PRELIMINARY DRAINAGE REPORT

For

WILLOUGHBY CORNER

LAFFAYETTE, COLORADO

Prepared for:

Boulder County Housing Authority
2525 13th Street, Suite 204
Boulder, Colorado 80304

Contact: Ian Swallow
(303) 413-7030

MARCH 2020

Drexel, Barrell & Co.
Engineers / Surveyors
710 11th Avenue, Suite L-45
Greeley, Colorado 80631
(970) 351-0645
Project: 21072-00GRCV

Prepared By:
Mark A. Butler, P.E.

Engineers/Surveyors

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March 26, 2020

City of Lafayette
Mr. Aaron Asquith
1249 S. Public Road
Lafayette, CO 80026

RE: Preliminary Drainage Report for Willoughby Corner

Dear Mr. Asquith:

We are pleased to submit, for your review and approval, this Preliminary Drainage Report for Willoughby Corner, located at East Emma Street and N. 120th Street, in Lafayette, Colorado.

The investigation and design within this report have been performed according to the criteria established in Section 1500, Design Criteria for Strom Drainage, the City of Lafayette Specifications & Standards.

We sincerely appreciate your time and consideration in the review of this project. If you should have any questions, please feel free to contact this office.

Respectfully,

Mark A. Butler, P.E.
Drexel, Barrell & Co.

"I hereby attest that this report for the final drainage design for Willoughby Corner, was prepared by me (or under my direct supervision) in accordance with the provisions Section 1500, Design Criteria for Strom Drainage, the City of Lafayette Specifications & Standards, for the responsible parties thereof. I understand that the City of Lafayette does not and shall not assume liability for drainage facilities designed by others."

Mark A Butler, PE
Registered Professional Engineer
State of Colorado No. 33625

TABLE OF CONTENTS

I. GENERAL LOCATION & DESCRIPTION

A. Location

1. The project site is located in the Southeast 1/4 of the of Section 2, Township 1 South, Range 39 West, of the 6th Principal Meridian, City of Lafayette, Boulder County, Colorado. See Vicinity Map, Appendix A.
2. The drainage basin bounded as follows:
    a. North, East Emma Street and open space
    b. West, by Canterbury Drive and open space.
    c. Southwest by vacated railroad right of way, warehouse, Peak to Peak Charter School is located further south and west of the site.
    d. South by an industrial facility
    e. East, by N. 120th Street and single family lots

B. Description of Property

1. The total area of the property is 23.82 acres. 25.92 acres, including area to the centerline of surrounding roads is included for drainage analysis.
2. The property is currently undeveloped with a good vegetative cover. The topography of the ground generally slopes to the northeast at grades of 1%.
    a. The “Soil Survey of Boulder County Area, Colorado” prepared by the U.S. Department of Agriculture, Soil Conservation Service, indicates that the surface soils on the site consist of Ascalon sandy loam, 0-3% slope, Hydrologic soil Type "B". See Appendix B
3. According to the FEMA Flood Insurance Rate Map (FIRM) Community Panel No. 08013C0602J, the site is not located in a designated 100-year floodplain or floodway. Attached in Appendix C

C. Proposed improvements

1. The proposed improvements for the subdivision include:
    a. The neighborhood, developed by Boulder County Housing Authority, proposes 400 permanently affordable homes in a variety of building types including duplexes, townhomes, and apartments as well as significant public amenities. In addition to new affordable workforce housing, the 24-acre neighborhood will include community gardens, a community building, dog park, trails, and park space.
    b. Site improvements will include roads, parking, utilities, storm system and detention.
2. Offsite improvements include the following road improvements:
    a. 120th Street widening and curb and gutter installation on the site side.
    b. Installation of curb and gutter on the site side of E. Emma Street.
    c. Construction of a roundabout at the intersection of E. Emma Street and Canterbury Drive.
    d. Construction of a roundabout on Canterbury at the south west corner of the site.

II. DRAINAGE BASINS & SUB-BASINS

A. Major Basin Description

1. The site historically drains to Coal Creek located approximately 3/4 mile to the east
2. The site falls within the Major-Sub-basin 3 referenced in the Master Drainage Plan, the following excerpts are included in Appendix D.
    a. Sub-basin 3 description, Page 9.
    b. Table 3, The drainage basin hydraulics are defined for existing and future development conditions, Sub-Basin 5A, from the Master Drainage Plan.
    c. Drainageway 3 Plan: The Master Drainage Plan includes the proposed design for a large drainage way to convey the future development storms to Coal Creek. Drainage Way 3 is proposed just north of Emma Street, see attached map, excerpt from the Master Drainage Plan. The location of the proposed detention pond and outfall are drawn onto the map. (No action has been taken on the design or construction of the proposed drainage way shown on the map.)

B. Existing Drainage Description

1. The existing ground slopes proximally 1% to a low point on the northeast corner of the property. Runoff is intended to pass offsite through a culvert under E. Emma Street to a drainage ditch on the north side of the road. The culvert currently appears to be plugged.
2. The open space to the west currently drains onto the site through two 12-inch culverts under Canterbury Drive.
3. Runoff from all other directions is blocked from entering the site by roads, railroad grade and structures.
4. There are no existing irrigation ditches or drainage facilities on the site.

C. Existing Condition Runoff

The undeveloped peak runoff rates and runoff coefficients associated with the existing undeveloped conditions are presented in Table 1. See calculations in Appendix E.

TABLE 1: EXISTING CONDITIONS RUNOFF RATES

Basin	Area (acres)	5-year Runoff Coefficients	10-year Runoff Coefficients	10-year Peak Runoff (cfs)	100-Year Runoff Coefficients	100-year Peak Runoff (cfs)
EX	24.90	0.13	0.23	18.83	0.53	71.27

III. DRAINAGE DESIGN CRITERIA

A. Hydrological Criteria

1. All proposed drainage design will conform to Section 1500, Design Criteria for Strom Drainage, the City of Lafayette Specifications & Standards.
2. The design storm frequencies for residential land use are the 2-year and 100-year storm events per City of Lafayette Storm Drainage Criteria.
3. The Rational Method was utilized to calculated peak runoff rates.
    a. Runoff coefficients and Imperviousness values are taken from Table 1500-5 of the City of Lafayette Storm Drainage Criteria.
4. Rainfall intensities were derived from the Rainfall Intensity (in/hr) at Time Duration found on Figure 1500-1, City of Lafayette Storm Drainage Criteria.

B. Hydraulic Criteria

2. According to City of Lafayette Storm Drainage Criteria
    a. Detention Pond release rates shall be restricted to the 10-year and 100-year recurrence interval storm. Additional, the pond will be provided with a Water Quality Capture Volume. Details for the outlet structure will be provided in the Final Drainage Report.
    b. The storm drainage system hydraulic features shall be designed for a 5-year initial storm and a 100-year major storm return period. Those calculations will be provided in Final Drainage Report.

C. Waiver/Variance from Criteria

1. We will be requesting a variance to the minimum separation at a couple of storm-sanitary sewer pipe crossings. Details for the variance request will be provided in the final drainage report.

IV. DRAINAGE FACILITY DESIGN

A. General Concept

1. The proposed drainage concept will involve routing surface drainage as well as runoff from onsite storm sewer facilities to the proposed detention pond located on the east side of the site.
2. The detention pond will discharge north under E. Emma street to the drainage ditch north of the site, the historic drainage path.
3. Offsite drainage from the parcels to the west will be routed on the west side of Canterbury, north to a new low point near the roundabout. A culvert will be constructed under E. Emma street with discharge to the drainage ditch north of the site, the historic drainage path.
4. A culvert will be installed to underground the drainage ditch, north of E. Emma Street under the proposed roundabout.

B. Basin Description

The Proposed Preliminary Drainage Plan shows the property divided into 3 Basins. designated as Basins A, OS1, and C.

1. **Basin A** is the full 24.90 acres, including the 22.5 acre site and offsite areas, adjacent roadways that runoff into the site, that will contribute to the proposed detention pond at design point #1.
    a. Basin A, will be further divided into Sub-basins in the final drainage report so that runoff rates can be determined to size storm facilities.
    b. There is a 0.38 acre section of Basin A that cannot be routed to detention. It is included in the area detention calculations but will actually discharge to Basin C.
2. **Basin OS1** includes the 6.57 acres of land to the west that currently drain to the existing culverts under Canterbury Drive. The west half of the Canterbury street improvements are included, but will be split into a separate Sub-basin in the final drainage report. Runoff will be rerouted by regrading along the west side of Canterbury Drive to move the a low point north near the proposed roundabout. A culvert under E. Emma Street at the roundabout will be sized to accommodate historic peak runoff. The existing culverts under Canterbury Drive will be removed.
3. **Basin C** is the north half of E. Emma Street that will be routed directly to the drainage ditch offsite.

C. Proposed Basin Runoff

The peak runoff rates and runoff coefficients associated with the site (Basin A) , are presented in Table 2. See calculations in Appendix F.

TABLE 2: PROPOSED CONDITIONS RUNOFF RATES, BASIN A

RUNOFF SUMMARY TABLE 2 Basin A, (24.90 Acres) Design Point #6		
RETURN PERIOD	RUNOFF COEFFICIENT	RUNOFF (cfs)
2-YEAR	0.42	20.28
5-YEAR	0.46	42.79
10-YEAR	0.51	47.14
100-YEAR	0.61	83.42

D. Storm Drainage Hydraulics

1. The proposed storm hydraulic calculations for inlets, curb cuts and storm pipes will be covered in depth in the Final Drainage report.
2. Preliminary runoff was calculated (but not included in this report) for a few Sub-basins to verify inlet and pipe sizes.
3. It was determined based on preliminary hydraulic calculations for Basin C that a 10 ft Type R on grade inlet would be required at the corner of E. Emma St. and 120th Ave. All other street inlets are in sump condition and 5'ft Type R inlets are proposed. Checks will be provided in the Final Drainage report.
4. Two 30-inch culverts are proposed on the north side of E. Emma street to underground the existing drainage ditch under the proposed cul-de-sac. Existing flow in the ditch is not known. There is limited depth from the proposed road elevation to the existing flow line of the ditch. The two 30-inch culverts were sized to have the same cross section as an up-stream 42-inch culvert while maintaining 1-foot of cover.
5. Sediment forebays are provided at the end of each proposed storm line where they discharge into the detention pond.

E. Stormwater Quality Pond Facility Details

1. The proposed Detention Pond will be sized to accommodate the volume requirements calculated for the developed site, Basin 'A':

   10-year Volume plus the full WQCV for the site (43,647 cf)

   100-year Volume plus 1/2 the WQCV for the site (72,615 cf)

2. A water quality outlet structure will be constructed at the low point in the pond Details and sizing of the outlet structure will be provided in the Final Drainage Report.

   a. A three stage water quality outlet structure will be used to regulate the WQCV, 10-year and the 100-year release rates.

   b. A proposed 18" diameter RCP outlet pipe will extend north from the outlet structure and tie into the existing storm ditch north of E. Emma Street. The depth of the detention pond is limited because the outlet pipe must cross above the existing 15-inch sanitary sewer at the discharge point.

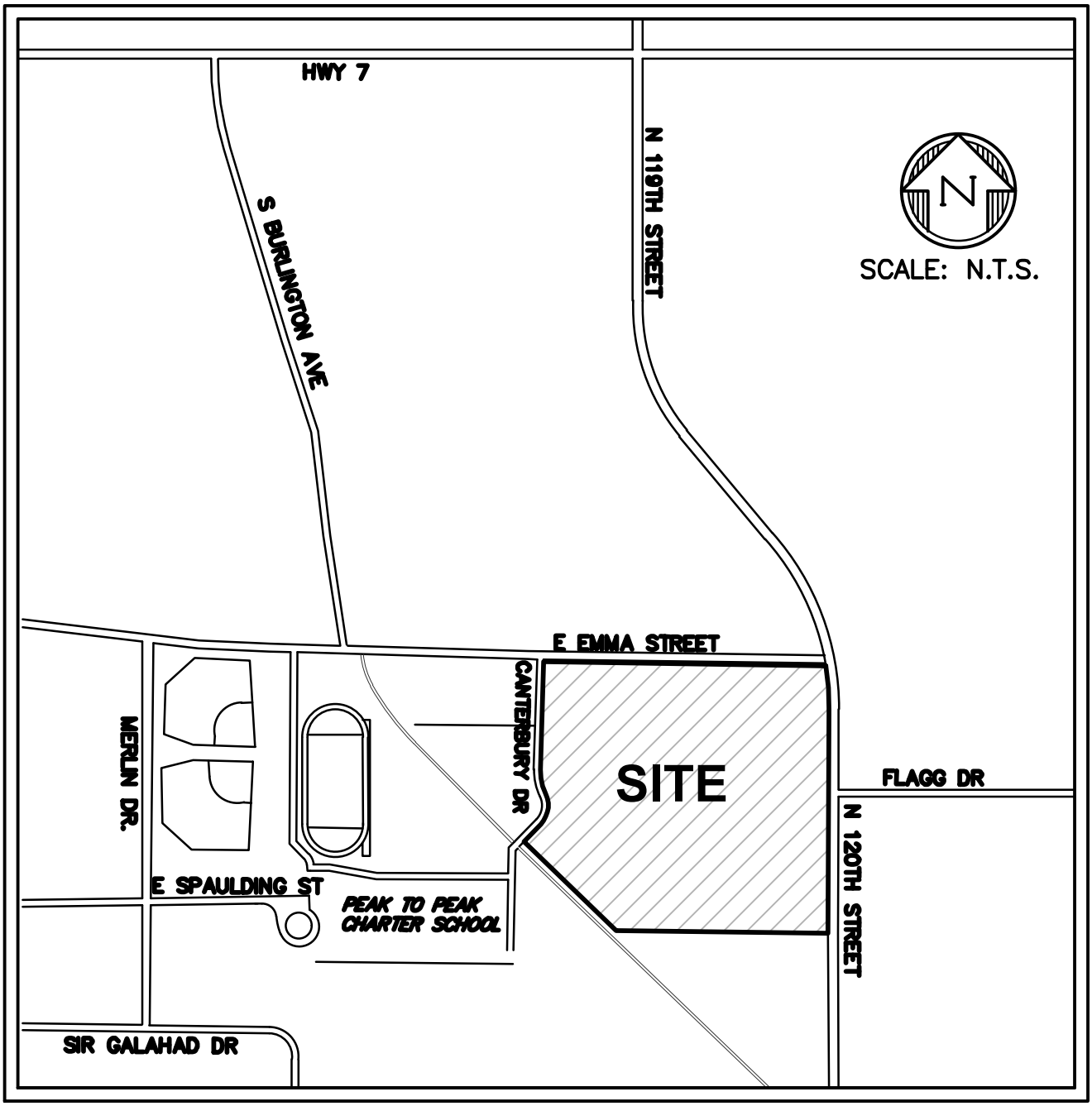
   c. During larger storm events, or plugging of the outlet structure, the water surface elevation in the pond would rise beyond the 100-year water surface elevation (5162.00) to a maximum height of Freeboard provided at 5163.00. In this scenario, the emergency overflow from the pond will flow over an emergency overflow spill way across E. Emma Street to the north. The design flow for the emergency overflow is 83.42 cfs, see Runoff calculations Basin A 100-yr storm in Appendix G

V. REFERENCES

1. Design Criteria for Strom Drainage Section 1500, the City of Lafayette Specifications & Standards.
2. Urban Storm Drainage Criteria Manual, Volumes I, II, & III, (2016).
3. ACAD Hydraflow Express software, 2006-2019
4. Excerpts from Blue Heron South "Master Drainage Plan" Final Drainage Report, December, 1980
5.

APPENDIX A

VICINITY MAP



WILLOUGHBY CORNER
0 120TH STREET
LAFAYETTE, CO.

Drexel, Barrell & Co.
Engineers • Surveyors

DATE: 3/27/2020

JOB NO: 21072-01

DWG. NO. VIC MAP

SHEET 1 OF 1

APPENDIX B

NRCS SOILS INFORMATION

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Boulder County Area, Colorado

WILLOUGHBY CORNER

February 15, 2019

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,730 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

Boulder County Area, Colorado

AcA—Ascalon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2swl3
Elevation: 3,870 to 5,960 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 135 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ascalon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: sandy loam
Bt1 - 6 to 12 inches: sandy clay loam
Bt2 - 12 to 19 inches: sandy clay loam
Bk - 19 to 35 inches: sandy clay loam
C - 35 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

Minor Components

Olnest

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

Vona

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

WdB—Weld loamy sand, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: jpt1
Elevation: 4,900 to 5,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 155 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Weld and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Weld

Setting

Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy eolian deposits

Typical profile

H1 - 0 to 12 inches: loamy sand
H2 - 12 to 31 inches: clay loam, silty clay, silty clay loam
H2 - 12 to 31 inches: silt loam, loam
H2 - 12 to 31 inches:
H3 - 31 to 60 inches:

H3 - 31 to 60 inches:

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 21.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Sandy (R067XB026CO)
Hydric soil rating: No

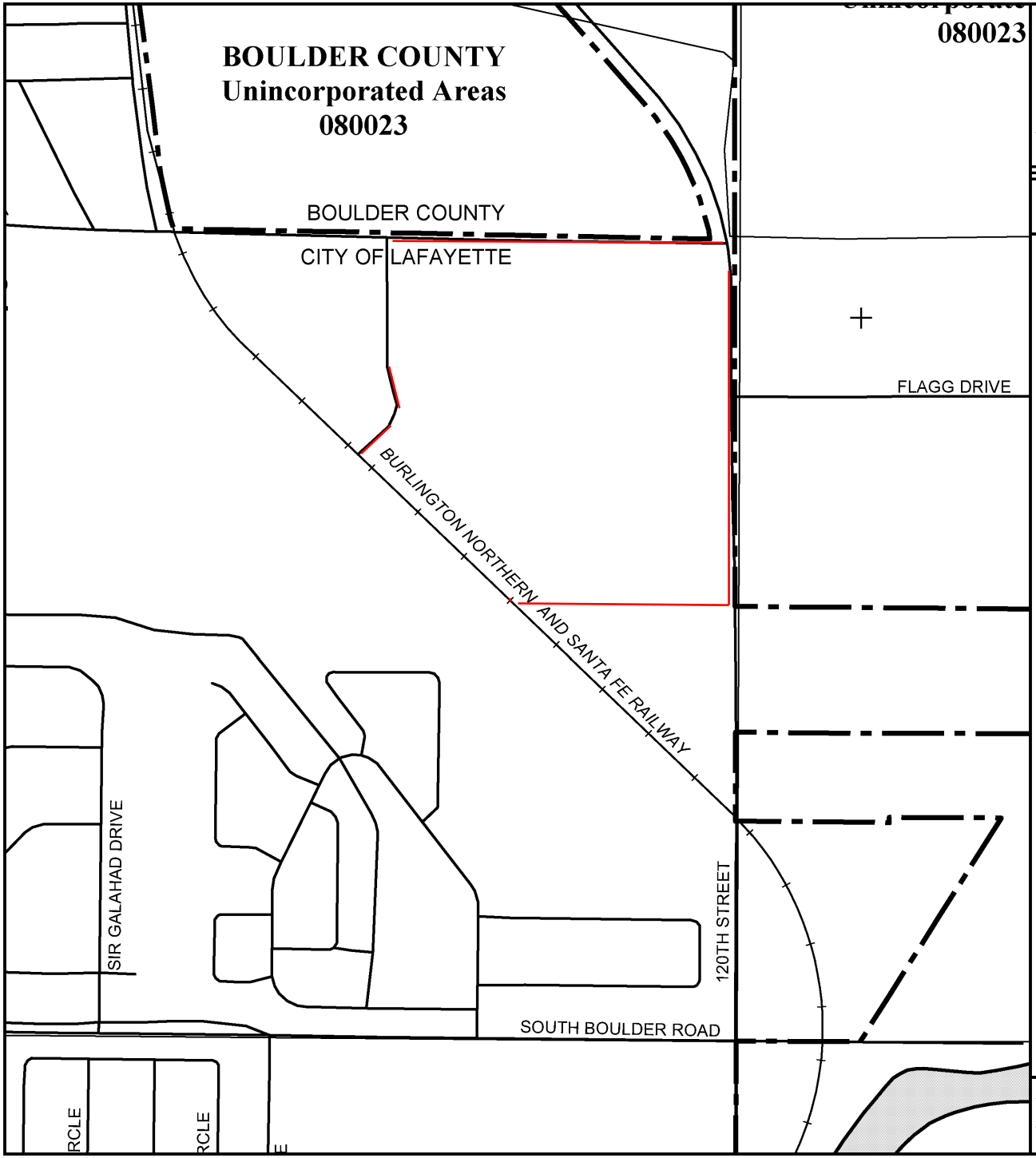
Minor Components

Ascalon

Percent of map unit: 10 percent
Hydric soil rating: No

APPENDIX C

FLOOD PLAIN MAP - FIRM



MAP SCALE 1" = 500'

250 0 500 1000 FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0602J

FIRM

FLOOD INSURANCE RATE MAP

BOULDER COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 602 OF 615

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOULDER COUNTY	080023	0602	J
LAFAYETTE, CITY OF	080026	0602	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08013C0602J

MAP REVISED
DECEMBER 18, 2012

Federal Emergency Management Agency

APPENDIX D

BLUE HERON SOUTH
FINAL DRAINAGE REPORT
EXCERPTS

Major Sub-Basin 3: The land ownerships in this basin include private, Boulder County, City of Lafayette and a Chicago, Burlington and Qunicy Railroad right-of-way. Small drainage ditches along Emma Street and Burlington Avenue have been used to convey stormwaters from the downtown areas of Lafayette. These ditches terminate at the intersection of Burlington Avenue and Emma Street, where a culvert then passes the flow to a small ditch which heads east through agricultural land, terminating in a sump area west of Coal Creek. Debris build up in the sump area has been a common problem during storm events. Present land uses consist of agricultural in the lower half of Basin 3, with fully developed urban conditions in the upper half of the basin (downtown Lafayette).

Major Sub-Basin 4: The land ownerships in this basin includes private, City of Lafayette and Chicago, Burlington and Qunicy Railroad right-of-way. A system of drainage ditches has been provided by existing commercial and residential developments which convey stormwaters to Coal Creek. These drainageways are mostly overgrown and drained by culverts of less than 10-year capacity. Present land uses are industrial and residential.

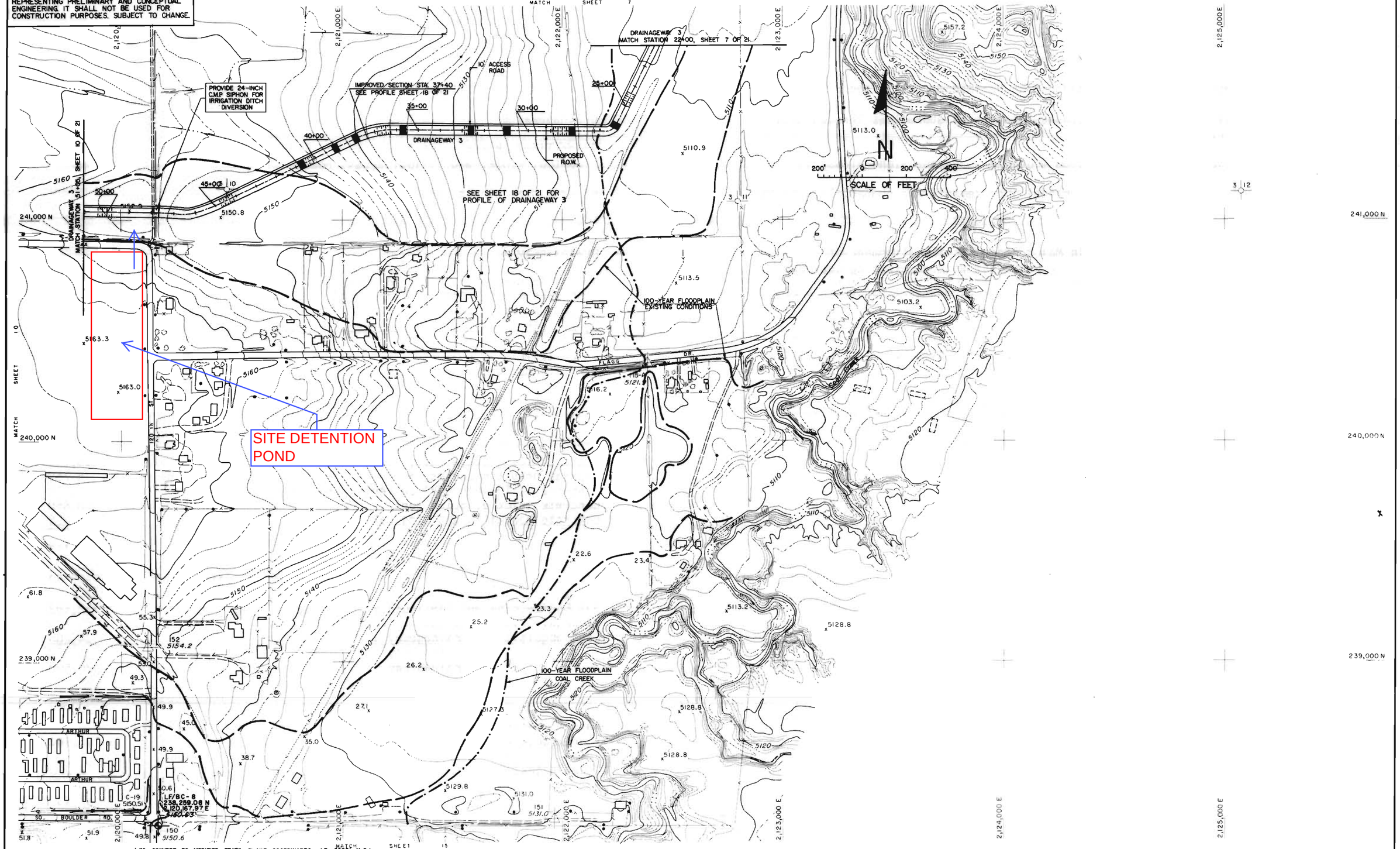
Major Sub-Basin 5: The land ownerships in this basin consist of private, City of Lafayette and State highway right-of-way (US 287). Currently, no drainageways exist for conveyance of stormflows from existing development which is largely in the upper half of the basin. Current land uses are agricultural in the lower portions of the basin and residential and light commercial in the upper portions of the basin. Waneka Reservoir, which lies in the extreme western section of Basin 5, serves as a water supply for the City of Lafayette. The reservoir embankment is sufficiently high to store the 100-year storm event from those areas tributary to the reservoir.

TABLE 3

SUMMARY OF SUB-BASIN HYDROLOGY
EXISTING AND FUTURE DEVELOPMENT CONDITIONS

Basin No.	Area (sq mi)	Length (mi)	Slope (ft/ft)	Percent Impervious (Ex. / Fut.)	Existing/Future Condition Peak Flow Rates 2-year	5-year	10-year	100-year
1A	.13	.88	.010	15 / 32	10 / 30	20 / 60	40 / 90	110 / 220
1B	.07	.68	.016	5 / 40	10 / 30	20 / 50	30 / 70	80 / 160
1C	.18	.77	.022	23 / 40	30 / 60	80 / 120	110 / 160	300 / 370
2A	.25	1.17	.013	10 / 37	10 / 60	50 / 120	70 / 160	220 / 390
2B	.10	.61	.022	10 / 24	10 / 20	30 / 50	50 / 80	150 / 200
3A	.19	1.03	.011	10 / 36	10 / 40	40 / 90	60 / 130	180 / 300
3B	.55	1.15	.019	19 / 36	50 / 130	170 / 280	260 / 370	760 / 920
3C	.28	.66	.021	16 / 36	30 / 100	120 / 200	170 / 270	480 / 670
3D	.18	1.07	.007	17 / 44	10 / 50	50 / 100	70 / 130	200 / 310
4A	.14	.75	.014	10 / 52	10 / 60	30 / 110	50 / 140	150 / 300
4B	.17	.95	.014	10 / 31	10 / 30	30 / 80	50 / 100	160 / 260
4C	.05	.61	.020	43 / 43	20 / 20	40 / 40	50 / 50	130 / 130
5A	.17	1.05	.013	10 / 51	10 / 60	50 / 110	70 / 140	190 / 310
5B	.11	.91	.015	34 / 34	30 / 30	60 / 60	90 / 90	210 / 210
5C	.19	1.03	.017	37 / 37	50 / 50	100 / 100	140 / 140	340 / 340
6A	.04	.42	.012	10 / 27	10 / 10	20 / 30	20 / 40	70 / 90
6B	.10	.88	.009	15 / 49	10 / 30	20 / 60	40 / 80	100 / 180
6C	.29	1.19	.008	35 / 38	60 / 70	130 / 140	170 / 190	430 / 440
6D	.54	1.48	.014	24 / 34	60 / 100	160 / 210	230 / 300	620 / 730
6E	.16	.53	.019	10 / 33	10 / 50	60 / 110	90 / 140	250 / 360
7A	.14	.90	.011	10 / 46	10 / 50	30 / 90	50 / 120	150 / 290
7B	.53	1.55	.018	21 / 41	50 / 120	140 / 240	210 / 330	560 / 770
8A	.19	.91	.011	10 / 40	10 / 50	40 / 110	60 / 140	190 / 350
8B	.15	.83	.015	32 / 55	40 / 80	90 / 140	120 / 170	290 / 380
9A	.16	.68	.010	33 / 33	20 / 20	40 / 40	60 / 50	140 / 130
9B	.27	1.29	.018	32 / 42	50 / 70	110 / 140	150 / 180	380 / 430
10A	.09	.66	.012	33 / 35	30 / 30	60 / 60	80 / 80	200 / 210
10B	.06	.43	.005	10 / 40	10 / 20	20 / 50	30 / 60	90 / 150
11	.10	.67	.013	55 / 66	60 / 70	100 / 120	130 / 150	280 / 300
12	.10	.59	.007	16 / 57	10 / 50	40 / 90	60 / 110	160 / 230

THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHALL NOT BE USED FOR CONSTRUCTION PURPOSES. SUBJECT TO CHANGE.



DATUM IS MEAN SEA LEVEL (TO CONVERT TO MODIFIED STATE PLANE COORDINATES AT 5500' M.S.L. MULTIPLY COORDINATES SHOWN BY 1.0002979)

GROUND CONTROL SURVEY BY	LANDMARK MAPPING
AERIAL PHOTOGRAPHY BY	SCHARF & ASSOC.
TOPOGRAPHIC MAPPING BY	LANDMARK MAPPING
CONTOUR INTERVAL 2'	DATE FLOWN 6-13-79

CAMP DRESSER & McKEE INC.
environmental engineers, scientists, planners & management consultants
Denver, Colorado 80222
CDM

DESIGNED	RNW	DATE	7/80
DRAWN	TLS	DATE	7/80
CHECKED	RNW	DATE	9/80
REVISED	RNW	DATE	12/80

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAFAYETTE — BOULDER COUNTY

BASINWIDE MAJOR DRAINAGEWAY PLANNING
SELECTED ALTERNATIVE PHASE B DESIGN

DRAINAGEWAY 3 PLAN
STA. 22+00 TO STA. 51+05

SHEET
11 OF 21

APPENDIX E

EXISTING CONDTIONS
HYDROLOGIC COMPUTATIONS

DREXEL, BARRELL & CO.

CIVIL ENGINEERS/LAND SURVEYORS

Engineers/Surveyors

Project: WILLOUGHBY CORNER — Job # *21072-01BLCV*

Client: Boulder County Housing Authority — Designed by: MAB — Date: 03/27/2020

COMPOSITE RUNOFF COEFFICIENTS

EXISTING CONDITIONS:

Basin	Area (sq. ft.)	Tables 1500-4 & 1500-5, City of Lafayette "Standards and Specifications" Description	Percent Imp. "I"	C_2	C_5	C_{10}	C_{100}	Weighted C_2	Weighted C_5	Weighted C_{10}	Weighted C_{100}	Weighted Imperv.
	35,120	Paved Streets	100%	0.87	0.88	0.90	0.93	0.03	0.03	0.03	0.03	3.2%
	0	Drives & Walks	96%	0.85	0.87	0.90	0.92	0.00	0.00	0.00	0.00	0.0%
'EX'	0	Roofs	90%	0.80	0.85	0.90	0.90	0.00	0.00	0.00	0.00	0.0%
	1,084,430	Lawns, Sandy Soil	0%	0.00	0.10	0.20	0.50	0.00	0.10	0.20	0.50	0.0%
24.90												
acres	1,084,430	<<Total Area	Total Weighted Runoff Coefficients C_2, C_5, C_{10},C_{100} & I>>					**0.03**	**0.13**	**0.23**	**0.53**	**3.24%**
	20,391	Paved Streets	100%	0.87	0.88	0.90	0.93	0.06	0.06	0.06	0.07	7.1%
	0	Drives & Walks	96%	0.85	0.87	0.90	0.92	0.00	0.00	0.00	0.00	0.0%
'OS1'	0	Roofs	90%	0.80	0.85	0.90	0.90	0.00	0.00	0.00	0.00	0.0%
	265,618	Lawns, Sandy Soil	0%	0.00	0.10	0.20	0.50	0.00	0.09	0.19	0.46	0.0%
6.57												
acres	286,009	<<Total OffsiteArea	Total Weighted Runoff Coefficients C_2, C_5, C_{10},C_{100} & I>>					**0.06**	**0.16**	**0.25**	**0.53**	**7.13%**

PROJECT INFORMATION

PROJECT:	WILLOUGHBY CORNER
PROJECT NO:	21072-01BLCV
DESIGN BY:	CWK
REV. BY:	MAB
AGENCY:	DREXEL BARRELL
REPORT TYPE:	PRELIMINARY DRAINAGE
DATE:	3/27/2020

Drexel, Barrell & Co.

*C-Values and Basin Imperviousness based on Table 7-2, City of Boulder "Design and Construction Standards"

$Q = CIA$

$T_c = T_i + T_t$

Initial or Overland Travel Time, T_i

$$T_i = \frac{1.8*(1.1-C_5)\,(L^{1/2})}{(S^{0.33})}$$

Overland Travel Time, $T_t = L/V$

Velocity, V

T_c (check) = L / 180 + 10

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA				INITIAL or OVERLAND TIME (t_i) (RO-3)			TRAVEL TIME (t_t) (RO-4)				t_c CHECK (URBANIZED BASINS) (RO-5)			FINAL t_c
BASIN	DESIGN PT:	C_5	AREA	LENGTH	SLOPE	t_i	LENGTH	SLOPE	V	t_t	COMP.	TOT. LENGTH	tc=(L/180)+10	
			Ac	Ft	%	Min	Ft	%	FPS	Min	t_c	Ft	Min	Min
PROPOSED	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
EX	1	0.13	24.90	300	1.0	30	976	1.0	2.00	8.1	38	1276	17.1	17.1
OS1	2	0.16	6.57	300	1.0	29	240	1.0	2.00	2.0	31	540	13.0	13.0

PROJECT INFORMATION

PROJECT:	WILLOUGHBY CORNER
PROJECT NO:	21072-01BLCV
DESIGN BY:	CWK
REV. BY:	MAB
AGENCY:	DREXEL BARRELL
REPORT TYPE:	PRELIMINARY DRAINAGE
DATE:	3/27/2020

Drexel, Barrell & Co.

*Rainfall Inensity (in/hr) based on Figure 1500-1 for calculated Tc, City of Laffayette "Secifications & Standards"

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING BASIN EX 2-5-10-100 YR STORM

DIRECT RUNOFF								TOTAL RUNOFF					REMARKS
RETURN PERIOD (YR)	DESIGN POINT	AREA (AC)	RUNOFF COEFF, C	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	t_c (MIN)	AREA (TOTAL)	Σ (C * A)	I (IN/HR)	Q (CFS)	
2	1	24.90	0.03	17.1	0.70	2.20	1.54						
5	1	24.90	0.13	17.1	3.20	2.80	8.96						
10	1	24.90	0.23	17.1	5.70	3.30	18.83						
100	1	24.90	0.53	17.1	13.20	5.40	71.27						

EXISTING BASIN OS1 2-5-10-100 YR STORM

DIRECT RUNOFF								TOTAL RUNOFF					REMARKS
RETURN PERIOD (YR)	DESIGN POINT	AREA (AC)	RUNOFF COEFF, C	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	t_c (MIN)	AREA (TOTAL)	Σ (C * A)	I (IN/HR)	Q (CFS)	
2	2	6.57	0.06	13.0	0.41	2.20	0.90						
5	2	6.57	0.16	13.0	1.02	2.80	2.86						
10	2	6.57	0.25	13.0	1.64	3.30	5.41						
100	2	6.57	0.53	13.0	3.48	5.40	18.81						

APPENDIX F

PROPOSED CONDITIONS
HYDROLOGIC COMPUTATIONS

DREXEL, BARRELL & CO.

CIVIL ENGINEERS/LAND SURVEYORS

Engineers/Surveyors

Project: WILLOUGHBY CORNER — Job # *21072-01BLCV*

Client: Boulder County Housing Authority — Designed by: MAB — Date: 03/27/2020

COMPOSITE RUNOFF COEFFICIENTS

PROPOSED CONDITIONS:

Basin	Area (sq. ft.)	Tables 1500-4 & 1500-5, City of Lafayette "Standards and Specifications"						Weighted C_2	Weighted C_5	Weighted C_{10}	Weighted C_{100}	Weighted Imperv.
		Description	Percent Imp. "I"	C_2	C_5	C_{10}	C_{100}					
	185,137	Paved Streets	100%	0.87	0.88	0.90	0.93	0.15	0.15	0.15	0.16	17.1%
	260,056	Drives & Walks	96%	0.85	0.87	0.90	0.92	0.20	0.21	0.22	0.22	23.0%
'A'	88,654	Roofs	90%	0.80	0.85	0.90	0.90	0.07	0.07	0.07	0.07	7.4%
	338,886	Lawns, Sandy Soil	0%	0.00	0.10	0.20	0.50	0.00	0.03	0.06	0.16	0.0%
	70,480	Duplex lots	70%	0.60	0.65	0.70	0.80	0.04	0.04	0.05	0.05	4.5%
	141,216	Multifamily lots	70%	0.60	0.65	0.70	0.80	0.08	0.08	0.09	0.10	9.1%
24.90												
acres	1,084,429	<<Total Area	Total Weighted Runoff Coefficients C_2, C_5, C_{10},C_{100} & I>>					**0.42**	**0.46**	**0.51**	**0.61**	**47.45%**
	11,787	Paved Streets	100%	0.87	0.88	0.90	0.93	0.04	0.04	0.04	0.04	4.1%
	8,703	Drives & Walks	96%	0.85	0.87	0.90	0.92	0.03	0.03	0.03	0.03	2.9%
'OS1'	0	Roofs	90%	0.80	0.85	0.90	0.90	0.00	0.00	0.00	0.00	0.0%
	265,519	Lawns, Sandy Soil	0%	0.00	0.10	0.20	0.50	0.00	0.09	0.19	0.46	0.0%
6.57												
acres	286,009	<<Total OffsiteArea	Total Weighted Runoff Coefficients C_2, C_5, C_{10},C_{100} & I>>					**0.06**	**0.16**	**0.25**	**0.53**	**7.04%**
	16,295	Paved Streets	100%	0.87	0.88	0.90	0.93	0.62	0.63	0.64	0.66	71.0%
	5,690	Drives & Walks	96%	0.85	0.87	0.90	0.92	0.21	0.22	0.22	0.23	23.8%
'C'	0	Roofs	90%	0.80	0.85	0.90	0.90	0.00	0.00	0.00	0.00	0.0%
	958	Lawns, Sandy Soil	0%	0.00	0.10	0.20	0.50	0.00	0.00	0.01	0.02	0.0%
0.53												
acres	22,943	<<Total OffsiteArea	Total Weighted Runoff Coefficients C_2, C_5, C_{10},C_{100} & I>>					**0.83**	**0.84**	**0.87**	**0.91**	**94.83%**

PROJECT INFORMATION

PROJECT:	WILLOUGHBY CORNER
PROJECT NO:	21072-01BLCV
DESIGN BY:	CWK
REV. BY:	MAB
AGENCY:	DREXEL BARRELL
REPORT TYPE:	PRELIMINARY DRAINAGE
DATE:	3/27/2020

Drexel, Barrell & Co.

*C-Values and Basin Imperviousness based on Table 7-2, City of Boulder "Design and Construction Standards"

$Q = CIA$

$T_c = T_i + T_t$

Initial or Overland Travel Time, T_i

$$T_i = \frac{1.8*(1.1-C_5)\,(L^{1/2})}{(S^{0.33})}$$

Overland Travel Time, $T_t = L/V$

Velocity, V

T_c (check) = L / 180 + 10

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA				INITIAL or OVERLAND TIME (t_i) (RO-3)			TRAVEL TIME (t_t) (RO-4)				t_c CHECK (URBANIZED BASINS) (RO-5)			FINAL t_c
BASIN	DESIGN PT:	C_5	AREA	LENGTH	SLOPE	t_i	LENGTH	SLOPE	V	t_t	COMP.	TOT. LENGTH	tc=(L/180)+10	
			Ac	Ft	%	Min	Ft	%	FPS	Min	t_c	Ft	Min	Min
PROPOSED	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
A	1	0.46	24.90	215	1.1	16.4	1530	0.9	1.90	13.4	29.8	1745	19.7	19.7
OS1	2	0.16	6.57	15	2.0	5.2	810	0.5	1.41	9.5	14.8	825	14.6	14.6
C	3	0.84	0.53	20	2.0	1.6	1185	2.0	2.83	7.0	8.6	1205	16.7	8.6

PROJECT INFORMATION

PROJECT:	WILLOUGHBY CORNER
PROJECT NO:	21072-01BLCV
DESIGN BY:	CWK
REV. BY:	MAB
AGENCY:	DREXEL BARRELL
REPORT TYPE:	PRELIMINARY DRAINAGE
DATE:	3/27/2020

Intensity, I (Figure 7-1) City of Boulder, "Design and Construction Standards"

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED 2 YR STORM

DIRECT RUNOFF							
BASIN (SITE)	DESIGN POINT	AREA (AC)	RUNOFF COEFF, C_2	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
A	1	24.90	0.42	19.7	10.40	1.95	20.28
OS1	2	6.57	0.06	14.6	0.41	2.55	1.03
C	3	0.53	0.83	8.6	0.44	2.70	1.18

PROPOSED 10 YR STORM

DIRECT RUNOFF							
BASIN (SITE)	DESIGN POINT	AREA (AC)	RUNOFF COEFF, C_{10}	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
A	1	24.90	0.51	19.7	12.59	3.40	42.79
OS1	2	6.57	0.25	14.6	1.64	4.40	7.23
C	3	0.53	0.87	8.6	0.46	4.80	2.20

PROPOSED 100 YR STORM

DIRECT RUNOFF							
BASIN (SITE)	DESIGN POINT	AREA (AC)	RUNOFF COEFF, C_{100}	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
A	1	24.90	0.61	19.7	15.17	5.50	83.42
OS1	2	6.57	0.53	14.6	3.48	7.17	24.97
C	3	0.53	0.91	8.6	0.48	7.40	3.55

APPENDIX G

PROPOSED

STORM WATER QUALITY

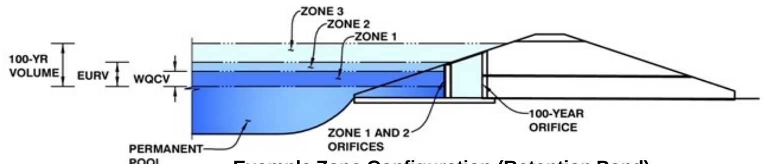
POND CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: **WILLOUGHBY CORNER**

Basin ID: **A**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	24.90	acres
Watershed Length =	1,500	ft
Watershed Length to Centroid =	750	ft
Watershed Slope =	0.011	ft/ft
Watershed Imperviousness =	47.45%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Lafayette - City Hall	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.414	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.258	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.81 in.) =	0.689	acre-feet		inches
5-yr Runoff Volume (P1 = 1.1 in.) =	1.020	acre-feet		inches
10-yr Runoff Volume (P1 = 1.01 in.) =	0.907	acre-feet	1.01	inches
25-yr Runoff Volume (P1 = 1.8 in.) =	2.441	acre-feet		inches
50-yr Runoff Volume (P1 = 2.17 in.) =	3.197	acre-feet		inches
100-yr Runoff Volume (P1 = 1.64 in.) =	2.207	acre-feet	1.64	inches
500-yr Runoff Volume (P1 = 3.69 in.) =	6.560	acre-feet		inches
Approximate 2-yr Detention Volume =	0.642	acre-feet		
Approximate 5-yr Detention Volume =	0.953	acre-feet		
Approximate 10-yr Detention Volume =	1.002	acre-feet		
Approximate 25-yr Detention Volume =	1.718	acre-feet		
Approximate 50-yr Detention Volume =	1.926	acre-feet		
Approximate 100-yr Detention Volume =	1.460	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.414	acre-feet
Zone 2 Volume (10-year - Zone 1) =	0.588	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.665	acre-feet
Total Detention Basin Volume =	1.667	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
5159.00	--	0.25	--	--	--	343	0.008	43	0.001
5159.25	--	0.50	--	--	--	1,666	0.038	294	0.007
5159.50	--	0.75	--	--	--	4,291	0.099	1,039	0.024
5159.75	--	1.00	--	--	--	8,164	0.187	2,595	0.060
5160.00	--	1.25	--	--	--	13,193	0.303	5,265	0.121
5160.25	--	1.50	--	--	--	18,804	0.432	9,265	0.213
5160.50	--	1.75	--	--	--	23,894	0.549	14,602	0.335
5160.75-WQCV	--	2.00	--	--	--	29,047	0.667	21,219	0.487
5161.00	--	2.25	--	--	--	33,744	0.775	29,068	0.667
5161.25	--	2.50	--	--	--	38,873	0.892	38,145	0.876
5161.50-10yr	--	2.75	--	--	--	44,520	1.022	48,569	1.115
5161.75	--	3.00	--	--	--	49,915	1.146	60,374	1.386
5162.00-100yr	--	3.25	--	--	--	55,231	1.268	73,517	1.688
5162.25	--	3.50	--	--	--	60,359	1.386	87,966	2.019
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APPENDIX H

CHARTS, TABLES AND GRAPHS

specifically listed in Table 1500-4 (Planned Building Groups, Shopping Centers, Trailer Parks, etc.), a composite runoff coefficient base on the percentage of the different types of surfaces involved may be calculated using the coefficients listed in Table 1500-5.

TABLE 1500-4. RECOMMENDED RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

Land Use or Surface Characteristics	Percent Impervious	Frequency 2	5	10	100
Business:					
Commercial Areas	95	0.87	0.87	0.88	0.89
Neighborhood Areas	70	0.60	0.65	0.70	0.80
Residential:					
Single-Family	*	0.40	0.45	0.50	0.60
Multi-Unit (detached)	50	0.45	0.50	0.60	0.70
Multi-Unit (attached)	70	0.60	0.65	0.70	0.80
½ Acre Lot or Larger	*	0.30	0.35	0.40	0.60
Apartments	70	0.65	0.70	0.70	0.80
Industrial:					
Light Areas	80	0.71	0.72	0.76	0.82
Heavy Acres	90	0.80	0.80	0.85	0.90
Parks, Cemeteries	7	0.10	0.10	0.35	0.60
Playgrounds	13	0.15	0.25	0.35	0.65
Schools	50	0.45	0.50	0.60	0.70
Railroad Yard Areas	40	0.40	0.45	0.50	0.60
Undeveloped areas:					
Historic Flow Analysis – Greenbelts, Agricultural	2		(See lawns)		
Offsite Flow Analysis (when land use not defined)	45	0.43	0.47	0.55	0.65
Streets:					
Paved	100	0.87	0.88	0.90	0.93
Gravel	13	0.15	0.25	0.35	0.65
Drives and Walks	96	0.87	0.87	0.88	0.89
Roofs	90	0.80	0.85	0.90	0.90
Lawns, Sandy Soil	0	0.00	0.01	0.05	0.20
Lawns, Clayey Soil	0	0.05	0.10	0.20	0.40

Note: These Rational Formula coefficients may not be valid for large basins.
* % impervious based on density. See Figure 1500-2.

Above Percent Impervious shall NOT be used for detention volume calculations. Actual site data must be applied in the appropriate equations.

TABLE 1500-5. RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS
(Rational Method)

Surface Type	2	5	10	100
Paved Streets	0.87	0.88	0.90	0.93
Gravel Streets	0.15	0.15	0.15	0.15
Drives and Walks	0.85	0.87	0.90	0.92
Roofs	0.80	0.85	0.90	0.90
Lawns, Sandy Soil	0.00	0.10	0.20	0.50
Lawns, Heavy Soil	0.10	0.20	0.30	0.60

The composite runoff coefficient (C_c) shall be calculated using

$$C = \frac{\sum C_i A_i}{A_t}$$

Where C = composite runoff coefficient
C_i = individual runoff coefficient
A_i = area of each different type of surface to be considered
A_t = total drainage area involved for which the composite coefficient is applicable
i = number of different types of surfaces to be considered

The Rational Method Formula for use with the initial and major storms shall be defined as:

$$Q = CIA$$

Where Q = storm flow (cfs)
I = rainfall intensity (in/hr) from Figure 1500-1
A = drainage area (acres)
C = runoff coefficient from Tables 1500-4 or 1500-5

1502.6. Time of Concentration

The time of concentration to be used in conjunction with the Rational Method and the Time-Intensity-Frequency Curves of Figure 1500-1 shall be calculated using the following procedure and equations:

$$Tc = Ti + Tf \qquad (1)$$

Where Tc = time of concentration (minutes)
Ti = initial time of concentration to first design point (minutes)
Tf = average flow time to downstream design points (minutes)

For urbanized conditions (i.e., after development), the initial time of concentration shall be calculated using the *lesser* value obtained from the following two equations:

$$Ti = \frac{L}{180} + 10 \qquad (2)$$

for large basins. For the purpose of these specifications, areas of one square mile or less are defined as small basins.

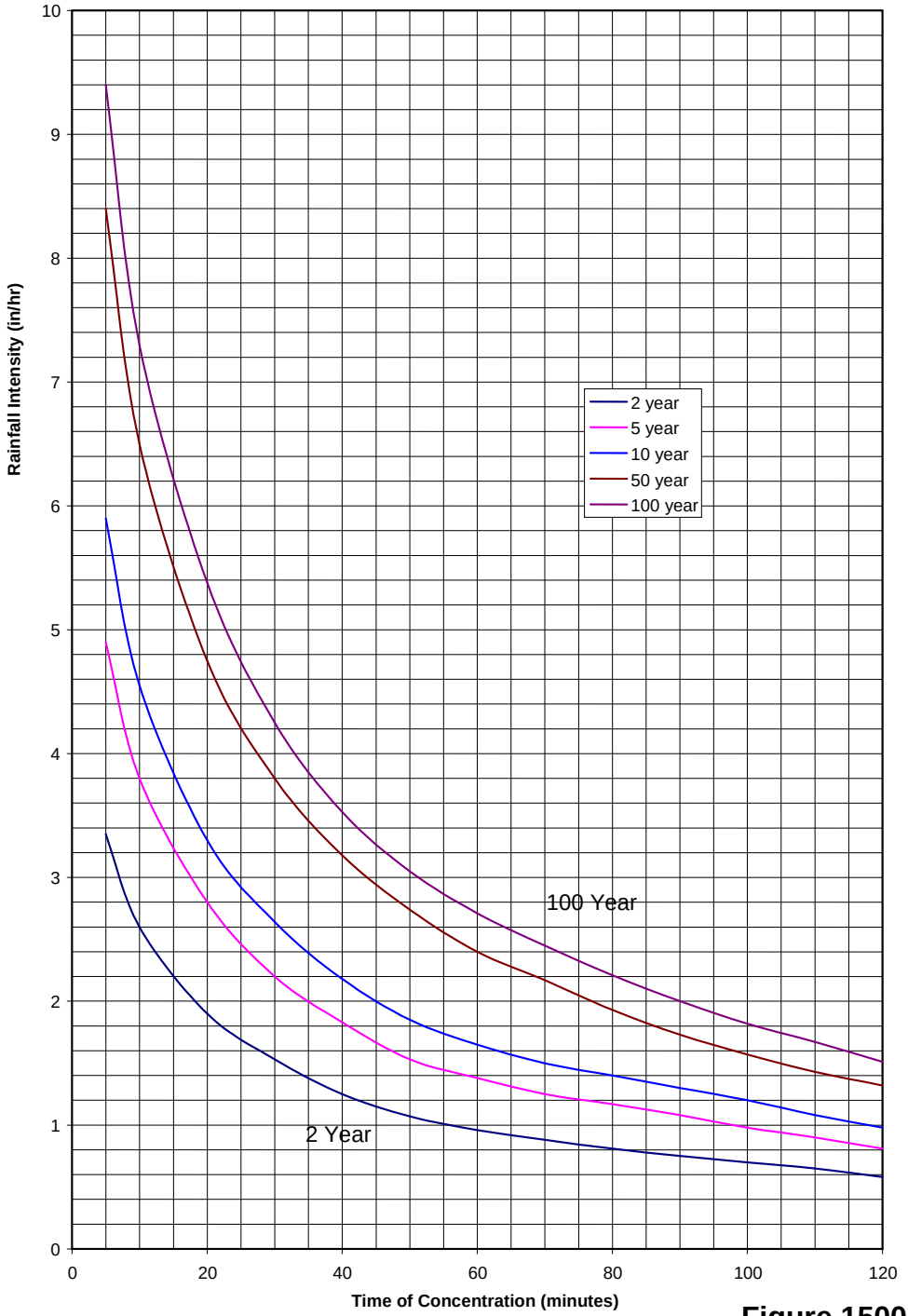


Figure 1500-1

TABLE 1500-3. 5-MINUTE INCREMENT, 2-HOUR DURATION DESIGN STORMS
For use with the Colorado Urban Hydrograph Procedure

Time (minutes)	Incremental Rainfall Depth/Return Period			
	2 Year	5 Year	10 Year	100 Year
5	0.01	0.01	0.02	0.03
10	0.03	0.04	0.05	0.05
15	0.07	0.10	0.12	0.11
20	0.14	0.20	0.24	0.22
25	0.24	0.36	0.43	0.41
30	0.14	0.18	0.19	0.68
35	0.07	0.10	0.12	0.38
40	0.04	0.06	0.07	0.22
45	0.04	0.06	0.07	0.14
50	0.03	0.04	0.05	0.14
55	0.03	0.04	0.05	0.11
60	0.03	0.04	0.05	0.11
65	0.02	0.03	0.03	0.11
70	0.02	0.03	0.03	0.05
75	0.02	0.03	0.03	0.05
80	0.02	0.03	0.03	0.05
85	0.02	0.03	0.03	0.05
90	0.01	0.01	0.03	0.05
95	0.01	0.01	0.02	0.03
100	0.01	0.01	0.02	0.03
105	0.01	0.01	0.02	0.03
110	0.01	0.01	0.02	0.03
115	0.01	0.01	0.02	0.03
120	0.01	0.01	0.02	0.03
Total	**1.04**	**1.45**	**1.76**	**3.14**

Reference: **Urban Drainage and Flood Control District Preliminary Design Storm Procedure,** Hydrology Research Program, August 1979

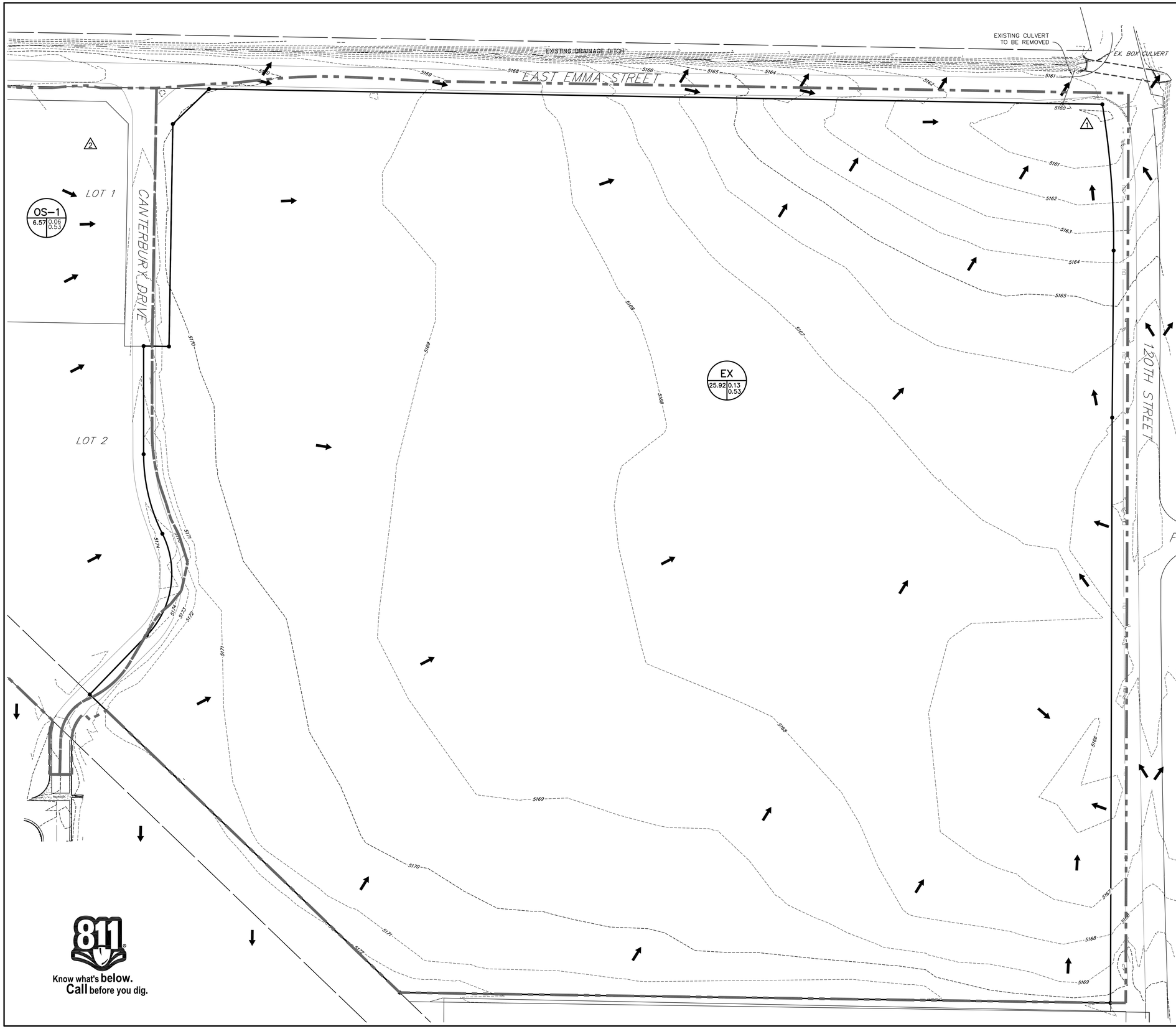
1502.4. Runoff Computation

Total storm water runoff shall be computed using the hydrologic methods set forth in Section 1501.2 above. Runoff computations for both the initial storm and the major storm shall be submitted with the proposed storm drainage plan. Computations shall be submitted on forms similar to those included in these specifications.

The Rational Method shall not be used to compute storm runoff for areas in excess of 200 acres or for complex drainage basins. Larger basins shall be analyzed using the Colorado Urban Hydrograph Procedure or other appropriate hydrograph methods as approved by the City Council or its designated representative.

1502.5. Runoff Coefficients

The runoff coefficients (C) to be used in conjunction with the Rational Method shall be those listed in Table 1500-4. As an alternative to said coefficients or for areas not



50 20 0 50 100

ORIGINAL SCALE: 1"=50'

LEGEND

- PROPERTY LINE
- EX. INTERMEDIATE CONTOUR 5164
- EX. INDEX CONTOUR 5165
- BASIN I.D. — A
- BASIN AREA (Acres) — 3.61
- 2 YR. RUNOFF COEFFICIENT — 0.36
- 100 YR. RUNOFF COEFFICIENT — 0.85
- DIRECTION OF FLOW
- EX. STORM LINE ..... ST
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN DESIGN POINT 1

EX. RUNOFF SUMMARY TABLE

DESIGN POINT	CONTRIBUTING AREA (acres)	RUNOFF 2-YR. (cfs)	RUNOFF 100-YR. (cfs)
1	24.90	1.54	71.27
2	6.57	0.90	18.81

APPROVED:

_____ _____

CITY ENGINEER DATE

REVIEW IS FOR GENERAL CONFORMANCE WITH TE CITY OF LAFAYETTE "STANDARDS AND SPECIFICATIONS," LATEST EDITION. SOLE RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THESE DOCUMENTS SHALL REMAIN WITH THE REGISTERED PROFESSIONAL ENGINEER SEALING THESE PLANS. THE CITY DOES NOT ACCEPT LIABILITY FOR FACILITIES DESIGNED BY OTHERS.

Know what's **below.** **Call** before you dig.

CHECKED BY: CWK
DRAWN BY: MAB

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WILLOUGHBY CORNER

0 120th ST
LAFAYETTE, CO

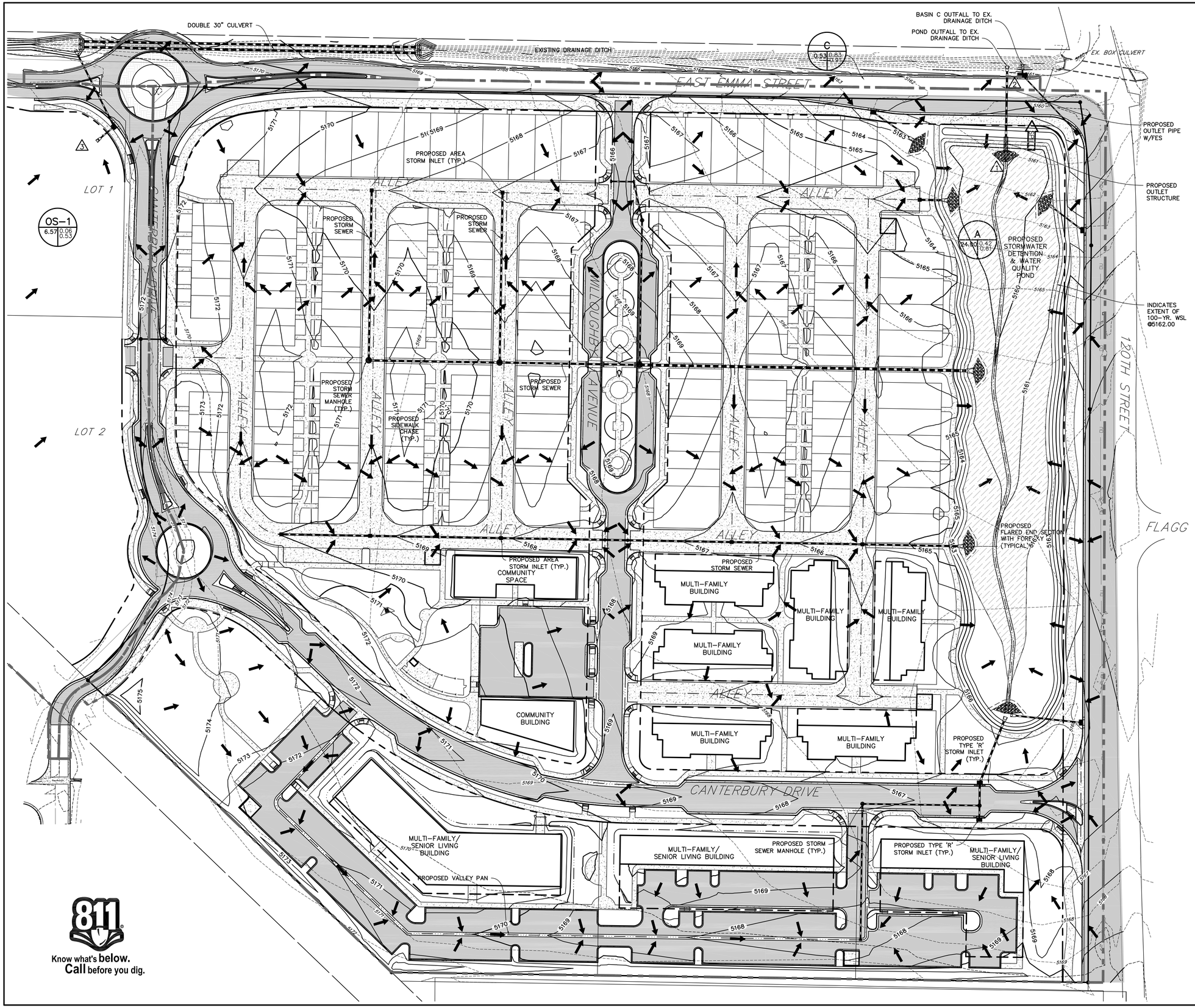
OWNER:
BOULDER COUNTY
HOUSING AUTHORITY
2525 13th ST, SUITE 204
BOULDER, CO 80302
303-441-1000

DREXEL, BARRELL & CO.
Engineers • Surveyors
1800 38th STREET
BOULDER, COLORADO 80301
CONTACT: CAMERON KNAPP, P.E.
(303) 442-4338

NOT FOR CONSTRUCTION

DATE:
03/27/2020 PRE PLAN

SHEET TITLE:
EXISTING DRAINAGE



50 20 0 50 100

ORIGINAL SCALE: 1"=50'

LEGEND

- PROPERTY LINE
- EX. INTERMEDIATE CONTOUR 5164
- EX. INDEX CONTOUR 5165
- BASIN I.D.
- BASIN AREA (Acres)
- 2 YR. RUNOFF COEFFICIENT
- 100 YR. RUNOFF COEFFICIENT
- DIRECTION OF FLOW
- EX. STORM LINE ..... ST
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN DESIGN POINT
- PROPOSED INTERMEDIATE CONTOUR 5164
- PROPOSED INDEX CONTOUR 5165
- PROPOSED STORM SEWER
- FLOWLINE OF DRAINAGE SWALE
- PROPOSED MANHOLE
- PROPOSED STORM INLET
- PROPOSED STORM SEWER
- AREA INUNDATED IN 100-YR STORM
- EMERGENCY OVERFLOW ..... SPILL

RUNOFF SUMMARY TABLE			
DESIGN POINT	CONTRIBUTING AREA (acres)	RUNOFF 2-YR. (cfs)	RUNOFF 100-YR. (cfs)
1	24.90	20.28	83.42
2	6.57	1.03	24.97
3	0.53	1.18	3.55

APPROVED:

CITY ENGINEER _____ DATE _____

REVIEW IS FOR GENERAL CONFORMANCE WITH TE CITY OF LAFAYETTE "STANDARDS AND SPECIFICATIONS," LATEST EDITION. SOLE RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THESE DOCUMENTS SHALL REMAIN WITH THE REGISTERED PROFESSIONAL ENGINEER SEALING THESE PLANS. THE CITY DOES NOT ACCEPT LIABILITY FOR FACILITIES DESIGNED BY OTHERS.

811 Know what's below. Call before you dig.

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DRAWN BY: MAB

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WILLOUGHBY CORNER

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LAFAYETTE, CO

OWNER:
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BOULDER, CO 80302
303-441-1000

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03/27/2020 PRE PLAN

SHEET TITLE:
PRELIMINARY DRAINAGE PLAN