding the Downtown Alliance, she advised interviewing the past staff which worked on that for information. She agreed with staff’s approach on scope and community engagement.
- **J. Gerstle** said the program seems reasonable and logical.
- **L. Payton** added that she appreciates the capacity building section.
- **B. Bowen** appreciated the work staff has done. He liked the idea of the tours because they can be a useful source of engagement and feedback. They will be informative and community building. It will be critical to stick to the eighteen-month process because the public needs a predictable series of events and to maintain trust in the process.

Key Issue: Boundaries

- **L. Payton** questioned if BVSD attendance areas were considered, because often people that attend the same school district feel like a neighborhood. She suggested an over-arching policy regarding South Boulder Creek since so much of the area is undeveloped and there is an existing natural floodplain. Therefore, an opportunity could be missed to do floodplain preservation. She did not object to any of the current divisions.
- **C. Gray** agreed with **L. Payton** and added that the school districts are another way to form communities. She recommended identifying certain pockets of neighborhoods that may fall within or adjacent to the boundaries and make sure their voices are heard in the Subcommunity Plan.

- **B. Bowen** appreciated how the boundaries have been presented. He said he has issue with how corridor planning is considered and encouraged making it more coherent and having the resident experience considered. He suggested conducting Palo Park and Crossroad simultaneously.
- **H. Zuckerman** suggested changing the name of “Central Uni Hill”.
- **P. Vitale** agreed with **B. Bowen**.
- **J. Gerstle** agreed with **B. Bowen** and **P. Vitale** regarding the combining of Palo Park and Crossroads. He recommended not using roads as dividing lines but using other land use characteristics such as elementary attendance. Regarding prioritization, he would like to see the Central Uni Hill area as one of the early plan areas.
- **C. Gray** agreed with **B. Bowen** regarding conducting Palo Park and Crossroad simultaneously due to the many small local businesses currently existing which need to be protected. This should be done sooner than later.
- **P. Vitale** suggested overlaying boundaries where our food is purchased.
- **J. Gerstle** added that communities also form around irrigation ditches.

Key Issue: Prioritization

- **H. Zuckerman** said that prioritizing Central Boulder with the Alpine-Balsam project is troubling. Central Boulder is a large area with a significant amount of businesses along with a variety of homes. It may be the most diverse area in the city. To place all of it under one Subcommunity Plan and to align it with a newly developed city-owned area could be difficult.
- **P. Vitale** agreed.
- **J. Gerstle** also agreed. He added, at the corner of Iris and Broadway, the county offices exist. He questioned if that should be included in the Central Boulder rather than the North Boulder area.
- **P. Vitale** reviewed that **B. Bowen**, **H. Zuckerman**, **J. Gerstle** and himself all agreed that Central Boulder should not be in the top three. He recommended replacing Central Boulder with Crossroads. He stated that his top three choices would be East Boulder, Palo Park and Crossroads.
- **B. Bowen** agreed with **P. Vitale**. He added that zoning and land use patterns around Crossroads are the most broken within the city.
- **J. Gerstle** said that Central Uni Hill should be in the top three at the expense of Crossroads.
- **L. Payton** said the Crossroads area would benefit from a plan. She would prefer a Form Based Code plan in that area. She stated her top choice would be Crossroads due to all the changes that seem to be occurring in that area. She is uncertain about the other two choices. She added that due to potential dividing within the Central Boulder area of the Subcommunity Plan, she did not fully agree with **H. Zuckerman** that there would be difficulty aligning communities together.
- **B. Bowen** agreed with **L. Payton**. He agreed also that having Form Based Codes being an outcome of this process would be ideal in the Crossroads area.
- **H. Zuckerman** said that if Subcommunity Plans become incorporated into the BVCP and a part of the Site Plan criteria, then they become decision making factors for the board. He said he would like to see Central Uni Hill have a new Subcommunity Plan.
- **C. Gray** agreed with making Crossroads and Central Uni Hill a priority. She would rather replace Central Boulder with one of these. She would keep Palo Park on the top three list.

7. DEBRIEF MEETING/CALENDAR CHECK

8. ADJOURNMENT

The Planning Board adjourned the meeting at 8:51 p.m.

APPROVED BY

Board Chair

DATE

DRAFT