Community & Economic
Development Department
www.adcogov.org

ADAMS COUNTY
COLORADO

4430 South Adams County Parkway
1st Floor, Suite W2000
Brighton, CO 80601-8204
PHONE 720.523.6800
FAX 720.523.6998

Re-submittal Form

Case Name/ Number: PRC2023-00006

Case Manager: Cody Spaid

Re-submitted Items:

- [X] Development Plan/ Site Plan
- [X] Plat
- [X] Parking/ Landscape Plan
- [X] Engineering Documents
- [ ] Subdivision Improvements Agreement (Microsoft Word version)
- [X] Other: Comment Responses, Narratives, Title Report

* **All re-submittals must have this cover sheet and a cover letter addressing review comments.**

Please note the re-submittal review period is 21 days.

The cover letter must include the following information:

- Restate each comment that requires a response
- Provide a response below the comment with a description of the revisions
- Identify any additional changes made to the original document

For County Use Only:

Date Accepted:

Staff (accepting intake):

Resubmittal Active: Engineering; Planner; Right-of-Way; Addressing; Building Safety;

Neighborhood Services; Environmental; Parks; Attorney; Finance; Plan Coordination

FRONTERRA
LANDSCAPE ARCHITECTURE
PLANNING

Dear Adams County,

Please consider this resubmittal package our formal request for review of the 5602 Lowell Boulevard Major Subdivision Application by the County staff. Our team thanks you for your consideration of this request.

The proposed Spano-Calabrese Subdivision consists of the following:

1. Division of Lot 2 Spano Subdivision (Parcel No. 0182508302001, 5820 Lowell Boulevard) creating a separate portion of land, totalling approximately one and a half (1.5) acres, to be sold to 5602 Lowell LLC.
2. Lot 2 Calabrese Subdivision (Parcel No. 0182508302003, 5660 Lowell Boulevard) and aforementioned portion of Lot 2 Spano Subdivision (Parcel No. 0182508302001) to be consolidated into a single lot, Lot 1 Calabrese Subdivision (Parcel No. 0182508302004, 5602 Lowell Boulevard).

Per correspondence received on October 4th, 2023 from Cody Spaid, Adams County Planner II, a noise wall is not required and we ask that the noise barrier requirements assoicated with this property be waived.

5602 LOWELL BOULEVARD REZONING PROPOSAL

5602 LOWELL BOULEVARD, DENVER, COLORADO 80221

FRONTERRA

LANDSCAPE ARCHITECTURE
PLANNING

Dear Adams County,

Please consider this package our formal request for review of the 5602 Lowell Boulevard Rezoning Application by the County staff. Our team thanks you for your consideration of this request.

The proposed Lowell Development Subdivision, depicted in the attached Plat, is currently zoned C-4 Commerical-4 District. We propose to rezone this property to R-4 Residential-4 District, to align with the future land use, Urban Residential, specified in the Adams County Comprehensive Plan.

NOVEMBER 21, 2023

From: **Laurie A. Clark** <LAClark@adcogov.org>
Date: Wed, Jan 3, 2024 at 10:42 AM
Subject: RE: 5602 LOWELL BLVD (Major Subdivision & Rezoning Resubmittal)
To: Josh McCarn <josh@fronterra.design>
Cc: Cody Spaid <CSpaid@adcogov.org>

Engineering comments for PRC2023-00006:

ENG13: A Floodplain Use Permit will be required for all proposed work within the FEMA regulated 100-yr floodplain and floodway.

Response: Loewen Engineering is submitting a grading plan for all of the necessary CLOMR improvements to the site. The CLOMR improvements are being done separate from the site development improvements.

ENG14: Approved CLOMR documents have been received.

Response: Loewen Engineering will be submitting plans to complete the CLOMR improvements and submit a LOMR to make the changes effective.

ENG15: The proposed flood channel improvements with maintenance access shall be contained within an easement to be dedicated on the Plat. Revise Plat to include the flood channel easement.

Response: An ~80' wide drainage easement containing the future 100-year floodplain boundary and channel maintenance access road was on the plat for the flood channel. The easement boundaries were determined through discussions with MHFD and Loewen Engineering.

ENG16: All proposed onsite drainage facilities with maintenance access shall be contained within easements to be dedicated on the Plat. Revise Plat to include Drainage Easements.

Response: Easements for both detention ponds were added to the plat. These are likely to change as the final grading design is completed.

ENG17: There is a proposed retaining wall along the north side of the flood channel maintenance access drive. Show that the wall is outside of the flood channel easement or revise the CLOMR documents to include the wall.

The limits of the floodplain are included on the drainage plan. The wall is outside of the floodplain, and the drainage easement goes up to the southern face of the wall.

ENG18: Provide the amount of fill material proposed for the site. If the applicant proposes to import greater than 10 CY of soil to this site, additional permitting is required. Per Section 4-04-02-02, of the Adams County Development Standards and Regulations, a Temporary or Special Use Permit is required to ensure that only clean, inert soil is imported into any site within un-incorporated Adams County. A Conditional Use Permit will be required if the importation exceeds 500,000 CY.

Response: Based on cut/fill quantities for the CLOMR improvements determined by Loewen engineering, preliminary grading calculations for the proposed development, and the geotechnical recommendations we anticipate having enough soil on-site to complete the necessary earthwork. The only imported material will be aggregate/engineered products from a local supplier.

ENG19: Provide grading plans that include the height of all proposed retaining walls.

Response: Exact wall heights will be determined during the grading design of the property. Based on our preliminary calculations we will have wall heights ranging from 3 feet to 12 feet with an average height of 6'. The tallest walls will be along the east edge of the developed area.

ENG20: The East Detention Pond is proposed to have vertical walls on all sides. Section 9-01-11-03-01-02 of the ACDSR requires pond side slopes to be no greater that 4:1.
Response: The preliminary pond volumes were calculated using a maximum slope within the pond area of 4:1, but due to the flood channel on the south side of the site, the maintenance access requirement for the flood channel, the height of the site above the open space to the east of the site, retaining walls were included in the East Detention Pond to be able to keep the site and detention pond separate from the floodplain.

It is common for dense urban developments to use retaining walls in detention ponds in order to shrink the footprint of the pond and utilize more of the property for the development. While retaining walls in the ponds are not ideal, they are sometimes necessary for a project to be economical since real estate is very expensive. The internal retaining walls may be reduced during the final grading design depending on the tributary area going to the East Pond.

Based on the preliminary calculations, the volume of the ponds as they are shown exceeds the required volumes. The tributary areas to each pond will be modified during the final grading design to be able to utilize both ponds' potential volume. The preliminary plans submitted for this process only show the ponds as place holders and preliminary calculations make us confident that there is enough space within the site layout to be able to provide adequate detention volume for the proposed improvements between both ponds.

Per Adams County Storm Drainage Design and Technical Criteria Section 9-01-11-03-01-02, The County may grant administrative relief on slope requirements based on site conditions. We are requesting relief from the slope requirements based the need to keep the East Pond separate from the floodplain.

ENG21: The West Detention Pond is proposed to have a "dropbox spillway". Section 9-01-11-03-01-04 of the ACDSR requires a weir spillway with the downstream path clearly identified.

Response: An emergency overflow weir was added to the West Detention Pond

ENG22: Provide maintenance access to the West Detention Pond.

Response: A pond access road was added to the south side of the pond. See the attached drainage plan.

ENG23: The Drainage Report requires Owner/Developer signature block.

Response: Owner/Developer Signature block added to the second page of the report.

ENG24: Add discussion in the Drainage Report showing how Low Impact Development Standards (LID) will be met.

Response: Specific LID elements and locations will be included with the final grading and landscape design.

ENG25: The Traffic Impact Study is acceptable as submitted. No roadway improvements will be required for Lowell Blvd.

Thank you,

Laurie Clark, PE, CFM
Civil Engineer - Senior, *Community & Economic Development*
ADAMS COUNTY, COLORADO
4430 South Adams County Parkway, 1st Floor
Brighton, CO 80601
o: 720.523.6897 | *laclark@adcogov.org*

LOWELL DEVELOPMENT SUBDIVISION - PRELIMINARY PLAT)001

A REPLAT OF LOT 2, SPANO SUBDIVISION AND LOTS 1 AND 2, CALABRESE SUBDIVISION
BEING PART OF THE SOUTHWEST QUARTER OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M.
COUNTY OF ADAMS, STATE OF COLORADO
SHEET 1 OF 3

els: edited

els: edited

OWNERSHIP AND DEDICATION CERTIFICATE

THE UNDERSIGNED, BEING THE OWNER(S), OF CERTAIN LANDS IN THE COUNTY OF ADAMS, COLORADO, DESCRIBED AS FOLLOWS:

A PARCEL OF LAND LOCATED IN THE SOUTHWEST QUARTER OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH PRINCIPAL MERIDIAN, BEING LOT 2, SPANO SUBDIVISION RECORDED FEBRUARY 2, 2005 AT RECEPTION NO. 20050202000110370, EXCEPT THAT PORTION OF LOT 2 DEEDED TO ADAMS COUNTY IN WARRANTY DEED RECORDED MAY 18, 2016 AT RECEPTION NO. 2016000038603, TOGETHER WITH LOTS 1 AND 2, CALABRESE SUBDIVISION, RECORDED FEBRUARY 2, 2005 AT RECEPTION NO. 20050202000110270, COUNTY OF ADAMS, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST CORNER OF SAID SECTION 8; THENCE N00°12'28"W ALONG THE WEST LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 8 A DISTANCE OF 543.31 FEET; THENCE N88°41'00"E A DISTANCE OF 30.07 FEET TO A POINT ON THE EAST RIGHT OF WAY LINE OF LOWELL BOULEVARD, SAID POINT BEING THE POINT OF BEGINNING; THENCE N00°12'27"W ALONG SAID EAST LINE A DISTANCE OF 577.60 FEET; THENCE N89°49'04"E ALONG THE SOUTH LINE OF LOT 1 OF SAID SPANO SUBDIVISION A DISTANCE OF 218.66 FEET; THENCE N00°12'28"W ALONG THE EAST LINE OF SAID LOT 1 A DISTANCE OF 208.71 FEET; THENCE S89°49'04"W ALONG THE NORTH LINE OF SAID LOT 1 A DISTANCE OF 208.72 FEET TO A POINT ON SAID EAST RIGHT OF WAY LINE; THENCE N00°12'28"W ALONG SAID EAST LINE A DISTANCE OF 280.62 FEET; THENCE ALONG THE BOUNDARIES OF SAID CALABRESE SUBDIVISION AND SAID SPANO SUBDIVISION FOR THE FOLLOWING TWENTY TWO (22) COURSES: 1) S85°59'58"E A DISTANCE OF 619.06 FEET; 2) S00°13'52"E A DISTANCE OF 156.99 FEET; 3) N89°47'39"E A DISTANCE OF 571.37 FEET; 4) N21°27'40"E A DISTANCE OF 385.02 FEET; 5) N69°04'18"E A DISTANCE OF 180.26 FEET; 6) N52°55'06"E A DISTANCE OF 132.02 FEET; 7) S38°28'05"W A DISTANCE OF 102.19 FEET; 8) S55°34'27"W A DISTANCE OF 226.57 FEET; 9) S18°42'43"W A DISTANCE OF 77.83 FEET; 10) S22°15'22"W A DISTANCE OF 51.72 FEET; 11) S06°30'23"W A DISTANCE OF 68.57 FEET; 12) S09°10'46"E A DISTANCE OF 99.23 FEET; 13) S13°21'07"W A DISTANCE OF 129.99 FEET; 14) S34°06'14"W A DISTANCE OF 70.25 FEET; 15) S43°13'43"W A DISTANCE OF 187.11 FEET; 16) S55°02'17"W A DISTANCE OF 74.97 FEET; 17) S24°16'14"W A DISTANCE OF 74.95 FEET; 18) S24°06'07"W A DISTANCE OF 85.02 FEET; 19) S00°10'09"E A DISTANCE OF 47.43 FEET; 20) S00°10'52"E A DISTANCE OF 53.79 FEET; 21) S35°03'08"W A DISTANCE OF 299.61 FEET; 22) S88°41'00"W A DISTANCE OF 827.14 FEET TO THE POINT OF BEGINNING;

CONTAINING 1,019,731 SQUARE FEET OR 23.410 ACRES, MORE OR LESS.

HAVE BY THESE PRESENTS LAID OUT, PLATTED, AND SUBDIVIDED THE SAME INTO LOTS, AND DEDICATED ALL EASEMENTS, AS SHOWN ON THIS PLAT, UNDER THE NAME AND STYLE OF "LOWELL DEVELOPMENT SUBDIVISION".

- PRELIMINARY PLAT. Remove " marks

EXECUTED THIS _____ DAY OF THE MONTH

OWNER: LOT 2, SPANO SUBDIVISION
SPANO FAMILY HOLDING, LLC

_____
BY: ANTHONY SPANO

els: edited

ACKNOWLEDGMENT:

STATE OF COLORADO)
)ss
COUNTY OF _____)

KNOW ALL MEN BY THESE PRESENTS THAT THE FOREGOING DEDICATION WAS ACKNOWLEDGED

BEFORE ME THIS _____ DAY OF THE MONTH OF _____, A.D., 20___.

BY ANTHONY SPANO AS MANAGER OF THE SPANO FAMILY HOLDINGS, LLC

MY COMMISSION EXPIRES _____ WITNESS MY HAND AND SEAL

_____.
NOTARY PUBLIC

OWNER: LOTS 1 AND 2, CALABRESE SUBDIVISION
5602 LOWELL, LLC

_____
MARKO S. MACKOVIC

ACKNOWLEDGMENT:

STATE OF COLORADO)
)ss
COUNTY OF _____)

KNOW ALL MEN BY THESE PRESENTS THAT THE FOREGOING DEDICATION WAS ACKNOWLEDGED

BEFORE ME THIS _____ DAY OF THE MONTH OF _____, A.D., 20___.

BY MARKO S. MACKOVIC AS MEMBER/MANAGER OF 5602 LOWELL, LLC

MY COMMISSION EXPIRES _____ WITNESS MY HAND AND SEAL

_____.
NOTARY PUBLIC

VICINITY MAP

SCALE: 1" = 2000'



Dedication Statements:
•Statements of land to be dedicated to the County for parks or other public uses, grants of easements and dedication of public streets to the Adams County are required.

a. All plats with public streets shall have the following sentence in the dedication statement: All
public streets are hereby dedicated to Adams County for public use.

b. All plats with public easements and/or tracts must have the following sentence in the dedication statement: The undersigned does hereby dedicate, grant and convey to Adams County those Public Easements (and tracts) as shown on the plat; and further restricts the use of all Public Easement to Adams County and/or its assigns, provided however, that the sole right and authority to release or quitclaim all or any such Public Easements shall remain exclusively vested in Adams County.

THE POLICY OF THE COUNTY REQUIRES THAT MAINTENANCE ACCESS SHALL BE PROVIDED TO ALL STORM DRAINAGE FACILITIES TO ASSURE CONTINUOUS OPERATIONAL CAPABILITY OF THE SYSTEM. THE PROPERTY OWNERS SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL DRAINAGE FACILITIES INCLUDING INLETS, PIPES, CULVERTS, CHANNELS, DITCHES, HYDRAULIC STRUCTURES, AND DETENTION BASINS LOCATED ON THEIR LAND UNLESS MODIFIED BY THE SUBDIVISION DEVELOPMENT AGREEMENT. SHOULD THE OWNER FAIL TO MAINTAIN SAID FACILITIES, THE COUNTY SHALL HAVE THE RIGHT TO ENTER SAID LAND FOR THE SOLE PURPOSE OF OPERATIONS AND MAINTENANCE. ALL SUCH MAINTENANCE COST WILL BE ASSESSED TO THE PROPERTY OWNERS.

els: edited

SURVEYOR'S CERTIFICATE:

I, JOHN P. EHRHART, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAT WAS MADE UNDER MY SUPERVISION AND THE MONUMENTS SHOWN HEREON ACTUALLY EXIST AND THIS PLAT ACCURATELY REPRESENTS SAID SURVEY MADE ON JULY 14, 2021.

_____
JOHN P. EHRHART
COLORADO P.L.S. #29414
EHRHART LAND SURVEYING, LLC

PLANNING COMMISSION APPROVAL
RECOMMENDED FOR APPROVAL BY THE ADAMS COUNTY PLANNING COMMISSION THIS _____ DAY OF _____ A.D. 202_

_____
CHAIR

BOARD OF COUNTY COMMISSIONERS' APPROVAL
APPROVED BY THE ADAMS COUNTY BOARD OF COUNTY COMMISSIONERS THIS _____ DAY OF _____ A.D. 202_

_____
CHAIR

ADAMS COUNTY ATTORNEY'S OFFICE

_____
APPROVED AS TO FORM

NOTES:

1) THIS PURPOSE OF THIS PLAT IS TO SUBDIVIDE THE EXISTING PROPERTIES INTO 2 LOTS, AS SHOWN HEREON.

2) THIS PLAT DOES NOT CONSTITUTE A TITLE SEARCH BY EHRHART LAND SURVEYING, LLC TO DETERMINE OWNERSHIP OR EASEMENTS OF RECORD. REFERENCE IS MADE TO [illegible] COMPANY FILE NO. TOC-30364-A REVISION NO. 3 WITH COMMITMENT DATE OF AUGUST 3, 2021, AND FIDELITY NATIONAL TITLE FILE NO. 100-N0035233-010-TO2, AMENDMENT NO. 4 WITH A COMMITMENT DATE OF NOVEMBER 15, 2023, FROM WHICH THIS SURVEY IS BASED. THIS PROPERTY IS SUBJECT TO ALL COVENANTS AND RESTRICTIONS RELATING TO THE USE AND CHARACTER OF THE LAND AND ALL MATTERS APPEARING OF PUBLIC RECORD AND AS MAY BE DISCLOSED BY A MORE RECENT TITLE COMMITMENT OR REPORT.

Revise

3) LINEAL UNITS USED ARE U.S. SURVEY FEET. THE U.S. SURVEY FOOT IS DEFINED AS 1200/3937 METERS.

els: how shall this be revised?

4) BASIS OF BEARINGS: THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 8, BEARING N00°12'28"W (ASSUMED), A DISTANCE OF 2633.71 FEET, MONUMENTED AS SHOWN HEREON.

5) ALL RIGHT-OF-WAY AND LOT AND BLOCK INFORMATION WAS TAKEN FROM THE PLAT OF CALABRESE SUBDIVISION RECORDED FEBRUARY 2, 2005 AT RECEPTION NO. 20050202000110270; AND THE PLAT OF SPANO SUBDIVISION RECORDED FEBRUARY 2, 2005 AT RECEPTION NO. 20050202000110370.

6) NOTICE: ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE SURVEYOR'S STATEMENT SHOWN HEREON.

7) PER THE STATE OF COLORADO BOARD OF LICENSURE FOR ARCHITECTS, PROFESSIONAL ENGINEERS, AND PROFESSIONAL LAND SURVEYORS RULE 1.6.B.2, THE WORD "CERTIFY" AS USED HEREON MEANS AN EXPRESSION OF PROFESSIONAL OPINION AND DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EXPRESSED OR IMPLIED. THE SURVEY REPRESENTED HEREON HAS BEEN PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION IN ACCORDANCE WITH APPLICABLE STANDARDS OF PRACTICE AND IS BASED UPON MY KNOWLEDGE, INFORMATION AND BELIEF.

8) CONFLICTING BOUNDARY EVIDENCE: THE CONCRETE PATH CROSSES THE PROPERTY, AS PLATTED, ALONG THE EAST BOUNDARY. THE PLAT DEFINES IT'S BOUNDARY AS RELATED TO TRACTS SHOWN ON A MAP IN A WARRANTY DEED RECORDED NOVEMBER 10, 1930 AT RECEPTION NO. 164420. THE MAP IN QUESTION IS REFERENCED AS BOOK 191, PAGE 471. SOME OF THE NUMBERS ON THE MAP ARE DIFFICULT TO READ AND THE LOCATION OF THE TRACTS IS NOT CERTAIN, WHICH MAY BE THE SOURCE OF SOME OF THESE ENCROACHMENTS. IN ADDITION, MANY EASEMENTS SHOWN ON THE PLAT AND ON THIS SURVEY ARE ALSO REFERENCED TO THESE TRACTS, CREATING A POSSIBLE DISCREPANCY IN THEIR LOCATIONS AS WELL, AND MAY EXPLAIN WHY THE EASEMENTS, AS PLATTED, DO NOT COVER THE UTILITIES THAT THEY ARE INTENDED TO BENEFIT. THE BOUNDARY AND THE EASEMENTS ARE SHOWN AS DELINEATED ON THE PLAT.

9) FLOOD ZONE CLASSIFICATION: CURRENTLY, THE SUBJECT PROPERTY IS LOCATED IN "FLOODWAY AREAS IN ZONE AE (FLOODPLAIN AREA THAT MUST BE KEPT FREE OF ENCROACHMENT SO THAT THE 1% ANNUAL CHANCE FLOOD CAN BE CARRIED WITHOUT SUBSTANTIAL INCREASE IN FLOOD HEIGHTS)", AND "ZONE X (AREAS OF LESS THAN 0.2% ANNUAL CHANCE FLOOD)" PER FLOOD INSURANCE RATE MAP FOR ADAMS COUNTY, COLORADO AND INCORPORATED AREAS, MAP NUMBER 08001C0591H, REVISED MARCH 5, 2007. THE LINES SHOWN HEREON REPRESENT THE NEW LIMITS OF THE FLOODPLAIN AROUND THE SUBJECT PROPERTY, AS DETERMINED FOR THE OWNER BY LOEWEN ENGINEERING INC AND SUBMITTED TO FEMA ON NOVEMBER 18, 2022, FEMA CASE NO. 23-08-0122R.

els: edited

RECORDER'S CERTIFICATE:

STATE OF COLORADO)
)ss
COUNTY OF ADAMS)

els: edited

I HEREBY CERTIFY THAT THIS INSTRUMENT WAS FILED FOR RECORD IN MY OFFICE ON THE _____ DAY OF _____, 20___

AT _____ O'CLOCK ___M., RECEPTION No. _____

CLERK AND RECORDER

BY: _____
DEPUTY

els: edited

BY: _____

REVISIONS	
1	11/16/23

EHRHART LAND SURVEYING
P.O. Box 930 • Erie, Colorado 80516
(303) 828-3340 • www.coloradols.com

ELS PROJECT NO.	S225088
DATE:	11/16/23
DRAWN BY:	JPE
CHECKED BY:	JMH

LOWELL DEVELOPMENT SUBDIVISION

CASE # plt2023-00001

A REPLAT OF LOT 2, SPANO SUBDIVISION AND LOTS 1 AND 2, CALABRESE SUBDIVISION
BEING PART OF THE SOUTHWEST QUARTER OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M.
COUNTY OF ADAMS, STATE OF COLORADO
SHEET 2 OF 3

W 1/4 COR. SEC. 8
#6 REBAR WITH 2.5" ALUMINUM CAP IN RANGE BOX, LS 23500

NORTH
SCALE: 1" = 100'
0 50 100 200

OWNER: CAROL HUDAK AND EDDIE ARTHUR BOHN
LAKE
OWNER: GILPIN INDUSTRIAL LLC
UNPLATTED
S85°59'58"E 619.06'(M&P)
FOUND 1.5" ALUMINUM CAP PLS 29414 50' WC
100-YEAR FLOODPLAIN SEE FLOOD ZONE NOTE
N81°00'42"E 9.54'(M) S86°00'32"E 10.03'(P)
N00°12'28"W 280.62'(M)
EXCEPTED PORTION OF LOT 2 REC 2016000038603 5/18/16
S01°13'52"E 156.99'(M) 157.00'(P)
OWNER: CAROL HUDAK AND EDDIE ARTHUR BOHN
LAKE
N89°47'39"E 571.37'(M) 571.42'(P)
N52°55'06"E 132.02'(M) 132.08'(P)
N69°04'18"E 180.26'(M) 180.30'(P)
S38°28'05"W 102.19'(M) 102.21'(P)
S55°34'27"W 226.57'(M) 226.67'(P)
N21°27'40"E 385.02'(M) 385.06'(P)
S18°42'43"W 77.83'(M) 77.84'(P)
S22°15'22"W 51.72'(M) 51.73'(P)
S06°30'23"W 68.57'(M) 68.58'(P)
S09°10'46"E 99.23'(M) 99.18'(P)
S13°21'07"W 129.99'(M) 130.02'(P)
S34°06'14"W 70.25'(M) 70.48'(P)
OWNER: COUNTY OF ADAMS
S43°13'43"W 187.11'(M) 187.06'(P)
S55°02'17"W 74.97'(M)
S24°16'14"W 74.95'(M) 74.98'(P)
S24°06'07"W 85.02'(M) 85.03'(P)
S00°10'09"E 47.43'(M) 47.36'(P)
S00°10'52"E 53.79'(M) 53.88'(P)
EASEMENT (APPROX.) BK 1099, PG 232, 9/25/63 AS SHOWN ON PLAT
EASEMENT (APPROX.) BK 2842, PG 42, 2/21/84 AS SHOWN ON PLAT
EASEMENT (APPROX.) BK 1099, PG 232 AND REC 20050202000110370 AS SHOWN ON PLAT

76'
90'
40'
9.94'
80'
30'

LOWELL BLVD.
RIGHT OF WAY VARIES

S89°49'04"W 208.72'(M) 208.71'(P)
N00°12'28"W 208.71'(M&P)
N89°49'04"E 218.66'(M) 218.71'(P)
S89°47'13"W 934.83'

LOT 1
SPANO SUBDIVISION
NOT A PART

LOT 2
10.559 ACRES
459,968 SQ. FT.

Identify the Spano Sub Lot as with the Calabrese as this lots legal will become Lot 2 of the Lowell Development Subdivision

LOTS IDENTIFIED

LOT LINES VACATED BY THIS PLAT

LOT 1
CALABRESE SUB.

Due to the following easement sheet, only provide those entitlements of record on this sheet. Do not include any easement to be dedicated herein.

ELS: EDITED

PORTION OF LOT 2
SPANO SUB.

Vacated by this plat

EASEMENT (APPROX.) BK 2842, PG 37, 2/21/84 AS SHOWN ON PLAT

ELS: EDITED

LOT 1
12.850 ACRES
559,763 SQ. FT.

BASIS OF BEARINGS
W LINE SW 1/4 SEC. 8
N00°12'28"W 2633.71'

N00°12'27"W 577.60'(M) 577.64'(P)

LOT 2, CALABRESE SUB.

100-YEAR FLOODPLAIN SEE FLOOD ZONE NOTE

EASEMENT BK 5188, PG 706, 12/22/97

20' ACCESS & UTILITY EASEMENT BK 5157, PG 658, 11/14/97 BK 5188, PG 706, 12/22/97

299.61'(M) 300.76'(P) S35°03'08"W

POINT OF BEGINNING

827.14'(M) S88°41'00"W

20' UTILITY EASEMENT BK 2842, PG 42, 2/21/84 AS SHOWN ON PLAT

N88°41'00"E 30.07'

543.31' N00°12'28"W

I-76 RIGHT-OF-WAY
OWNER: STATE OF COLORADO

SW CORNER SEC 8
#6 REBAR WITH 2.5" ALUMINUM CAP IN RANGE BOX, LS 20699

POINT OF COMMENCEMENT

LEGEND

- FOUND SECTION CORNER AS DESCRIBED
- FOUND 0.75" BRASS DISK & NAIL, ILLEGIBLE
- FOUND #5 REBAR WITH 1.25" YELLOW PLASTIC CAP, LS 6973 – UNLESS NOTED OTHERWISE
- FOUND #5 REBAR WITH 1.25" YELLOW PLASTIC CAP, EHRHART, PLS 29414
- (P) PLATTED DISTANCE
- (M) MEASURED DISTANCE
- WC WITNESS CORNER
- EXTERIOR BOUNDARY LINE
- INTERIOR LOT LINE
- EXISTING EASEMENT
- NEW EASEMENT
- 100-YEAR FLOODPLAIN BOUNDARY

This needs to be provided on the following sheet

ELS: EDITED

EHRHART LAND SURVEYING
P.O. Box 930 • Erie, Colorado 80516
(303) 828-3340 • www.coloradols.com

ELS PROJECT NO. S225088
DATE: 11/16/23
DRAWN BY: JPE
CHECKED BY: JMH

LOWELL DEVELOPMENT SUBDIVISION

CASE # plt2023-00001

A REPLAT OF LOT 2, SPANO SUBDIVISION AND LOTS 1 AND 2, CALABRESE SUBDIVISION
BEING PART OF THE SOUTHWEST QUARTER OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M.
COUNTY OF ADAMS, STATE OF COLORADO
SHEET 3 OF 3

ELS: EDITED

What is this? Width, etc.

Any easement not currently with entitlement to the property must have "to be dedicated by separate instrument on the plat" especially with any private easement. Be careful with "exclusive easement" language on this survey as other utilities have the right to cross these areas if no other option is available. If being dedicated, this must be stated.

ELS: EDITED

ELS: EDITED

Identify the LOT

ELS: EDITED

LINE LEGEND
MONUMENT KEY

ELS: EDITED

If this is the same purpose remove the line so it contiguous without a line break

How are utilities getting here?

ELS: EDITED

If this is exclusive you cannot cross it with utilities and have no legal way to continue this easement as it will be segmented

Identify the Lot with all of its information: Sq. Ft. and Ac.

ELS: EDITED

ELS: PER ENGINEER - Per Denver Water Engineering Standards, 16th Edition, published 2021, Section 5.11;
"Private roadways: The easement shall have a minimum width of 30 feet. Denver Water or the Distributor shall have exclusive use of 20 feet thereof, except for right angle utility crossings."

Need to dedicate this within the dedication statement since no easement of record provided.

ELS: EDITED

NORTH
SCALE: 1" = 60'
0 30 60 120

LEGEND

SS SANITARY SEWER
ESMT EASEMENT

EHRHART LAND SURVEYING
P.O. Box 930 • Erie, Colorado 80516
(303) 828-3340 • www.coloradols.com

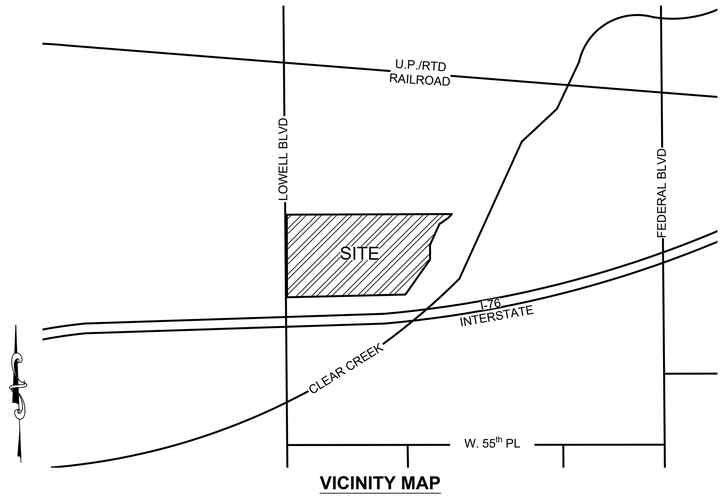
ELS PROJECT NO. **S225088**
DATE: 11/16/23
DRAWN BY: JPE
CHECKED BY: JMH

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

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VICINITY MAP

SCALE: 1" = 500'

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LEGEND

- = TRANSFORMER
- = LIGHT FIXTURE
- = UTILITY POLE
- = GAS METER
- = 4' MANHOLE
- = 5' MANHOLE
- = CLEAN OUT
- = TYPE C INLET
- = TYPE R INLET
- = FLARED END SECTION
- = DECIDUOUS TREE
- = BUSH
- = H2O VALVE
- = HYDRANT
- = PROPERTY LINE
- = ROAD CENTERLINE
- = EASEMENT
- = SETBACK
- = FLOW LINE
- = WATER LINE
- = SANITARY SEWER LINE
- = ELECTRICAL LINE
- = OVERHEAD ELECTRIC LINE
- = COMMUNICATIONS LINE
- = STORM SEWER OR CULVERT
- = GAS LINE
- = EXISTING MAJOR CONTOUR
- = EXISTING MINOR CONTOUR
- = PROPOSED MAJOR CONTOUR
- = PROPOSED MINOR CONTOUR
- = TOP OF BANK
- = TOE OF BANK
- = COLUMN
- = HANDICAP MARKING
- = SIGN
- = BOLLARD
- = 1 1/2" - 2" H2O SERVICE METER
- = 3/4" SERVICE METER
- = ASPHALT
- = CONCRETE
- = GRAVEL
- = RIP-RAP
- = BICYCLE PARKING
- = LANDSCAPE AREA
- = EXISTING BUILDING
- = FLOODPLAIN

INDEX OF PUBLIC UTILITIES

DENVER WATER
1600 WEST 12TH AVENUE
DENVER, COLORADO 80204
(303) 628-6000

BERKELEY WATER AND SANITATION DISTRICT
4455 WEST 58TH AVENUE, UNIT A
ARVADA, COLORADO 80002
(303) 477-1914

XCEL ENERGY (ELEC & GAS)
JASON BERSANO
9580 HWY 85,
HENDERSON, COLORADO 80640
(303) 628-2720
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ABBREVIATIONS

LABEL	MEANING
A.E.	ACCESS EASEMENT
ac	ACRE
APPROX	APPROXIMATE
BM	BENCHMARK
BW	BOTTOM OF WALL
CMP	CORRUGATED METAL PIPE
C.O.	CLEAN OUT
CONC	CONCRETE
COM	COMPACT
COV'D	COVERED
CP	CONTROL POINT
CPP	CORRUGATED POLY PIPE
DEMO	DEMOLISH
D.E.	DRAINAGE EASEMENT
D-RAMP	DIRECTIONAL RAMP
P-RAMP	PARALLEL RAMP
ELEC	ELECTRICAL

ELEV	ELEVATION
EOR	ENGINEER OF RECORD
EMER	EMERGENCY
E.S.E.	EXCLUSIVE SEWER EASEMENT
E.W.E.	EXCLUSIVE WATER EASEMENT
E.W.S.E.	EXCLUSIVE WATER & SEWER EASEMENT
EX	EXISTING
FD	FOUND
FF	FINISHED FLOOR
FL	FLOW LINE
FND	FOUNDATION
FO	FIBER OPTIC
GND	GROUND
HDPE	HIGH DENSITY POLYETHYLENE
HP	HIGH POINT
HYD	HYDRANT
H2O	WATER
I/I	INVERT IN
I/O	INVERT OUT

INV	INVERT
LP	LOW POINT
LZ	LOADING/UNLOADING ZONE
MAX	MAXIMUM
MH	MANHOLE
MTR	METER
MIN	MINIMUM
PED	PEDISTAL
PK	PARKING
P.E.	PROFESIONAL ENGINEER
PLA	PROFESSIONAL LAND SURVEYOR
PLS	PROFESSIONAL LAND SURVEYOR
PROP	PROPOSED
PVC	POLY-VINYL CHLORIDE
RCP	REINFORCED CONCRETE PIPE
RET	RETAINING
ROW	RIGHT-OF-WAY
SE	SEWER EASEMENT
SNOW	SNOW COLLECTION AREA

SRVC	SERVICE
SS	SANITARY SEWER
STRM	STORM
SUB	SUBDIVISION
TBC	TOP BACK OF CURB
TBW	TOP BACK OF WALK
TELE	TELEPHONE
TC	TOP OF CURB
TO	TOP OF
TW	TOP OF WALL
TOC	TOP OF CONCRETE
TOF	TOP OF FOUNDATION
TRANS	TRANSFORMER
TW	TOP OF WALL
TYP	TYPICAL
U&AE	UTILITY & ACCESS EASEMENT
U&DE	UTILITY & DRAINAGE EASEMENT
UE	UTILITY EASEMENT
VO	VEHICLE OVERHANG

WC	WITNESS CORNER
W & S	WATER & SEWER
WW	WINDOW WELL
YPC	YELLOW PLASTIC CAP

NOTE:
PUBLIC IMPROVEMENTS SHALL CONFORM TO ADAMS COUNTY STANDARDS AND SPECIFICATIONS AND LATEST EDITION OF COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS

811 FOR BURIED UTILITY INFORMATION THREE (3) BUSINESS DAYS BEFORE YOU DIG CALL 811 (or 1-800-922-1987) UTILITY NOTIFICATION CENTER OF COLORADO (UNCC) www.co811.org

ENTITLEMENTS REVIEW ONLY NOT FOR CONSTRUCTION

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LOWELL DEVELOPMENT, LLC
5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

PROJECT NUMBER 22-C14
DOCUMENT DATE:
1/24/2024 5:07 PM
DOCUMENT PHASE:
FOR PERMIT - ROUND 1

REV	DATE	DESCRIPTION
DRAWN BY: TJH/DS	DATE: 01/09/2024	CHECKED BY: TJH
		DATE: 01/24/2024

COVER SHEET

C-0

SHEET 1 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

GENERAL NOTES FOR CONSTRUCTION PLANS

1. EXISTING UNDERGROUND UTILITIES, EXCEPT SERVICE LINES, KNOWN TO THE ENGINEER HAVE BEEN SHOWN ON THE DRAWINGS. LOCATIONS ARE APPROXIMATE ONLY AND MAY PROVE TO BE INACCURATE. THE CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF THE EXISTENCE, LOCATION AND PROTECTION OF ALL UTILITIES WITHIN THE CONSTRUCTION AREA. PWM§9-1.02(A)

2. BEFORE COMMENCING WITH WORK, THE CONTRACTOR SHALL NOTIFY ALL PUBLIC AND PRIVATE COMPANIES WHO MAY HAVE UTILITIES WITHIN THE PROJECT LIMITS. THE CONTRACTOR SHALL COORDINATE WITH THESE ENTITIES ALL EXCAVATION PERFORMED. THE CONTRACTOR SHALL OBTAIN ALL PERMITS REQUIRED BY UTILITY OWNERS. PWM§9-1.02(A)

3. IN THE EVENT OF DAMAGE TO ANY EXISTING UTILITY, THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE REPAIR AND PAYMENT FOR REPAIR OF ALL SUCH DAMAGE. PWM§9-1.02(A)

4. THE CONTRACTOR SHALL MAKE ARRANGEMENTS FOR AND PAY ALL COSTS FOR RELOCATION OF UTILITIES REQUIRING RELOCATION AS INDICATED ON THE DRAWINGS. SHOULD UTILITY OBSTRUCTIONS, NOT SHOWN ON THE DRAWINGS, BE ENCOUNTERED AND REQUIRE RELOCATION, THE CONTRACTOR SHALL NOTIFY THE OWNER AND THE ENGINEER AND SHALL MAKE ARRANGEMENTS NECESSARY FOR SUCH RELOCATION. THE OWNER SHALL PAY THE COSTS FOR SUCH RELOCATION. PWM§9-1.02(A)

5. THE CONTRACTOR SHALL RESTORE OR PROTECT FROM DAMAGE ALL EXISTING IMPROVEMENTS ENCOUNTERED IN PERFORMANCE OF THE WORK. IMPROVEMENTS DAMAGED, AS A RESULT OF THIS WORK SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER, AS DETERMINED BY THE ENGINEER. PWM§9-1.02(B)

6. ADJACENT PROPERTY SHALL BE PROTECTED BY THE CONTRACTOR FROM ANY DAMAGE. THE CONTRACTOR SHALL BE HELD SOLELY LIABLE FOR ANY DAMAGE TO ADJACENT PROPERTY AND SHALL BE RESPONSIBLE FOR ALL COSTS RESULTING FROM REPAIR OF SUCH DAMAGE. PWM§9-1.02(B)

7. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO EXAMINE SOIL CONDITIONS AND CHARACTERISTICS, INCLUDING THE PRESENCE OF GROUNDWATER THAT WILL BE ENCOUNTERED WITHIN THE LIMITS OF CONSTRUCTION. PWM§9-1.02(C)

8. ALL EXCAVATION SHALL BE PROTECTED BY BARRICADES, LIGHTS, SIGNS, ETC., AS REQUIRED BY GOVERNING FEDERAL, STATE AND LOCAL SAFETY CODES AND REGULATIONS. PWM§9-1.03(A)

9. SHEETING, SHORING AND BRACING. WHERE TRENCH WALLS ARE NOT EXCAVATED AT A STABLE SLOPE, THE CONTRACTOR SHALL PROVIDE AND MAINTAIN SUPPORT SUFFICIENT TO PREVENT CAVING, SLIDING OR FAILURE AND PROPERTY OR BODILY DAMAGE. ANY DAMAGE DUE TO INADEQUATE SUPPORT SHALL BE REPAIRED AT THE SOLE EXPENSE OF THE CONTRACTOR. PWM§9-1.03(B)

10. UNDER NORMAL CONSTRUCTION CONDITIONS, SUPPORT SHALL BE REMOVED AS WORK PROGRESSES. SUPPORT SHALL REMAIN INSTALLED IF DIRECTED BY THE ENGINEER OR IF PIPE DOES NOT HAVE SUFFICIENT STRENGTH TO SUPPORT BACKFILL BASED ON TRENCH WIDTH AS DEFINED BY THE SHEETING. SHEETING SHALL NOT BE REMOVED AFTER THE START OF BACKFILLING.PWM§9-1.03(B)

11. USE OF A MOVABLE TRENCH SHIELD OR COFFIN BOX WILL NOT BE ALLOWED WHERE PIPE STRENGTH IS INSUFFICIENT TO SUPPORT BACKFILL AS DEFINED BY THE TRENCH WIDTH AFTER THE TRENCH SHIELD IS REMOVED. PWM§9-1.03(B)

12. THE CONTRACTOR SHALL BE HELD SOLELY RESPONSIBLE FOR ANY VIOLATION OF APPLICABLE SAFETY STANDARDS. PARTICULAR ATTENTION IS CALLED TO MINIMUM REQUIREMENTS OF OSHA AND COLORADO OCCUPATIONAL SAFETY AND HEALTH (COSH). PWM§9-1.03(B)

13. EXCAVATION TO BE PROTECTED FROM SURFACE WATER AT ALL TIMES. AT NO TIME SHALL EXCAVATED AREA BE ALLOWED TO FILL WITH STORM WATER RUNOFF. CONTRACTOR SHALL PROVIDE PROPER, TEMPORARY DRAINAGE STRUCTURES AT THEIR COST TO DETOUR RUNOFF FROM EXCAVATED AREAS. PWM§9-1.03(C)

14. REMOVE ALL VEGETATION, STUMPS, ROOTS, ORGANIC MATTER, DEBRIS AND OTHER MISCELLANEOUS STRUCTURES AND MATERIALS FROM PROJECT SITE. DISPOSE OF OFF-SITE. PWM§9-3.01(A)

15. STRIP EXISTING TOPSOIL FROM ALL AREAS TO BE DISTURBED BY CONSTRUCTION. TOPSOIL TO BE STOCKPILED SEPARATELY FROM EXCAVATED MATERIALS. PWM§9-3.01(B)

16. LIMITS OF EXCAVATION. TRENCHES TO BE EXCAVATED ALONG LINES AND GRADES SHOWN ON THE DRAWINGS, OR AS MODIFIED IN THE FIELD BY THE ENGINEER. TRENCH WIDTHS FOR PIPE LOADING TO BE MEASURED 12 INCHES ABOVE TOP OF PIPE. PWM§9-3.02(A)

17. TRENCH EXCAVATION NOT TO BE COMPLETED MORE THAN 100 FEET IN ADVANCE OF PIPE INSTALLATION. BACKFILL TO BE COMPLETED WITHIN100 FEET OF PIPE INSTALLATION. PWM§9-3.02(A)

18. FACILITIES SHALL BE MAINTAINED UNTIL ALL CONCRETE IS CURED AND BACKFILLING IS IN PLACE AT LEAST 24 INCHES ABOVE ANTICIPATED WATER LEVELS BEFORE WATER REMOVAL IS DISCONTINUED; ALL WATER REMOVAL SHALL BE SUBJECT TO APPROVAL BY THE ENGINEER.PWM§9-3.02(C)

19. EXCAVATED MATERIAL TO BE STOCKPILED SO AS NOT TO ENDANGER THE WORK OR PUBLIC SAFETY. MAINTAIN EXISTING VEHICULAR AND PEDESTRIAN TRAFFIC WITH MINIMUM DISRUPTION. MAINTAIN EMERGENCY ACCESS AND ACCESS TO EXISTING FIRE HYDRANTS AND WATER VALVES. MAINTAIN NATURAL DRAINAGE COURSES AND STREET GUTTERS. PWM§9-3.02(D)

20. BACKFILL MATERIAL TO BE SEGREGATED FROM STOCKPILED TOPSOIL AND UNUSABLE BACKFILL MATERIALS. PWM§9-3.02(D)

21. EXCAVATION TO BE DONE IN ACCORDANCE WITH THESE SPECIFICATIONS AND AS SHOWN ON THE APPROVED DRAWINGS. ADEQUATE WORKING CLEARANCES TO BE MAINTAINED AROUND APPURTENANCES. PROVISIONS FOR BASE AND BOTTOM PREPARATIONS SHALL APPLY TO ALL APPURTENANCES. PWM§9-3.02(E)

22. PRECAUTIONS TO BE TAKEN TO MAINTAIN TRENCH WIDTHS IN THE VICINITY OF ADJACENT PIPELINES AND CONDUITS.

23. WHERE SOILS ARE SUITABLE AND HAVE ADEQUATE STRENGTH, BOTTOM TO BE GRADED THAT PIPE BARREL RESTS UNIFORMLY ON UNDISTURBED SOIL. ALL ROCKS OR STONES THAT MAY RESULT IN A POINT BEARING ON THE PIPE SHALL BE REMOVED. PWM§9-3.03(A)

24. UNDISTURBED GRADES SHALL BE WITHIN 0.1 FEET TOLERANCE. SOILS FOR FINAL PIPE GRADE PLACED WITHIN THESE LIMITS SHALL BE ¨Ú-INCH SCREENED ROCK.PWM§9-3.03(A)

25. MATERIAL TO BE REMOVED TO ALLOW INSTALLATION OF ALL FITTING AND JOINT PROJECTIONS WITHOUT AFFECTING PLACEMENT OF PIPE. PWM§9-3.03(B)

26. WHENEVER TRENCH IS OVER-EXCAVATED TO ELIMINATE POINT BEARING BY ROCKS OR STONES OR WHEN UNDISTURBED GRADE TOLERANCES OF 0.1 FOOT ARE EXCEEDED, THE CONTRACTOR IS TO RE-ESTABLISH GRADE USING CLASS 6 AGGREGATE BEDDING MATERIAL. COMPACTION SHALL BE 95% MAXIMUM DENSITY. ALL WORK TO RE-ESTABLISH GRADE SHALL BE AT THE CONTRACTOR'S EXPENSE. PWM§9-3.03(C)

27. ROCK EXCAVATION SHALL BE DEFINED AS REMOVAL OF BOULDERS IN EXCESS OF 3 CUBIC YARDS OF SOLID OR FRACTURED ROCK, WHICH MAKES HAND SHAPING OF THE BOTTOM IMPOSSIBLE AND WHICH REQUIRES TECHNIQUES, SUCH AS BLASTING OR JACKING FOR REMOVAL, OTHER THAN THOSE WHICH ARE BEING EMPLOYED BY THE CONTRACTOR OR ARE NORMALLY USED IN TRENCH EXCAVATION, SUCH AS USE OF BACKHOES, TRENCHERS, DRAGLINES, ETC. SHOULD UNANTICIPATED ROCK CONDITIONS BE ENCOUNTERED, IMMEDIATELY NOTIFY THE ENGINEER. IF IN THE OPINION OF THE ENGINEER, ROCK EXCAVATION IS REQUIRED AND THE CONTRACTOR HAS IN FACT MADE A DILIGENT AND DETERMINED EFFORT TO REMOVE THE MATERIAL USING NORMAL EXCAVATION PROCEDURES AS STATED ABOVE, AND THE CONTRACTOR COULD NOT HAVE REASONABLY BEEN EXPECTED TO DETERMINE THE EXISTENCE OF SUCH MATERIAL DURING THEIR SITE INVESTIGATION, THEN A CONTRACT PRICE FOR ROCK EXCAVATION SHALL BE NEGOTIATED BETWEEN THE CONTRACTOR AND THE OWNER. NO PAYMENT SHALL BE MADE FOR EXCAVATION PERFORMED PRIOR TO DETERMINATION OF A NEGOTIATED PRICE. PWM§9-3.03(E)

28. ROCK SHALL BE REMOVED TO A 4 INCH DEPTH BELOW GRADE. ADDITIONALLY, ALL ROCK LOOSENED DURING JACKING, BLASTING, ETC., SHALL BE REMOVED FROM THE TRENCH. FOR PAYMENT PURPOSES, MAXIMUM TRENCH WIDTH TO BE PAID FOR SHALL BE AS DEFINED IN SUBSECTION 3.02. PWM§9-3.03(E)

29. EXCEPT IMMEDIATELY NEXT TO THE PIPE, MECHANICAL OR AIR OPERATED TAMPING EQUIPMENT TO BE USED. HAND EQUIPMENT, SUCH AS T-BAR TO BE USED TO PIPE IF NECESSARY. CARE TO BE TAKEN WHEN COMPACTING UNDER, ALONGSIDE AND IMMEDIATELY ABOVE PIPE TO PREVENT CRUSHING, FRACTURING SHIFTING OF THE PIPE. THE CONTRACTOR IS TO NOTE DENSITIES REQUIRED FOR MATERIALS ARE OR BEING BACKFILLED AND SHALL USE APPROPRIATE APPROVED EQUIPMENT TO OBTAIN THOSE DENSITIES. PWM§9-3.04(A)

30. WHEEL ROLLING IS NOT CONSIDERED TO BE AN ADEQUATE COMPACTION TECHNIQUE TO MEET THESE SPECIFICATIONS AND WILL NOT BE ALLOWED. WHERE 85% COMPACTION IS REQUIRED, WHEEL ROLLING MAY BE CONSIDERED. BEFORE ACCEPTANCE, THE CONTRACTOR SHALL BACKFILL A PORTION OF THE TRENCH AND PAY FOR DENSITY TESTING TO VERIFY ADEQUACY OF THE PROPOSED BACKFILL TECHNIQUES. PWM§9-3.04(A)

31. A HYDRO HAMMER MAY BE ALLOWED TO OBTAIN THE SPECIFIED DENSITY UP TO 4 FEET IN DEPTH. THE CONTRACTOR WILL BE REQUIRED TO RE-EXCAVATE THOSE AREAS THAT HAVE BEEN TAMPED SO THAT DENSITY TESTS CAN BE TAKEN TO INSURE THAT THE SPECIFIED DENSITY IS BEING OBTAINED FULL DEPTH. PWM§9-3.04(A)

32. GENERALLY MAINTAIN MOISTURE OF BACKFILL MATERIAL WITH 2% OF OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D698. MAINTAIN CLOSER TOLERANCES AS NEEDED TO OBTAIN DENSITIES REQUIRED. PWM§9-3.04(B)

33. MAXIMUM DENSITY (100%) BASED ON ASTM D698 OR AASHTO T99. PWM§9-3.04(C)
    - 33.1. BEDDING MATERIAL, INCLUDING MATERIAL USED FOR OVER-EXCAVATION OF ANY KIND: 95%.
    - 33.2. SELECT MATERIAL: 95%
    - 33.3. BACKFILL BENEATH EXISTING OR PROPOSED PAVEMENT, ROADWAYS, SIDEWALKS, CURBS, UTILITY LINES AND OTHER IMPROVEMENTS OR WITHIN 5 FEET HORIZONTALLY OF SUCH IMPROVEMENTS: 95%.
    - 33.4. BACKFILL WITHIN PUBLIC OR DESIGNATED RIGHT-OF-WAY: 90% OR AS SHOWN ON THE APPROVED DRAWINGS.
    - 33.5. BACKFILL WITHIN UNDEVELOPED, GREEN OR UNDESIGNATED AREA: 85%.
    - 33.6. BACKFILL FOR ANY FILL OVER OVERCUT GRADING IN AREAS OF LOT/HOME CONSTRUCTION: 95%.

34. THE MAXIMUM LOOSE LIFTS OF BACKFILL MATERIAL TO BE AS FOLLOWS: USE SMALLER LIFTS WHERE NECESSARY TO OBTAIN REQUIRED DENSITIES: PWM§9-3.04(D)
    - 34.1. BEDDING AND SELECT MATERIAL: 6 INCHES (OR SEE SECTION 3.03A).
    - 34.2. BACKFILL MATERIAL: 12 INCHES WHERE 95% COMPACTION REQUIRED; 24 INCH WHERE LESS THAN 95% COMPACTION REQUIRED.

35. BACKFILLING TO BE DONE GENERALLY AT THE SAME TIME AS ADJACENT PIPELINES. BACKFILLING PROCEDURE TO CONFORM TO THIS SECTION. USE SPECIAL TECHNIQUES OR MATERIALS AS SHOWN ON DRAWINGS. PWM§9-3.04(E)

36. CONTRACTOR TO DISPOSE OF EXCESS EXCAVATION OFF SITE. THE OWNER SHALL HAVE THE RIGHT TO ELECT TO HAVE THE EXCESS EXCAVATION DISPOSED OF AT A DESIGNATED SITE WITHIN THE PROJECT LIMITS. EXCAVATION MAY BE WASTED ON-SITE ONLY IF APPROVED BY THE ENGINEER. DISPOSAL IN ANY CASE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. PWM§9-3.04(F)

37. JETTING AND WATER INUNDATION ARE GENERALLY NOT PERMITTED METHODS OF COMPACTION. THE ENGINEER MAY ALLOW JETTING UNDER CERTAIN FIELD CONDITIONS. TECHNIQUES INCLUDING DEPTH OF LIFTS, AMOUNT OF WATER TO BE USED, PENETRATION OF HOSE JET, ETC., SHALL BE AT THE DIRECTION OF THE ENGINEER. NO JETTING WILL BE ALLOWED ON MATERIALS WITH A 200 MINUS GRADATION OF GREATER THAN 15%. CONTRACTOR SHALL PAY COST OF ALL WATER USED, SOIL CLASSIFICATION TESTING AND RETESTING OR RECOMPACTION REQUIRED. NO JETTING SHALL BE DONE PRIOR TO WRITTEN APPROVAL AND DIRECTION OF THE ENGINEER. PWM§9-3.04(G)

38. CONTRACTOR TO MAINTAIN ALL BACKFILL IN A SATISFACTORY CONDITION DURING THE EXTENT OF THE CONTRACT AND WARRANTY PERIOD. ALL SURFACE DETERIORATION DETERMINED TO BE THE RESPONSIBILITY OF THE CONTRACTOR AND THE CONTRACTOR UPON NOTICE BY THE OWNER SHALL REPAIR ALL SETTLEMENT AT ONCE. ALL COSTS FOR REPAIR AND ALL LIABILITY, AS A RESULT OF SURFACE DETERIORATION OR SETTLEMENT, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. PWM§9-3.04(H)

39. BECAUSE OF THE PRESENCE OF GROUND WATER, A CLAY BARRIER MAY BE REQUIRED TO BE INSTALLED FULL DEPTH IN TRENCH IN PLACE OF ALL BEDDING MATERIAL AND BACKFILL. THIS BARRIER SHALL BE FULL DEPTH AND TWO FEET THICK AND INSTALLED EVERY 100 LINEAR FEET OF TRENCH. CLAY BARRIER INSTALLATION SHALL BE CONSIDERED INCIDENTAL TO THE PIPE INSTALLATION AND NOT PAID FOR SEPARATELY. PWM§9-3.04(I)

40. ALL EXISTING SURFACE IMPROVEMENTS AND SITE CONDITIONS DISTURBED OR DAMAGED DURING CONSTRUCTION TO BE RESTORED TO A CONDITION EQUAL TO PRE-CONSTRUCTION CONDITION. ALL RESTORATION COSTS ARE CONSIDERED INCIDENTAL TO EXCAVATION AND BACKFILL. PWM§9-3.05

41. REPLACE, REPAIR OR RECONSTRUCT ALL IMPROVEMENTS AS REQUIRED. WORK WILL NOT BE ACCEPTED UNTIL RESTORATION IS ACCEPTED BY ENGINEER AND ALL AFFECTED PROPERTY OWNERS. IMPROVEMENTS INCLUDE, BY EXAMPLE, OTHER UTILITIES, CULVERTS, STRUCTURES, CURB AND GUTTER, MAILBOXES, SIGNS, SPRINKLER SYSTEMS, ETC. PWM§9-3.05(A)

42. THE CONTRACTOR IS TO RE-ESTABLISH EXISTING FINAL GRADE OR FINISH FINAL GRADES AS MODIFIED AND SHOWN ON THE APPROVED DRAWINGS. THE CONTRACTOR IS TO BACKFILL TO PROPER SUBGRADE ELEVATION WITH BACKFILL MATERIAL TO ALLOW PLACEMENT OF SURFACE IMPROVEMENTS OR MATERIALS. PWM§9-3.05(B)

43. ALL ROADWAYS TO BE RESTORED TO ORIGINAL CONDITION WITH MATERIAL TYPES REMOVED. MATERIALS AND METHODS TO CONFORM TO APPLICABLE PORTIONS OF CURRENT COLORADO DEPARTMENT OF TRANSPORTATION (CDOT) SPECIFICATIONS. ADDITIONAL REQUIREMENTS ARE: PWM§9-3.05(C)
    - 43.1. MINIMUM BASE COURSE MATERIAL ON GRAVEL ROADWAYS OR MINIMUM DEPTH GRAVEL ON HARD SURFACE ROADWAYS TO BE 8 INCH, UNLESS SHOWN OTHERWISE ON APPROVED DRAWINGS.
    - 43.2. MINIMUM BITUMINOUS SURFACING TO BE 3 INCH UNLESS SHOWN OTHERWISE ON APPROVED DRAWINGS.
    - 43.3. MINIMUM CONCRETE PAVEMENT SURFACING TO BE 6 INCH, UNLESS SHOWN OTHERWISE ON APPROVED DRAWINGS.

44. IT SHOULD BE FULLY UNDERSTOOD THAT IT WILL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO ACHIEVE THE SPECIFIED DENSITIES FOR ALL EMBEDMENT AND BACKFILL MATERIAL PLACED. CONTRACTOR WILL BE RESPONSIBLE FOR ENSURING THAT CORRECT METHODS ARE BEING USED FOR THE PLACEMENT AND COMPACTION OF SAID MATERIALS. CORRECT BACKFILL METHODS INCLUDE, BUT ARE NOT LIMITED TO: PWM§9-4.01
    - 44.1. USE OF PROPER EQUIPMENT FOR EXISTING SOIL CONDITION ENCOUNTERED.
    - 44.2. MOISTURE CONTENT OF EXISTING SOILS; DETERMINATION IF WATER SHOULD BE ADDED OR IF SOIL SHOULD BE AIR DRIED TO REDUCE MOISTURE CONTENT.
    - 44.3. CONTRACTOR MAY, AT THEIR OWN EXPENSE, HAVE AN APPROVED GEOTECHNICAL ENGINEER MONITOR THE METHODS OF BACKFILL AND COMPACTION USED TO ENSURE THAT THE DESIRED DENSITIES ARE BEING OBTAINED. INSPECTION AND TESTING WILL BE PERFORMED AS DIRECTED BY THE TOWN. TESTING WILL BE CONDUCTED AS A QUALITY CONTROL CHECK TO VERIFY THE CONTRACTOR'S COMPLIANCE WITH THE STANDARDS INDICATED THE SPECIFICATIONS.

45. INSPECTION AND TESTING TO BE PERFORMED AT THE DIRECTION OF THE ENGINEER. CONTRACTOR TO COOPERATE FULLY WITH ALL PERSONS ENGAGED IN TESTING. CONTRACTOR TO EXCAVATE AS REQUIRED TO ALLOW TESTING. CONTRACTOR TO BACKFILL ALL TEST EXCAVATIONS IN ACCORDANCE WITH THESE SPECIFICATIONS. ANY AREAS, WHICH REQUIRE A SPECIFIED DENSITY, INCLUDING FILL, BACKFILL, TRENCHES, EMBANKMENTS, ROAD BASE, HOT BITUMINOUS PAVEMENT, BACKFILL FOR STRUCTURES, SHALL BE TESTED. PWM§9-4.02

46. DENSITY/MOISTURE RELATIONSHIPS TO BE DEVELOPED FOR ALL SOIL TYPES ENCOUNTERED ACCORDING TO ASTM D698 OR AASHTO T99. PWM§9-4.03(A)

47. TESTING FOR DENSITY DURING COMPACTION OPERATIONS TO BE DONE IN ACCORDANCE WITH ASTM D2922 USING NUCLEAR DENSITY METHODS. PWM§9-4.03(B)

48. MINIMUM OF 1 TEST EVERY 250' TRENCH PER LIFT OR AS DIRECTED BY ENGINEER. CONTRACTOR TO EXCAVATE TO DEPTHS REQUIRED BY TOWN FOR TESTING AND BACKFILL TEST HOLES TO DENSITY SPECIFIED. PWM§9-4.03(C)

49. IN THE EVENT OF FAILURE TO MEET COMPACTION CRITERIA, CONTRACTOR SHALL RE-EXCAVATE AND RE-BACKFILL AT DIRECTION OF TOWN. ALL RETESTING TO BE PAID FOR BY CONTRACTOR AND TO BE PERFORMED BY SOILS TESTING FIRM APPROVED BY THE TOWN. PWM§9-4.03(D)

BERKELEY SANITARY SEWER NOTES:

1. ALL MATERIALS AND WORKMANSHIP FOR SANITARY SEWER CONSTRUCTION SHALL CONFORM TO THE LATEST BERKELEY WATER AND SANITATION DISTRICT STANDARDS AND THE LATEST CITY AND COUNTY OF DENVER, DEPARTMENT OF PUBLIC WORKS, STORM DRAINAGE AND SANITARY SEWER CONSTRUCTION DETAILS AND TECHNICAL SPECIFICATIONS, WASTEWATER MANAGEMENT DIVISION STANDARD DETAILS.

2. AT LEAST 5 DAYS PRIOR TO THE START OF CONSTRUCTION, A PRE-CONSTRUCTION MEETING WILL BE HELD AT THE DISTRICT'S OFFICE AND ATTENDED BY THE CONTRACTOR AND REPRESENTATIVES OF THE OTHER APPROVING AGENCIES. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT THE DISTRICT ENGINEER TO SCHEDULE THIS MEETING.

3. THE CONTRACTOR TO VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL TIE IN POINTS AND PROVIDE THE DATA TO THE DISTRICT ENGINEER PRIOR TO CONSTRUCTION.

4. THE CONTRACTOR WILL IDENTIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR WILL REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY AND PRIOR TO CONSTRUCTION.

5. THE CONTRACTOR SHALL HAVE IN THEIR POSSESSION AT ALL TIMES ONE SIGNED COPY OF PLANS APPROVED BY THE BERKELEY WATER AND SANITATION DISTRICT AND THE DISTRICT ENGINEER. THESE PLANS WILL ALSO INCLUDE ALL ADDENDUMS OR REVISIONS WHICH HAVE BEEN REVIEWED AND APPROVED BY THE BERKELEY WATER AND SANITATION DISTRICT AND THE DISTRICT ENGINEER.

6. PRIOR TO THE START OF WORK WHERE THE NEW SEWER MAIN IS TO BE INSTALLED INTO EXISTING DISTRICT SEWER SYSTEMS, THE NEAREST MANHOLE TO THE PONT OF TIE-IN SHALL BE PLUGGED WITH A PLUMBER'S PLUG ON THE INLET SIDE BY THE CONTRACTOR. THIS PLUG SHALL REMAIN IN PLACE UNTIL INITIAL ACCEPTANCE BY THE DISTRICT. ITS PURPOSE SHALL BE TO PREVENT MUD, WATER OR OTHER MATERIALS FROM ENTERING THE LINE DURING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PUMPING AND CLEANING THESE MANHOLES AND REMOVING THE PLUG WHEN SO INSTRUCTED BY THE DISTRICT.

7. ALL DIRECT BURY SEWER MAINS SHALL BE PVC, ASTM D-3034, SDR35 OR APPROVED EQUIVALENT.

8. SEWER LINES SHALL BE 10 FEET FROM WATER LINES EXCEPT WHEN CROSSING EACH OTHER. FOR SEWER LINES WHICH CROSS LESS THAN 1 1 /2 FEET VERTICALLY FROM WATER LINES, THE CLOSEST SANITARY SEWER JOINT SHALL BE A MINIMUM OF 6 FEET FROM THE CROSSING.

9. ALL MANHOLES SHALL BE WATER TIGHT, WET PRECAST CONCRETE, A MINIMUM OF 48 INCH IN DIAMETER WITH CONCENTRIC CONE, 24 INCH CAST IRON RING (8" DEPTH) AND COVER, UNLESS OTHERWISE SPECIFIED. CONCRETE ADJUSTMENT RINGS SHALL BE USED FOR ADJUSTMENT TO MATCH FINAL PAVEMENT ELEVATIONS AND SET IN FLEXIBLE BUTYL RUBBER CAULKING TO OBTAIN A WATER TIGHT SEAL. CONCRETE ADJUSTMENT RINGS SHALL BE 4" MINIMUM IN DEPTH TO ELIMINATE MULTIPLE JOINTS.

10. PIPE BEDDING SHALL BE CLASS "B" AND SHALL CONFORM TO ASTM C-33 OR AASHTO D-448 GRADATION NO. 6 OR NO. 67. SQUEEGEE BEDDING IS PREFERRED. BEDDING DEPTH SHALL BE 6" UNDER AND AROUND THE SIDES OF THE PIPE AND 12" OVER THE PIPE. CONSOLIDATION IN PIPE ZONE SHALL BE BY HAND TAMPING.

11. ALUMINUM FOIL WARNING TAPE SHALL BE USED FOR ALL NEW DIRECT BURY SEWER MAINS. THE TAPE WILL BE INSTALLED 2' BELOW FINISHED GRADE. TAPE MUST BE GREEN IN COLOR.

12. FERNCO STRONGBAC□ RC SERIES PIPE COUPLINGS WILL BE REQUIRED FOR PIPE AND LATERAL SERVICES. APPROPRIATE CONCRETE CRADLES SHALL ALSO BE INSTALLED AROUND FERNCO STRONGBACK.

13. TRENCH BACKFILL CANNOT HAVE ROCKS LARGER THAN 4" IN DIAMETER.

14. IF GROUND WATER IS ENCOUNTERED, CUT-OFF WALLS OR FLASH FILL SHALL BE INSTALLED AROUND THE PIPE EVERY 300'+/-AND 10' FROM EACH SIDE OF MANHOLE. FLASH FILL MUST MEET ADAMS COUNTY STANDARDS.

15. IF GROUNDWATER, UNSUITABLE OR UNSTABLE SOILS BE ENCOUNTERED, A SUB-BEDDING BASE DEPTH OF 18" MINIMUM OF 2" MINIMUM DIAMETER CRUSHED ROCK, SURROUNDED AND COVERED BY GEOTEXTILE FABRIC SHALL BE INSTALLED.

16. IF SEWAGE BYPASS PUMPING IS NECESSARY, THE CONTRACTOR WILL SUPPLY AND MONITOR THE PUMP DURING THE ENTIRE PUMPING PERIOD. . A BACK-UP PUMP WILL BE ONSITE FOR USE IF NECESSARY. BYPASS HOSE SHALL BE PROTECTED FROM TRAFFIC DAMAGE USING APPROVED APPARATUS FOR ALL SEWAGE BYPASS PUMPING. THE CONTRACTOR WILL HAVE CONTINUOUS ON SITE MONITORING OF PUMPING OPERATIONS.

17. PRIOR TO THE INITIAL ACCEPTANCE AND FINAL ACCEPTANCE WALK-THROUGH, THE CONTRACTOR/DEVELOPER SHALL JET CLEAN THE ENTIRE NEW SANITARY SEWER SYSTEM AND PUMP OUT AT THE PLUGGED MANHOLE AND DISPOSE OF JET-CLEANING WATER OFFSITE IN ACCORDANCE WITH LATEST CDPHE STANDARDS. AFTER CLEANING THE NEW SEWER MAIN, THE CONTRACTOR WILL DUMP CLEAN WATER DOWN THE NEW SANITARY SEWER MAIN PRIOR TO THE VIDEO INSPECTION. THE CONTRACTOR WILL PUMP OUT AND DISPOSE OF WATER AT A DISTRICT APPROVED MANHOLE. CONTRACTOR WILL VIDEO THE NEW SANITARY SEWERS BEFORE BOTH ACCEPTANCES BY THE DISTRICT AND PROVIDE VIDEOS TO THE DISTRICT FOR REVIEW.

18. ABANDONING PROCEDURES:
    - FOR SANITARY SEWER MAINS TO BE ABANDONED -PLACE MECHANICAL PLUG IN THE PIPE AND FILL 5' OF ABANDONED SEWER LINE WITH CONTROLLED LOW SLUMP MATERIALS (CLSM).
    - FOR SANITARY SEWER MANHOLES TO BE ABANDONED -REMOVE CAST IRON COVER, RIM, CONCRETE ADJUSTMENT RINGS AND CONE. FILL LOWER 1 /3 OF MANHOLE WITH CLSM AND REMAINDER OF MANHOLE WITH CLEAN BACKFILL. SALVAGE MANHOLE COVER AND RIM.
    - THE MANHOLE COVERS AND RIMS ARE THE PROPERTY OF THE DISTRICT. CONTACT DISTRICT ENGINEER FOR DISPOSITION.

19. ALL MANHOLE AND SANITARY SEWER MAIN TESTING SHALL BE WITNESSED BY A REPRESENTATIVE OF THE DISTRICT. A MINIMUM OF 48 HOURS ADVANCED NOTICE IS REQUIRED PRIOR TO TESTING.

20. ALL MATERIALS AND TESTING TO ADHERE TO LATEST APPLICABLE ASTM STANDARDS.

21. CONSTRUCTION STAKING STATIONING TO USE CONSTRUCTION PLAN STATIONING.

22. SANITARY SEWER SERVICE LOCATION AND ELEVATIONS OUT OF BUILDINGS INFORMATION WILL BE PROVIDED TO DISTRICT ENGINEER PRIOR TO CONSTRUCTION OF SERVICE LINE.

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PROJECT NUMBER 22-C14
DOCUMENT DATE:
1/24/2024 5:08 PM
DOCUMENT PHASE:
FOR PERMIT - ROUND 1

DRAWN BY:	DATE	CHECKED BY:	DATE
TJHOS	01/09/2024	TJH	01/24/2024

REV	DATE	DESCRIPTION

GENERAL NOTES
C-1
SHEET 2 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

NOTES:

1. EXISTING BOUNDARY, UTILITY, IMPROVEMENT LOCATIONS, AND TOPOGRAPHY INFORMATION BASED ON FIELD SURVEY CONDUCTED BY EHRHART LAND SURVEYING IN OCTOBER OF 2022.
   - 1.1. HORIZONTAL DATUM: US STATE PLANE COORDINATES, NAD 1983, MODIFIED STATE PLANE NORTH ZONE, GEOID MODEL GEOID 18. GROUND COORDINATES DERIVED USING A COMBINED SCALE FACTOR OF 0.99973994 AND BEING SCALED ABOUT CONTROL POINT No. 98 (N 1170542.63, E 3130753.89). AN X CHISELED INTO THE CONCRETE ON TOP OF THE RETAINING WALL ALONG THE EAST SIDE OF LOWELL BOULEVARD
   - 1.2. VERTICAL DATUM: VERTICAL DATUM ESTABLISHED USING NGS CONTROL POINT "HIDDEN" (PID AB3302 - 3.25" BRASS DISK) HAVING A NAVD88 ELEVATION OF 5285.30 ft. THE ELEVATION WAS VERIFIED USING AN NGS OPUS SOLUTION WITH GEOID 18.
   - 1.3. ON-SITE CONTROL POINT No. 98 IS AN X CHISELED INTO THE CONCRETE ON TOP OF THE RETAINING WALL ALONG THE EAST SIDE OF LOWELL BOULEVARD WITH AN ELEVATION OF 5231.91', NAVD 88.
2. REPLACE ANY PROPERTY PINS DISTURBED BY SITE CLEARING AND DEMOLITION ACTIVITIES.

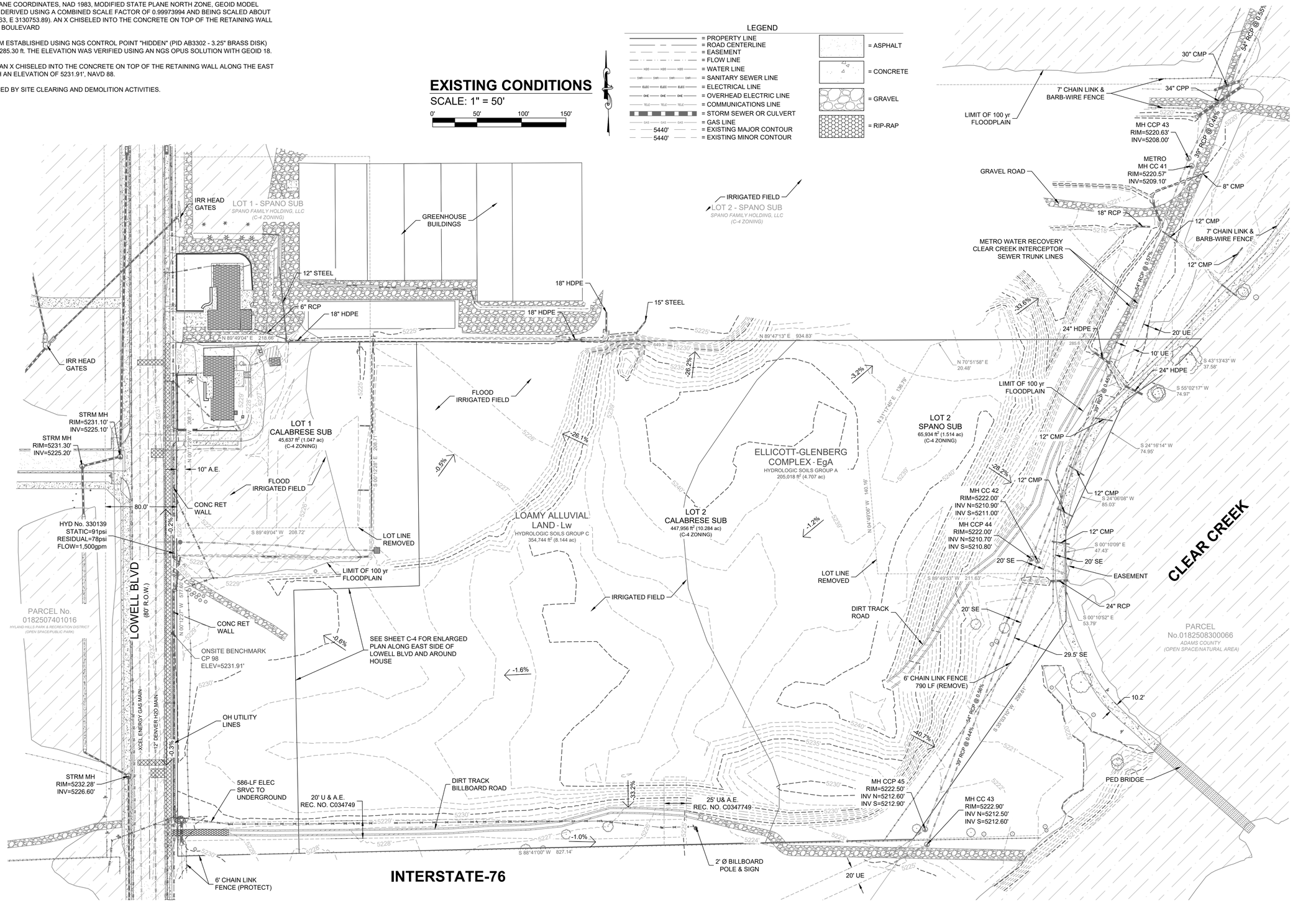
EXISTING CONDITIONS

SCALE: 1" = 50'

0' 50' 100' 150'

LEGEND

- = PROPERTY LINE
- = ROAD CENTERLINE
- = EASEMENT
- = FLOW LINE
- = WATER LINE
- = SANITARY SEWER LINE
- = ELECTRICAL LINE
- = OVERHEAD ELECTRIC LINE
- = COMMUNICATIONS LINE
- = STORM SEWER OR CULVERT
- = GAS LINE
- = EXISTING MAJOR CONTOUR
- = EXISTING MINOR CONTOUR
- = ASPHALT
- = CONCRETE
- = GRAVEL
- = RIP-RAP



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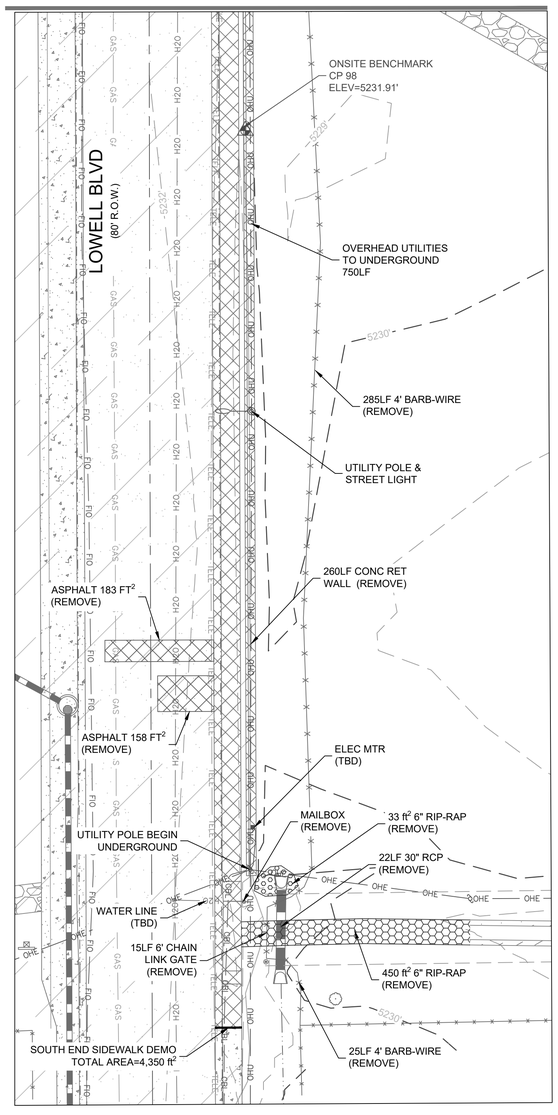
EXISTING CONDITIONS

C-2

SHEET 3 OF XX

LOWELL BLVD APTS

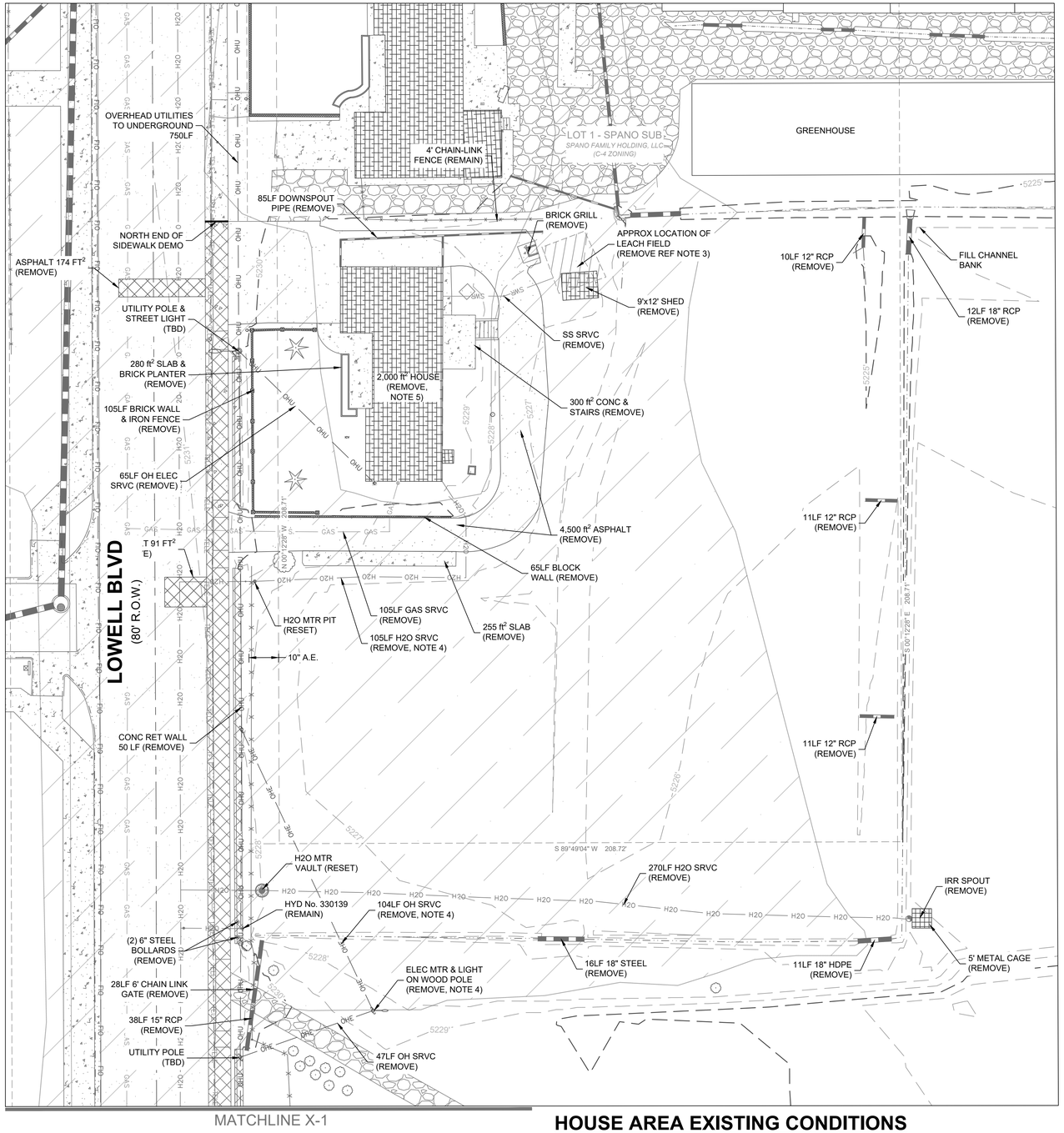
LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO



LOWELL BLVD EXISTING CONDITIONS

SCALE: 1" = 20'

0' 20' 40' 60'



HOUSE AREA EXISTING CONDITIONS

SCALE: 1" = 20'

0' 20' 40' 60'

NOTES:

1. EXISTING BOUNDARY, UTILITY, IMPROVEMENT LOCATIONS, AND TOPOGRAPHY INFORMATION BASED ON FIELD SURVEY CONDUCTED BY EHRHART LAND SURVEYING IN OCTOBER OF 2022.
   - 1.1. HORIZONTAL DATUM: US STATE PLANE COORDINATES, NAD 1983, MODIFIED STATE PLANE NORTH ZONE, GEOID MODEL GEOID 18. GROUND COORDINATES DERIVED USING A COMBINED SCALE FACTOR OF 0.99973994 AND BEING SCALED ABOUT CONTROL POINT No. 98 (N 1170542.63, E 3130753.89). AN X CHISELED INTO THE CONCRETE ON TOP OF THE RETAINING WALL ALONG THE EAST SIDE OF LOWELL BOULEVARD
   - 1.2. VERTICAL DATUM: VERTICAL DATUM ESTABLISHED USING NGS CONTROL POINT "HIDDEN" (PID AB3302 - 3.25" BRASS DISK) HAVING A NAVD88 ELEVATION OF 5285.30 ft. THE ELEVATION WAS VERIFIED USING AN NGS OPUS SOLUTION WITH GEOID 18.
   - 1.3. ON-SITE CONTROL POINT No. 98 IS AN X CHISELED INTO THE CONCRETE ON TOP OF THE RETAINING WALL ALONG THE EAST SIDE OF LOWELL BOULEVARD WITH AN ELEVATION OF 5231.91'.
2. REPLACE ANY PROPERTY PINS DISTURBED BY SITE CLEARING AND DEMOLITION ACTIVITIES.
3. SEPTIC TANK, INFILTRATORS, AND SERVICE LINE TO BE EXCAVATED AND REMOVED. FILL AND COMPACT WITH APPROVED SOILS.
4. CONTACT XCEL TO COORDINATE GAS & ELECTRICAL SERVICE ABANDONMENT.
   - 4.1. CONNECTION TO OR DISCONNECTION FROM THE COMPANY'S DISTRIBUTION SYSTEM SHALL BE MADE BY THE COMPANY. UNDER NO CIRCUMSTANCES WILL THE CUSTOMER BE PERMITTED TO CLIMB THE COMPANY'S POLES, ACCESS THE COMPANY'S UNDERGROUND FACILITIES, OR MAKE CONNECTIONS TO THE COMPANY'S LINES, EXCEPT AS SPECIFIED IN SECTION 2.13.4 SAFETY, UNLOCK, OPEN, AND/OR DE-ENERGIZE ANY ELECTRIC POWER EQUIPMENT PROCEDURES IN THIS SECTION.
   - 4.2. THE COMPANY SHALL BE NOTIFIED WHEN IT IS NECESSARY TO CUT THE METER SEAL DUE TO SITUATIONS WHERE THE ELECTRIC SERVICE MUST BE DISCONNECTED DURING AN EMERGENCY OR WHERE IT NECESSARY TO ACCESS THE METER SOCKET BY A LICENSED ELECTRICIAN. NO PERSONS, OTHER THAN EMPLOYEES OR AGENTS OF THE COMPANY, MAY RELOCATE METERS OR OTHER EQUIPMENT OWNED BY THE COMPANY (XCEL ENERGY STANDARD 2.7).
   - 4.3. ONLY AUTHORIZED COMPANY EMPLOYEES OR QUALIFIED INDIVIDUALS AUTHORIZED BY THE COMPANY ARE PERMITTED TO CONNECT, DISCONNECT, MOVE OR REMOVE METERS. ALL METERS, SERVICE WIRES, AND OTHER ELECTRICAL FACILITIES INSTALLED BY THE COMPANY UPON THE CUSTOMER'S PREMISES FOR DELIVERING OR MEASURING ELECTRICAL ENERGY TO THE CUSTOMER SHALL CONTINUE TO BE THE PROPERTY OF THE COMPANY (XCEL ENERGY STANDARD 4.10.4).
5. BACKFILL FOUNDATION HOLE PER GEOTECH RECOMMENDATIONS (CTL THOMPSON, INC. PROJECT NO. DN51,902-125-R1 DATED MAY 23, 2023).
   - 5.1. THE ON-SITE SOIL IS GENERALLY SUITABLE FOR REUSE AS NEW FILL, PROVIDED DEBRIS, ORGANICS/VEGETATION AND OTHER DELETERIOUS MATERIALS ARE SUBSTANTIALLY REMOVED.
   - 5.2. SOIL PARTICLES LARGER THAN 3 INCHES IN DIAMETER SHOULD NOT BE USED FOR FILL UNLESS BROKEN DOWN. IF IMPORTED FILL IS NECESSARY FOR GENERAL SITE GRADING PURPOSES, IT SHOULD IDEALLY CONSIST OF SOIL HAVING SIMILAR CHARACTERISTICS AS THE ON-SITE SOILS.
   - 5.3. POTENTIAL FILL MATERIALS SHOULD BE SUBMITTED TO CTL FOR APPROVAL PRIOR TO IMPORTING TO THE SITE. PRIOR TO FILL PLACEMENT, DEBRIS, ORGANICS/VEGETATION AND DELETERIOUS MATERIALS SHOULD BE SUBSTANTIALLY REMOVED FROM AREAS TO RECEIVE FILL.
   - 5.4. THE SURFACE TO BE FILLED SHOULD BE SCARIFIED TO A DEPTH OF AT LEAST 8 INCHES, MOISTURE CONDITIONED AND COMPACTED TO THE CRITERIA BELOW.
   - 5.5. SUBSEQUENT FILL SHOULD BE PLACED IN THIN (8 INCHES OR LESS) LOOSE LIFTS, MOISTURE CONDITIONED TO WITHIN 2 PERCENT OF OPTIMUM MOISTURE CONTENT FOR SAND/GRAVEL AND BETWEEN OPTIMUM AND 3 PERCENT ABOVE OPTIMUM FOR CLAY, AND COMPACTED TO A MINIMUM OF 95 PERCENT OF STANDARD PROCTOR MAXI-MUM DRY DENSITY (ASTM D 698).
   - 5.6. IF MORE THAN 20 FEET OF FILL IS PLANNED, COMPACTION OF FILL PLACED MORE THAN 20 FEET BELOW PROPOSED GRADE SHOULD BE INCREASED TO AT LEAST 100 PERCENT OF STANDARD PROCTOR COMPACTION.

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EXISTING CONDITIONS

C-3

SHEET 4 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

RESIDENTIAL AREA COVERAGE

- BUILDINGS
  - APARTMENTS = 6 @ 16,324 ft²/bldg
  - DETACHED GARAGES = 1 @ 1,753 ft²/bldg
    4 @ 2,003 ft²/bldg
  - TRASH ENCLOSURE = 697 ft²
  - MAINTENANCE SHOP = 626 ft²
  - CLUB HOUSE = 7,983 ft²
  - TOTAL BUILDING AREA = 117,015 ft² (20.9%)
- PAVEMENT/ROADS = 161,358 ft² (28.8%)
- SITE CONCRETE/SIDEWALKS = 72,165 ft² (12.9%)
- PACKED GRAVEL = 18,653 ft² (3.3%)
- LANDSCAPE AREA = 190,571 ft² (34.0%)
  - TOTAL AREA = 559,762 ft² (12.850 ac)

LOT IMPERVIOUSNESS

- PAVEMENT = 161,358 ft² @ 100%
- BUILDING = 117,015 ft² @ 90%
- SITE CONCRETE/SIDEWALKS = 72,165 ft² @ 90%
- PACKED GRAVEL = 18,653 ft² @ 40%
- LANDSCAPE AREA = 190,571 ft² @ 2%
  - TOTAL IMPERVIOUS AREA = 342,893 ft², 61.3%

SITE PARKING COUNT

PER ADAMS COUNTY DEVELOPMENT REGULATIONS § 4-15-04-03

- (84) 2 BEDROOM UNITS @ 1.5 SPACES PER UNIT = 126 SPACES
- (180) 1 BEDROOM UNITS @ 1.0 SPACES PER UNIT = 180 SPACES
- (84) STUDIO UNITS @ 0.75 SPACES PER UNIT = 63 SPACES
- VISITOR PARKING @ 15% OF TENANT PARKING = 55 SPACES

TOTAL SPACES REQUIRED = 424

PHASE I

- TANDEM GARAGE = 88
- GARAGE SPACES = 35
- COVERED SPACES = 56
- REGULAR SPACES = 232

PHASE II

- TANDEM GARAGE = 12
- GARAGE SPACES = 11
- REGULAR SPACES = 6

TOTAL SPACES PROVIDED = 442

- BICYCLE PARKING @ 5% OF TENANT PARKING = 22 SPACES
- ADA SPACES = 9 (w/ 2 VAN ACCESSIBLE PER ADA § 208.2)

OVERALL SITE PLAN

SCALE: 1" = 40'

0' 40' 80' 120'

PLAN KEY

A B C D

LOT 1 - SPANO SUB
SPANO FAMILY HOLDING, LLC
(C-4 ZONING)

LOT 2 - SPANO SUB
SPANO FAMILY HOLDING, LLC
(C-4 ZONING)

LOWELL BLVD
(80' R.O.W.)

PHASE I

PHASE II

LOT 1
LOWELL DEVELOPMENT SUBDIVISION
554,247 ft² (12.724 ac)
(R-4 ZONING)

BLDG 1 4-STORY APARTMENT

BLDG 2 4-STORY APARTMENT

BLDG 3 4-STORY APARTMENT

BLDG 4 4-STORY APARTMENT

BLDG 5 4-STORY APARTMENT

2-STORY CLUB HOUSE

MAINTENANCE SHOP

GARAGE G-1 6-UNITS

GARAGE G-2 6-UNITS

GARAGE G-3 6-UNITS

GARAGE G-4 6-UNITS

COV'D PARKING

COM COV'D PK

COM PK 2' VO PK

2'-OV PK

2' VO PK

POOL DECK 15,000 ft²

DOG PARK 8,378 ft²

POND ACCESS

WEST DETENTION POND DETAIL/C-XX

EAST DETENTION POND DETAIL/C-XX

32'x20' TRASH ENCLOSURE REF C-XX

CONC RET WALL

BLOCK RET WALL

6' DECORATIVE FENCE

4' DECORATIVE FENCE

6' PRIVACY FENCE

EX 6' CHAIN LINK

EX 6' CHAIN LINK FENCE

GATE

TRAIL CONNECTION

20' REAR SETBACK

25' SIDE SETBACK

25' FRONT SETBACK

20' E.W.E.

20' E.S.E.

35' E.W.S.E.

35' E.S.E.

10' U.E.

100-yr FLOODPLAIN BOUNDARY

100-YR FLOODPLAIN BOUNDARY

BOTTOM OF CHANNEL

FLOODPLAIN CHANNEL

20' MAINTENANCE ACCESS

2' Ø BILLBOARD POLE & SIGN

BARRICADE

PARCEL No.0182508300066
ADAMS COUNTY
(OPEN SPACE/NATURAL AREA)

CLEAR CREEK

N 89°49'04" E 218.66'

N 89°47'13" E 934.83'

S 43°13'43" W 37.58'

S 55°02'17" W 74.97'

S 24°16'14" W 74.95'

S 24°06'08" W 85.03'

S 00°10'09" E 47.43'

S 00°10'52" E 53.79'

S 88°41'00" W 827.14'

N 00°12'27" W 577.60'

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5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

PROJECT NUMBER 22-C14
DOCUMENT DATE:
1/24/2024 5:08 PM
DOCUMENT PHASE:
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REV	DATE	DESCRIPTION	DRAWN BY	DATE	CHECKED BY	DATE
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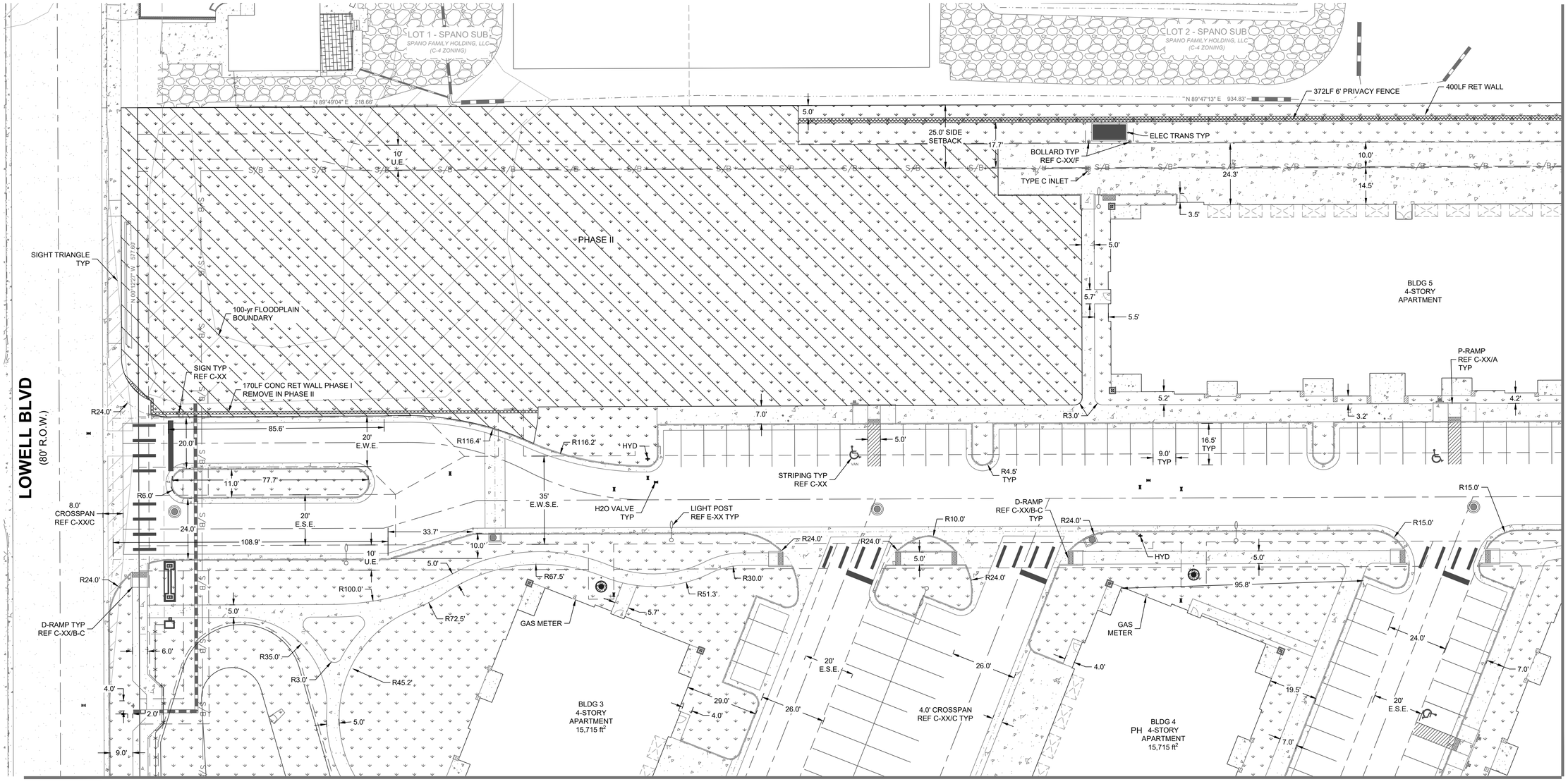
OVERALL SITE

C-4

SHEET 5 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO



MATCHLINE SITE PLAN C

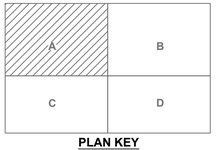
SITE PLAN A - PHASE I

SCALE: 1" = 20'

0' 20' 40' 60'

NOTES:

1. REFERENCE C-XX FOR PAVEMENT PLAN.
2. REFERENCE C-XX FOR SIGNAGE & STRIPING PLAN.
3. REFERENCE C-XX FOR ELEVATIONS & GRADING PLAN.



PLAN KEY

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MATCHLINE SITE PLAN B

LOWELL DEVELOPMENT, LLC
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TJH/DS	01/09/2024	TJH	01/24/2024

REV	DATE	DESCRIPTION

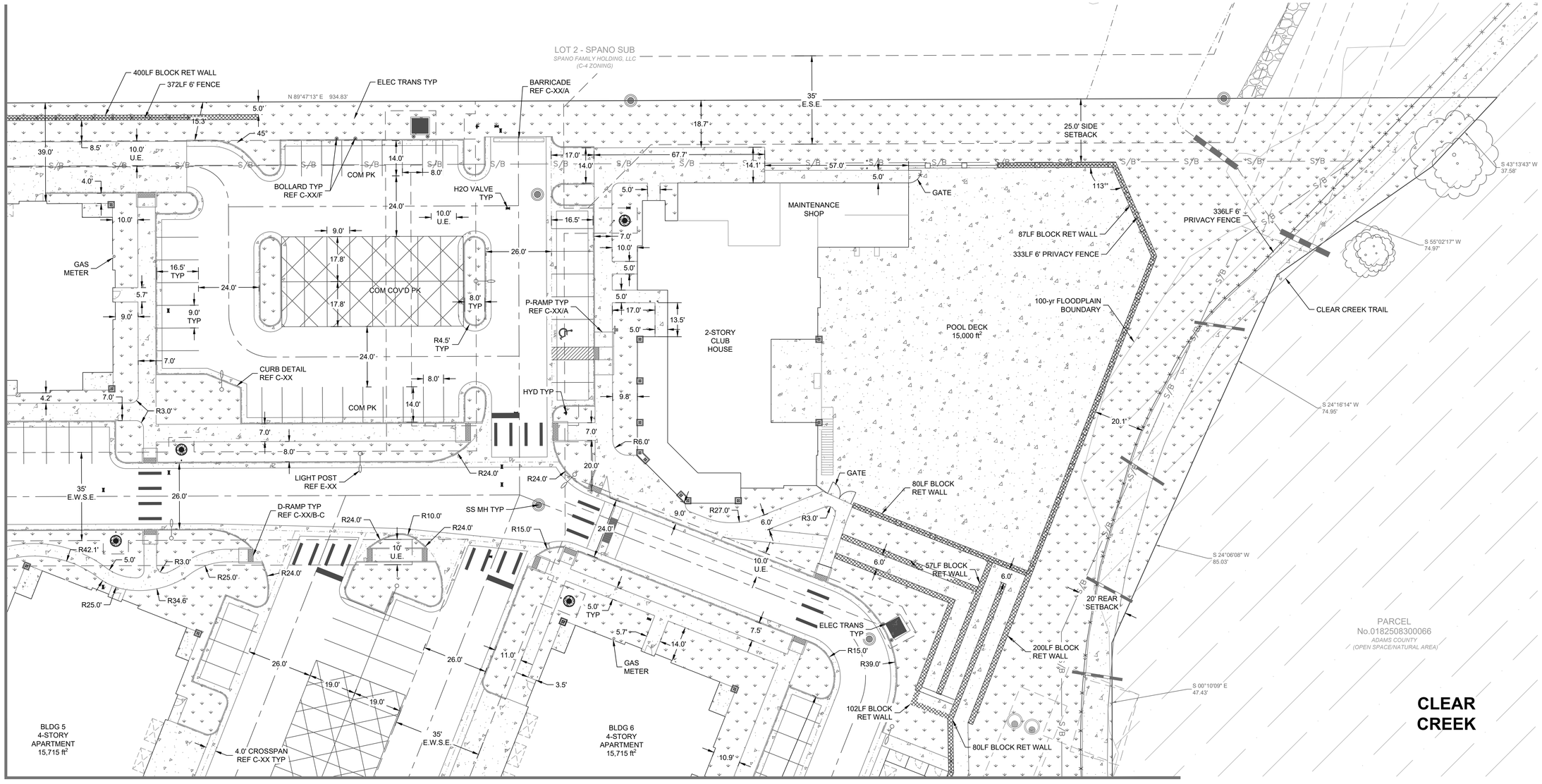
SITE PLAN A
PHASE I

C-5

SHEET 6 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO



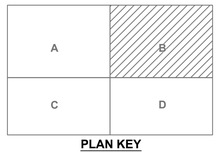
SITE PLAN B - PHASE I

SCALE: 1" = 20'

0' 20' 40' 60'

NOTES:

1. REFERENCE C-XX FOR PAVEMENT PLAN.
2. REFERENCE C-XX FOR SIGNAGE & STRIPING PLAN.
3. REFERENCE C-XX FOR ELEVATIONS & GRADING PLAN.



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PROJECT NUMBER 22-C14
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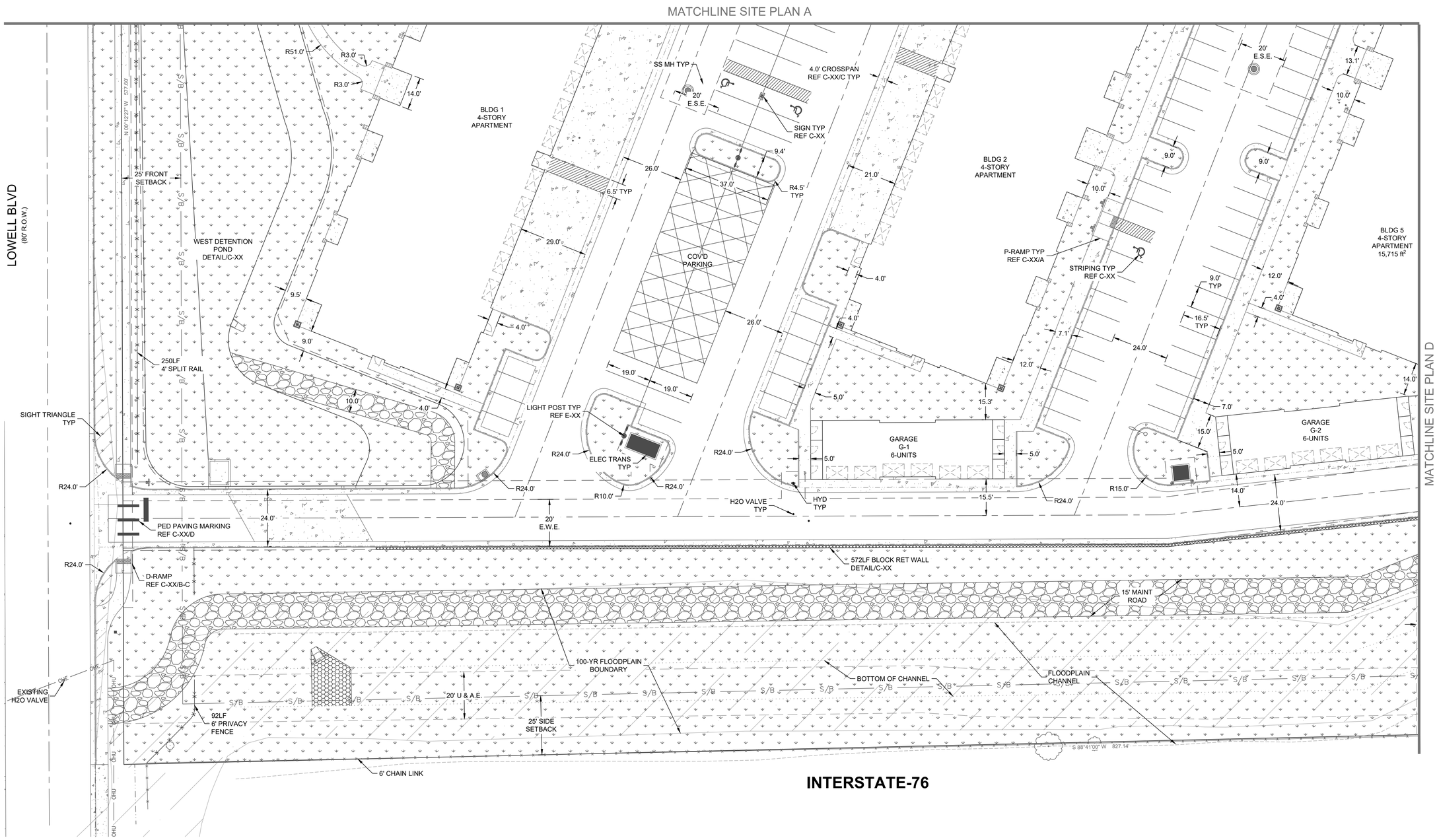
SITE PLAN B
PHASE I

C-6

SHEET 7 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO



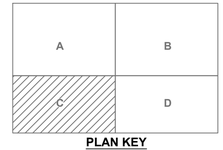
SITE PLAN C - PHASE I

SCALE: 1" = 20'

0' 20' 40' 60'

NOTES:

1. REFERENCE C-XX FOR PAVEMENT PLAN.
2. REFERENCE C-XX FOR SIGNAGE & STRIPING PLAN.
3. REFERENCE C-XX FOR ELEVATIONS & GRADING PLAN.



PLAN KEY

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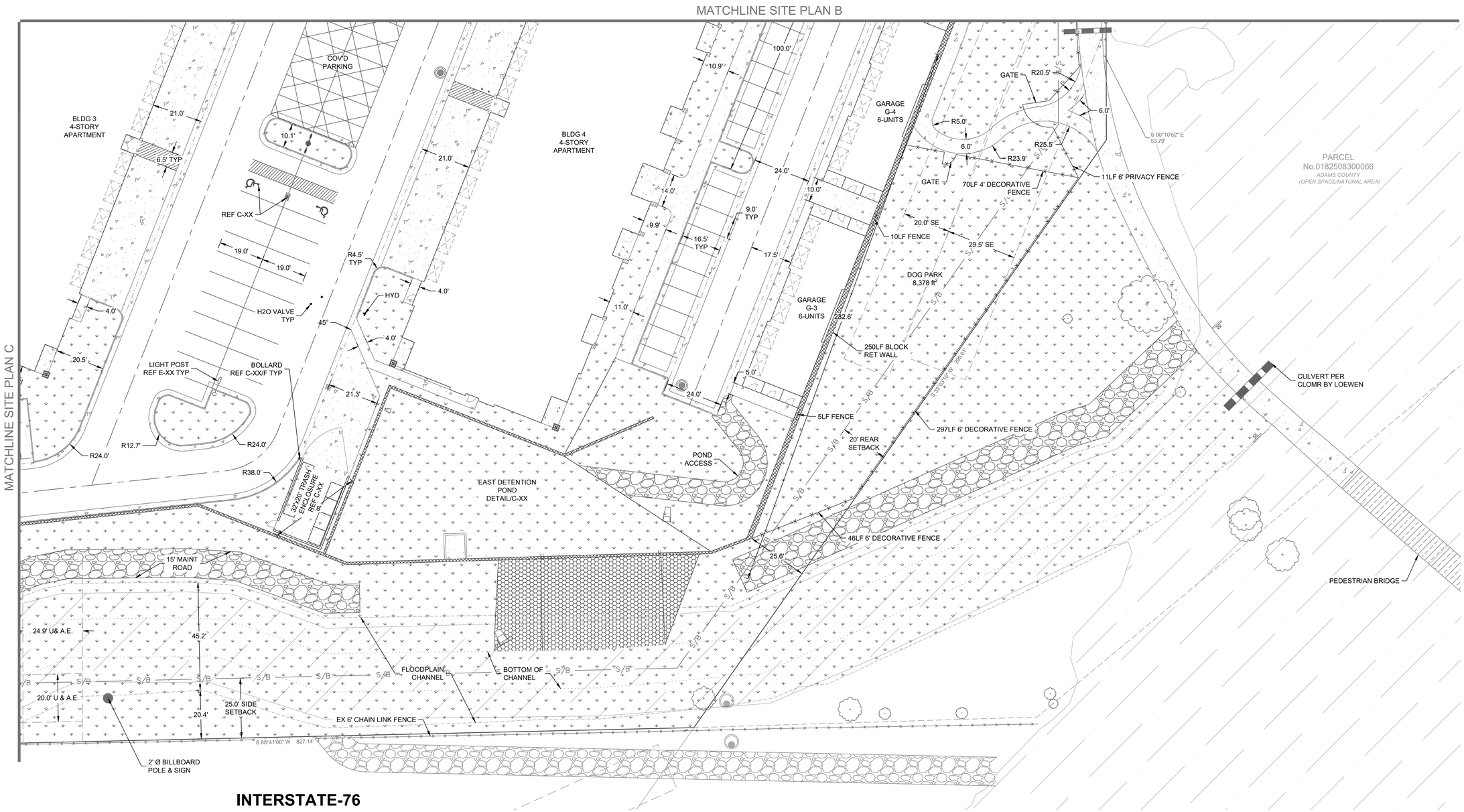
SITE PLAN C
PHASE I

C-7

SHEET 8 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO



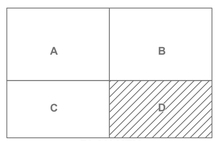
SITE PLAN D - PHASE I

SCALE: 1" = 20'

0' 20' 40' 60'

NOTES:

1. REFERENCE C-XX FOR PAVEMENT PLAN.
2. REFERENCE C-XX FOR SIGNAGE & STRIPING PLAN.
3. REFERENCE C-XX FOR ELEVATIONS & GRADING PLAN.



PLAN KEY

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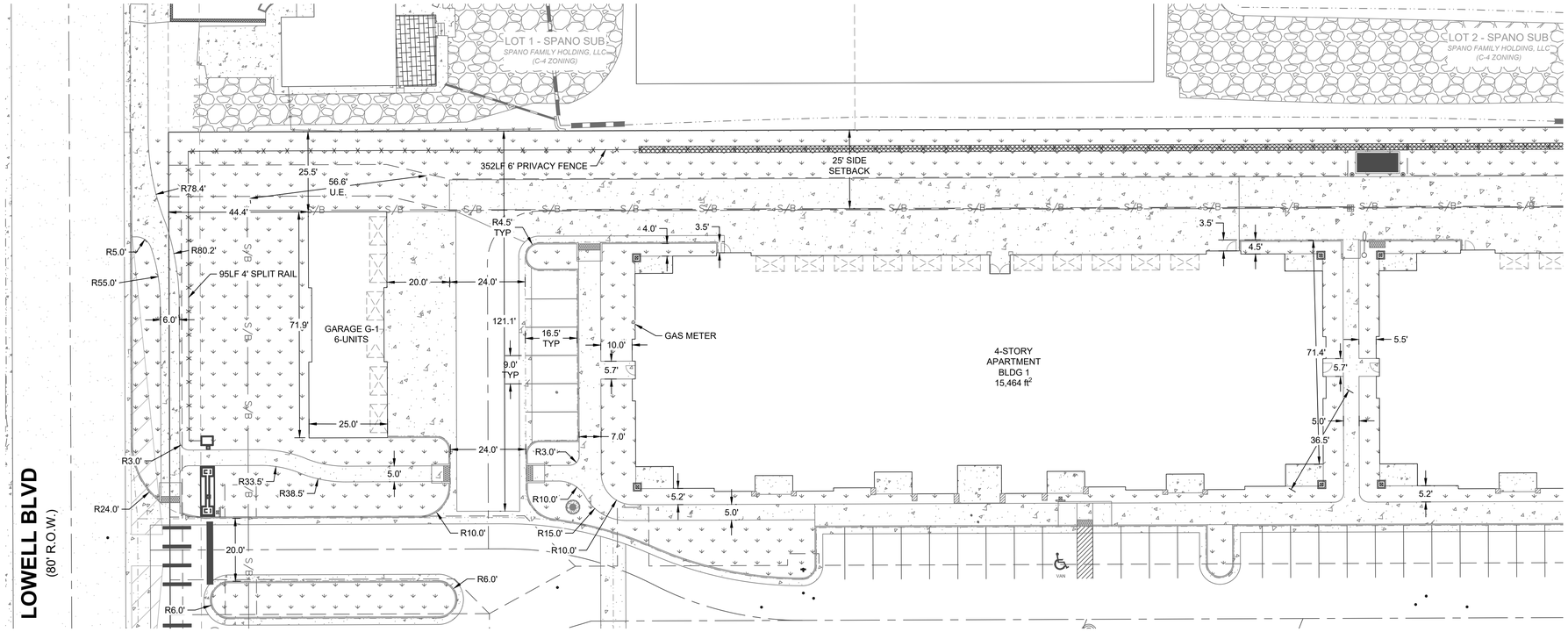
SITE PLAN D
PHASE I

C-8

SHEET 9 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO



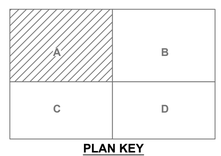
SITE PLAN A - PHASE II

SCALE: 1" = 20'

0' 20' 40' 60'

NOTES:

1. REFERENCE C-XX FOR PAVEMENT PLAN.
2. REFERENCE C-XX FOR SIGNAGE & STRIPING PLAN.
3. REFERENCE C-XX FOR ELEVATIONS & GRADING PLAN.



PLAN KEY

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SITE PLAN A
PHASE II

C-9

SHEET 10 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

OVERALL UTILITY PLAN

SCALE: 1" = 40'

0' 40' 80' 120'

LEGEND

- = PROPERTY LINE
- = PARKING STRIPING
- = ROAD CENTERLINE
- = EASEMENT
- = FENCE
- = FLOWLINE
- = WATER LINE
- = SANITARY SEWER LINE
- = ELECTRICAL LINE
- = OVERHEAD ELECTRIC LINE
- = COMMUNICATIONS LINE
- = STORM SEWER LINE
- = GAS LINE
- = ASPHALT
- = CONCRETE
- = GRAVEL
- = LANDSCAPE AREA

ENDING PROP BURIED ELEC MAIN

CONNECTION TO PROP UNDERGROUND ELEC MAIN

CONNECTION TO EX GAS MAIN

CONNECTION TO EX H_2O MAIN

CONNECTION TO EX GAS MAIN

CONNECTION TO EX TELE MAIN

CONNECTION TO EX H_2O MAIN

STARTING PROP BURIED ELEC MAIN

LOWELL BLVD (80' R.O.W.)

LOT 1 - SPANO SUB
SPANO FAMILY HOLDING, LLC
(C-4 ZONING)

LOT 2 - SPANO SUB
SPANO FAMILY HOLDING, LLC
(C-4 ZONING)

10' U.E.

10' UE

10' IRRIGATION EASEMENT

20' E.W.E.

35' E.W.S.E.

20' E.S.E.

HYD No. 330139
STATIC=91psi
RESIDUAL=78psi
FLOW=1,500gpm

DRAINAGE MAINTENANCE EASEMENT

SIDEWALK EASEMENT

WEST DETENTION POND

8' U.E.

4-STORY APARTMENT BLDG 6

4-STORY APARTMENT BLDG 1

4-STORY APARTMENT BLDG 2

4-STORY APARTMENT BLDG 3

4-STORY APARTMENT BLDG 4

4-STORY APARTMENT BLDG 5

6" FIRE SRVC
2" H_2O SRVC

6" SS SRVC W/ 2-WAY CO W/ TRAFFIC RATED CO LID

6" SS SRVC
6" 2-WAY CO W/ TRAFFIC RATED CO LID

STUB IN PHASE I
INSTALL METER IN PHASE II

8" PVC H_2O MAIN

8" PVC SS MAIN

MH S-5
MH S-5A
MH S-6
MH S-6A
MH S-7

HYD

11' U.E.

30' E.S.E.

6" 2-WAY CO
6" SS SRVC

6" SS SRVC
6" 2-WAY CO

2" H_2O SRVC
6" FIRE SRVC

MH S-1
MH S-2
MH S-3
MH S-4
MH S-4A

35' E.S.E.

4" SS SRVC

MAINTENANCE SHOP

6" FIRE SRVC
1" H_2O SRVC
4" SS SRVC

2-STORY CLUB HOUSE

10' U.E.

11' U.E.

35' E.W.S.E.

6" 2-WAY CO W/ TRAFFIC RATED CO LID

6" SS SRVC

20' E.W.E.

EAST DETENTION POND

DRAINAGE MAINTENANCE EASEMENT

RAP

TRASH ENCLOSURE 640 ft²

DRAINAGE & ACCESS EASEMENT

MH CCP 43
=5220.63'
INV=5208.00'

MH T-1

CONNECTOR PIPE
12" PVC

METRO MH CC 41
RIM=5220.57'
INV=5209.10'

20' E.S.E.

20' E.S.E.

SOUTH BRANCH
8" PVC SS MAIN

36" RCP @ 0.53%

METRO WATER RECOVERY
CLEAR CREEK INTERCEPTOR
SEWER TRUNK LINES

36" RCP @ 0.46%

54" RCP @ 0.44%

MH CCP 44
RIM=5222.00'
INV N=5210.70'
INV S=5210.80'

MH CC 42
RIM=5222.00'
INV N=5210.90'
INV S=5211.00'

PARCEL
No.0182508300066
ADAMS COUNTY
(OPEN SPACE/NATURAL AREA)

CLEAR CREEK

MH CCP 45
RIM=5222.50'
INV N=5212.60'
INV S=5212.90'

MH CC 43
RIM=5222.90'
INV N=5212.50'
INV S=5212.60'

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DRAWN BY: LH/DS DATE: 01/09/2024 CHECKED BY: TJH DATE: 01/24/2024

OVERALL UTILITY

C-10

SHEET 11 OF XX

LOWELL BLVD APTS - SITE PLAN

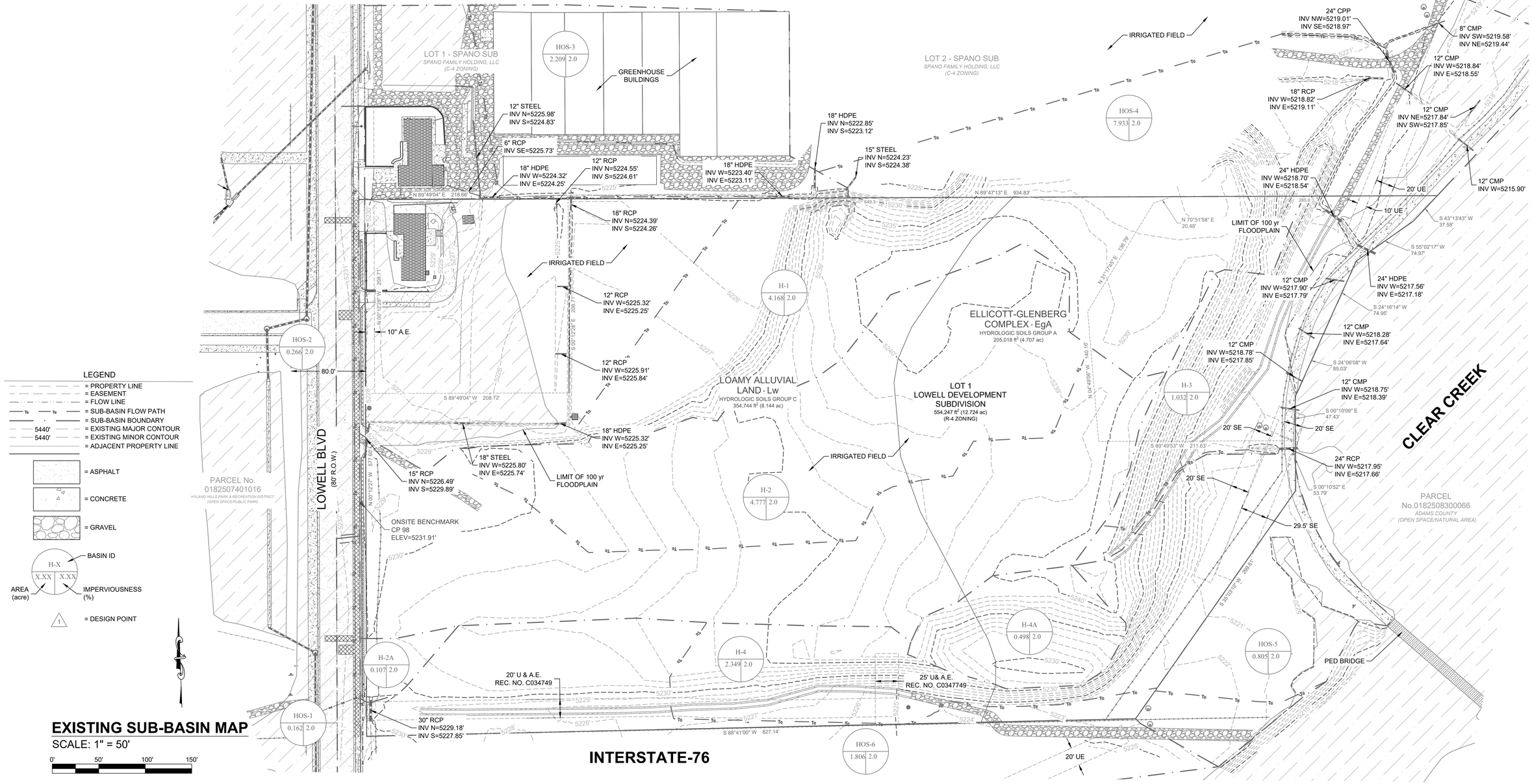
LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

Table 1. Historic Sub-Basin Summary

Basin ID	Basin Parameters						Runoff Coefficients, C			Runoff, Q			Conveyance
	Area (acre)	L (ft)	Δ (ft)	Avg So	I	tuse (min)	C5	C10	C100	Q5 (cfs)	Q10 (cfs)	Q100 (cfs)	
H-1	4.168	561.3	1.8	0.3%	2%	35	0.04	0.12	0.41	0.27	1.00	5.98	Sheet Flow/Channelization
H-2	5.275	800.7	9.5	1.2%	2%	31	0.04	0.10	0.37	0.36	1.11	7.20	Sheet Flow
H-3	1.032	194.3	20.6	10.6%	2%	5	0.01	0.01	0.13	0.04	0.05	1.21	Sheet Flow/Channelization
H-4	2.847	650.6	10.8	1.7%	2%	31	0.04	0.10	0.36	0.20	0.60	3.78	Sheet Flow/Channelization
HOS-1	0.162	184.9	1.0	0.5%	2%	10	0.05	0.15	0.49	0.02	0.09	0.52	Sheet Flow/Curb & Gutter
HOS-2	0.266	416.8	1.6	0.4%	2%	24	0.05	0.15	0.49	0.03	0.10	0.57	Sheet Flow/Curb & Gutter
HOS-3	2.209	505.6	3.5	0.7%	2%	35	0.05	0.15	0.49	0.18	0.66	3.79	Sheet Flow/Channelization
HOS-4	7.933	634.1	6.1	1.0%	2%	29	0.04	0.11	0.39	0.57	1.91	11.91	Sheet Flow/Channelization
HOS-5	0.805	188.4	3.4	1.8%	2%	22	0.01	0.01	0.13	0.02	0.02	0.48	Sheet Flow
HOS-6	1.806				2%	31	0.04	0.12	0.42	0.12	0.46	2.80	Sheet Flow/Channelization
Hist. Site	13.323	Total Historic On-Site Generated Runoff								0.87	2.76	18.18	
Hist. Off-Site	1.806	Total Historic Off-Site Runoff Coming On-site								0.12	0.46	2.80	

NOTES:

1. EXISTING BOUNDARY, UTILITY, IMPROVEMENT LOCATIONS, AND TOPOGRAPHY INFORMATION BASED ON FIELD SURVEY CONDUCTED BY EHRHART LAND SURVEYING IN OCTOBER OF 2022.
   - 1.1. HORIZONTAL DATUM: US STATE PLANE COORDINATES, NAD 1983, MODIFIED STATE PLANE NORTH ZONE, GEOID MODEL GEOID 18. GROUND COORDINATES DERIVED USING A COMBINED SCALE FACTOR OF 0.99973994 AND BEING SCALED ABOUT CONTROL POINT No. 98 (N 1170542.63, E 3130753.89) AN X CHISELED INTO THE CONCRETE ON TOP OF THE RETAINING WALL ALONG THE EAST SIDE OF LOWELL BOULEVARD.
   - 1.2. VERTICAL DATUM: VERTICAL DATUM ESTABLISHED USING NGS CONTROL POINT "HIDDEN" (PID AB3302 - 3.25" BRASS DISK) HAVING A NAVD88 ELEVATION OF 5285.30 ft. THE ELEVATION WAS VERIFIED USING AN NGS OPUS SOLUTION WITH GEOID 18.
   - 1.3. ON-SITE CONTROL POINT No. 98 IS AN X CHISELED INTO THE CONCRETE ON TOP OF THE RETAINING WALL ALONG THE EAST SIDE OF LOWELL BOULEVARD WITH AN ELEVATION OF 5231.91'.



LEGEND

- = PROPERTY LINE
- = EASEMENT
- = FLOW LINE
- = SUB-BASIN FLOW PATH
- = SUB-BASIN BOUNDARY
- 5440' = EXISTING MAJOR CONTOUR
- 5440' = EXISTING MINOR CONTOUR
- = ADJACENT PROPERTY LINE
- = ASPHALT
- = CONCRETE
- = GRAVEL
- BASIN ID (H-X), AREA (acre) (X.XX), IMPERVIOUSNESS (%) (X.XX)
- = DESIGN POINT

EXISTING SUB-BASIN MAP

SCALE: 1" = 50'

0' 50' 100' 150'

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REV.	DATE	DESCRIPTION	DRAWN BY: TJH	DATE: 07/06/2023	CHECKED BY: TJH	DATE: 07/06/2023

EXISTING SUB-BASINS

C-21

SHEET 22 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

Table 2. Proposed Sub-Basin Summary

Basin ID	Basin Parameters						Runoff Coefficients, C			Runoff, Q			Conveyance
	Area (acre)	L (ft)	Δ (ft)	Avg So	I	tuse (min)	C5	C10	C100	Q5 (cfs)	Q10 (cfs)	Q100 (cfs)	
P-1	1.429	319	5.4	1.7%	71.9%	11	0.63	0.66	0.78	2.64	3.40	7.09	Sheet Flow/Curb & Gutter
P-2	0.971	157	3.0	1.9%	25.5%	16	0.24	0.32	0.59	0.56	0.93	3.02	Sheet Flow/Channelization
P-3	0.618	233	2.5	1.1%	91.2%	5	0.78	0.80	0.85	2.00	2.53	4.75	Sheet Flow/Curb & Gutter
P-4	0.596	201	2.3	1.1%	84.1%	5	0.72	0.75	0.83	1.78	2.29	4.47	Sheet Flow/Curb & Gutter
P-5	0.380	137	1.4	1.0%	79.7%	5	0.69	0.72	0.81	1.09	1.40	2.78	Sheet Flow/Channelization
P-6	1.359	295	3.7	1.3%	81.1%	10	0.70	0.73	0.81	2.89	3.72	7.28	Sheet Flow/Curb & Gutter
P-7	1.586	412	6.0	1.5%	83.1%	10	0.70	0.72	0.80	3.38	4.28	8.39	Sheet Flow/Curb & Gutter
P-8	2.338	338	4.1	1.2%	80.8%	10	0.66	0.68	0.75	4.69	5.96	11.59	Sheet Flow/Curb & Gutter
P-9	0.911	269	2.7	1.0%	61.8%	10	0.47	0.48	0.59	1.30	1.64	3.55	Sheet Flow/Curb & Gutter
P-10	1.889	362	21.5	5.9%	11.7%	7	0.11	0.17	0.44	0.77	1.47	6.71	Flood Diversion Channel/Culvert
P-11	0.772	250	21.1	8.4%	17.5%	10	0.29	0.32	0.47	0.68	0.93	2.40	Sheet Flow/Ex Culverts
P-12						0	0.00	0.00	0.00	0.00	0.00	0.00	Sheet Flow
Captured	10.189	On-Site Developed Imp %			77%	Total Captured Runoff				20.33	26.16	52.92	
Un-Captured	2.662					Total Un-captured Runoff				1.45	2.39	9.11	

LEGEND

= PROPERTY LINE
= EASEMENT
= FLOW LINE
= SUB-BASIN FLOW PATH
= SUB-BASIN BOUNDARY
= EXISTING MAJOR CONTOUR
= EXISTING MINOR CONTOUR
= ADJACENT PROPERTY LINE

H-X
X.XX | X.XX
BASIN ID
AREA (acre)
IMPERVIOUSNESS (%)

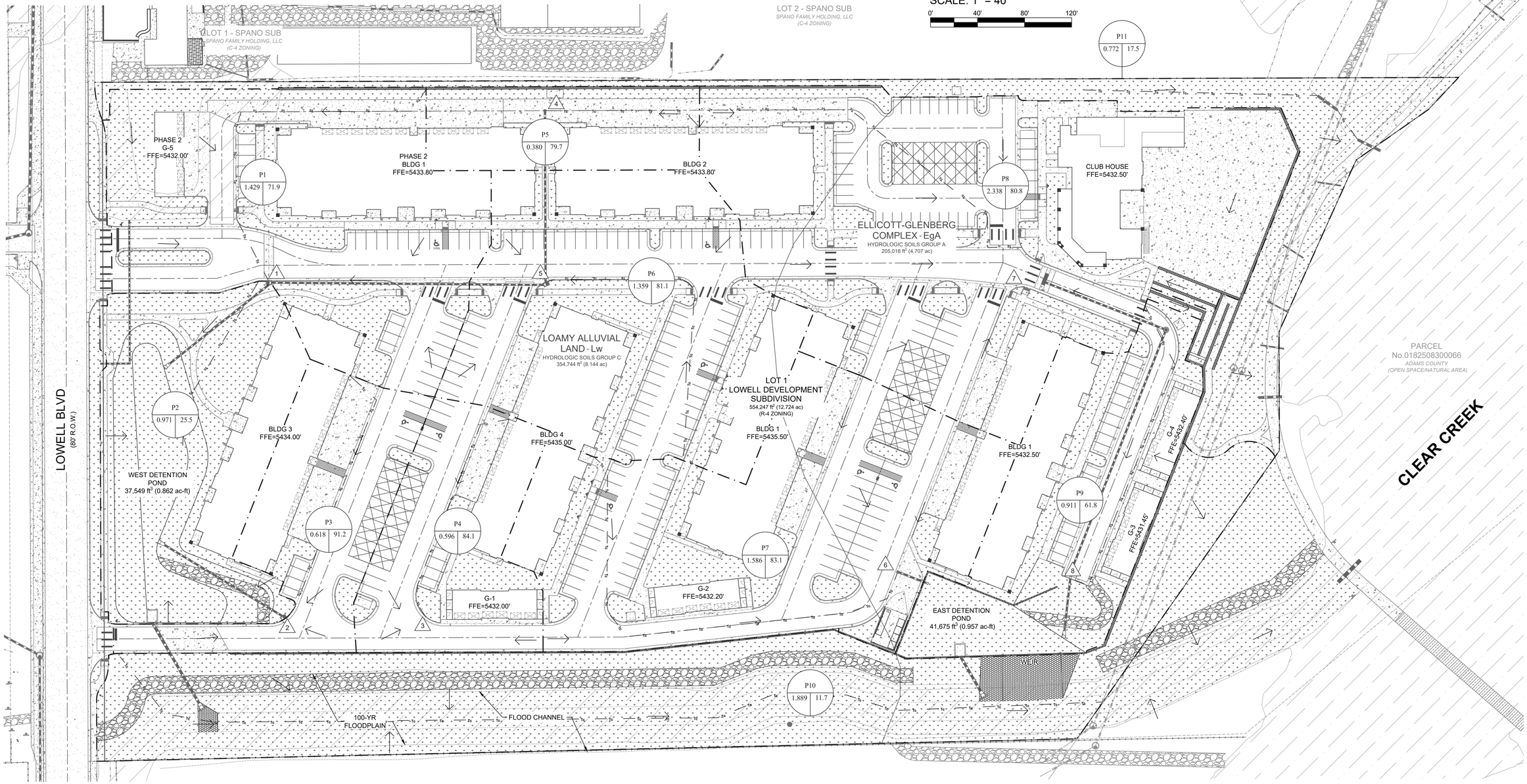
1 = DESIGN POINT

= ASPHALT
= CONCRETE
= GRAVEL
= LANDSCAPE AREA

PROPOSED SUB-BASIN MAP

SCALE: 1" = 40'

0' 40' 80' 120'



ENTITLEMENTS REVIEW ONLY NOT FOR CONSTRUCTION

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LOWELL DEVELOPMENT, LLC
5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

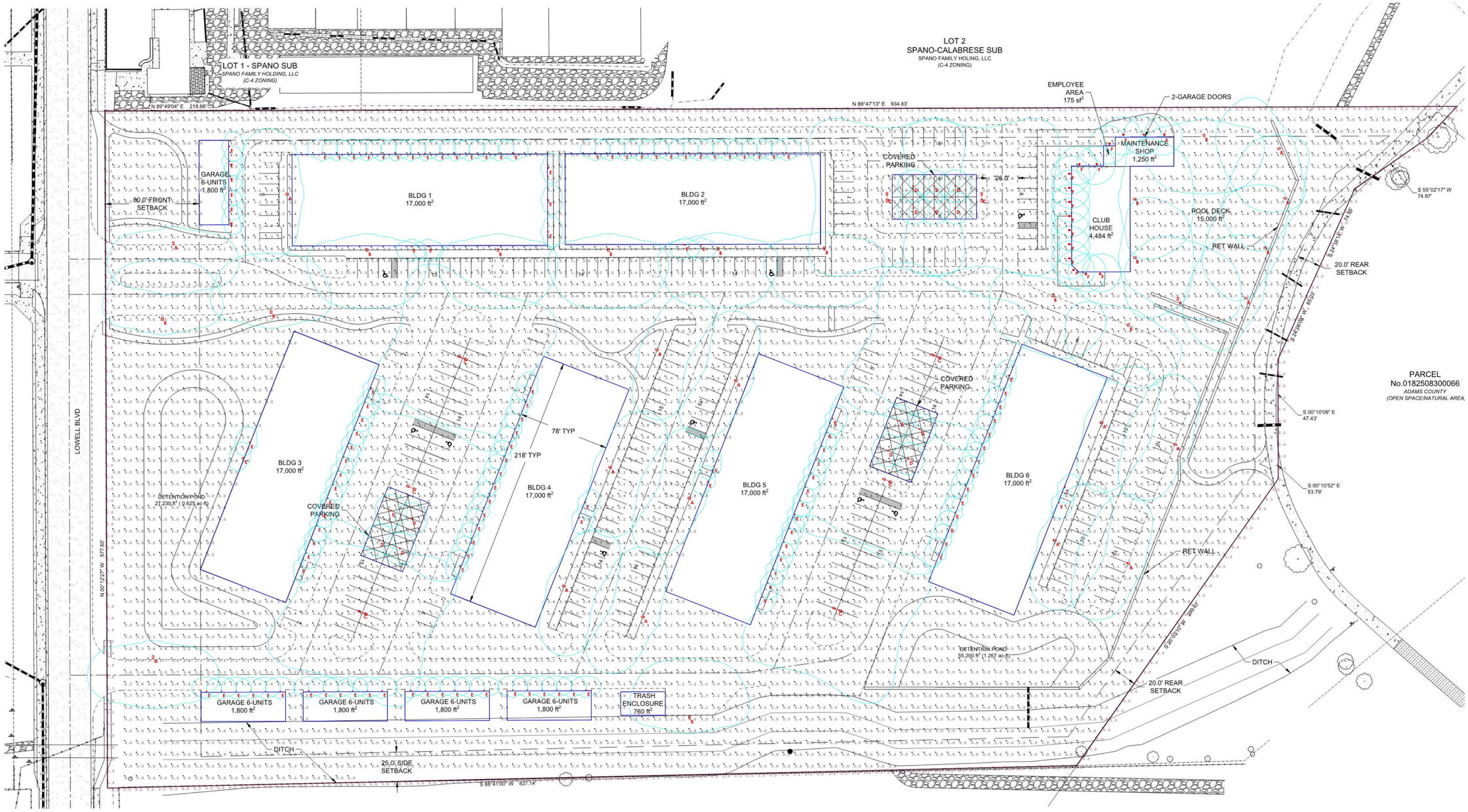
PROJECT NUMBER 22-C14
DOCUMENT DATE:
1/24/2024 5:08 PM
DOCUMENT PHASE:
FOR PERMIT - ROUND 1

REV.	DATE	DESCRIPTION	DRAWN BY:	DATE	CHECKED BY:	DATE
			PHDS	01/09/2024	TJH	01/24/2024

PROPOSED BASIN
C-22
SHEET 21 OF XX

Luminaire Schedule							
Symbol	Qty	Tag	Description	LLF	Luminaire Lumens	Luminaire Watts	Mounting Height
	13	A	ILP Skyline Area Light SAS-12L-U-30-T3-HSS	0.900	8655	82.2	20
	18	B	ILP Skyline Area Light SAS-12L-U-30-T4-HSS	0.900	8194	82.2	20
	8	C	ILP Skyline Area Light (Twin-180) SAS-12L-U-30-TSS on 20' pole	0.900	12738	82.2	20
	14	D	PIL Surface Mount Downlight MIMIK_10_CEILING_TECH_730_071765	0.900	700	10	9
	129	E	PIL Wall Pack QUASAR_20_TECH_830_070170	0.900	695	11	8
	16	F	Barn Light Avalon 16" Gooseneck LED Sconce	0.900	1179	16	9

Calculation Summary						
Label	Units	Avg	Max	Min	Avg/Min	Max/Min
PROP LINE	Fc	0.03	1.2	0.0	N.A.	N.A.
SITE	Fc	1.10	7.8	0.0	N.A.	N.A.



1 SITE PLAN - PHOTOMETRIC
SCALE: 1" = 40'-0"

PROFICIENT ENGINEERING
5335 W 48th Ave Suite 103
Denver, CO 80212
720.779.3556
PROJECT # 323056

ENTITLEMENTS REVIEW ONLY

ASHER ARCHITECTS + ENGINEERS
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e: David@AsherArch.com

COLORADO LICENSED
BRIAN M. ASHERTH
41592
PROFESSIONAL ENGINEER

LOWELL DEVELOPMENT

5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT
No.1

PROJECT INFORMATION:
22-C13
DOCUMENT DATE:
7/7/2023 5:09:12 PM
DOCUMENT PHASE:
FOR REVIEW - ROUND 1

REV #	DATE	COMMENTS

DRAWN BY: RD
CHECKED BY:
DATE 7/7/2023
DATE 7/7/2023

SITE PLAN - PHOTOMETRIC

E1.1

A:

Project Name: Lowell Development	Part Number:	Type:

SKYLINE
AREA LIGHT SERIES

407-478-3759
www.ilp-inc.com

Product Overview

SCAN ME



* Shown with UMB Mounting

FEATURES

- Specification Grade die-cast aluminum housing
- Bronze polyester powder coat finish (standard)
- Custom and factory select colors available
- 5 Optical Distributions with Highest Uniformity in their product class
- Factory Rotatable Type 2, 3, 4, 5 Square, & Automotive Front Row Optics
- Optional Spill Light Control Integral Shield (HSS)
- Universal Quick Pole Mount Allows for 1 man installation on existing poles with no drilling required
- 9 Different Optional Mounting Methods (3G Rated)[3]
- Single Fastener hinged door driver access
- 120–277V Universal Voltage or 347–480V High Voltage
- 0–10V Dimmable Driver (std.)
- PIR Occupancy, Photocell, & Bi-Level Dimming Sensors Available
- 3-Pin & 7-Pin ANSI C136.41 Control Receptacle Options
- Wireless control integrated luminaire
- 3000K, 4000K & 5000K CCT
- >70 Color Rendering Index (CRI)
- Calculated L80 >100,000 hrs @ 25°C per TM-21-11
- IP66 Rated Luminaire
- Dark Sky Compliant[1,2]
- 5 Year Warranty; 10 Year Optional Warranty[4]
- ETL Listed for Wet Locations
- DesignLights Consortium® Premium Qualified Luminaire

[1] 3000K is IDA Listed [2] Must select UMB, WFM, or HTM mounting options to qualify
[3] TRN & SLPF 1.5G Rated [4] Requires additional Surge Protection (SP1, SP2, SP480V2); For additional details see General Terms and Conditions

SUITABLE APPLICATIONS

• Parking Lots • Parking Structure • Parks • Education • Hospitals • Car Dealerships • Roadways • Shopping Centers

ORDERING GUIDE

SERIES	LUMENS	VOLTAGE	CCT	DISTRIBUTION	ORIENTATION	MOUNTING	FINISH	WARRANTY
☑ **SAS** Small	☐ **6L** 6,000 lm	☑ **U** 120-277v	☑ **30** 3000K	☐ **T2** T2 - Type 2	☐ (Blank) - Standard	☐ **SLPF** Adjustable Slip Fitter	☐ **BRZ**	☐ **(Blank)** 5YR
	☐ **9L** 9,000 lm	☐ **HV** 347-480v	☐ **40** 4000K	☐ **T3** T3 - Type 3	☐ **L** Optics Rotated Left	☐ **UMB** Universal Fixed	☐ **BLK**	☐ **10YR**[4] 10YR
	☑ **12L** 12,000 lm		☐ **50** 5000K	☐ **T4** T4 - Type 4	☐ **R** Optics Rotated Right	☐ **UMB/R** Universal Mount Sqr/ Rnd pole 3"-6"	☐ **WHT**	
	☐ **15L** 15,000 lm			☐ **T5S** Type 5 Square		☐ **UAB** Universal Adjustable	☐ **SLV**	
	☐ **18L** 18,000 lm			☐ **FTA** Forward Throw Automotive		☐ **UAB/R** Universal Adjustable Sqr/Rnd pole 3"-6"	☐ **RALxxxx** [9]	
☐ **SAM** Med	☐ **24L** 24,000 lm					☐ **WFM** Wall Fixed Mount		
	☐ **30L** 30,000 lm					☐ **WAM** Wall Adjustable Mount		
	☐ **36L** 36,000 lm					☐ **TRN** Trunnion Mount		
	☐ **42L** 42,000 lm					☐ **HTM** Horizontal Tenon Mount		
	☐ **50L** 50,000 lm							

BASIC CONTROLS		ADVANCED CONTROLS	
☐ **(Blank)**	None	☐ **(Blank)**	None
☐ **FAO**[5,8]	Field Adjustable Output	☐ **SYN**[5,8]	Synapse Control System
☐ **CR3P**	3-Pin NEMA Control receptacle	☐ **SYNS/LX**[5,8]	Synapse Control System w/ Sensor (X = Mounting Height 3=10-20', 7=20-40')
☐ **CR7P**[6,8]	7-Pin NEMA Control receptacle	☐ **SU/SS/LR/IL**[5,8]	Enlighted SS Individual Lighting (IL) Sensor with Control Unit
☐ **FSP-311/LX**[5,7,8]	Legrand FSP-311 120-277V Sensor (X = Mounting Height 3=10-20', 7=20-40')	☐ **SU/SS/LR/CL**[5,8]	Enlighted SS Connected Lighting (CL) Sensor with Control Unit
☐ **FSP-321/LX**[5,8]	Legrand FSP-321 347-480V Sensor (X = Mounting Height 3=10-20', 7=20-40')	☐ **SU/SS/LR/IOT**[5,8]	Enlighted SS Internet of Things (IOT) Sensor with Control Unit
☐ **CR3P/FAO**[8]	Universal 3-Pin control receptacle (See acc. for photocells) with Field Adjustable Output - 7 level selection connected to 0-10V dimming wires	☐ **ZLD1Z**[5,8]	Leviton ZLD1Z 120-277V Bluetooth Groupable Sensor (16 Devices) with 8-20' & 20-40' lens included
☐ **CR7P/FSP/Lx**[8]	Universal 7-Pin control receptacle with FSP Sensor (X= Mounting Height, 3=20', 7=40') (Controls provided by others)		

OPTIONS - FACTORY INSTALLED			ACCESSORIES				
☐ **(Blank)**	None		☐ **SAx/BIRD**	Bird Spikes (x= fixture size)		☐ **TL7/HVG**[1,7]	Synapse Twist Lock Mesh Network 480V
☐ **SP1**[1]	10kA Surge Protection Device		☐ **SAx/GS**[2]	Rotatable Glare Shield (x= fixture size)		☐ **TLPC/HV**[1]	347-480V Twist Lock Photocell
☐ **SP2**[1]	20kA Surge Protection Device		☐ **TL7/B2**[1,6,7]	Synapse Twist Lock Mesh Network 120-277V		☐ **TLPC/UNV**[1,4]	120-277V Twist Lock Photocell
☐ **SP1HV**	10kA Max 480V Surge Protector		☐ **ILP PAINT CHIP PACK**	ILP Standard Color Paint Chips			
☐ **SP480V2**	20kA Max 480V Surge Protector						
☑ **HSS**[2]	Rotatable House Side Shield						
☐ **FUSE/SXXX**	FUSE 120V, 277V, 347V (x= voltage)						
☐ **FUSE/DXXX**	FUSE 208V, 240V, 480V (x= voltage)						

[1] Not available with HV option [2] Option Not DLC qualified
[3] Requires Bluetooth Enabled device for programming (provided by others)
[4] Only Compatible with CR3P and CR7P
[5] Contact Factory for Site Layout, For HV models contact Factory for pricing.
[6] Dimming Leads will be wired to receptacle unless otherwise specified
[7] CR7P Required
[8] Only one control option allowed
[9] Contact factory for pricing and availability
[10] Requires additional Surge Protection (SP1, SP2, SP480V2); For additional details see General Terms and Conditions. Consult Factory for pricing

B:

Project Name: Lowell Development	Part Number:	Type:

SKYLINE
AREA LIGHT SERIES

407-478-3759
www.ilp-inc.com

Product Overview

SCAN ME



* Shown with UMB Mounting

FEATURES

- Specification Grade die-cast aluminum housing
- Bronze polyester powder coat finish (standard)
- Custom and factory select colors available
- 5 Optical Distributions with Highest Uniformity in their product class
- Factory Rotatable Type 2, 3, 4, 5 Square, & Automotive Front Row Optics
- Optional Spill Light Control Integral Shield (HSS)
- Universal Quick Pole Mount Allows for 1 man installation on existing poles with no drilling required
- 9 Different Optional Mounting Methods (3G Rated)[3]
- Single Fastener hinged door driver access
- 120–277V Universal Voltage or 347–480V High Voltage
- 0–10V Dimmable Driver (std.)
- PIR Occupancy, Photocell, & Bi-Level Dimming Sensors Available
- 3-Pin & 7-Pin ANSI C136.41 Control Receptacle Options
- Wireless control integrated luminaire
- 3000K, 4000K & 5000K CCT
- >70 Color Rendering Index (CRI)
- Calculated L80 >100,000 hrs @ 25°C per TM-21-11
- IP66 Rated Luminaire
- Dark Sky Compliant[1,2]
- 5 Year Warranty; 10 Year Optional Warranty[4]
- ETL Listed for Wet Locations
- DesignLights Consortium® Premium Qualified Luminaire

[1] 3000K is IDA Listed [2] Must select UMB, WFM, or HTM mounting options to qualify
[3] TRN & SLPF 1.5G Rated [4] Requires additional Surge Protection (SP1, SP2, SP480V2); For additional details see General Terms and Conditions

SUITABLE APPLICATIONS

• Parking Lots • Parking Structure • Parks • Education • Hospitals • Car Dealerships • Roadways • Shopping Centers

ORDERING GUIDE

SERIES	LUMENS	VOLTAGE	CCT	DISTRIBUTION	ORIENTATION	MOUNTING	FINISH	WARRANTY
☑ **SAS** Small	☐ **6L** 6,000 lm	☑ **U** 120-277v	☑ **30** 3000K	☐ **T2** T2 - Type 2	☐ (Blank) - Standard	☐ **SLPF** Adjustable Slip Fitter	☐ **BRZ**	☐ **(Blank)** 5YR
	☐ **9L** 9,000 lm	☐ **HV** 347-480v	☐ **40** 4000K	☐ **T3** T3 - Type 3	☐ **L** Optics Rotated Left	☐ **UMB** Universal Fixed	☐ **BLK**	☐ **10YR**[4] 10YR
	☑ **12L** 12,000 lm		☐ **50** 5000K	☑ **T4** T4 - Type 4	☐ **R** Optics Rotated Right	☐ **UMB/R** Universal Mount Sqr/ Rnd pole 3"-6"	☐ **WHT**	
	☐ **15L** 15,000 lm			☐ **T5S** Type 5 Square		☐ **UAB** Universal Adjustable	☐ **SLV**	
	☐ **18L** 18,000 lm			☐ **FTA** Forward Throw Automotive		☐ **UAB/R** Universal Adjustable Sqr/Rnd pole 3"-6"	☐ **RALxxxx** [9]	
☐ **SAM** Med	☐ **24L** 24,000 lm					☐ **WFM** Wall Fixed Mount		
	☐ **30L** 30,000 lm					☐ **WAM** Wall Adjustable Mount		
	☐ **36L** 36,000 lm					☐ **TRN** Trunnion Mount		
	☐ **42L** 42,000 lm					☐ **HTM** Horizontal Tenon Mount		
	☐ **50L** 50,000 lm							

BASIC CONTROLS		ADVANCED CONTROLS	
☐ **(Blank)**	None	☐ **(Blank)**	None
☐ **FAO**[5,8]	Field Adjustable Output	☐ **SYN**[5,8]	Synapse Control System
☐ **CR3P**	3-Pin NEMA Control receptacle	☐ **SYNS/LX**[5,8]	Synapse Control System w/ Sensor (X = Mounting Height 3=10-20', 7=20-40')
☐ **CR7P**[6,8]	7-Pin NEMA Control receptacle	☐ **SU/SS/LR/IL**[5,8]	Enlighted SS Individual Lighting (IL) Sensor with Control Unit
☐ **FSP-311/LX**[5,7,8]	Legrand FSP-311 120-277V Sensor (X = Mounting Height 3=10-20', 7=20-40')	☐ **SU/SS/LR/CL**[5,8]	Enlighted SS Connected Lighting (CL) Sensor with Control Unit
☐ **FSP-321/LX**[5,8]	Legrand FSP-321 347-480V Sensor (X = Mounting Height 3=10-20', 7=20-40')	☐ **SU/SS/LR/IOT**[5,8]	Enlighted SS Internet of Things (IOT) Sensor with Control Unit
☐ **CR3P/FAO**[8]	Universal 3-Pin control receptacle with FSP Sensor (X= Mounting Height, 3=20', 7=40') (Controls provided by others)	☐ **ZLD1Z**[5,8]	Leviton ZLD1Z 120-277V Bluetooth Groupable Sensor (16 Devices) with 8-20' & 20-40' lens included
☐ **CR7P/FSP/Lx**[8]			

OPTIONS - FACTORY INSTALLED			ACCESSORIES				
☐ **(Blank)**	None		☐ **SAx/BIRD**	Bird Spikes (x= fixture size)		☐ **TL7/HVG**[1,7]	Synapse Twist Lock Mesh Network 480V
☐ **SP1**[1]	10kA Surge Protection Device		☐ **SAx/GS**[2]	Rotatable Glare Shield (x= fixture size)		☐ **TLPC/HV**[1]	347-480V Twist Lock Photocell
☐ **SP2**[1]	20kA Surge Protection Device		☐ **TL7/B2**[1,6,7]	Synapse Twist Lock Mesh Network 120-277V		☐ **TLPC/UNV**[1,4]	120-277V Twist Lock Photocell
☐ **SP1HV**	10kA Max 480V Surge Protector		☐ **ILP PAINT CHIP PACK**	ILP Standard Color Paint Chips			
☐ **SP480V2**	20kA Max 480V Surge Protector						
☑ **HSS**[2]	Rotatable House Side Shield						
☐ **FUSE/SXXX**	FUSE 120V, 277V, 347V (x= voltage)						
☐ **FUSE/DXXX**	FUSE 208V, 240V, 480V (x= voltage)						

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[10] Requires additional Surge Protection (SP1, SP2, SP480V2); For additional details see General Terms and Conditions. Consult Factory for pricing

C:

Project Name: Lowell Development	Part Number:	Type:

SKYLINE
AREA LIGHT SERIES

407-478-3759
www.ilp-inc.com

Product Overview

SCAN ME



* Shown with UMB Mounting

FEATURES

- Specification Grade die-cast aluminum housing
- Bronze polyester powder coat finish (standard)
- Custom and factory select colors available
- 5 Optical Distributions with Highest Uniformity in their product class
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- Wireless control integrated luminaire
- 3000K, 4000K & 5000K CCT
- >70 Color Rendering Index (CRI)
- Calculated L80 >100,000 hrs @ 25°C per TM-21-11
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- Dark Sky Compliant[1,2]
- 5 Year Warranty; 10 Year Optional Warranty[4]
- ETL Listed for Wet Locations
- DesignLights Consortium® Premium Qualified Luminaire

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SUITABLE APPLICATIONS

• Parking Lots • Parking Structure • Parks • Education • Hospitals • Car Dealerships • Roadways • Shopping Centers

ORDERING GUIDE

SERIES	LUMENS	VOLTAGE	CCT	DISTRIBUTION	ORIENTATION	MOUNTING	FINISH	WARRANTY
☑ **SAS** Small	☐ **6L** 6,000 lm	☑ **U** 120-277v	☑ **30** 3000K	☐ **T2** T2 - Type 2	☐ (Blank) - Standard	☐ **SLPF** Adjustable Slip Fitter	☐ **BRZ**	☐ **(Blank)** 5YR
	☐ **9L** 9,000 lm	☐ **HV** 347-480v	☐ **40** 4000K	☐ **T3** T3 - Type 3	☐ **L** Optics Rotated Left	☐ **UMB** Universal Fixed	☐ **BLK**	☐ **10YR**[4] 10YR
	☑ **12L** 12,000 lm		☐ **50** 5000K	☐ **T4** T4 - Type 4	☐ **R** Optics Rotated Right	☐ **UMB/R** Universal Mount Sqr/ Rnd pole 3"-6"	☐ **WHT**	
	☐ **15L** 15,000 lm			☑ **T5S** Type 5 Square		☐ **UAB** Universal Adjustable	☐ **SLV**	
	☐ **18L** 18,000 lm			☐ **FTA** Forward Throw Automotive		☐ **UAB/R** Universal Adjustable Sqr/Rnd pole 3"-6"	☐ **RALxxxx** [9]	
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	☐ **30L** 30,000 lm					☐ **WAM** Wall Adjustable Mount		
	☐ **36L** 36,000 lm					☐ **TRN** Trunnion Mount		
	☐ **42L** 42,000 lm					☐ **HTM** Horizontal Tenon Mount		
	☐ **50L** 50,000 lm							

BASIC CONTROLS		ADVANCED CONTROLS	
☐ **(Blank)**	None	☐ **(Blank)**	None
☐ **FAO**[5,8]	Field Adjustable Output	☐ **SYN**[5,8]	Synapse Control System
☐ **CR3P**	3-Pin NEMA Control receptacle	☐ **SYNS/LX**[5,8]	Synapse Control System w/ Sensor (X = Mounting Height 3=10-20', 7=20-40')
☐ **CR7P**[6,8]	7-Pin NEMA Control receptacle	☐ **SU/SS/LR/IL**[5,8]	Enlighted SS Individual Lighting (IL) Sensor with Control Unit
☐ **FSP-311/LX**[5,7,8]	Legrand FSP-311 120-277V Sensor (X = Mounting Height 3=10-20', 7=20-40')	☐ **SU/SS/LR/CL**[5,8]	Enlighted SS Connected Lighting (CL) Sensor with Control Unit
☐ **FSP-321/LX**[5,8]	Legrand FSP-321 347-480V Sensor (X = Mounting Height 3=10-20', 7=20-40')	☐ **SU/SS/LR/IOT**[5,8]	Enlighted SS Internet of Things (IOT) Sensor with Control Unit
☐ **CR3P/FAO**[8]	Universal 3-Pin control receptacle with FSP Sensor (X= Mounting Height, 3=20', 7=40') (Controls provided by others)	☐ **ZLD1Z**[5,8]	Leviton ZLD1Z 120-277V Bluetooth Groupable Sensor (16 Devices) with 8-20' & 20-40' lens included
☐ **CR7P/FSP/Lx**[8]			

OPTIONS - FACTORY INSTALLED			ACCESSORIES				
☐ **(Blank)**	None		☐ **SAx/BIRD**	Bird Spikes (x= fixture size)		☐ **TL7/HVG**[1,7]	Synapse Twist Lock Mesh Network 480V
☐ **SP1**[1]	10kA Surge Protection Device		☐ **SAx/GS**[2]	Rotatable Glare Shield (x= fixture size)		☐ **TLPC/HV**[1]	347-480V Twist Lock Photocell
☐ **SP2**[1]	20kA Surge Protection Device		☐ **TL7/B2**[1,6,7]	Synapse Twist Lock Mesh Network 120-277V		☐ **TLPC/UNV**[1,4]	120-277V Twist Lock Photocell
☐ **SP1HV**	10kA Max 480V Surge Protector		☐ **ILP PAINT CHIP PACK**	ILP Standard Color Paint Chips			
☐ **SP480V2**	20kA Max 480V Surge Protector						
☑ **HSS**[2]	Rotatable House Side Shield						
☐ **FUSE/SXXX**	FUSE 120V, 277V, 347V (x= voltage)						
☐ **FUSE/DXXX**	FUSE 208V, 240V, 480V (x= voltage)						

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[7] CR7P Required
[8] Only one control option allowed
[9] Contact factory for pricing and availability
[10] Requires additional Surge Protection (SP1, SP2, SP480V2); For additional details see General Terms and Conditions. Consult Factory for pricing

A, B, C POLES:

Project Name:	Part Number:	Type:

ILP POLES
STRAIGHT ROUND STEEL POLES

407-478-3759
www.ilp-inc.com



FEATURES

- Straight 4", 4.5", or 5" round steel poles
- Shaft – 42,000 p.s.i minimum yield
- Two-Piece Base Covers Included
- Reinforced handholes with grounding lug and removable cover
- Top tenon or drill pattern with removable pole cap
- Four galvanized anchor bolts w/ galvanized hardware Included
- Anchor bolt templates included
- Pre-ship anchor bolts with template – Prepay Freight & Add
- Finishes: ILP Bronze (BRZ), Black (BLK), Silver (SLV), & White (WHT) & custom colors upon request.
- Pole Vibration Dampeners available upon request
- 1 Year Limited Warranty

ORDERING GUIDE

SERIES	POLE TYPE	SIZE (in)	HEIGHT(ft)	GAUGE	DRILL PATTERN	DRILL LEGEND[2] OR TENON	OPTIONS	FINISH
☑ **ILPOLE**[1]	☑ **SR** (Straight Round)	☐ **4**	☐ **10** ☑ **20** ☐ **30**	☑ **11**	☑ **SKY=Skyline**	☐ **1**	☐ **PSA**	☐ **BRZ**
		☐ **4.5**	☐ **11** ☐ **21**		☐ **VWP=Viewpoint**	☐ **2**	☐ **LAB**	☑ **BLK**
		☐ **5**	☐ **12** ☐ **22**			☐ **2L**	☐ **GV**	☐ **SLV**
			☐ **13** ☐ **23**			☐ **3T**	☐ **CPL34/xy**[4]	☐ **WHT**
			☐ **14** ☐ **24**			☐ **4**	☐ **NPL34/xy**[4]	☐ **CC**[5]
			☐ **15** ☐ **25**			☐ **TN2**	☐ **FDL/xy**[4]	
			☐ **16** ☐ **26**				☐ **GFCI/xy**[4]	
			☐ **17** ☐ **27**				☐ **EHH/xy**[4,5]	
			☐ **18** ☐ **28**				☐ **VB**	
			☐ **19** ☐ **29**					

[1]Includes base cover, anchor bolts, template, & hardware
[2]Refer to the fixture spec sheet for the correct drilling template pattern and orientation compatibility.
[3]When ordering tenon mounting and drill mounting for the same pole, follow this example: -2/TN2. Combinations require an extra handhole option.
[4]Specify location and orientation when ordering option. For "x": Specify the height above the base of pole in feet or feet and inches; separate feet and inches with a "_". Example: 5ft = 5 and 20ft 3in = 20_3 For "y": Specify orientation from handhole (A,B,C,D) Refer to the Handhole Orientation diagram below. Example: 3/4" coupling at 5' 8" orientation C = CPL34/5-8C
[5]Combination of tenon-top and drill mount includes extra handhole.
[6]Consult factory for availability of alternate finishes; subject to longer lead-times

OPTIONS LEGEND					
PSA	Pre-Shipped Anchor Bolts		**FDL/xy**[4]	Festoon Out Less Electrical	
LAB	Less Anchor Bolts		**GFCI/xy**[4]	Festoon Outlet w/ GFCI	
GV	Pole Dip Galvanizing		**EHH/xy**[4,5]	Extra Hand Hole	
CPL34/xy[4]	3/4" Coupling		**VB**	Vibration Dampener	
NPL34/xy[4]	3/4" Threaded Nipple				

COLOR LEGEND					
BRZ	Bronze		**WHT**	White	
BLK	Black		**CC**	Custom Color	
SLV	Silver				

ILP POLES
STRAIGHT ROUND STEEL POLES

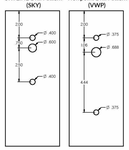
POLE DRILLING TEMPLATES

DRILL LEGEND			
-1	Single Fixture Drill Pattern	-3T	Three Fixture Drill Pattern
-2	Two Fixtures at 180° Drill Pattern	-4	Four Fixtures Drill Pattern
-2L	Two Fixtures at 90° Drill Pattern		

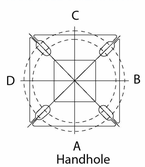
Sides	A	B	C	D
Handhole	x			
Single (-1)	x			
D180 (-2)	x		x	
D90 (-2L)	x	x		
T90 (3T)	x	x	x	
Q90 (-4)	x	x	x	x

POLE DRILLING PATTERN LINE DRAWINGS

SKYLINE Drill Pattern (SKY) / Viewpoint Drill Pattern (VWP)



HANDHOLE ORIENTATION



IMPORTANT INSTALLATION NOTES:

- Do not erect poles without having fixtures installed.
- Factory-supplied templates must be used when setting anchor bolts. ILP will not accept claim for incorrect anchorage placement due to failure to use ILP templates.
- If poles are stored outside, all protective wrapping must be removed immediately upon delivery to prevent finish damage.
- ILP is not responsible for the foundation design.

SPECIFICATIONS

POLE SHAFT
Square 4", 4.5", or 5" straight pole shaft of consistent wall thickness. Made from hot-rolled electro-welded ASTM-A500 Grade C steel tubing with a minimum yield of 42 KSI. The pole shaft is a continuous flat sided square tube with uniform round radii corners.

POLE BASE
Pole base is made from ASTM-A36 hot-rolled steel. Bases can be modified to match existing foundations; consult factory.

HAND HOLE
Standard Reinforced hand-hole with grounding lug is located 18" above pole base. Every handhole includes a cover and cover attachment hardware. The handhole has a nominal dimension of 3" x 6".

POLE TOP
A black top cap is provided for all poles that have side-mount luminaire assemblies. On Tenon Mount steel poles, tenon is 2-3/8" O.D. high-strength pipe 4" in length.

BASE COVER
A matching finish two-piece clamshell ABS Plastic base cover is provided with every order.

HARDWARE
Anchor bolts conform to ASTM F 1554-07a Grade 55 with a minimum yield strength of 55 KSI. Above grade threaded portion is hot-dipped galvanized per ASTM A-153 (approx. 12"). Anchor Bolts ship with pole unless specified, utilize PSA option and refer to pricing guide for information.

FESTOON/GFCI
Weatherproof festoon outlet without electrical or with self-testing ground fault circuit interrupter is optional.

POLE VIBRATION DAMPER
A pole vibration damper is recommended in open terrain areas of the country where low steady state winds are common. Non-tapered poles and lightly loaded poles are more susceptible to destructive vibration if a damper is not installed.

FINISH
Protected with a durable polyester powder coat finish to withstand extreme weather changes without cracking or peeling. Bronze, White, Black, and Silver finishes standard. RAL Colors, Custom finishes, Hot-dipped Galvanized, or Paint over Hot-dipped Galvanized available; consult factory.

WARRANTY
1 Year Warranty (Terms and Conditions apply).
See Website for more details. https://www.ilp-inc.com/documents/

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LOWELL DEVELOPMENT SUB AMENDMENT No.1
5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB

PROJECT INFORMATION:
22-C14
DOCUMENT DATE:
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SKY/ANNA	06/21/23			
CHECKED BY:	DATE			
DAVID	07/07/23			

CUTSHEET

E1.2

D:

PERFORMANCE iN LIGHTING | powered by GEWISS

PRODUCT CODE 071765
PROJECT
TYPE

MIMIK 10 CEILING TECH

IP 65 | WET | cULus LISTED | DARK SKY | RAL

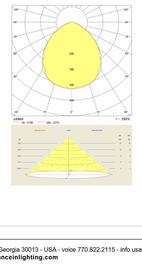
Part number	071765
Lampholder:	LED
Wattage:	10W
Finishing:	AN-96 / Iron gray / Textured
Degree of protection:	IP65
CRI:	70
Kelvin:	3000
Luminaire lumen output [lm]:	701 lm
L:	L80
B:	B10
Lifetime:	60000 h
cULus:	✓
Voltage:	120/277 V
Min. ambient temperature [°C]:	-20
Max. ambient temperature [°C]:	35



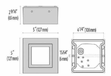
Description

Ceiling mount series. Fixtures consist of:
- Multi-step powder-coat painting process, optimized against UV rays and corrosion.
- Copper-free (<1%) precision die-cast aluminum housing and mounting plate.
- Micro-prismatic patterned, tempered, silk-screened, flat glass diffuser (TECH versions).
- Custom molded, anti-aging gasket(s).
- Stainless steel external hardware.
- Custom MCPCB utilized to maximize heat dissipation and promote long LED life.
- Diffuse light emission (TECH).
- Input voltage: 120-277 V (50 / 60 Hz), integral driver.
- The luminaire may be configured with numerous options and multiple standard finishes. Not all options are available in all configurations. Consult factory for more information about specification sheet details to build your light.
- Product meets Buy American Act (BAA) requirements within ARRA.
- 5-year warranty.

Photometric data



Technical drawings



Performance in Lighting - 2621 Keys Pointe - Conyers, Georgia 30013 - USA - voice 770.822.2115 - info.usa@pil.lighting
www.performanceinlighting.com

E:

PERFORMANCE iN LIGHTING | powered by GEWISS

PRODUCT CODE 070170
PROJECT
TYPE

QUASAR 20 TECH

PRONTO | IP 65 | WET | 0-10V | cULus LISTED | ADA | RAL

Part number	070170
Lampholder:	LED
Wattage:	11W
Finishing:	AN-96 / Iron gray / Textured
Degree of protection:	IP65
CRI:	80
Kelvin:	3000
IESNA Type:	Type I
BUG Rating:	B0-U1-G0
Luminaire lumen output [lm]:	695 lm
L:	L80
B:	B10
Lifetime:	60000 h
cULus:	✓
Voltage:	120/277 V
Min. ambient temperature [°C]:	-30
Max. ambient temperature [°C]:	45





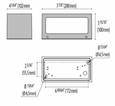
Description

Wall sconce series. Fixtures consist of:
- Multi-step powder-coat painting process, optimized against UV rays and corrosion.
- Copper-free (<1%) precision die-cast aluminum housing and mounting plate.
- Micro-prismatic patterned, tempered, silk-screened, flat glass diffuser.
- Custom molded, anti-aging gasket(s).
- Stainless steel external hardware.
- High-efficiency COB, combined with an optimized passive cooling system, provides a long LED life.
- Internal specular reflector coated with 5-layers of PVD 99.98% pure aluminum providing >95% reflection.
- Single (TECH) or dual (DOUBLE TECH) light emission.
- Type I light distribution.
- Input voltage: 120-277 V (50 / 60 Hz), integral 0-10 V dimming driver.
- Junction box mounting plate included (for 4" octagon box only, provided by others).
- The luminaire may be configured with numerous options and multiple standard finishes. Not all options are available in all configurations. Consult factory for more information about specification sheet details to build your light.
- Product meets Buy American Act (BAA) requirements within ARRA.
- 5-year warranty.

Photometric data



Technical drawings



F:

SPS-0457 REV B
AVALON INTEGRATED LED SERIES
JOB NAME: Lowell Development FIXTURE TYPE:

BLE - G - WHA16 - 100 - ___ - ___ - ___ - ___ - ___ - ___ - ___
(A) (B) (C) (D) (E) (F) (G)
(H) - (I) - (J) - (K) - (L)

Order Example: BLE - G - WHA14 - 100 - G15 - 100 - NA - WC - 400 - LED27 - 3000K - DL

A – MOUNTING STYLE
C	Cord Hung
CN	Chain Hung
F	Flush Mount[1]
G	Gooseneck
S	Stem Mount

B – SHADE SIZE
AVALON:

WHA8	8" Shade[1]
WHA10	10" Shade[1]
WHA12	12" Shade
WHA14	14" Shade
WHA16	16" shade

C – SHADE FINISH
PORCELAIN FINISHES[2]:

150	Black
250	White
350	Vintage Green
355	Jadite
455	Cherry Red
550	Yellow
650	Bronze
750	Cobalt Blue
765	Delphite Blue
850	Graphite
950	Metallic Chrome

POWDER COAT FINISHES[3]:

100	Black
105	Textured Black
106	Matte Black
200	White
206	Matte White
300	Dark Green
307	Emerald Green
311	Jadite
370	Mint
380	Chartreuse
390	Teal
400	Barn Red
420	Orange
470	Watermelon
480	Blush Pink
490	Magenta
495	Sherbet Orange
500	Buttery Yellow
570	Sunflower
600	Bronze
601	Chocolate

C – SHADE FINISH (CONTINUED)
POWDER COAT FINISHES[3]:

605	Rust
615	Oil-Rubbed Bronze
700	Royal Blue
705	Navy
710	Cobalt Blue
715	Delphite Blue
790	Lavender
800	Industrial Grey
805	Charcoal Granite
810	Graphite
975	Galvanized

NATURAL METALS[4]:

995	Raw Copper
996	Weathered Copper
997	Raw Brass
998	Weathered Brass
999	Oil-Rubbed Copper

D – MOUNTING
*Please Note: If Flush Mount (F) is selected in **Section A**, please select **NA***

NA	Not Applicable

CSA LISTED CORDS:

SBK	Standard Black
SWH	Standard White
CSB	Black Cloth
CSW	White Cloth
CMG	Grey Cloth
CSR	Red Cloth
CRZ	Red Chevron Cloth
CSBB	Black & Brown Cloth
CSRW	Red & White Cloth
CSGW	Gold & White Cloth
CSBG	Black & Gold Cloth
CSBW	Black & White Cloth
CSBP	Black & Pink Cloth
CSUW	Blue & White Cloth

CHAIN MOUNT OPTIONS[5,6]:

CN36	3' of Chain
CN48	4' of Chain
CN60	5' of Chain
CN72	6' of Chain

D – MOUNTING (CONTINUED)
GOOSENECK OPTIONS:

G1[5]	G10[5]	G24[5]
G2[5,6]	G11[5]	G25[5]
G3[5,7]	G12[5]	G26[5]
G4[5,7]	G13[5]	G32[5]
G5[5]	G14[5]	G34[5,6]
G6[5]	G15[5]	G35[5]
G7[5]	G16[5]	G36[5,6]
G8[5]	G17[5]	G64[5,6]
G9[5]	G22[5]	G65[5,6]

STEM MOUNT OPTIONS:

ST506	.5" Stem Mount, 6"[5]
ST512	.5" Stem Mount, 12"[5]
ST518	.5" Stem Mount, 18"[5]
ST524	.5" Stem Mount, 24"[5]
ST536	.5" Stem Mount, 36"[5]
ST548	.5" Stem Mount, 48"[5]
ST706	.75" Stem Mount, 6"[4]
ST712	.75" Stem Mount, 12"[4]
ST718	.75" Stem Mount, 18"[4]
ST724	.75" Stem Mount, 24"[4]
ST736	.75" Stem Mount, 36"[4]
ST748	.75" Stem Mount, 48"[4]

E – MOUNTING FINISH
*Please Note: See **Section C** for Finish Options. 980-Brushed Aluminum is also available for Gooseneck (Not Available with G26, G40, G64 & G65) and Stem mounting styles. If a Porcelain shade finish is selected, mounting will be powder coat painted-to-match. Porcelain shade finishes are not available with a Natural Metal mounting finish*
(1) If Cord Hung (C), selection identifies canopy finish
(2) If Chain Hung (CN) Mounting Style, selection identifies chain and canopy finish. Natural Metals are not applicable
(3) If Stem Mount (S) Mounting Style, selection identifies stem and canopy finish (N) If Flush Mount (F) Mounting Style, selection identifies hex coupler and canopy finish. Natural Metals are not applicable

980	Brushed Aluminum

F – CORDS[8]
*Please Note: See **Section D** for all applicable CSA Listed Cord Options*

NA	Not Applicable

G – SHADE ACCESSORIES[9]

NA	None
WC	Wire Cage
ACR	Acrylic Diffuser[9,10]

H – SHADE ACCESSORY FINISH
*Please Note: See **Section C** for Finish Options. Natural Metals not applicable. If Porcelain Finish is selected, accessory will be powder coat painted-to-match*

NA	Not Applicable

I – MOUNTING ACCESSORY
Please Note: Mounting Accessories below are only applicable with select Mounting Styles. Please refer to product listings on our website for further detail.

NA	None/Not Applicable
HSC	Hang Straight Canopy[4,11]
LDBPC	LED Decorative Backing Plate Cover[11,13]
LDCHX	LED Decorative Backing Plate Cover & Hex Cover[12,13]

J – LIGHT SOURCE

LED11	850 Lumen, 11W LED
LED16	1250 Lumen, 16W LED
LED27	2000 Lumen, 27W LED[14]
LED38	3000 Lumen, 38W LED[3,14]
LED43	4000 Lumen, 43W LED[3,14]

K – COLOR TEMPERATURE

2700K	2700K, Warm White
3000K	3000K, Neutral White
3500K	3500K, Bright White
4000K	4000K, Cool White

L – LED LENS

DL	Domed Lens
FL	Flat Lens

IMPORTANT: *(1) Not available with Acrylic Diffuser shade accessory (2) All Porcelain Enamel finished shades feature a white interior and a black outer rim (3) All Powder Coat finished shades, Galvanized excluded, feature a white interior (4) Natural Metals have a longer estimated manufacturing time, please check the website for exact lead time. There are no returns accepted on Natural Metals (5) Not available in Natural Metals (6) Not applicable if WHA8 is selected in Section B (7) Not compatible with 16" shade size (8) Only applicable if Chain Hung Mounting Style selected in Section A, select NA if another Mounting Style is selected (9) Acrylic Diffuser limits the maximum lumen selection as well as reduces lumens delivered and LPW. Selection Limits: 2000 Max for 12" through 16" shades (10) Fixture is CSA Listed for Damp Locations with Acrylic Diffuser (11) Only applicable if Stem Mounting Style is selected in Section A (12) Only applicable if Gooseneck Mounting Style is selected in Section A (13) Not Available with G3, G4, G11, G15, G26 & G36 Gooseneck option (14) Not applicable if WHA8 or WHA10 is selected in Section B*

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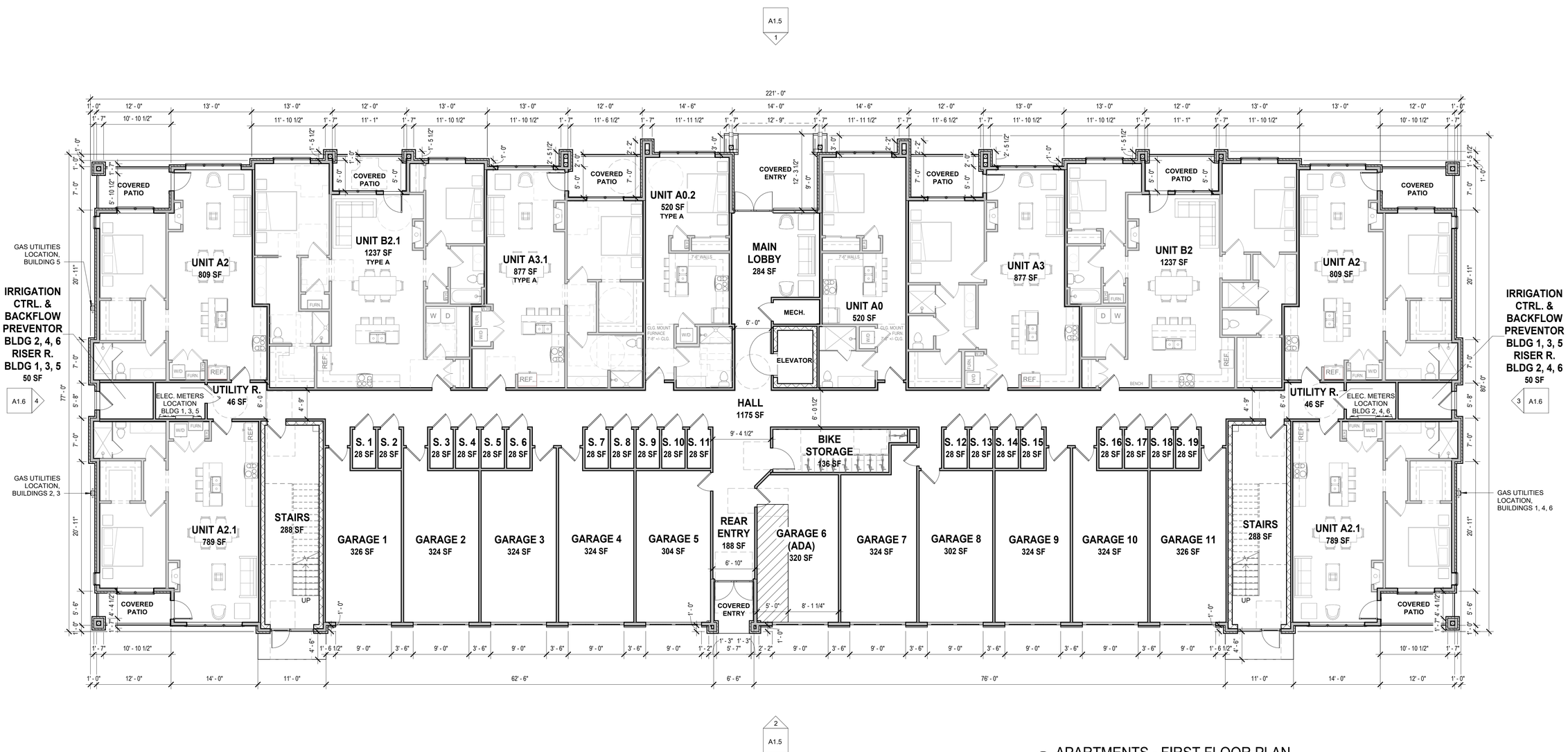
LOWELL DEVELOPMENT
5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

PROJECT INFORMATION:
22-C14
DOCUMENT DATE:
7/7/2023 10:51:11 AM
DOCUMENT PHASE:
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DRAWN BY:	DATE	COMMENTS
DAVID ASHER	06/21/23	
SVDV	07/07/23	
CHECKED BY:	DATE	
REVD	07/07/23	
REV B	DATE	

CUTSHEET

E1.3



1 APARTMENTS - FIRST FLOOR PLAN

SCALE: 1/8" = 1'-0"

AREA SCHEDULE - BY LEVEL

TYPE	LEVEL	AREA
COMMON AREAS	T.O. SUBFLR 1	2716 SF
GARAGE/STORAGE	T.O. SUBFLR 1	4136 SF
UNFINISHED - UTILITY	T.O. SUBFLR 1	260 SF
UNITS	T.O. SUBFLR 1	8739 SF
10		15851 SF
COMMON AREAS	T.O. SUBFLR 2	1834 SF
UNFINISHED - UTILITY	T.O. SUBFLR 2	236 SF
UNITS	T.O. SUBFLR 2	13475 SF
7		15545 SF
COMMON AREAS	T.O. SUBFLR 3	1834 SF
UNFINISHED - UTILITY	T.O. SUBFLR 3	236 SF
UNITS	T.O. SUBFLR 3	13467 SF
7		15537 SF
COMMON AREAS	T.O. SUBFLR 4	1624 SF
UNFINISHED - UTILITY	T.O. SUBFLR 4	236 SF
UNITS	T.O. SUBFLR 4	13467 SF
7		15327 SF
Grand total: 31		62260 SF

AREA SCHEDULE - TOTALS

TYPE	LEVEL	AREA
COMMON AREAS	<varies>	8008 SF
GARAGE/STORAGE	T.O. SUBFLR 1	4136 SF
UNFINISHED - UTILITY	<varies>	968 SF
UNITS	<varies>	49147 SF
Grand total: 31		62260 SF

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GIOVANNA	06/21/23	
SK	07/07/23	
CHECKED BY:	DATE	
DV	07/07/23	
REV #	DATE	

APT. FLOOR PLAN
A1.0

A1.5
1



A1.6 4
3 A1.6
2
A1.5

1 APARTMENTS - SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

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CHECKED BY:	DATE	
DAVID	7/7/23	
REV #	DATE	

APT. FLOOR PLAN
A1.1



1 APARTMENTS - THIRD FLOOR PLAN
SCALE: 1/8" = 1'-0"

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DAVID	07/07/23	
REV #	DATE	

APT. FLOOR PLAN
A1.2



1 APARTMENTS - FORTH FLOOR PLAN
SCALE: 1/8" = 1'-0"

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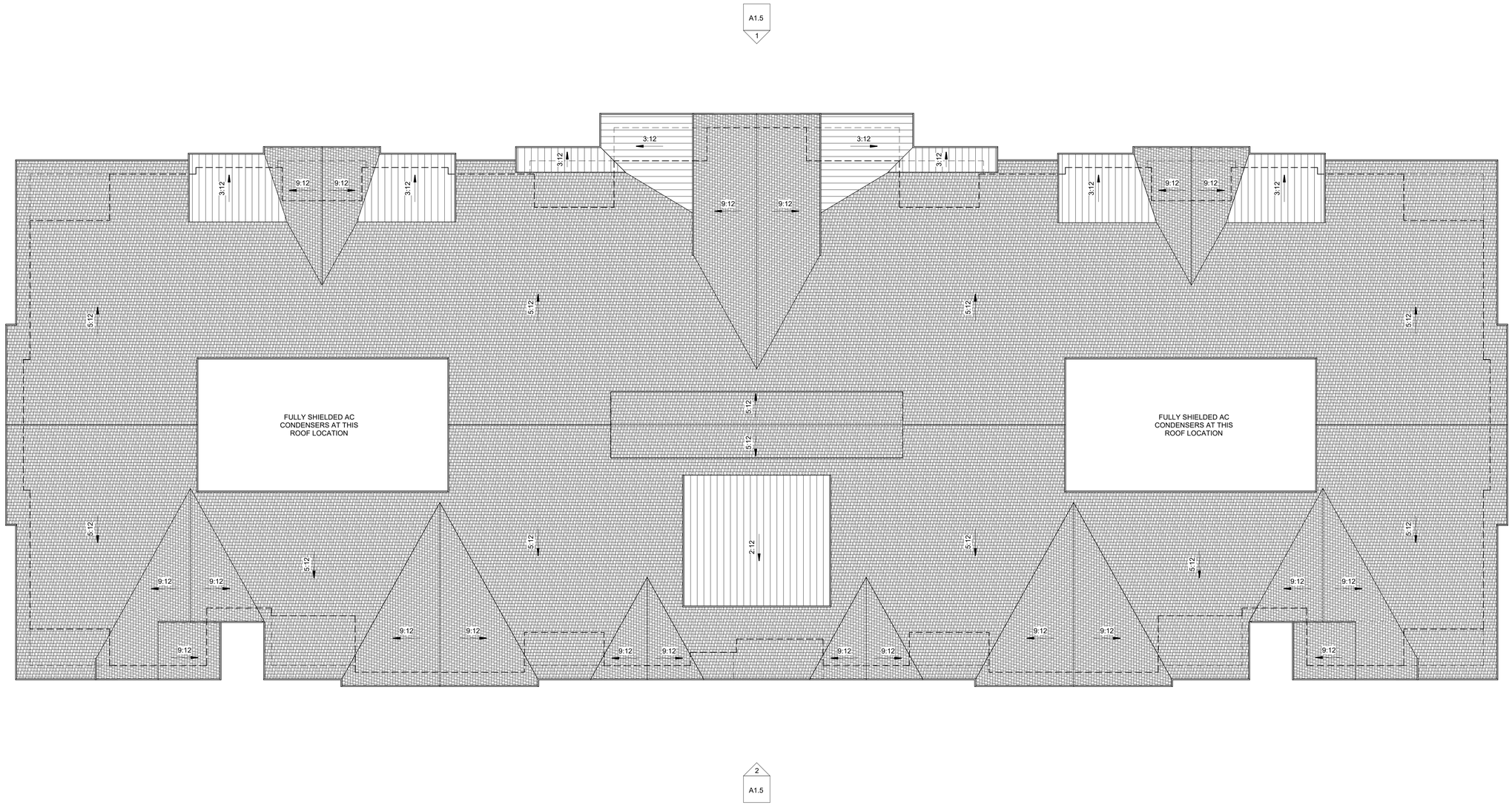
LOWELL DEVELOPMENT

5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

PROJECT INFORMATION:
22-C14
DOCUMENT DATE:
7/7/2023 9:20:00 AM
DOCUMENT PHASE:
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	DATE	COMMENTS
DRAWN BY: SIOVANNA	06/21/23	
CHECKED BY:	DATE	
REV #	7/7/23	

APT. FLOOR PLAN
A1.3



1 APARTMENTS - ROOF PLAN

SCALE: 1/8" = 1'-0"

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PROJECT INFORMATION:
22-C14
DOCUMENT DATE:
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DOCUMENT PHASE:
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SKV/ANNA	06/21/23	
CHECKED BY:	DATE	
DMA	07/07/23	
REV #	DATE	

APT. ROOF PLAN

A1.4



2 APARTMENTS - BACK ELEVATION
SCALE: 1/8" = 1'-0"



1 APARTMENTS - FRONT ELEVATION
SCALE: 1/8" = 1'-0"

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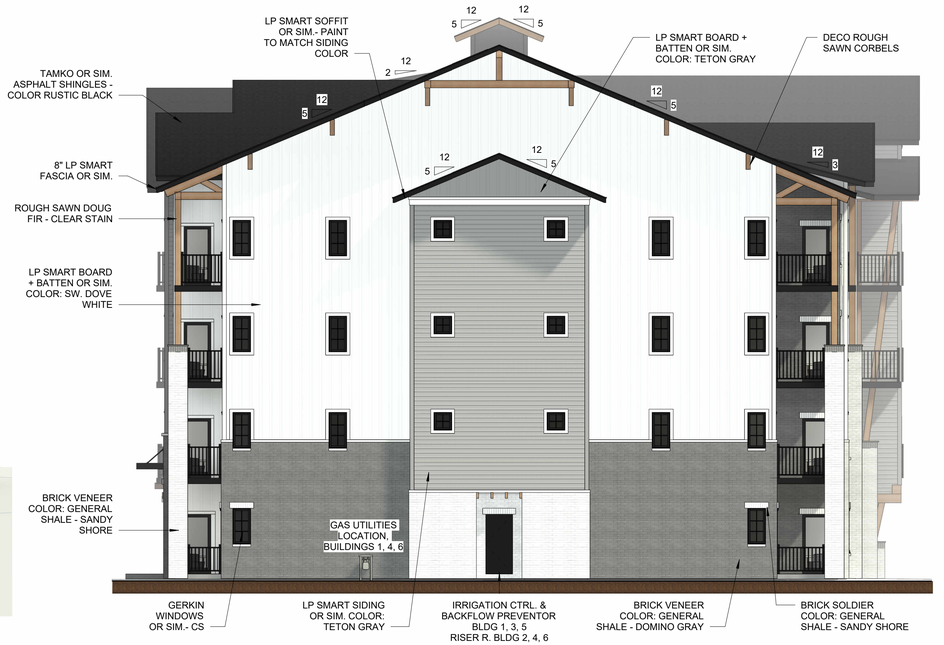
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GIOVANNA	06/21/23
CHECKED BY:	DATE
DAVID	07/07/23
REV #	DATE COMMENTS

APT. ELEVATIONS

A1.5



5 BACK PERSPECTIVE
SCALE:



3 APARTMENTS - LEFT SIDE ELEVATION
SCALE: 1/8" = 1'-0"



6 FRONT PERSPECTIVE
SCALE:



4 APARTMENTS - RIGHT SIDE ELEVATION
SCALE: 1/8" = 1'-0"

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PROJECT INFORMATION:
22-C14
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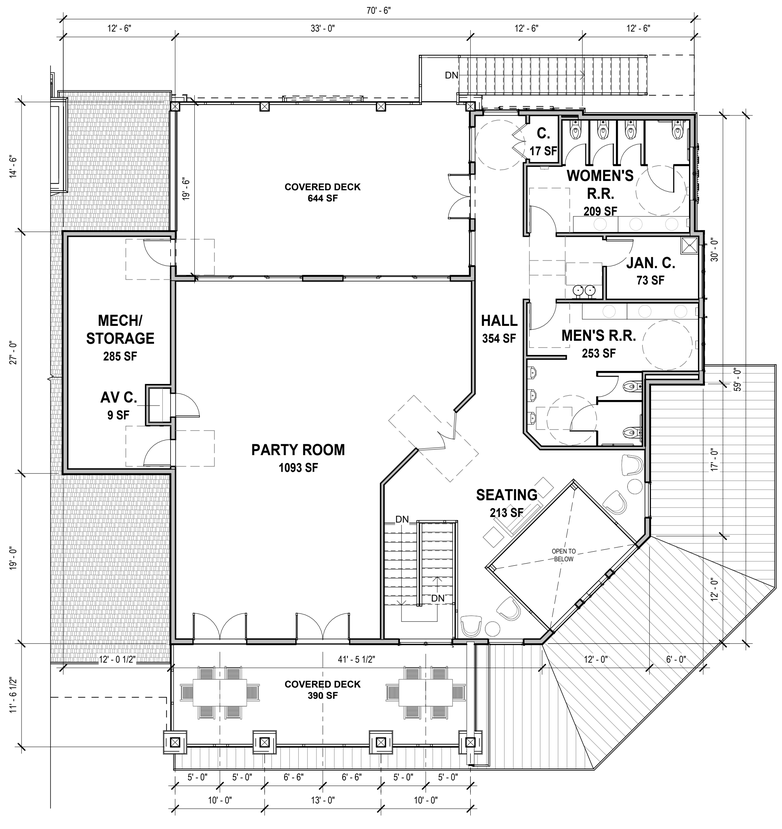
APT. ELEVATIONS
A1.6

AREA SCHEDULE - FINISHED

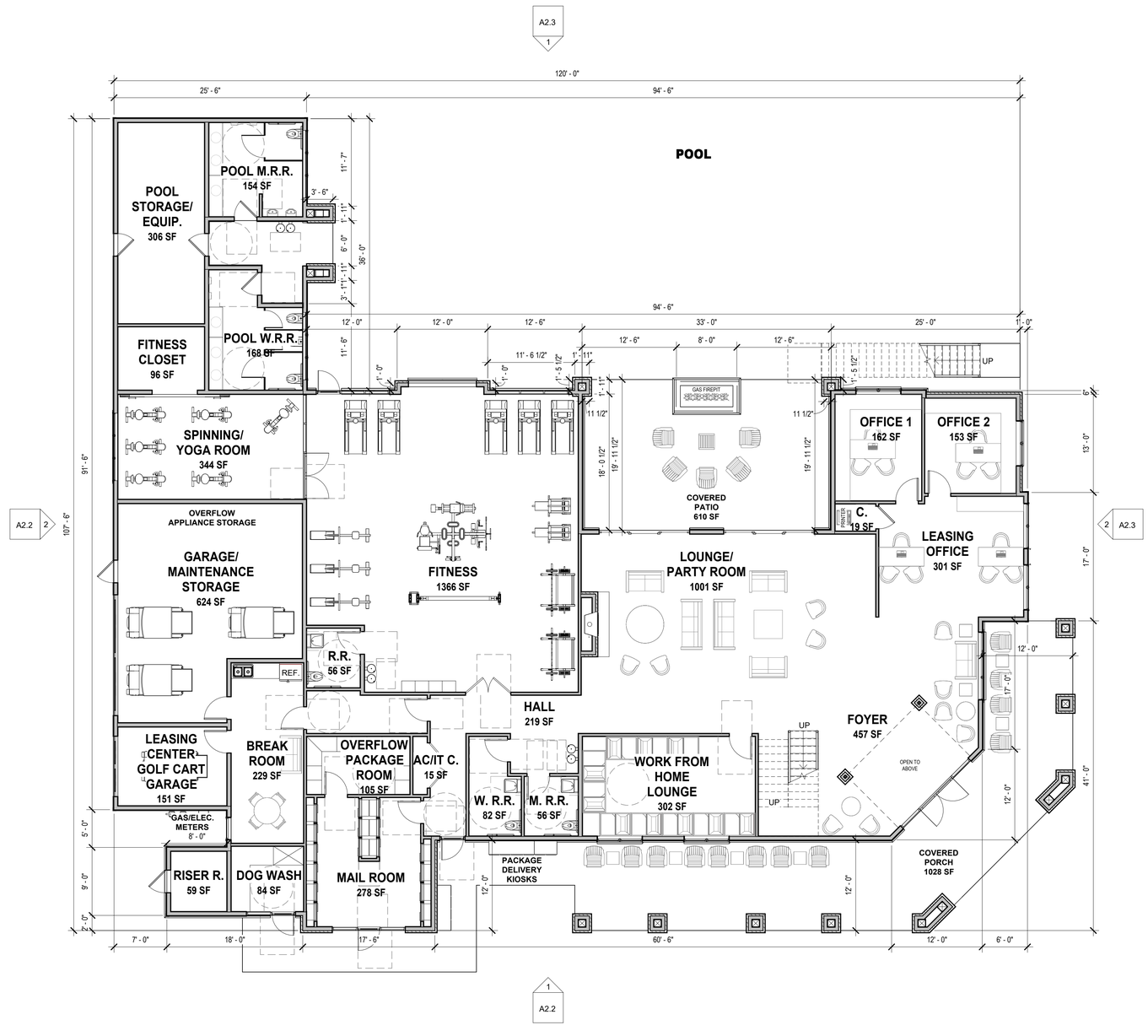
TYPE	LEVEL	AREA
FINISHED - FIRST FLOOR	T.O. SUBFLR 1	5892 SF
FINISHED - POOL RESTROOMS	T.O. SUBFLR 1	377 SF
FINISHED - SECOND FLOOR	T.O. SUBFLR 2	2423 SF
Grand total: 4		8692 SF

AREA SCHEDULE - BY LEVEL

TYPE	LEVEL	AREA
FINISHED - FIRST FLOOR	T.O. SUBFLR 1	5892 SF
FINISHED - POOL RESTROOMS	T.O. SUBFLR 1	377 SF
UNFINISHED - GARAGE/STORAGE/EQUIP.	T.O. SUBFLR 1	1273 SF
7		7542 SF
FINISHED - SECOND FLOOR	T.O. SUBFLR 2	2423 SF
UNFINISHED - MECH. ROOM	T.O. SUBFLR 2	338 SF
2		2761 SF
Grand total: 9		10304 SF



2 CLUBHOUSE - SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"



1 CLUBHOUSE - FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"

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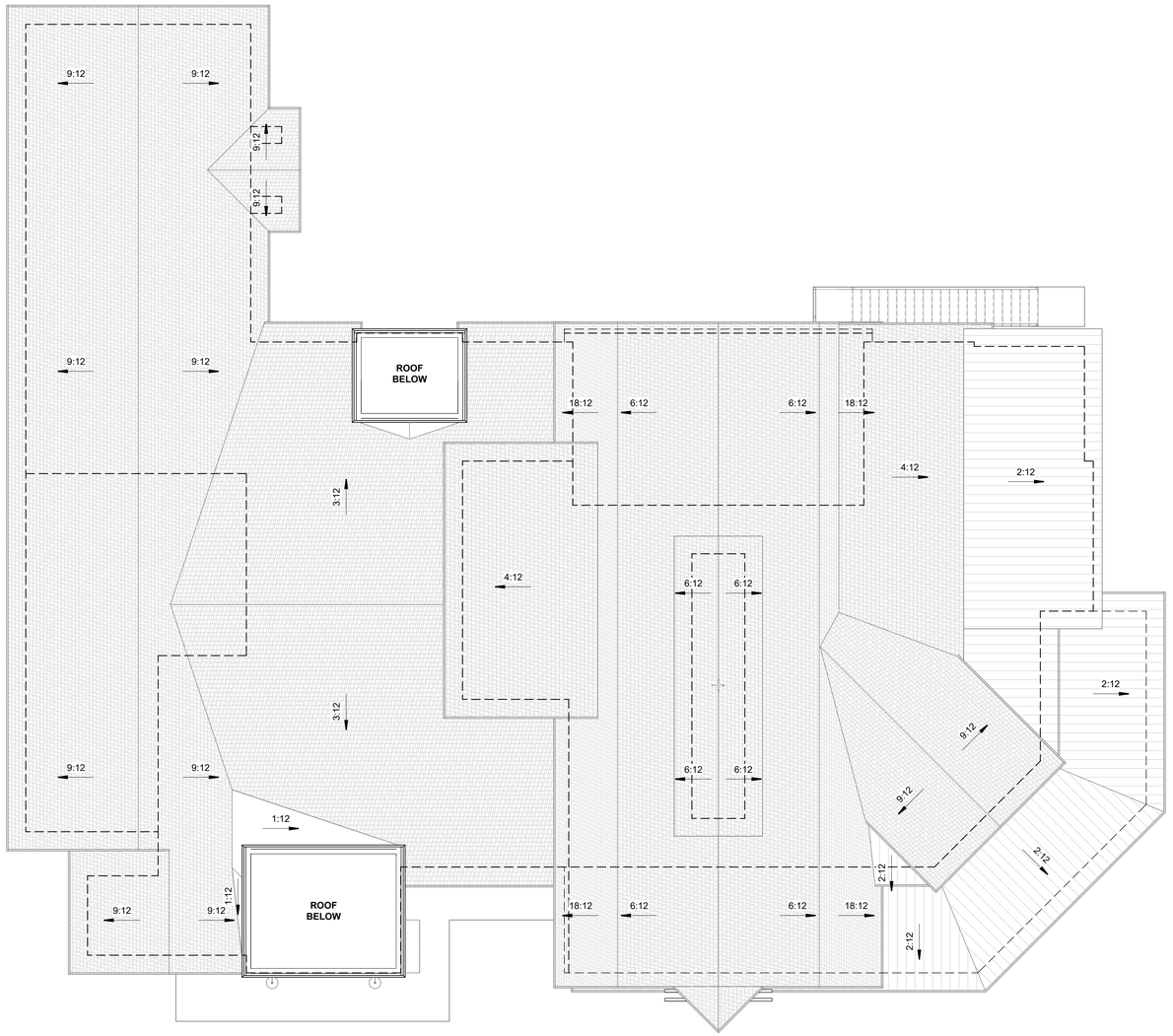
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PROJECT INFORMATION:
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DRAWN BY:	DATE	COMMENTS
SAVANNA	06/07/23	
CHECKED BY:	DATE	
DAVID	07/07/23	
REV #	DATE	

CLUBHOUSE FLOOR PLANS
A2.0



1 CLUBHOUSE - ROOF FLOOR PLAN
SCALE: 1/8" = 1'-0"

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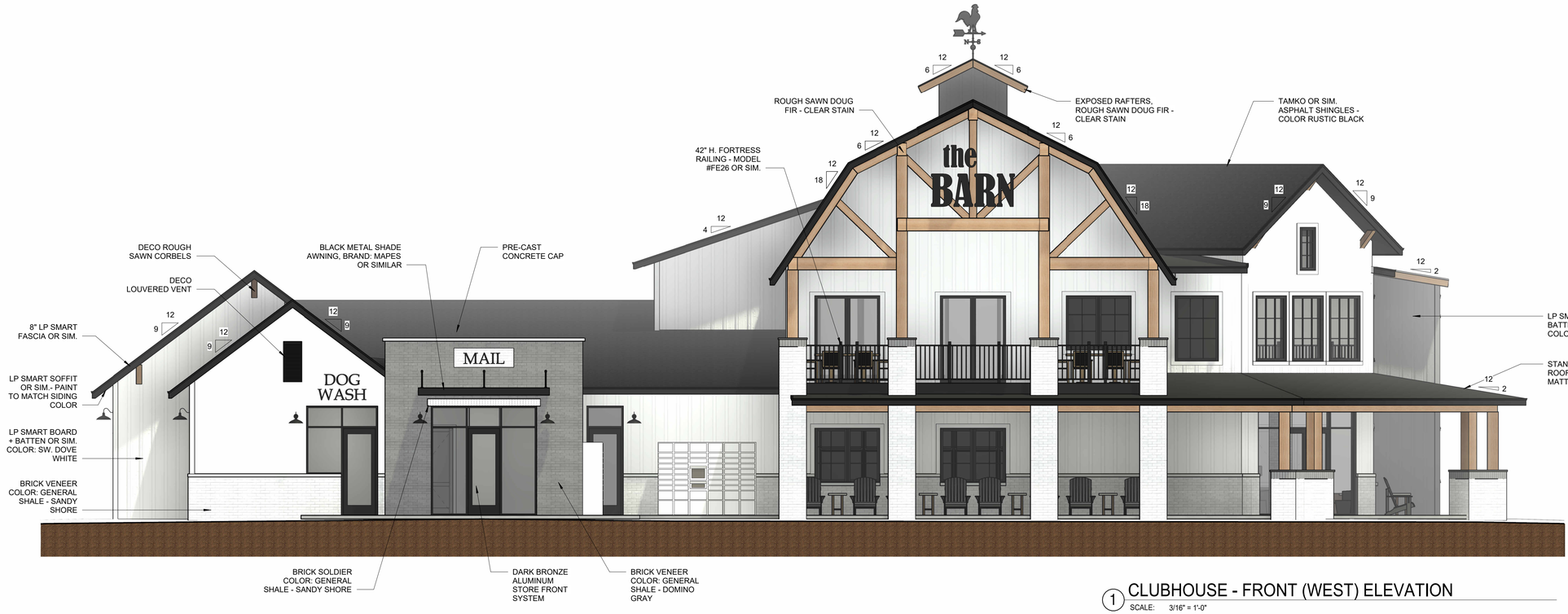
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DENVER, CO 80221
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22-C14
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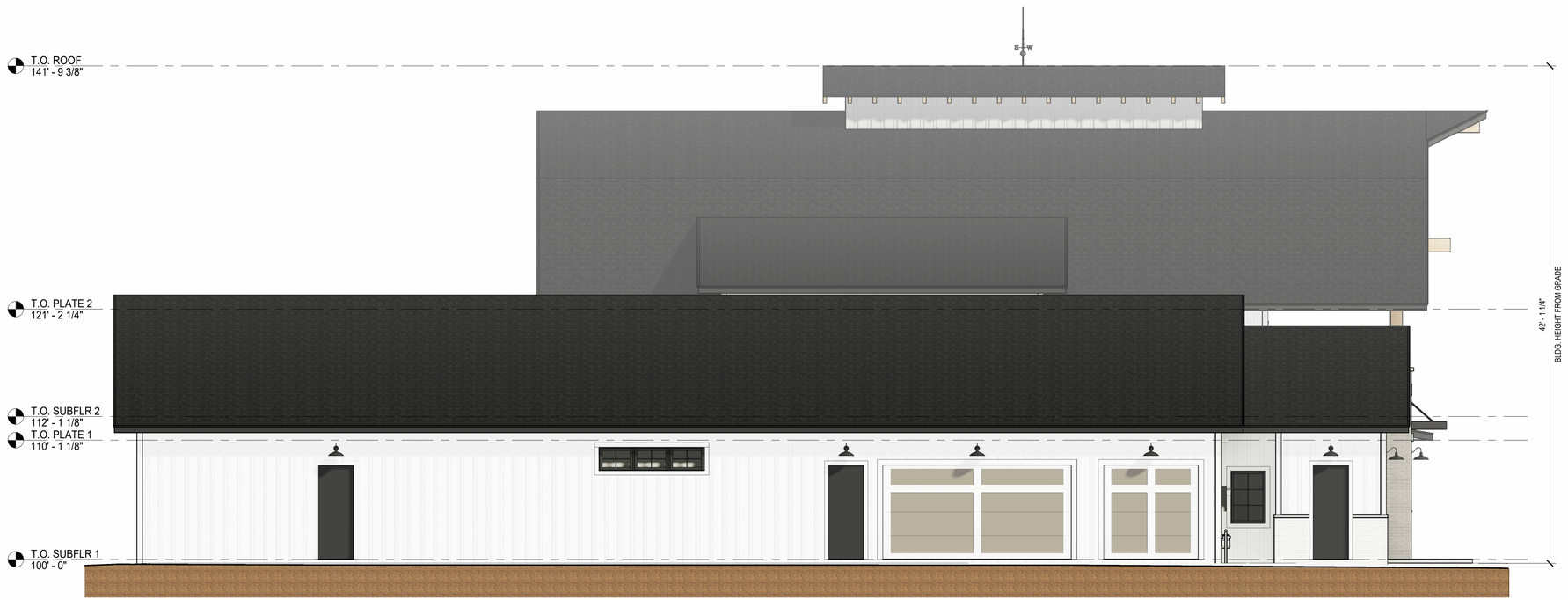
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SKOVANNA	06/21/23
CHECKED BY:	DATE
REV #	7/07/23
REV #	DATE
COMMENTS	

CLUBHOUSE ROOF PLAN

A2.1



1 CLUBHOUSE - FRONT (WEST) ELEVATION
SCALE: 3/16" = 1'-0"



2 CLUBHOUSE - NORTH ELEVATION
SCALE: 3/16" = 1'-0"

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SAVANNA	06/21/23	
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DAVID	07/07/23	
REV #	DATE	

CLUBHOUSE ELEVATIONS

A2.2



1 CLUBHOUSE - EAST ELEVATION

SCALE: 3/16" = 1'-0"



2 CLUBHOUSE - SOUTH ELEVATION

SCALE: 3/16" = 1'-0"

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22-C14
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7/7/2023 9:06:00 AM
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DRAWN BY:	DATE	COMMENTS
SAVANNA	06/21/23	
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DAVID	07/07/23	
REV #	DATE	

CLUBHOUSE ELEVATIONS

A2.3



1 CLUBHOUSE - FRONT PERSPECTIVE
SCALE:



2 CLUBHOUSE - REAR PERSPECTIVE
SCALE:

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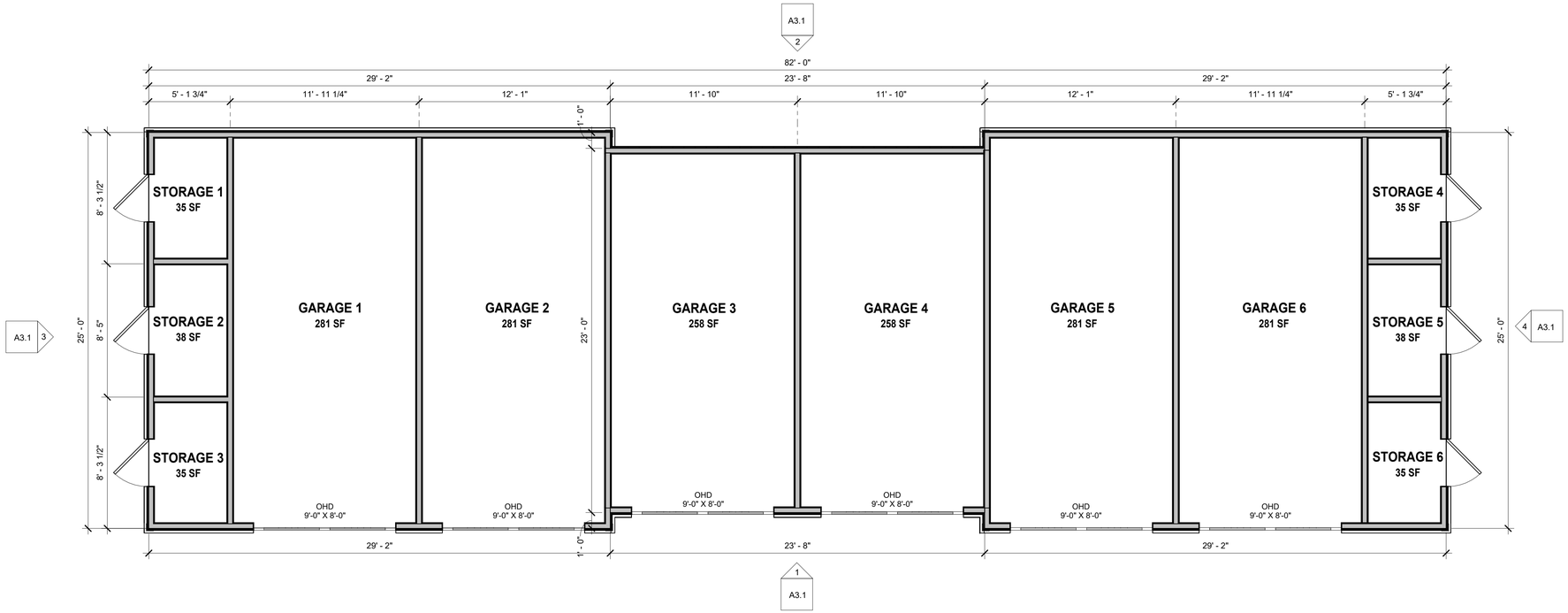
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REV #	DATE COMMENTS

CLUBHOUSE ELEVATIONS

A2.4

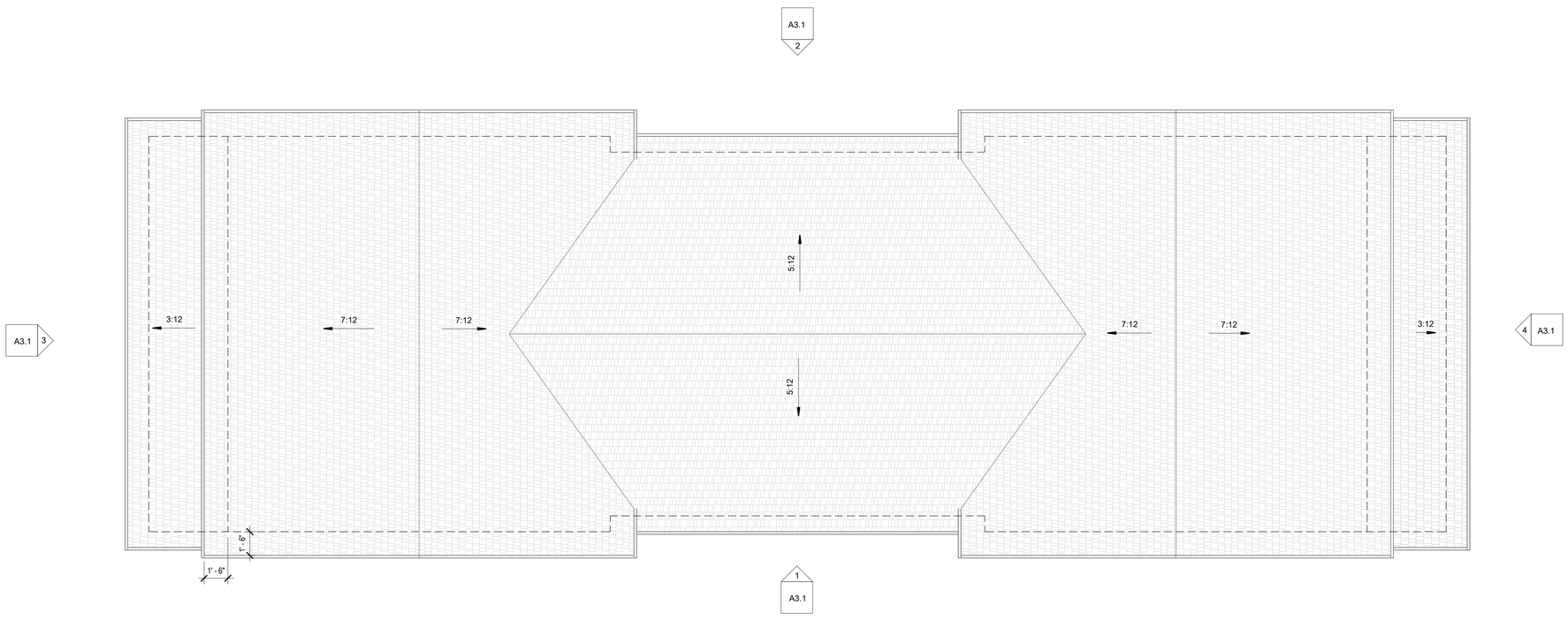
AREA SCHEDULE - TOTALS

TYPE	LEVEL	AREA
UNIFINISHED - GARAGES	T.O. SUBFLR 1	1761 SF
UNIFINISHED - STORAGE	T.O. SUBFLR 1	265 SF
Grand total: 3		2025 SF



1 GARAGE - FLOOR PLAN

SCALE: 1/4" = 1'-0"



2 GARAGE - ROOF PLAN

SCALE: 1/4" = 1'-0"

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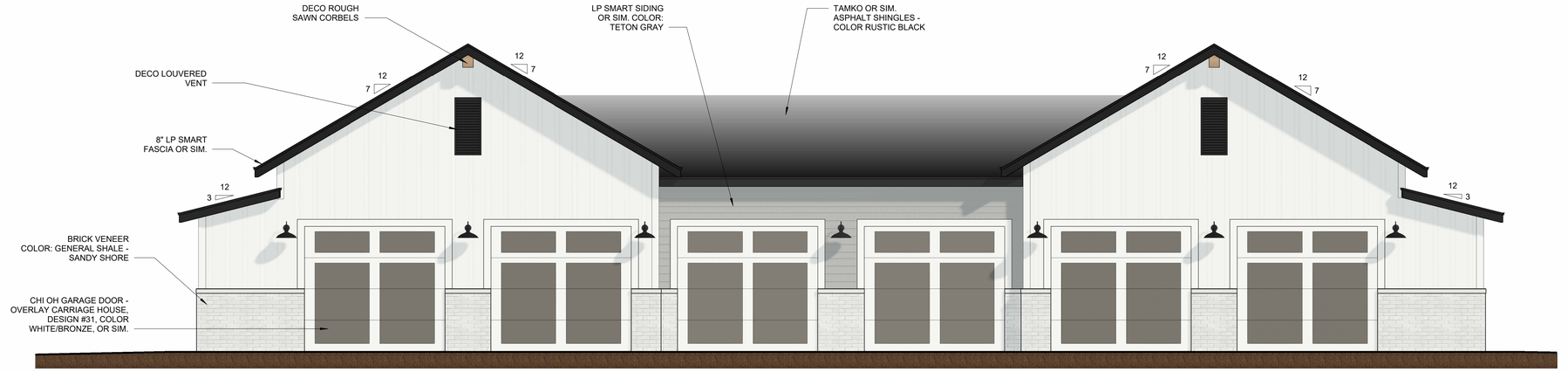
LOWELL DEVELOPMENT
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DENVER, CO 80221
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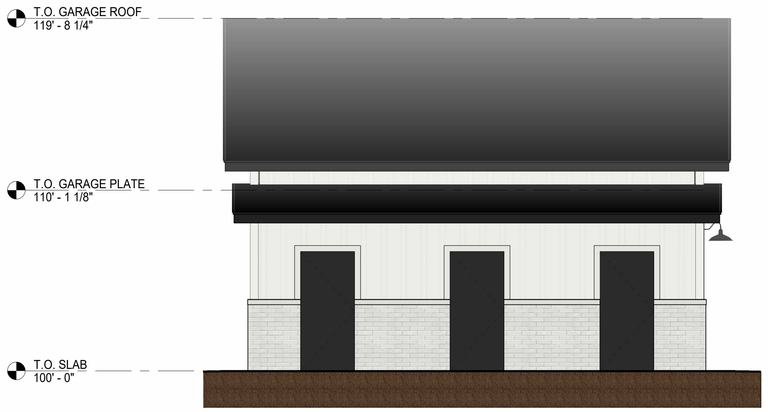
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GARAGE W/ STORAGE PLANS

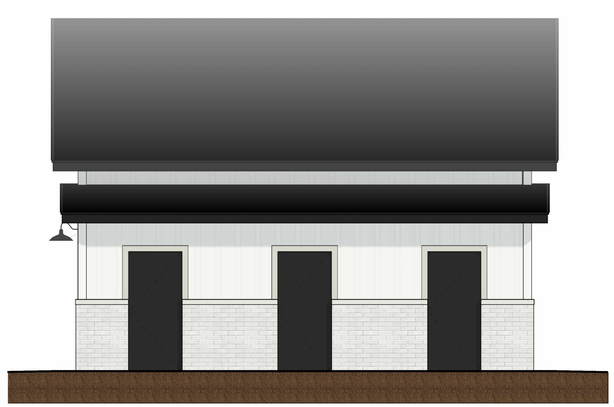
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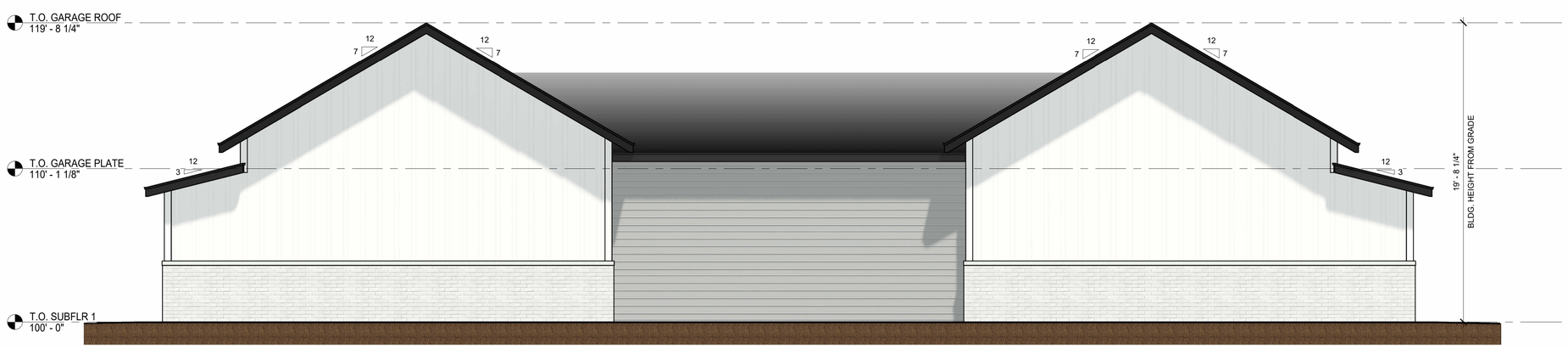
1 FRONT ELEVATION
1/4" = 1'-0"



3 SIDE ELEVATION
SCALE: 1/4" = 1'-0"



4 SIDE ELEVATION
SCALE: 1/4" = 1'-0"



2 REAR ELEVATION
SCALE: 1/4" = 1'-0"

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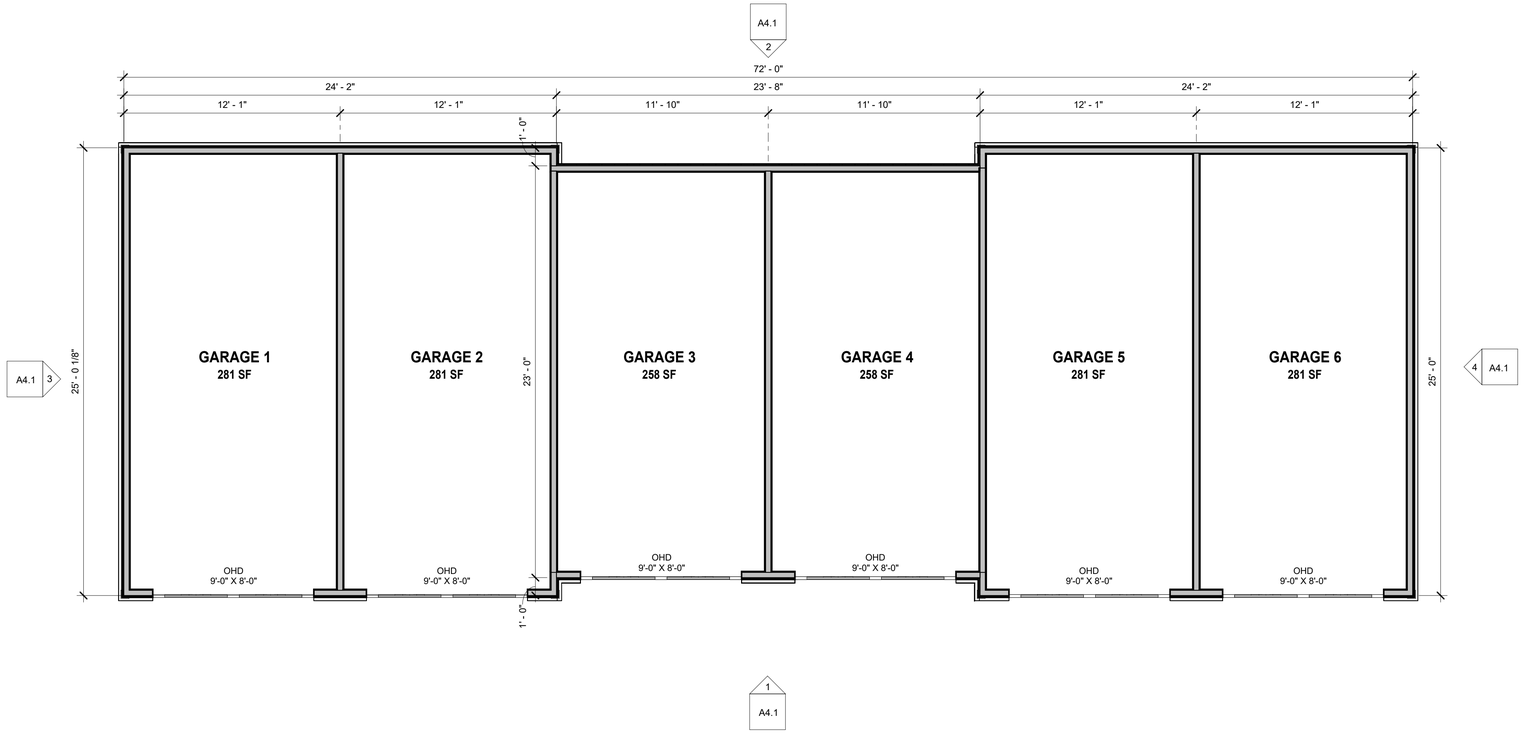
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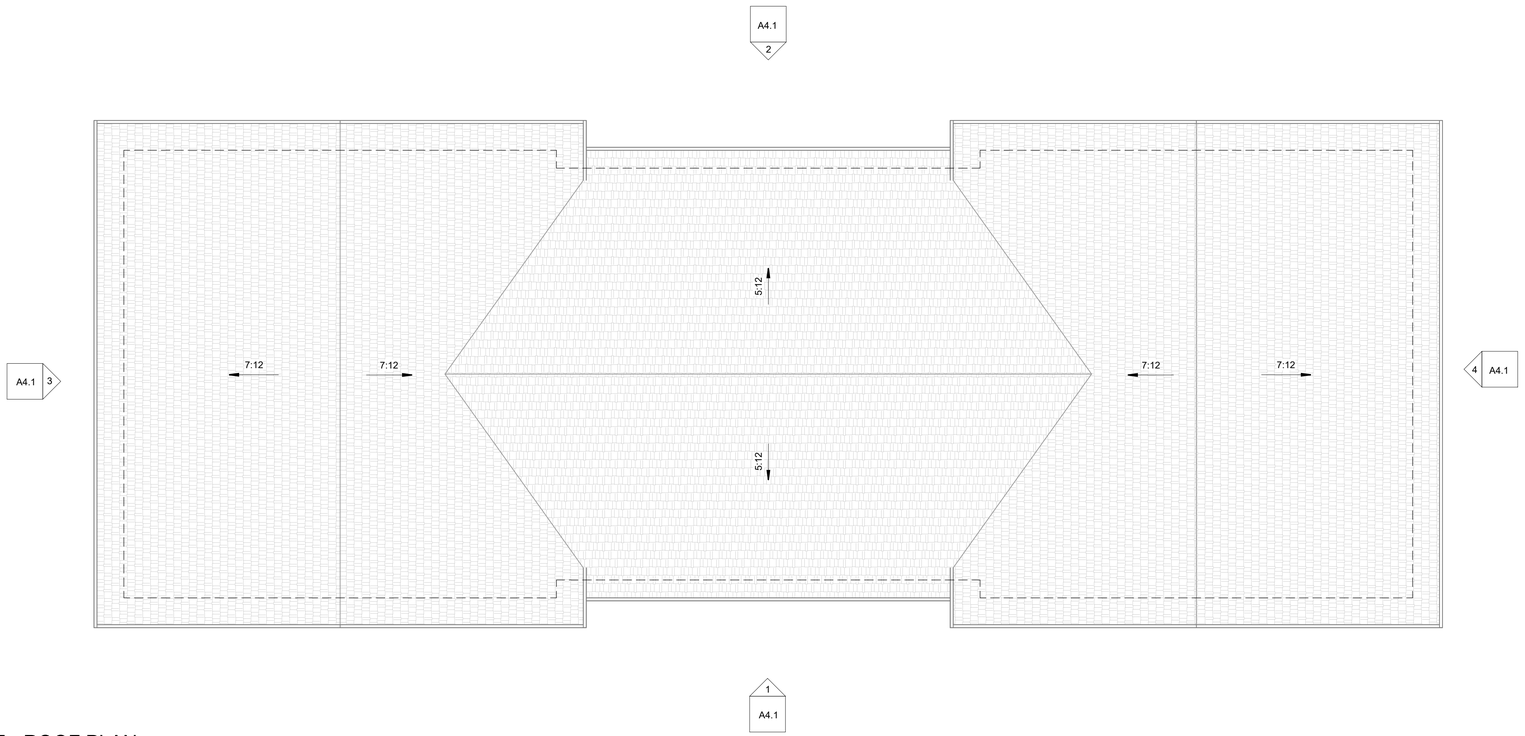
GARAGE W/ STORAGE ELEVATIONS
A3.1

AREA SCHEDULE - TOTALS

TYPE	LEVEL	AREA
UNIFINISHED - GARAGES	T.O. SUBFLR 1	1778 SF
Grand total: 1		1778 SF



1 GARAGE - FLOOR PLAN
SCALE: 1/4" = 1'-0"



2 GARAGE - ROOF PLAN
SCALE: 1/4" = 1'-0"

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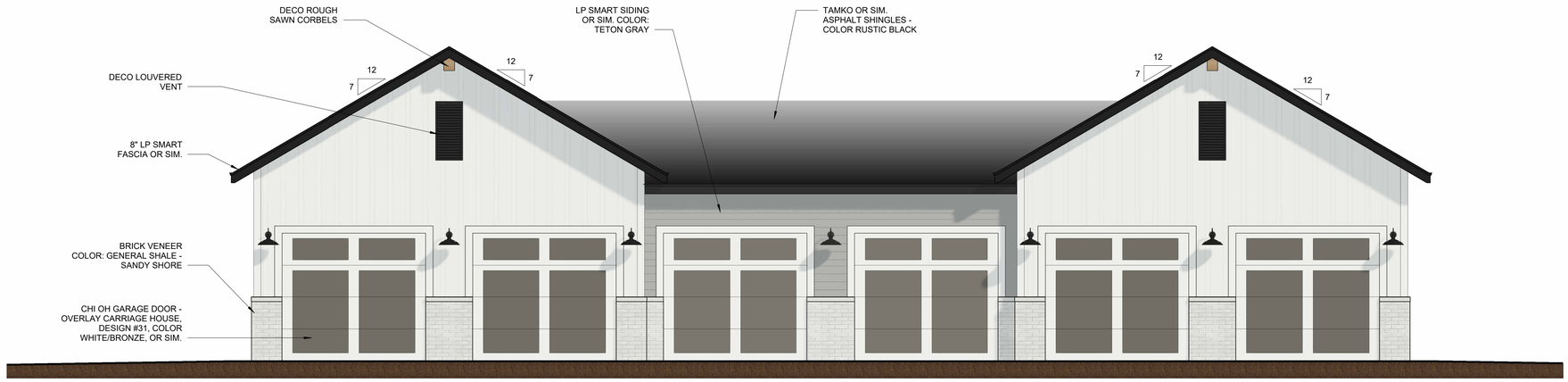
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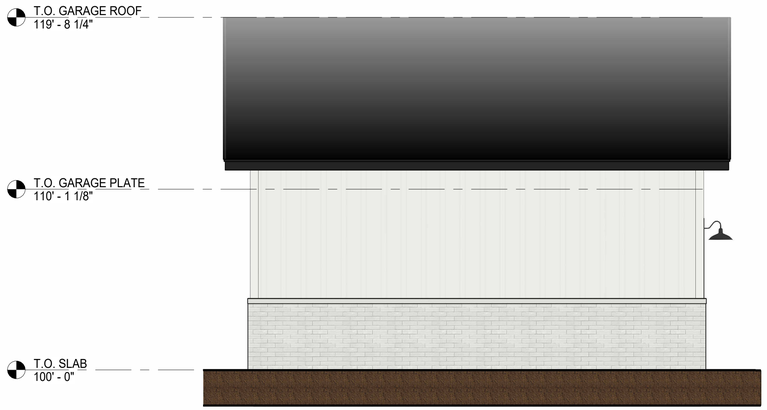
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REV #	DATE
	COMMENTS

GARAGE PLANS

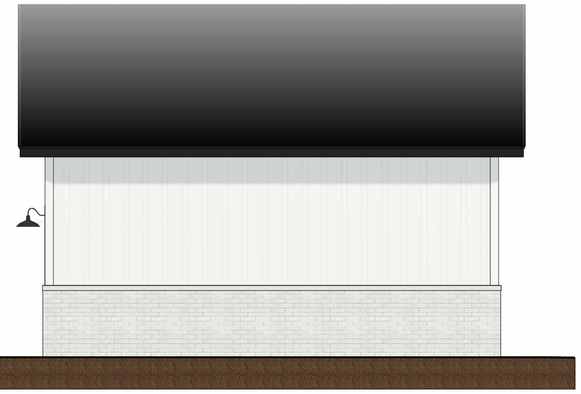
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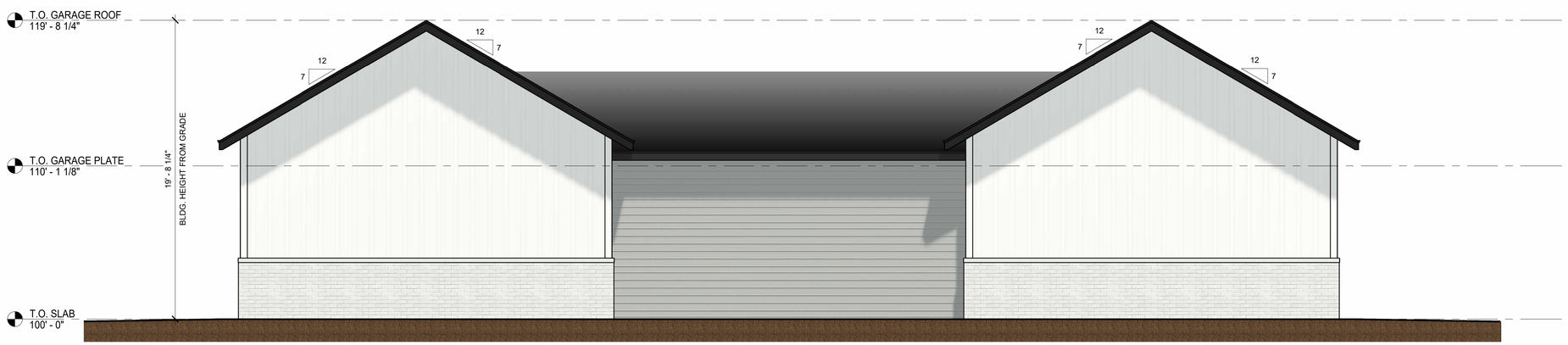
1 FRONT ELEVATION
1/4" = 1'-0"



3 SIDE ELEVATION
SCALE: 1/4" = 1'-0"



4 SIDE ELEVATION
SCALE: 1/4" = 1'-0"



2 REAR ELEVATION
SCALE: 1/4" = 1'-0"

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PROJECT INFORMATION:
22-C14
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7/10/2023 1:09:46 PM
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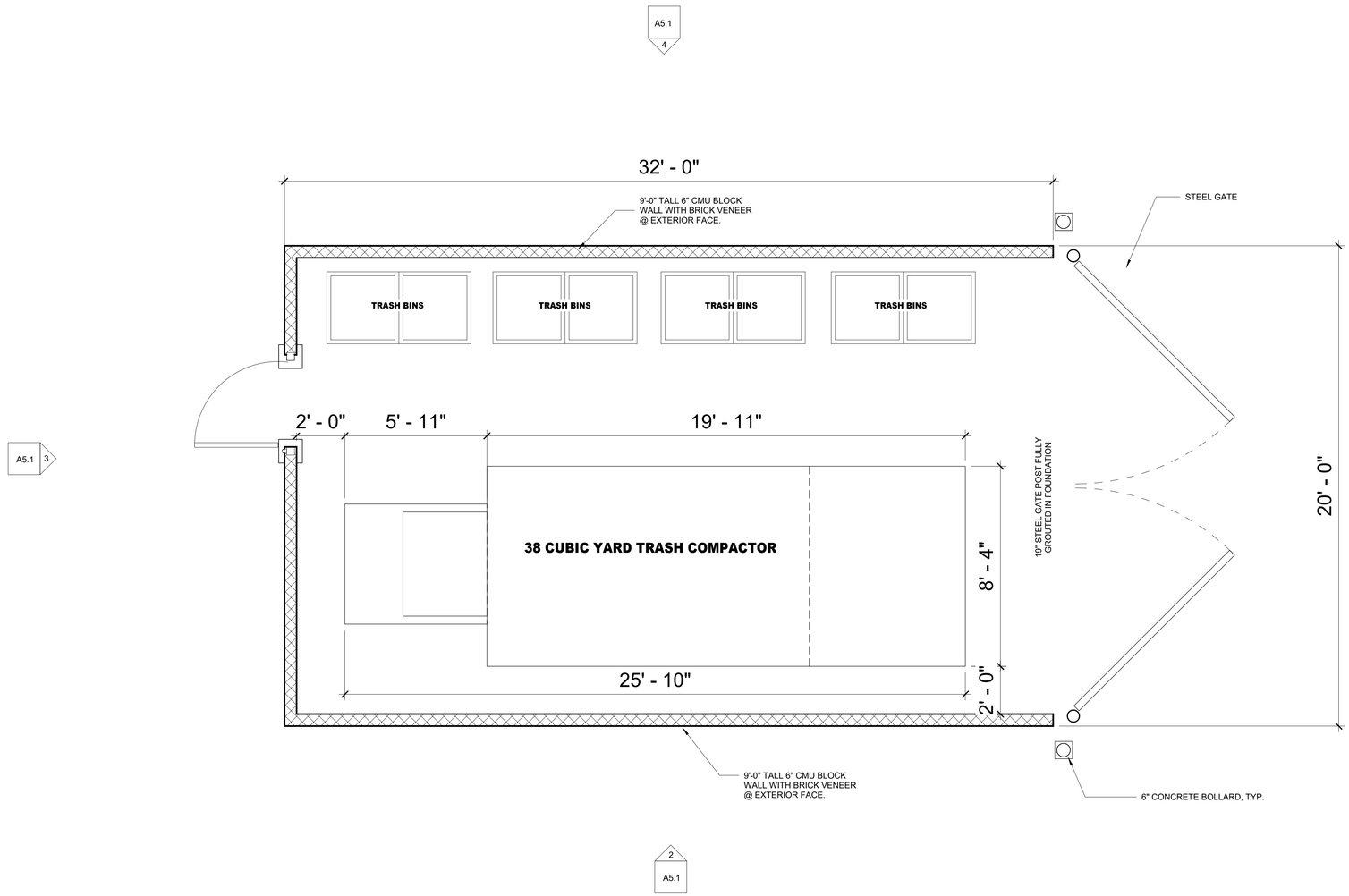
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GIOVANNA	06/21/23
CHECKED BY:	DATE
REV #	DATE
1	7/07/23

COMMENTS

GARAGE ELEVATIONS
A4.1

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1 TRASH ENCLOSURE PLAN

VERIFY SIZE WITH OWNER AND CIVIL SITE PLAN PRIOR TO CONSTRUCTION

LOWELL DEVELOPMENT

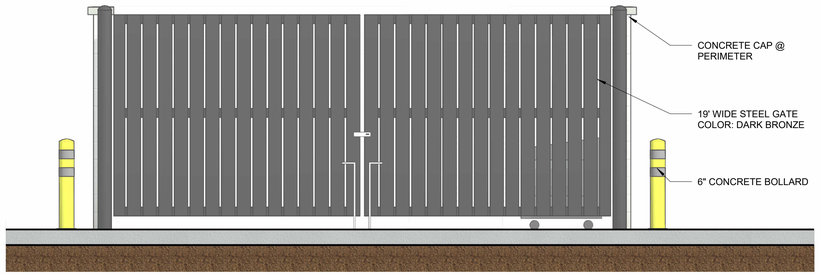
5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT
No.1

PROJECT INFORMATION:
22-C14
DOCUMENT DATE:
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DOCUMENT PHASE:
FOR REVIEW - ROUND 1

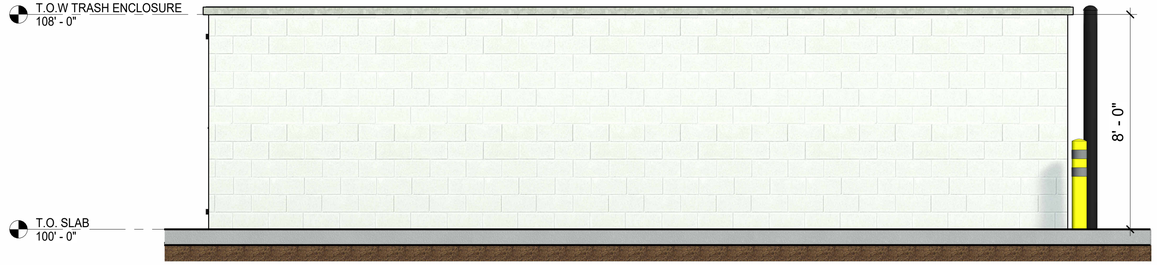
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SAM	07/07/23			
CHECKED BY:	DATE			
DAVID	07/07/23			

SITE
DETAILS

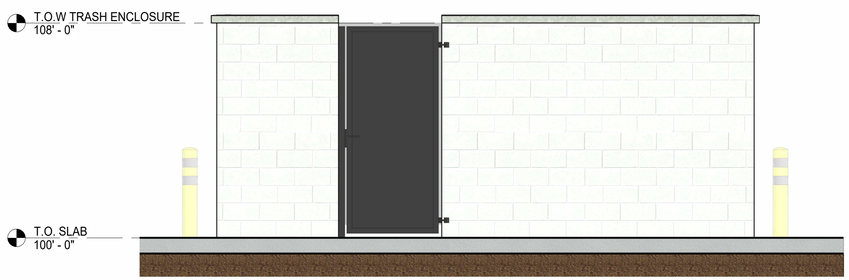
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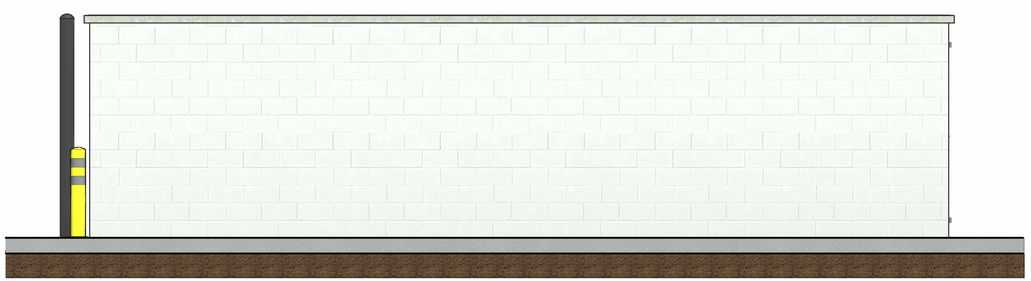
1 FRONT ELEVATION
SCALE: 3/8" = 1'-0"



2 SIDE ELEVATION
SCALE: 3/8" = 1'-0"



3 REAR ELEVATION
SCALE: 3/8" = 1'-0"



4 SIDE ELEVATION
SCALE: 3/8" = 1'-0"

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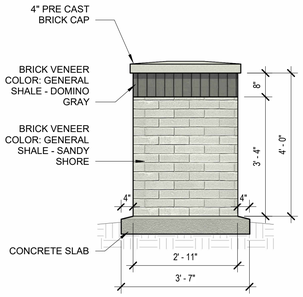
ASHER ARCHITECTS + ENGINEERS
512 5th St.
BERTHOUD CO. 80513
p: 970-532-9970
w. AsherArch.com
e: David@AsherArch.com

LOWELL DEVELOPMENT
5602 & 5660 LOWELL BLVD
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LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

PROJECT INFORMATION:
22-C14
DOCUMENT DATE:
7/7/2023 12:05:23 PM
DOCUMENT PHASE:
FOR REVIEW - ROUND 1

DRAWN BY:	DATE
JESUS	06/21/23
ZAVIS	07/07/23
CHECKED BY:	DATE
DAVID	07/07/23
REV #	DATE COMMENTS

SITE DETAILS
A5.1



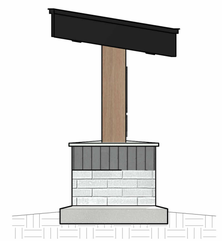
11 TYP. FENCE TERMINATION COLUMN - ELEVATION
SCALE: 1/2" = 1'-0"



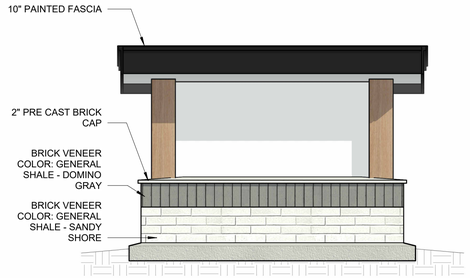
10 MONUMENT SIGN 3 - FRONT PERSPECTIVE
SCALE:



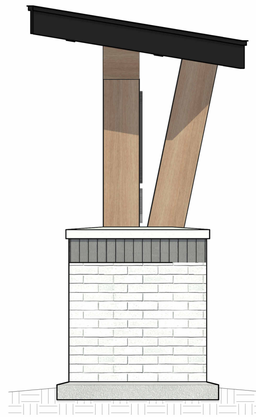
5 MONUMENT SIGNS 1 & 2 - FRONT PERSPECTIVE
SCALE:



9 MONUMENT SIGN 3 - SIDE ELEVATION
SCALE: 1/2" = 1'-0"



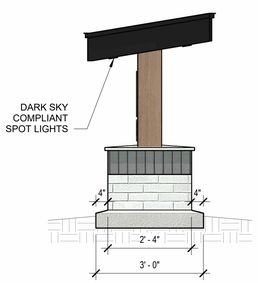
8 MONUMENT SIGN 3 - REAR ELEVATION
SCALE: 1/2" = 1'-0"



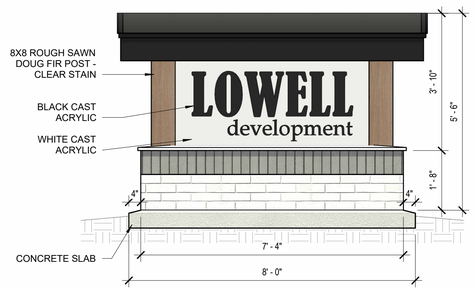
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SCALE: 1/2" = 1'-0"



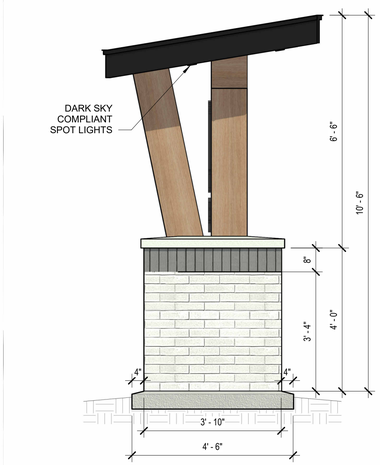
2 MONUMENT SIGNS 1 & 2 - REAR ELEVATION
SCALE: 1/2" = 1'-0"



7 MONUMENT SIGN 3 - SIDE ELEVATION
SCALE: 1/2" = 1'-0"



6 MONUMENT SIGN 3 - FRONT ELEVATION
SCALE: 1/2" = 1'-0"



3 MONUMENT SIGNS 1 & 2 - SIDE ELEVATION
SCALE: 1/2" = 1'-0"



4 MONUMENT SIGNS 1 & 2 - FRONT ELEVATION
SCALE: 1/2" = 1'-0"

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DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

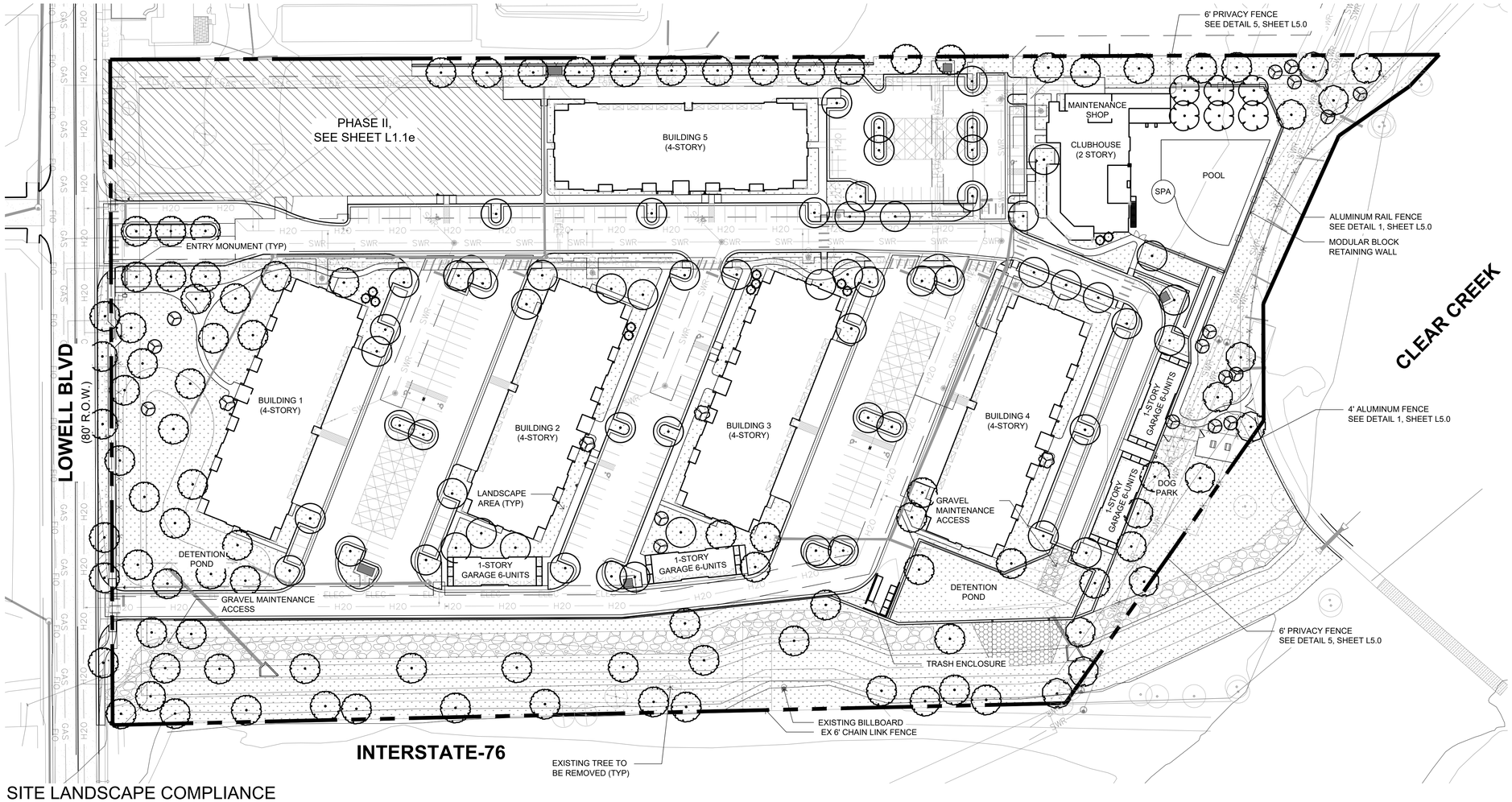
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DOCUMENT DATE:
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DOCUMENT PHASE:
FOR REVIEW - ROUND 1

	DATE
DRAWN BY: GIOVANNA	06/21/23
CHECKED BY:	DATE
REVID	07/07/23
REV #	DATE
	COMMENTS

SITE DETAILS
A5.2

SITE DEVELOPMENT PLAN
LOWELL DEVELOPMENT

MAJOR SUBDIVISION & REZONING
OVERALL LANDSCAPE PLAN
DENVER, COUNTY OF ADAMS, STATE OF COLORADO
SHEET 1 OF 10



SITE LANDSCAPE COMPLIANCE

R.O.W. LANDSCAPE REQUIREMENTS

Specifications		Required	Provided
Length (LF)			361
Minimum Width (LF)		20	20
PER 40 LF Trees	1	10	11
PER 40 LF Shrubs	2	20	TBD

SITE LANDSCAPE CALCULATIONS

Specifications	Species	Required	Provided
Gross Site Area (SF)			559,762
Landscape Area (SF) (30% Gross Site Area)		167,929	197,604
Open Space (SF) (15% Gross Site Area)		83,964	TBD
Turfgrass			N/A
Nonliving Ornamental			TBD
Trees *(1 Tree / 1,500 sf)*		112	235
Shrubs *(2 shrubs / 1,500 sf)*		224	TBD

DIVERSITY

Trees	Quantity	Diversity
Large Deciduous	202	86%
Ornamental*	33	14%
	235	

*Evergreen trees are included in the ornamental count.

PARKING LOT

PHASE 1

Specifications	Required	Provided
Parking Lot Area (SF)		
Parking Stalls (Excluding garage spaces)		288
Landscape Islands	29	44
Landscape Area (SF)	10,080	10,327
Large Trees (2" Caliper)	29	41

PHASE 2

Specifications	Required	Provided
Parking Lot Area (SF)		
Parking Stalls (Excluding garage spaces)		6
Landscape Islands	0	2
Landscape Area (SF)	0	238
Large Trees (2" Caliper)	0	1

NORTH ADJOINING PROPERTY BUFFER

Type B

Specifications		Required	Provided
Boundary (LF)			1153
Minimum Width (LF)		20	20
PER 40 LF Trees	1	29	30

EAST ADJOINING PROPERTY BUFFER

Type C

Specifications		Required	Provided
Boundary (LF)			673
Minimum Width (LF)		15	20
PER 40 LF Trees*	1	17	9

*Deficiencies due to site utility conflicts. Additional trees have been included in other areas to offset deficiency.

SOUTH ADJOINING PROPERTY BUFFER

Type D

Specifications		Required	Provided
Boundary (LF)			827
Minimum Width (LF)		15	25
PER 60 LF Trees*	3	41	15

*Deficiencies due to site utility conflicts. Additional trees have been included in other areas to offset deficiency.

WEST ADJOINING PROPERTY BUFFER

Type A

Specifications		Required	Provided
Boundary (LF)			361
Minimum Width (LF)		5	20
PER 80 LF Trees*	1	5	11

LEGEND

- LANDSCAPE AREA
- PROPOSED DECIDUOUS TREE
- PROPOSED EVERGREEN TREE
- PROPOSED ORNAMENTAL TREE
- x — PROPOSED FENCE

SCALE: 1" = 50'
0 25' 50' 100' 150'
NORTH

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FRONTERRA
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PLANNING

TFG Design, LLC
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LOWELL DEVELOPMENT
SITE DEVELOPMENT PLAN
5602 LOWELL BOULEVARD
DENVER, COLORADO 80221
ADAMS COUNTY

PROJECT INFORMATION:
PROJECT NUMBER: 295-2203AD
DATE: 07.10.2023
PHASE: SDP

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SHEET TITLE:
OVERALL LANDSCAPE PLAN

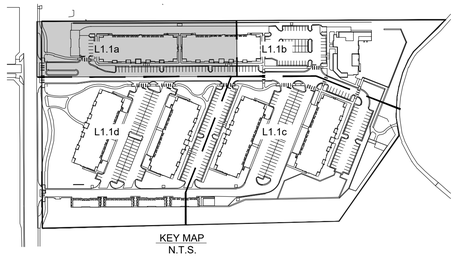
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SHEET 1 OF 10

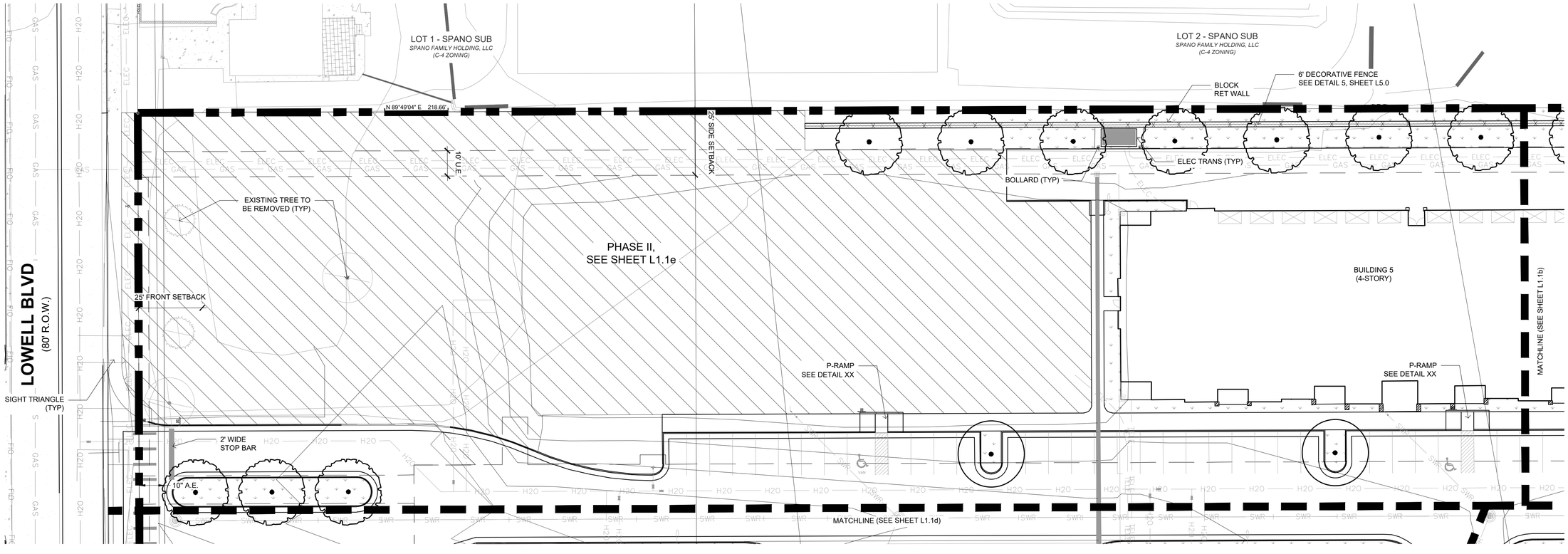
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SITE DEVELOPMENT PLAN
LOWELL DEVELOPMENT

MAJOR SUBDIVISION & REZONING
LANDSCAPE ENLARGEMENT
DENVER, COUNTY OF ADAMS, STATE OF COLORADO
SHEET 2 OF 10



KEY MAP
N.T.S.



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LOWELL DEVELOPMENT

SITE DEVELOPMENT PLAN

5602 LOWELL BOULEVARD
DENVER, COLORADO 80221

ADAMS COUNTY

PROJECT INFORMATION:
PROJECT NUMBER: 295-2203AD
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PHASE: SDP

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SHEET NUMBER:
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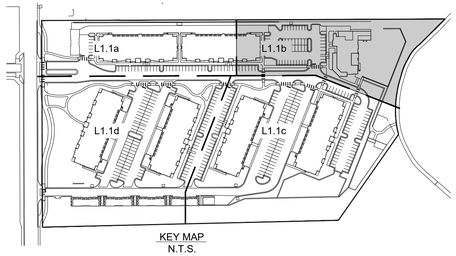
SHEET 2 OF 10

SCALE: 1" = 20'
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NORTH

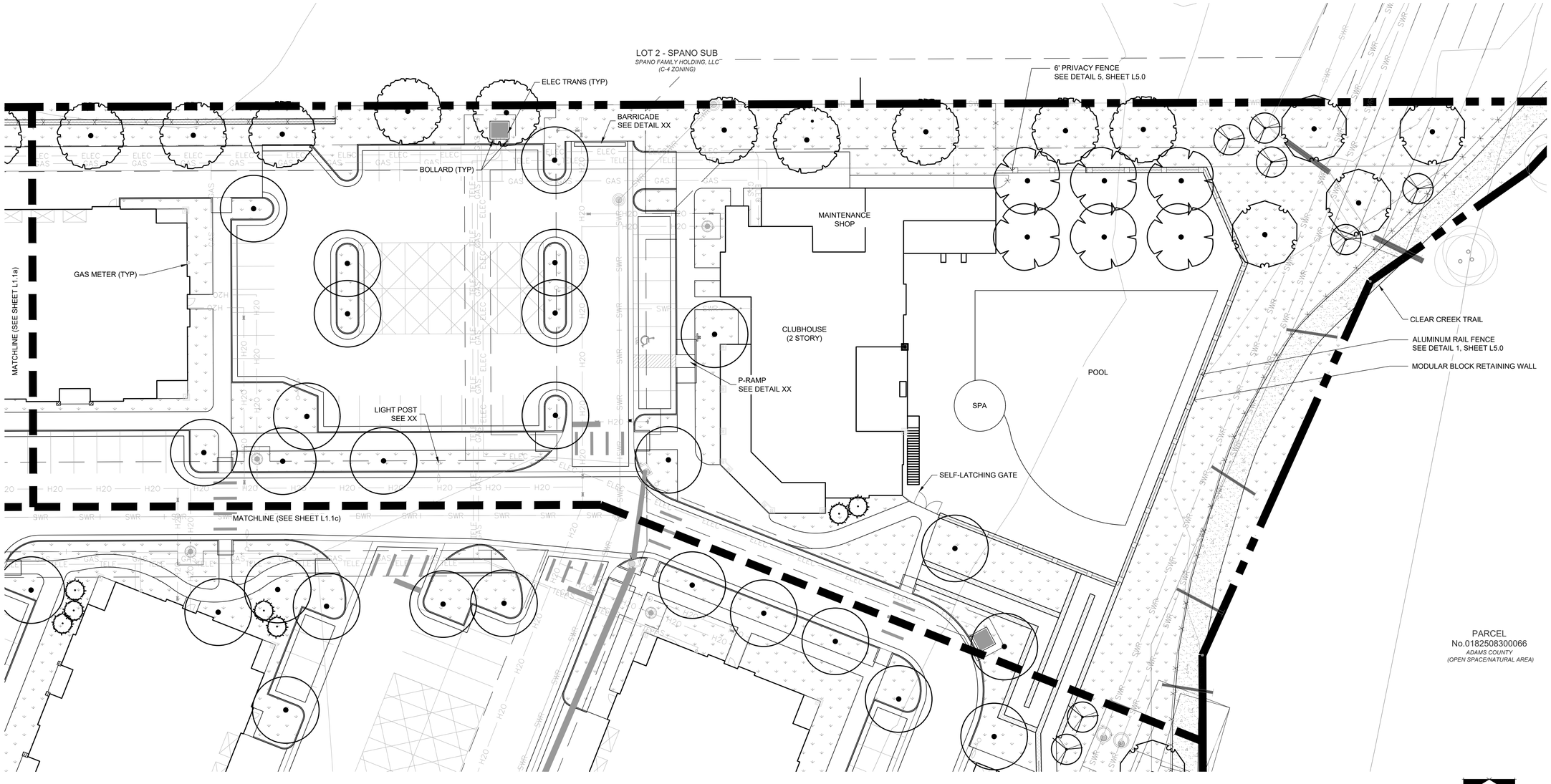
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SITE DEVELOPMENT PLAN
LOWELL DEVELOPMENT

MAJOR SUBDIVISION & REZONING
LANDSCAPE ENLARGEMENT
DENVER, COUNTY OF ADAMS, STATE OF COLORADO
SHEET 3 OF 10



KEY MAP
N.T.S.



SCALE: 1" = 20'
0 10' 20' 40' 60'
NORTH

811

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ADAMS COUNTY

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SHEET TITLE:
LANDSCAPE ENLARGEMENT

SHEET NUMBER:
L1.1B

SHEET 3 OF 10

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MATCHLINE (SEE SHEET L1.1b)

D-RAMP
SEE DETAIL XX

STRM INLET (TYP)

H2O METER (TYP)

MATCHLINE (SEE SHEET L1.1d)

BUILDING 3
(4-STORY)

BUILDING 4
(4-STORY)

1-STORY
GARAGE
6-UNITS

TRAIL CONNECTION

4' ALUMINUM FENCE
SEE DETAIL 1, SHEET L5.0

ALUMINUM GATE (TYP)
SEE DETAIL 2, SHEET L5.0

PET WASTE STATION
SEE DETAIL 6, SHEET L5.0

1-STORY
GARAGE
6-UNITS

DOG
PARK

H2O VALVE (TYP)

LIGHT POST
SEE XX

1-STORY
GARAGE
6-UNITS

DETENTION POND

GRAVEL
MAINTENANCE
ACCESS

RET WALL
SEE XX

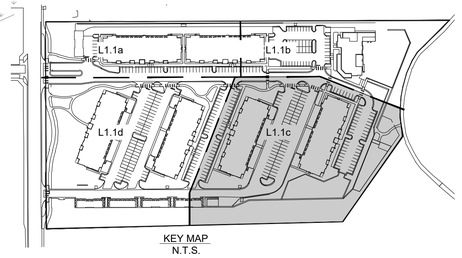
TRASH ENCLOSURE

EXISTING BILLBOARD

EX 6' CHAIN LINK FENCE

SCALE: 1" = 20'
0 10' 20' 40' 60'

NORTH



KEY MAP
N.T.S.

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LOWELL DEVELOPMENT

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5602 LOWELL BOULEVARD
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ADAMS COUNTY

PROJECT INFORMATION:
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SHEET TITLE:
LANDSCAPE ENLARGEMENT

SHEET NUMBER:
L1.1C

SHEET 4 OF 10

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10" A.E.

MATCHLINE (SEE SHEET L1.1a)

ENTRY MONUMENT (TYP)

D-RAMP
SEE DETAIL XX

H2O METER

BUILDING 1
(4-STORY)

BUILDING 2
(4-STORY)

P-RAMP
SEE DETAIL XX

MATCHLINE (SEE SHEET L1.1c)

LOWELL BLVD
(80' R.O.W.)

LANDSCAPE AREA (TYP)

DETENTION POND

LIGHT POST
SEE XX

1-STORY
GARAGE
6-UNITS

SIGHT TRIANGLE (TYP)

D-RAMP
SEE DETAIL XX

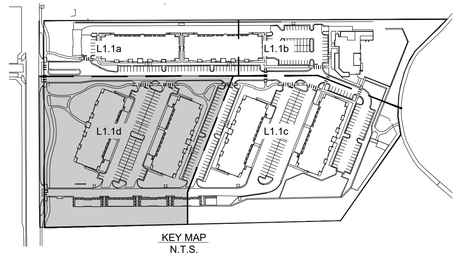
BLOCK
RET WALL

GRAVEL MAINTENANCE ACCESS

20' U & A.E.
REC. NO. C0347749

25' SIDE SETBACK

INTERSTATE-76



KEY MAP
N.T.S.

SCALE: 1" = 20'
0 10' 20' 40' 60'

NORTH

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LOWELL DEVELOPMENT

SITE DEVELOPMENT PLAN

5602 LOWELL BOULEVARD
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PROJECT INFORMATION:
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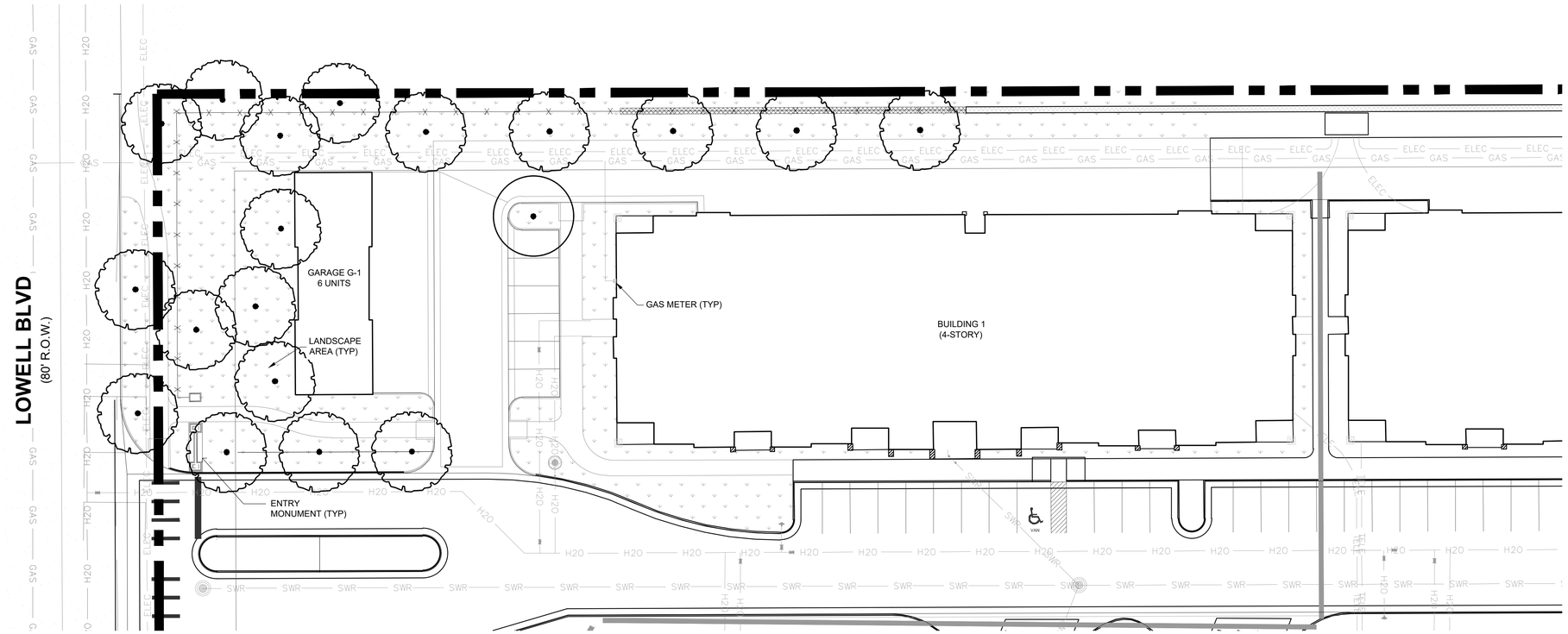
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SHEET 5 OF 10

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SITE DEVELOPMENT PLAN
LOWELL DEVELOPMENT

MAJOR SUBDIVISION & REZONING
PHASE 2 LANDSCAPE
DENVER, COUNTY OF ADAMS, STATE OF COLORADO
SHEET 6 OF 10



SCALE: 1" = 20'
0 10' 20' 40' 60'
NORTH

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LOWELL DEVELOPMENT

SITE DEVELOPMENT PLAN

5602 LOWELL BOULEVARD
DENVER, COLORADO 80221

ADAMS COUNTY

PROJECT INFORMATION:
PROJECT NUMBER: 295-2203AD
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SHEET TITLE:
PHASE 2 LANDSCAPE

SHEET NUMBER:
L1.1E

SHEET 6 OF 10

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SITE DEVELOPMENT PLAN
LOWELL DEVELOPMENT

MAJOR SUBDIVISION & REZONING
PLANT SCHEDULE
DENVER, COUNTY OF ADAMS, STATE OF COLORADO
SHEET 6 OF 10

PLANT SCHEDULE

Ornamental Trees		Quantity	Botanical	Common	Size	Water Use Range
	ALF	17	Amelanchier laevis 'Spring Flurry'	Spring Flurry Serviceberry	6' Ht.	Low
	CCI	4	Crataegus crus-galli inermis	Thornless Cockspur Hawthorn	1.5" Cal.	Low
	PHE	12	Pinus heldreichii	Bosnian Pine	6' Ht.	Low
		33				
Large Trees						
	GSK	62	Gleditsia triacanthos inermis 'Skycole'	Skyline Thornless Honey Locust	2" Cal.	Low
	QBI	13	Quercus bicolor	Swamp White Oak	2" Cal.	Low
	GDE	6	Gymnocladus dioica 'Espresso'	Seedless Kentucky Coffeetree	2" Cal.	Low
	QGA	86	Quercus gambelii	Gambel Oak	2" Cal.	Low
		200				

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FRONTERRA

LANDSCAPE ARCHITECTURE
PLANNING

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LOWELL DEVELOPMENT

SITE DEVELOPMENT PLAN

5602 LOWELL BOULEVARD
DENVER, COLORADO 80221

ADAMS COUNTY

PROJECT INFORMATION:
PROJECT NUMBER: 295-2203AD
DATE: 07.10.2023
PHASE: SDP

REVISIONS:

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SHEET TITLE:
PLANT SCHEDULE

SHEET NUMBER:
L2.0

SHEET **6** OF **10**

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FILE LOCATION: Z:\Shared\Projects\295 Arbor Architecture\295-2203AD Lowell Development\Arch\ACAD\01 SDP\DWG\Landscape\L2.0 PLANT SCHEDULE AND NOTES.dwg

LANDSCAPE SPECIFICATIONS

MATERIALS:

1. WEED BARRIER: WEED BARRIER MAY BE TYPAR 3341 OR APPROVED EQUAL. PLACE WEED BARRIER BENEATH COBBLE MULCH AREAS.

2. COBBLE MULCH: SEE DETAIL SHEET L4.0. SUBMIT SAMPLE.

3. EDGING: ALL BEDS ADJACENT TO TURF AREAS TO BE EDGED WITH CONCRETE HEADER PER *DETAIL X.*

4. TREE STAKES: 8-FOOT LONG, 2-INCH DIAMETER PRESSURE TREATED LODGE POLE PINE STAKES (OR METAL "T" POSTS AS ALLOWED BY LANDSCAPE ARCHITECT. APPROVAL REQUIRED PRIOR TO INSTALLATION.)

5. GUY ANCHORS: 24-INCH LONG METAL "T" POSTS.

6. GUYING AND STAKING WIRE: GALVANIZED IRON OR STEEL 12-GAUGE WIRE.

7. WEBBING: 2-INCH NYLON WEBBING OR RUBBERIZED CLOTH.

8. TREE WRAP: 4-INCH MINIMUM WIDTH COMMERCIAL TREE WRAP.

9. SAFETY CAPS: INDUSTRY STANDARD (FOR METAL "T" POST ONLY)

10. SOIL AMENDMENT: AMEND EXISTING SOIL WITH SQUEEGEE AT A MINIMUM OF 6" DEPTH OR REMOVE A MINIMUM OF 6" SOIL AND REPLACE WITH SQUEEGEE TOPSOIL MIX AT 1:1 RATIO. IF PLANTING BED IS CONTAINED BY A CURB OR CONCRETE WALK, REMOVE ADDITIONAL 2-3" SOIL TO ALLOW FOR SQUEEGEE MULCH AT 2-3" DEPTH.

11. FERTILIZER: FERTILIZER FOR TURF SHALL BE COMMERCIAL TYPE, OF UNIFORM COMPOSITION, FREE FLOWING, AND CONFORMING TO APPLICABLE STATE AND FEDERAL LAWS. SUBMIT MANUFACTURER'S GUARANTEED ANALYSIS. FORMULATED FERTILIZER ANALYSIS SHALL BE SUBMITTED TO OWNER'S REPRESENTATIVE FOR REVIEW AND SHALL BE BASED UPON RECOMMENDATIONS MADE BY SOIL LAB. CONTRACTOR SHALL SUBMIT SOIL SAMPLE TO SOIL LAB FOR ANALYSIS AND FERTILIZER RECOMMENDATIONS.

IF SOIL TYPES ARE SIMILAR IN STRUCTURE, THE CONTRACTOR MAY USE A CONSISTENT FORMULATED FERTILIZER FOR THE ENTIRE SITE AREA. HOWEVER, IF SOIL STRUCTURES ARE VASTLY DIFFERENT, A FORMULATED FERTILIZER FOR EACH SPECIFIC SITE AREA WILL BE REQUIRED.

FERTILIZER FOR TREE AND SHRUB, BACKFILL MIX, AND GROUND COVER AREAS SHALL BE OSMOCOTE SIERRABLEND, 9 MONTH SLOW-RELEASE FERTILIZER.

12. NATIVE SEED MIX: ALL SEEDING SHALL BE COMPLETED BETWEEN APRIL 15 AND MAY 31, OR BETWEEN SEPTEMBER 1 AND OCTOBER 15.

NATIVE SEEDED AREAS SHALL BE SEEDED WITH THE FOLLOWING MIXES PER THE LOCATIONS SPECIFIED ON THE ADAMS COUNTY APPROVED LANDSCAPE PLAN:

INTERIOR NATIVE SEED MIX:
SEEDING RATE: Irrigated Turf Seed Rate 5 lbs / 1,000sf

0.25 lbs Blue Grama, Birdseye Source ID
0.25 lbs Blue Grama, Hatchita Certified
2.25 lbs Buffalograss, Sundancer
2.25 lbs Buffalograss, Texoka

PERIMETER NATIVE SEED MIX:
SEEDING RATE: Irrigated Turf Seed Rate 5 lbs / 1,000sf

2.50 lbs Buffalograss, Sundancer
2.50 lbs Buffalograss, Texoka

13. TEMPORARY SOIL STABILIZATION SEED MIX: ALL SEEDING SHALL BE COMPLETED BETWEEN APRIL 15 AND MAY 31, OR BETWEEN SEPTEMBER 1 AND OCTOBER 15.

NATIVE SEEDED AREAS SHALL BE SEEDED WITH THE FOLLOWING MIXES PER THE LOCATIONS SPECIFIED ON THE ADAMS COUNTY APPROVED LANDSCAPE PLAN:

TEMPORARY SOIL STABILIZATION SEED MIX:
SEEDING RATE: Irrigated Turf Seed Rate 5 lbs / 1,000sf

5.00 lbs Perennial Rye, PhD

14. BLUEGRASS SOD: BLUEGRASS SOD SHALL CONTAIN THE FOLLOWING SEED MIX OR ALTERNATIVE AS APPROVED BY ADAMS COUNTY:

Turfgrass sod shall be the BTF-Texas Mix from Bittersweet Turf Farms

33% SPF30 Texas/Kentucky Hybrid Bluegrass
34% Solar Green Texas/Kentucky Hybrid Bluegrass
33% Bandera Texas/Kentucky Hybrid Bluegrass

SOD SHALL BE A MINIMUM OF ⅝ INCH THICK, HARVESTED IN ROLLS FERTILIZED TWO TO THREE WEEKS BEFORE CUTTING, AND SHALL BE CUT NOT MORE THAN ONE DAY PRIOR TO PLANTING. SOD SHALL BE ONE YEAR OLD, MINIMUM, GROWN UNDER INTENSIVE CARE AND CULTIVATION TO PRODUCE A THICK, EVEN STAND OF GRASS. NATIVE SEED MIX A: ALL SEEDING SHALL BE COMPLETED BETWEEN APRIL 15 AND MAY 31, OR BETWEEN SEPTEMBER 1 AND OCTOBER 15.

15. TREES, SHRUBS, AND GROUND COVERS: PLANT MATERIALS SHALL BE A FIRST-CLASS REPRESENTATIVE OF ITS SPECIES; HEALTHY, WELL BRANCHED AND WELL PROPORTIONED IN RESPECT TO HEIGHT AND WIDTH RELATIONSHIPS; FREE FROM DISEASE, INJURY, INSECTS, AND WEED ROOTS; AND CONFORMING TO THE REQUIREMENTS OF THE COLORADO NURSERY ACT. (SEE LANDSCAPE CONTRACTORS OF COLORADO STANDARD SPECIFICATIONS FOR APPROPRIATE SECTIONS OF THE NURSERY ACT). ALL PLANTS SHALL BE NURSERY STOCK FROM GROWERS LOCATED IN USDA HARDINESS ZONES 1, 2, 3 OR 4. BOTANIC AND COMMON NAMES: PLANT NAMES GIVEN IN THE PLANT LIST ARE IN CONFORMANCE WITH STANDARD HORTICULTURAL PRACTICE IN THIS AREA. PLANTS ARE TO BE DELIVERED TO THE SITE WITH TAGS BEARING THE BOTANIC NAME AS INDICATED BY THE PLANT LIST.

INSTALLATION:

CLEARING. PRIOR TO ANY SOIL PREPARATION, EXISTING VEGETATION TO REMAIN AND WHICH MIGHT INTERFERE WITH THE SPECIFIED SOIL PREPARATION SHALL BE MOWED, GRUBBED, RAKED, AND THE DEBRIS REMOVED FROM THE SITE. PRIOR TO OR DURING GRADING OR TILLAGE OPERATION, THE GROUND SURFACE SHALL BE CLEARED OF MATERIALS THAT MIGHT HINDER FINAL OPERATIONS.

PREPARE ALL AREAS TO BE PLANTED AS FOLLOWS:
RIP ALL AREAS TO BE PLANTED, SEEDED AND/OR SODDED TO A MINIMUM OF 8 INCHES IN TWO DIRECTIONS USING AN AGRICULTURAL RIPPER WITH TINES SPACED AT NO GREATER THAN 18 INCHES. AREAS ADJACENT TO WALKS, STRUCTURES, CURBS, ETC, WHERE THE USE OF LARGE MECHANICAL EQUIPMENT IS DIFFICULT, SHALL BE WORKED WITH SMALLER EQUIPMENT OR BY HAND.

SOIL PREPARATION: AMEND EXISTING SOIL WITH SQUEEGEE AT A MINIMUM OF 6" DEPTH OR REMOVE A MINIMUM OF 6" SOIL AND REPLACE WITH SQUEEGEE TOPSOIL MIX AT 1:1 RATIO. IF PLANTING BED IS CONTAINED BY A CURB OR CONCRETE WALK, REMOVE ADDITIONAL 2-3" SOIL TO ALLOW FOR SQUEEGEE MULCH AT 2-3" DEPTH. OBTAIN A UNIFORM MIXTURE WITH NO POCKETS OF SOIL OR AMENDMENTS REMAINING.

TREE AND SHRUB PLANTING:
1. SUBSTITUTIONS. ANY PLAN SUBSTITUTIONS ARE TO BE APPROVED BY LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

2. ESTABLISHED LOCATION: STAKE TREES AND FLAG OR SET OUT ALL SHRUBS IN LOCATIONS SHOWN ON THE PLANS PRIOR TO INSTALLATION FOR REVIEW BY OWNER. THE FOLLOWING ARE MINIMUM DISTANCES THAT PLANT MATERIALS CAN BE PLACED FROM ADJACENT WALLS, FENCES OR PAVED AREAS:
LARGE SHRUBS: 4 FEET
MEDIUM SHRUBS: 2-1/2 FEET
PERENNIALS, GRASSES AND GROUND COVERS: 18 INCHES

3. PLANTING PITS:
DIG PLANTING PITS A MINIMUM OF 2 TIMES AS WIDE AS DIAMETER OF ROOT BALL OR CONTAINER, AND A DEPTH SUFFICIENT TO ALLOW TOP OF ROOT BALL AT TRUNK TO SIT A MINIMUM OF 3" ABOVE SURROUNDING GRADE FOR SHRUBS.

INCORPORATE COMPOST BY DISKING OR ROTOTILLING INTO THE TOP 4 TO 6 INCHES OF SOIL. OBTAIN A UNIFORM MIXTURE WITH NO POCKETS OF SOIL OR AMENDMENTS REMAINING.

RESTORE THE FINE GRADE OF ALL AREAS TO BE PLANTED, SEEDED AND/OR SODDED WITH FLOAT DRAG TO REMOVE IRREGULARITIES RESULTING FROM TILLING OPERATIONS. FLOAT DRAG TWO DIRECTIONS. REMOVE ANY ADDITIONAL STONES OVER 1-1/2 INCHES THAT HAVE COME TO THE SURFACE. UPON COMPLETION OF FINISH GRADING OPERATIONS, THE CONTRACTOR MUST PROVIDE A FINISH LANDSCAPE GRADE THAT SHALL CONFORM TO THE GRADES AND ELEVATIONS SHOWN ON THE ENGINEERING DRAWINGS. CONTRACTOR SHALL PROVIDE POSITIVE DRAINAGE IN ALL LANDSCAPE AREAS.
SHRUBS. ROUGHEN SIDES OF THE PIT TO REMOVE ANY COMPACTING OR GLAZING. LOOSEN SOIL AT BOTTOM OF PIT TO A MINIMUM DEPTH OF SIX INCHES. MIX LOOSENED SOIL WITH SPECIFIED BACKFILL. BACKFILL MATERIAL: TREE AND SHRUB PLANTING PITS SHALL BE BACKFILLED WITH THE FOLLOWING MIX:
75% TOPSOIL BY VOLUME (SOIL EXCAVATED FROM PLANTING PITS).
25% COMPOST BY VOLUME.
THE SPECIFIED BACKFILL MATERIALS SHALL BE PRE-MIXED USING INDUSTRY ACCEPTED TECHNIQUE IN ORDER TO OBTAIN A UNIFORM, EVENLY BLENDED CONSISTENCY, FREE FROM POCKETS OF UNBLENDED MATERIAL AND CLODS OR STONES GREATER THAN TWO INCHES IN DIAMETER. BACKFILL MIX SHALL BE DELIVERED TO EACH PLANTING PIT AFTER MIXING HAS OCCURRED.

PLANTING:
1. REMOVE STOCK FROM CONTAINER. DO NOT BREAK THE ROOT BALL. A SPADE SHALL NOT BE USED. SCARIFY SIDES AND BOTTOM OF ROOT BALL.

2. PLACE BACKFILL MIX INTO PLANTING PIT TO A DEPTH SUCH THAT THE PLANT, WHEN PLANTED, WILL BE THREE INCHES ABOVE FINISH GRADE FOR DECIDUOUS TREES, FOUR TO SIX INCHES FOR CONIFEROUS TREES, AND TWO INCHES ABOVE FINISH GRADE FOR ALL SHRUBS.

3. UNTIE AND REMOVE BURLAP FROM TOP THIRD OF ROOT BALL ON BALLED AND BURLAPPED MATERIAL. REMOVE WIRE BASKETS FROM TOP AND MINIMUM OF 2/3 OF ALL SIDE OF ROOT BALL.

4. BACKFILL ONE-HALF OF PIT WITH BACKFILL MIXTURE AND WATER IN THOROUGHLY BEFORE PLACING ANY MORE BACKFILL. DO NOT WORK WET SOIL.

5. BACKFILL THE REST OF THE PLANTING PIT WITH BACKFILL MIXTURE AND TAMP TO COMPACT. WATER IN THOROUGHLY. DO NOT WORK WET SOIL
APPLY SLOW RELEASE FERTILIZER, PER MANUFACTURER'S DIRECTION OF SIZE OF PLANT MATERIAL, BY SPREADING EVENLY OVER THE TOP OF THE ENTIRE PLANTING PIT.

6. STAKE OR GUY ALL TREES IN A TRUE VERTICAL POSITION. WRAP DECIDUOUS TREES BOTTOM TO TOP. STAPLE OR TACK IN PLACE AT TOP. WRAP APPROXIMATELY NOVEMBER 15 AND REMOVE APPROXIMATELY MAY 15.

7. IF TREES ARE PLANTED IN A SPADE DUG HOLE, THEY SHALL BE DEEP WATERED WITH A WATERING NEEDLE ANGLING FROM THE INSIDE OF THE BALL OUT THROUGH THE PERIMETER OF THE SOIL.

WEED BARRIER INSTALLATION
1. WEED BARRIER SHALL BE PLACED IN ALL SHRUB BED AREAS WHERE 5-GALLON SHRUB MATERIAL IS USED OR WHERE NOTED IN PLAN AND DETAILS. AT ALL EDGES OF CURBS, WALLS, STRUCTURES, PAVEMENTS, AND HEADERS, WEED BARRIER SHALL BE SECURED WITH 11-GAUGE, 6-INCH LONG STAPLES AT 18 INCHES O.C. AT ALL EDGES.

2. NO WEED BARRIER SHALL BE PLACED IN AREAS RECEIVING ONE GALLON AND SMALLER PLANT MATERIAL.

3. NO WEED BARRIER SHALL BE PLACED IN SOIL PLANTING RINGS OF DECIDUOUS AND CONIFEROUS TREES PLANTED IN SODDED OR SEEDED AREAS.

STEEL HEADER CONSTRUCTION
1. LAYOUT STEEL HEADER IN LOCATIONS SHOWN ON PLANS AND RECEIVE REVIEW OF OWNER PRIOR TO INSTALLATION. LOCATE BY SCALING OFF OF PLAN. INSTALL PLUMB WITH GRADES MAINTAINING A MINIMUM CONSTANT HEIGHT FLUSH WITH ADJACENT TURF AREAS.
INSTALL USING STRAIGHT LINES AND SMOOTH CURVES. STAKE STEEL HEADER USING PINS OF TWO FEET O.C. PROVIDE DRAINAGE SLITS OR HOLES AT SUFFICIENT INTERVALS TO ALLOW EXCESS WATER TO DRAIN AWAY.

SEEDING
1. TIME OF SEEDING: UNLESS OTHERWISE APPROVED, ALL TURF SEEDING SHALL BE COMPLETED BETWEEN APRIL 15 AND MAY 31, OR BETWEEN SEPTEMBER 1 AND OCTOBER 15.

2. PRIOR TO SEEDING, SOIL SHALL BE TESTED AND BE AMENDED PER THE SOIL TEST RESULT'S RECOMMENDATIONS.

3. DRILL SEEDING: DRILL SEED USING A DRILL IMPLEMENT EQUIPPED WITH THE FOLLOWING PREFERABLE FEATURES;
DEPTH BANDS - TO ALLOW SEEDING AT THE PROPER DEPTH
SEED BOX AGITATOR - TO PROMOTE SEED MIXING
SEED BOX BAFFLES - TO AID IN EVEN SEED DISTRIBUTION AMONG ROWS
SEED-METERING DEVICE - TO PROMOTE EVEN SEED DISTRIBUTION WITHIN ROWS
FURROW OPENERS - TO PERMIT PROPER SEED PLACEMENT FROM SEED SPOUTS, AND
DRAG CHAINS - TO AID IN SEED COVERAGE

THE DRILL WILL BE ADJUSTED TO PLANT SEED TO THE PROPER DEPTH. THE DEPTH OF SEEDING WILL BE APPROXIMATELY 0.25 TO 0.50 INCH. DRILL ROW SPACING WILL BE SET AT APPROXIMATELY 6 TO 8 INCHES. THE DRILL WILL THEN BE TOWED ACROSS THE SEEDBED TO COMPLETE THE PLANTING OPERATION. DRILL SEEDING WILL TAKE PLACE IMMEDIATELY FOLLOWING THE COMPLETION OF FINAL SEED BED PREPARATION TECHNIQUES.

4. BROADCAST SEEDING: BROADCAST SEEDING SHALL ONLY OCCUR IN AREAS INACCESSIBLE TO A DRILL SEEDER. BROADCAST SEED ONLY AFTER ALL TREES AND SHRUBS HAVE BEEN PLANTED IN THESE AREAS. BROADCAST SEEDING WILL BE ACCOMPLISHED USING HAND-OPERATION "CYCLONE-TYPE" SEEDERS OR ROTARY BROADCAST EQUIPMENT ATTACHED TO CONSTRUCTION OR RE-VEGETATION MACHINERY. ALL MACHINERY WILL BE EQUIPPED WITH METERING DEVICES. BROADCASTING BY HAND WILL BE ACCEPTABLE ON SMALL, ISOLATED SITES. WHEN BROADCAST SEEDING, PASSES WILL BE MADE OVER EACH SITE TO BE SEEDED IN A MANNER TO ENSURE AN EVEN DISTRIBUTION OF SEED. WHEN USING HOPPER TYPE EQUIPMENT, SEED SHOULD BE FREQUENTLY MIXED WITHIN THE HOPPER TO DISCOURAGE SEED SETTLING AND UNEVEN PLANTING DISTRIBUTION OF SPECIES.

5. BROADCAST SEEDING WILL TAKE PLACE IMMEDIATELY FOLLOWING THE COMPLETION OF FINAL SEEDBED PREPARATION TECHNIQUES. BROADCAST SEEDING SHOULD NOT BE CONDUCTED WHEN WIND VELOCITIES WOULD PROHIBIT EVEN SEED DISTRIBUTION. THE BROADCAST SEEDING RATE WILL BE TWICE THE RATE OF DRILL SEEDING.

6. HYDROSEEDING: MIX SPECIFIED SEED, FERTILIZER, AND FIBER MULCH (CONWED FIBERS HYDRO MULCH 2000 OR EQUAL) IN WATER, USING EQUIPMENT SPECIFICALLY DESIGNED FOR HYDROSEED APPLICATION. CONTINUE MIXING UNTIL UNIFORMLY BLENDED INTO HOMOGENEOUS SLURRY SUITABLE FOR HYDRAULIC APPLICATION.

APPLY SLURRY UNIFORMLY TO ALL AREAS TO BE SEEDED IN A ONE-STEP PROCESS. APPLY SLURRY AT A RATE SO THAT MULCH COMPONENT IS DEPOSITED AT NOT LESS THAN 2,000 LB/ACRE DRY WEIGHT, AND SEED COMPONENT IS DEPOSITED AT NOT LESS THAN THE SPECIFIED SEED-SOWING RATE.

MULCHING
MULCH FOLLOWING ALL SOIL PREPARATION AND PLANTING.
1. SHRUB BEDS: MULCH SHRUB BED PLANTING AREA PER COBBLE MULCH BORDER DETAIL, SEE SHEET L4.0.

PERENNIAL & ANNUAL BEDS: MULCH ALL ANNUAL, PERENNIAL AND GROUND COVER PLANTING AREAS PER COBBLE MULCH BORDER DETAIL, SEE SHEET L4.0.

2. TREE PLANTING RINGS IN IRRIGATED TURF AREAS: MULCH ALL SOIL PLANTING RINGS OF DECIDUOUS AND CONIFEROUS TREES WITH A 3" LAYER OF SQUEEGEE MULCH.

NATIVE SEED ESTABLISHMENT/MAINTENANCE
1. WEED MITIGATION/IDENTIFICATION:
THE MAINTENANCE ACCOUNT MANAGER SHALL CONDUCT MULTIPLE SITE VISITS PER MONTH TO IDENTIFY WEEDS AND ANY UNDESIRABLE APPEARANCE OF THE NATIVE AREA. ONCE WEEDS ARE IDENTIFIED, A MAINTENANCE CREW WILL BE SCHEDULED TO PULL THE WEEDS BY HAND OR SPRAY, AS NECESSARY. THIS CREW SHALL BE EDUCATED AND CERTIFIED TO USE CHEMICALS PER INSTRUCTIONS ON THE LABEL.

2. IRRIGATION MAINTENANCE/MONITORING:
THE MAINTENANCE IRRIGATION TECH SHALL BE RESPONSIBLE FOR MONITORING, MAINTAINING, PROGRAMMING, AND REPAIRING SITE IRRIGATION.

3. IRRIGATION SCHEDULE:
MONTH 1: FOUR DAILY CYCLES TO MAINTAIN MOISTURE LEVEL OF 1" DEPTH. IRRIGATION TECH SHALL MAKE NECESSARY ADJUSTMENTS TO TIME ACCORDING TO WEATHER AND TEMPERATURES. ACCOUNT MANAGER, OWNERS AND IRRIGATION TECH WILL WATCH FOR SEEDLINGS.

MONTH 2: ASSUMING SEEDLINGS HAVE GERMINATED AND EMERGED SUCCESSFULLY, ONE DAILY CYCLE TO MAINTAIN SURFACE MOISTURE OF 2-3". IRRIGATION TECH SHALL MAKE NECESSARY ADJUSTMENTS TO TIME ACCORDING TO WEATHER AND TEMPERATURES. RECOMMENDATION IS FOR SOME SURFACE DRYING BETWEEN IRRIGATION CYCLES.

MONTH 3: ONE IRRIGATION CYCLE PER WEEK TO MAINTAIN A MOISTURE LEVEL OF 4-6". IRRIGATION TECH SHALL MAKE NECESSARY ADJUSTMENTS TO TIME ACCORDING TO WEATHER AND TEMPERATURES. RECOMMENDATION IS FOR SOME SURFACE DRYING BETWEEN IRRIGATION CYCLES.

4. IDENTIFYING/RESEEDING BARE AREAS:
IF FOUND, AREAS SHALL BE BROADCAST SEEDED BY HAND AND RAKED IN OVER BARE AREAS LARGER THAN ONE SQUARE FOOT AND IRRIGATION SCHEDULE WILL BE ADJUSTED TO HELP ESTABLISHMENT.

LONG TERM MAINTENANCE:

PRUNING SCHEDULE:
1. MAINTENANCE CREWS WILL PRUNE BEDS, INCLUDING THE EXISTING BEDS NOT IN THE NATIVE AREA, IN EARLY SPRING PRIOR TO BUDDING, SUMMER AFTER FLOWERING IS COMPLETE, AND FALL AFTER PLANTS GO DORMANT. PRUNING TO BE PERFORMED AS NEEDED TO PROMOTE THE HEALTH AND MAINTAIN A NEAT APPEARANCE THAT HIGHLIGHTS THE NATURAL QUALITIES OF THE SPECIFIC PLANT, AS OPPOSED TO SHEARING INTO A FORMAL SHAPE.

MOWING SCHEDULE:
1. ONCE THE NATIVE AREA HAS BECOME ESTABLISHED AND SEED HEADS ARE PRESENT, MOWING OPERATIONS SHALL COMMENCE. THE ENTIRE NATIVE AREA WILL BE MOWED ONCE PER YEAR IN LATE FALL OR EARLY SPRING, ONCE SEED HEADS ARE PRESENT TO ALLOW GRASS TO NATURALLY RE-SEED ITSELF.
2. NATIVE AREAS WITHIN THE CACTUS HILL LATERAL EASEMENT WILL BE MOWED AS NEEDED TO MAINTAIN A MAXIMUM HEIGHT OF TWELVE (12) INCHES.

MONITORING NATIVE CONVERSION AREA FOR WEEDS AFTER ESTABLISHMENT:
1. ACCOUNT MANAGER, OWNERS, MAINTENANCE CREWS, SPRAY TECHNICIANS WILL MONITOR SITE REGULARLY TO IDENTIFY WEEDS THAT CAN BE PULLED BY HAND AND SPRAY, IF NECESSARY. A CERTIFIED SPRAY TECHNICIAN SHALL BE SCHEDULED AS NEEDED.

IRRIGATION INSPECTION, MONITORING AND REPAIR:
1. MONTHLY SITE INSPECTIONS FOR POSSIBLE LEAKS OR IRRIGATION PROBLEMS WILL BE DONE BY AN IRRIGATION TECHNICIAN AND ACCOUNT MANAGER.

IRRIGATION SCHEDULE AFTER ESTABLISHMENT:
1. THE GOAL OF THIS PROJECT IS TO REDUCE WATER USAGE AS MUCH AS POSSIBLE. THE NATIVE GRASSES SPECIFIED WILL SURVIVE ON RAINWATER THAT IS COMMON IN COLORADO (LESS THAN 2" PER MONTH WILL STILL RESULT IN GREEN APPEARANCE YEAR-ROUND). IN DROUGHT SEASONS, THERE MAY BE THE NEED TO IRRIGATE, WHICH WILL BE DETERMINED AT THAT TIME BY THE ACCOUNT MANAGER.

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LANDSCAPE ARCHITECTURE
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LOWELL DEVELOPMENT
SITE DEVELOPMENT PLAN
5602 LOWELL BOULEVARD
DENVER, COLORADO 80221
ADAMS COUNTY

PROJECT INFORMATION:
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SHEET TITLE:
LANDSCAPE SPECIFICATIONS

SHEET NUMBER:
L3.0

SHEET 7 OF 10

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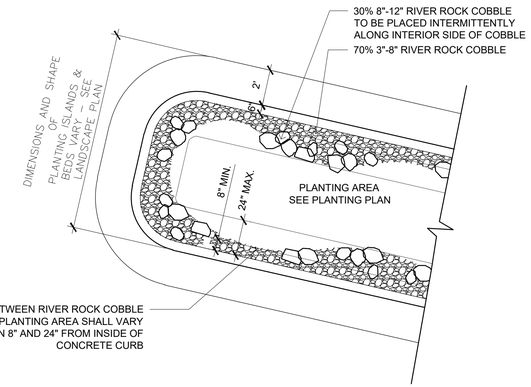
SITE DEVELOPMENT PLAN
LOWELL DEVELOPMENT

MAJOR SUBDIVISION & REZONING
LANDSCAPE DETAILS & NOTES
DENVER, COUNTY OF ADAMS, STATE OF COLORADO
SHEET 8 OF 10

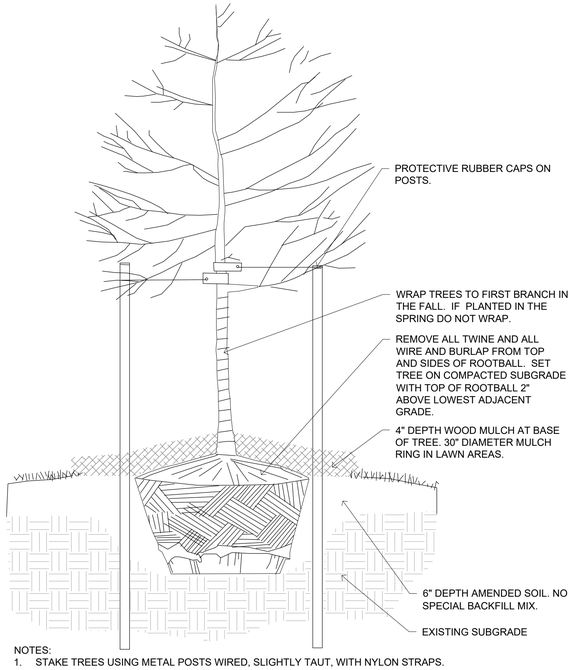
GENERAL LANDSCAPE NOTES

1. PLANT QUALITY: ALL PLANT MATERIAL SHALL BE A-GRADE OR NO. 1 GRADE - FREE OF ANY DEFECTS, OF NORMAL HEALTH, HEIGHT, LEAF DENSITY AND SPREAD APPROPRIATE TO THE SPECIES AS DEFINED BY THE AMERICAN ASSOCIATION OF NURSERYMEN (AAN) STANDARDS. ALL TREES SHALL BE BALL AND BURLAP OR EQUIVALENT. TO ACHIEVE A MORE NATURAL LANDSCAPE CHARACTER, ALL TREES & LARGE SHRUBS OF THE SAME VARIETY SHALL BE INSTALLED IN A RANGE OF SIZES, WHILE STILL MEETING THE MINIMUM SIZE REQUIREMENTS OUTLINED IN THE PLANT SCHEDULE.
2. IRRIGATION: ALL LANDSCAPE AREAS WITHIN THE SITE INCLUDING SHRUB BEDS AND TREE AREAS SHALL BE IRRIGATED WITH AN AUTOMATIC IRRIGATION SYSTEM. THE IRRIGATION PLAN MUST BE REVIEWED AND APPROVED BY THE ADAMS COUNTY WATER UTILITIES DEPARTMENT PRIOR TO THE ISSUANCE OF A BUILDING PERMIT. ALL SHRUB BEDS AND TREES SHALL BE IRRIGATED WITH AN AUTOMATIC DRIP (TRICKLE) IRRIGATION SYSTEM, OR WITH AN ACCEPTABLE ALTERNATIVE APPROVED BY ADAMS COUNTY WITH THE IRRIGATION PLANS. THE IRRIGATION SYSTEM SHALL BE ADJUSTED TO MEET THE WATER REQUIREMENTS OF THE INDIVIDUAL PLANT MATERIAL AND INCLUDE AN AUTOMATIC RAIN SENSOR.
3. TOPSOIL: TO THE MAXIMUM EXTENT FEASIBLE, TOPSOIL THAT IS REMOVED DURING CONSTRUCTION ACTIVITY SHALL BE CONSERVED FOR LATER USE ON AREAS REQUIRING REVEGETATION AND LANDSCAPING.
4. SOIL AMENDMENTS: SOIL AMENDMENTS SHALL BE PROVIDED AND DOCUMENTED IN ACCORDANCE WITH ADAMS COUNTY STANDARDS. THE SOIL IN ALL LANDSCAPE AREAS, INCLUDING PARKWAYS AND MEDIANS, SHALL BE THOROUGHLY LOOSENED TO A DEPTH OF NOT LESS THAN EIGHT(8) INCHES AND SOIL AMENDMENT SHALL BE THOROUGHLY INCORPORATED INTO THE SOIL OF ALL LANDSCAPE AREAS TO A DEPTH OF AT LEAST SIX(6) INCHES BY TILLING, DISCING OR OTHER SUITABLE METHOD, AT A RATE OF AT LEAST THREE (3) CUBIC YARDS OF SOIL AMENDMENT PER ONE THOUSAND (1,000) SQUARE FEET OF LANDSCAPE AREA. PRIOR TO THE ISSUANCE OF ANY CERTIFICATE OF OCCUPANCY, A WRITTEN CERTIFICATION MUST BE SUBMITTED TO THE COUNTY THAT ALL PLANTED AREAS, OR AREAS TO BE PLANTED, HAVE BEEN THOROUGHLY LOOSENED AND THE SOIL AMENDED, CONSISTENT WITH THE REQUIREMENTS SET FORTH IN THE ADAMS COUNTY MUNICIPAL CODE.
5. INSTALLATION AND GUARANTEE: ALL LANDSCAPING SHALL BE INSTALLED ACCORDING TO SOUND HORTICULTURAL PRACTICES IN A MANNER DESIGNED TO ENCOURAGE QUICK ESTABLISHMENT AND HEALTHY GROWTH.
6. MAINTENANCE: TREES AND VEGETATION, IRRIGATION SYSTEMS, FENCES, WALLS AND OTHER LANDSCAPE ELEMENTS WITH THESE FINAL PLANS SHALL BE CONSIDERED AS ELEMENTS OF THE PROJECT IN THE SAME MANNER AS PARKING, BUILDING MATERIALS AND OTHER SITE DETAILS. THE APPLICANT, LANDOWNER OR SUCCESSORS IN INTEREST SHALL BE JOINTLY AND SEVERALLY RESPONSIBLE FOR THE REGULAR MAINTENANCE OF ALL LANDSCAPING ELEMENTS IN GOOD CONDITION. ALL LANDSCAPING SHALL BE MAINTAINED FREE FROM DISEASE, PESTS, WEEDS AND LITTER, AND ALL LANDSCAPE STRUCTURES SUCH AS FENCES AND WALLS SHALL BE REPAIRED AND REPLACED PERIODICALLY TO MAINTAIN A STRUCTURALLY SOUND CONDITION.
7. REPLACEMENT: ANY LANDSCAPE ELEMENT THAT DIES, OR IS OTHERWISE REMOVED, SHALL BE PROMPTLY REPLACED IN ACCORDANCE WITH THE REQUIREMENTS OF THESE PLANS.
8. ALL STREET TREES SHALL BE PLACED A MINIMUM TEN (10) FEET AWAY FROM THE EDGES OF DRIVEWAYS AND ALLEYS.
9. PLACEMENT OF ALL LANDSCAPING SHALL BE IN ACCORDANCE WITH THE SIGHT DISTANCE CRITERIA AS SPECIFIED BY ADAMS COUNTY. NO STRUCTURES OR LANDSCAPE ELEMENTS GREATER THAN 30" SHALL BE ALLOWED WITHIN THE SIGHT DISTANCE TRIANGLE OR EASEMENTS WITH THE EXCEPTION OF DECIDUOUS TREES PROVIDED THAT THE LOWEST BRANCH IS AT LEAST 6' FROM GRADE. ANY FENCES WITHIN THE SIGHT DISTANCE TRIANGLE OR EASEMENT MUST BE NOT MORE THAN 42" IN HEIGHT AND OF AN OPEN DESIGN.
10. THE FINAL LANDSCAPE PLAN SHALL BE COORDINATED WITH ALL OTHER FINAL PLAN ELEMENTS SO THAT THE PROPOSED GRADING, STORM DRAINAGE, AND OTHER DEVELOPMENT IMPROVEMENTS DO NOT CONFLICT WITH NOR PRECLUDE INSTALLATION AND MAINTENANCE OF LANDSCAPE ELEMENTS ON THIS PLAN.
11. MINOR CHANGES IN SPECIES AND PLANT LOCATIONS MAY BE MADE DURING CONSTRUCTION -- AS REQUIRED BY SITE CONDITIONS OR PLANT AVAILABILITY. OVERALL QUANTITY, QUALITY, AND DESIGN CONCEPT MUST BE CONSISTENT WITH THE APPROVED PLANS. IN THE EVENT OF CONFLICT WITH THE QUANTITIES INCLUDED IN THE PLANT LIST, SPECIES AND QUANTITIES ILLUSTRATED SHALL BE PROVIDED. ALL CHANGES OF PLANT SPECIES AND LOCATION MUST HAVE WRITTEN APPROVAL BY THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
12. A PLANTING PERMIT IS REQUIRED AND MUST BE OBTAINED PRIOR TO THE INSTALLATION OF ANY PLANT MATERIAL ON PUBLIC RIGHT-OF-WAY (ROW).

LANDSCAPE PLANTING DETAILS

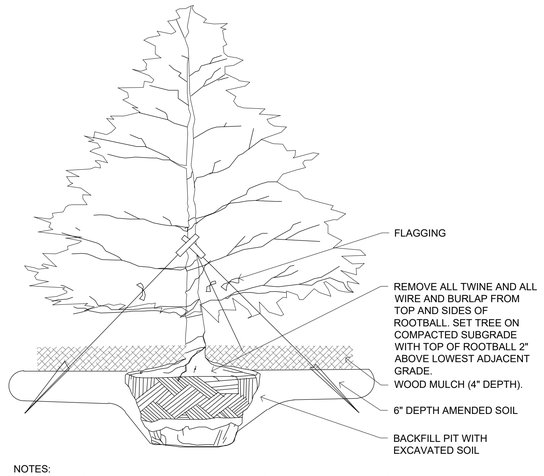


1 Shrub Bed Perimeter
SCALE: N.T.S.



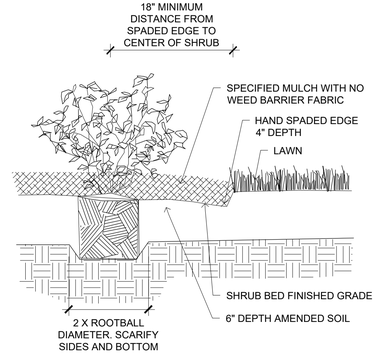
NOTES:
1. STAKE TREES USING METAL POSTS WIRED, SLIGHTLY TAUT, WITH NYLON STRAPS.
2. SET POSTS VERTICALLY PLUMB.
3. NO RUBBER HOUSES ALLOWED.

2 Deciduous Tree Planting
SCALE: N.T.S.



NOTES:
1. GUY ALL CONIFER TREES AND ALL DECIDUOUS TREES LARGER THAN 2½" CAL. AS SHOWN.
2. IN SODDED AREAS, CUT SOD IN 36" CIRCLE AND MULCH. FOR CONIFERS CUT SOD AT DRIP LINE OF TREE AND MULCH.
3. GUY EVERGREEN TREES IN 3 PLACES AT 45 DEGREE ANGLE SLIGHTLY TAUT ONLY TO ALLOW SOME MOVEMENT. USE NYLON STRAPS (NOT HOSES) WITH METAL GROMMETS.

3 Evergreen Tree Planting
SCALE: N.T.S.



NOTES:
1. PLACE SHRUBS A MINIMUM OF 18" FROM PLANTING BED EDGE (STEEL HEADER, CURBS, WALKS, WALLS, ETC.) FOR 1 GALLON SHRUBS, 3' MINIMUM FOR 5 GALLON DECIDUOUS SHRUBS, 4' FOR CONIFER SHRUB.
2. FOR 5 GALLON AND LARGER PLANT MATERIAL CONSTRUCT A 2" HIGH WATERING RING AROUND SHRUB AT EDGE OF PLANTING PIT. FOR 1 GALLON MATERIAL, CONSTRUCT A 2" X 18" DIA. WATER RING AND MULCH INSIDE OF THE WATER RING.

4 Shrub Planting
SCALE: N.T.S.

www.tfgdesign.com
FRONTERRA
LANDSCAPE ARCHITECTURE
PLANNING

TFG Design, LLC
P.O. Box
Loveland CO 80539
(970) 669.3737
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OWNER:
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5895 W 56th Avenue
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303.888.8802
marko@macinvestmentgroup.com

LOWELL DEVELOPMENT
SITE DEVELOPMENT PLAN
5602 LOWELL BOULEVARD
DENVER, COLORADO 80221
ADAMS COUNTY

PROJECT INFORMATION:
PROJECT NUMBER: 295-2203AD
DATE: 07.10.2023
PHASE: SDP

REVISIONS:

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SHEET TITLE:
LANDSCAPE DETAILS & NOTES

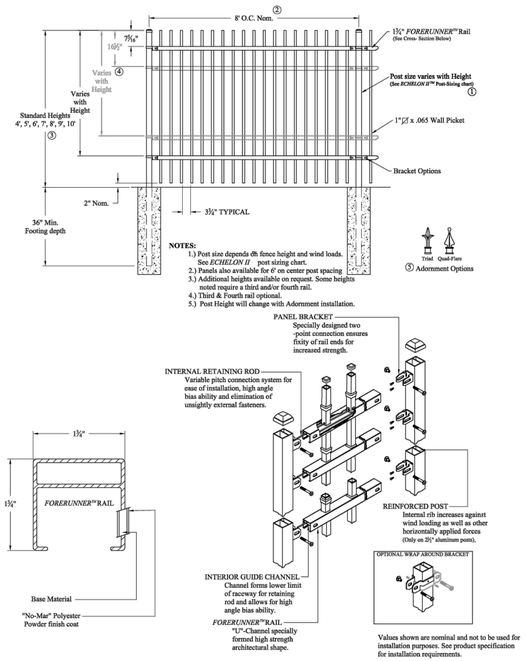
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L4.0

SHEET 8 OF 10

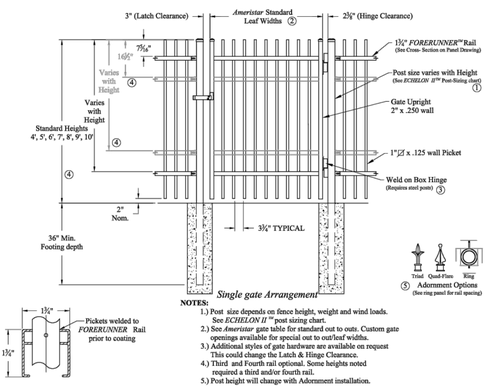
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PLOT DATE: 10/24/2023 8:09 AM
File LOCATION: Z:\Shared Projects\06 Asher Architecture\295-2203AD Lowell Development\Arch\DWG\1 SDP\SHEETS\Landscape\L4.0 LANDSCAPE DETAILS.dwg

SITE DEVELOPMENT PLAN
LOWELL DEVELOPMENT

MAJOR SUBDIVISION & REZONING
SITE DETAILS
DENVER, COUNTY OF ADAMS, STATE OF COLORADO
SHEET 9 OF 10

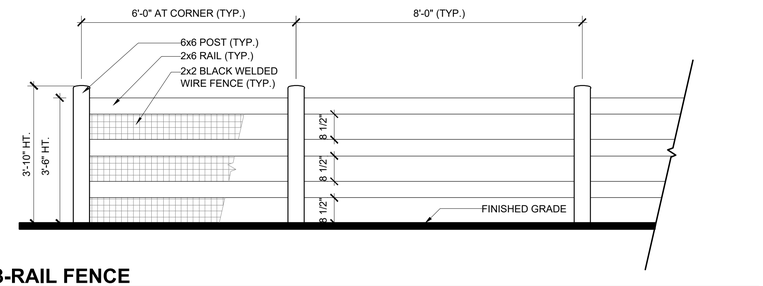


1 ALUMINUM RAIL FENCE
SCALE: NTS

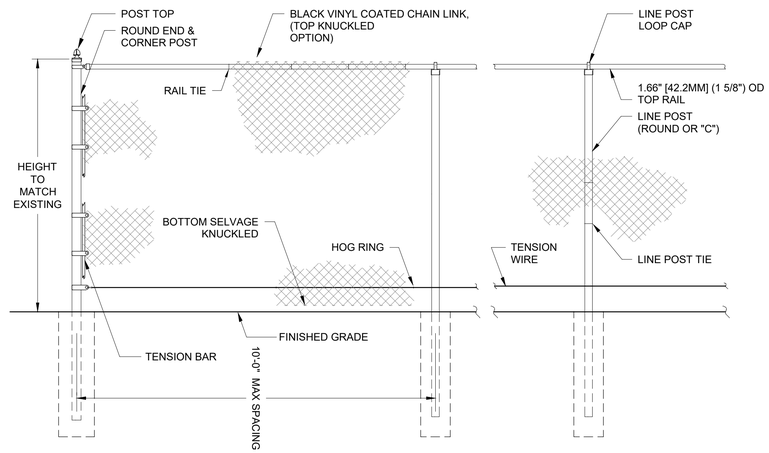


2 ALUMINUM RAIL GATE (SELF-LATCHING)
SCALE: NTS

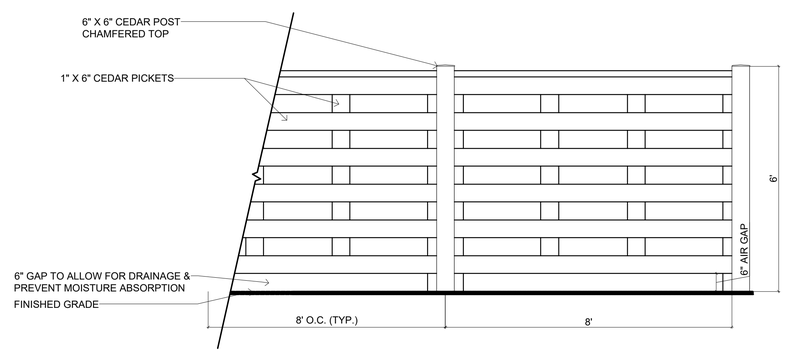
NOTES:
1. WELDED WIRE TO BE ATTACHED TO INSIDE SURFACE (LOT SIDE) OF RAIL FENCE FOR CHILD SAFETY REASONS.
2. ALL WOOD TO BE CEDAR, SANDED AND SEALED WITH WATER-BASED PENETRATING STAIN, COLOR TO BE LIGHT GRAY.



3 3-RAIL FENCE
SCALE: NTS

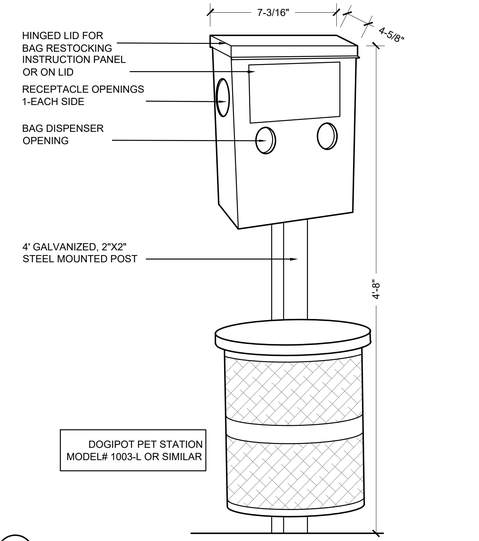


4 BLACK VINYL COATED CHAIN LINK FENCE
SCALE: NTS



5 PRIVACY FENCE
SCALE: NTS

NOTE: ALL WOOD TO BE SANDED AND SEALED WITH WATER-BASED PENETRATING STAIN



6 PET STATION WITH TRASH CONTAINER
SCALE: NTS

NOTE: ALL FENCES TO BE STEPPED TO ACCOMODATE GRADE CHANGE

811

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5602 Lowell LLC
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Arvada, Colorado 80002
303.888.8802
marko@macinvestmentgroup.com

LOWELL DEVELOPMENT

SITE DEVELOPMENT PLAN

5602 LOWELL BOULEVARD
DENVER, COLORADO 80221

ADAMS COUNTY

PROJECT INFORMATION:
PROJECT NUMBER: 295-2203AD
DATE: 07.10.2023
PHASE: SDP

REVISIONS:

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SHEET TITLE:
SITE DETAILS

SHEET NUMBER:
L5.0

SHEET 9 OF 10

DRAWN BY: wra
PLOT DATE: 11/21/2023 9:00 AM
FILE LOCATION: Z:\Shared\Projects\06 Active Architects\295-2203AD Lowell Development\Arch\ACAD\01 SDP\DWGs\Landscape\L5.0 SITE DETAILS.dwg

LOWELL DEVELOPMENT SUBDIVISION
PRELIMINARY PLAT

CASE # plt2023-00001

A REPLAT OF LOT 2, SPANO SUBDIVISION AND LOTS 1 AND 2, CALABRESE SUBDIVISION
BEING PART OF THE SOUTHWEST QUARTER OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M.
COUNTY OF ADAMS, STATE OF COLORADO
SHEET 1 OF 3

OWNERSHIP AND DEDICATION CERTIFICATE:

THE UNDERSIGNED, BEING THE OWNER(S), OF CERTAIN LANDS IN THE COUNTY OF ADAMS, COLORADO, DESCRIBED AS FOLLOWS:

A PARCEL OF LAND LOCATED IN THE SOUTHWEST QUARTER OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH PRINCIPAL MERIDIAN, BEING LOT 2, SPANO SUBDIVISION RECORDED FEBRUARY 2, 2005 AT RECEPTION NO. 20050202000110370, EXCEPT THAT PORTION OF LOT 2 DEEDED TO ADAMS COUNTY IN WARRANTY DEED RECORDED MAY 18, 2016 AT RECEPTION NO. 2016000038603, TOGETHER WITH LOTS 1 AND 2, CALABRESE SUBDIVISION, RECORDED FEBRUARY 2, 2005 AT RECEPTION NO. 20050202000110270, COUNTY OF ADAMS, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST CORNER OF SAID SECTION 8; THENCE N00°12'28"W ALONG THE WEST LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 8 A DISTANCE OF 543.31 FEET; THENCE N88°41'00"E A DISTANCE OF 30.07 FEET TO A POINT ON THE EAST RIGHT OF WAY LINE OF LOWELL BOULEVARD, SAID POINT BEING THE POINT OF BEGINNING; THENCE N00°12'27"W ALONG SAID EAST LINE A DISTANCE OF 577.60 FEET; THENCE N89°49'04"E ALONG THE SOUTH LINE OF LOT 1 OF SAID SPANO SUBDIVISION A DISTANCE OF 218.66 FEET; THENCE N00°12'28"W ALONG THE EAST LINE OF SAID LOT 1 A DISTANCE OF 208.71 FEET; THENCE S89°49'04"W ALONG THE NORTH LINE OF SAID LOT 1 A DISTANCE OF 208.72 FEET TO A POINT ON SAID EAST RIGHT OF WAY LINE; THENCE N00°12'28"W ALONG SAID EAST LINE A DISTANCE OF 280.62 FEET; THENCE ALONG THE BOUNDARIES OF SAID CALABRESE SUBDIVISION AND SAID SPANO SUBDIVISION FOR THE FOLLOWING TWENTY TWO (22) COURSES:
1) S85°59'58"E A DISTANCE OF 619.06 FEET; 2) S00°13'52"E A DISTANCE OF 156.99 FEET;
3) N89°47'39"E A DISTANCE OF 571.37 FEET; 4) N21°27'40"E A DISTANCE OF 385.02 FEET;
5) N69°04'18"E A DISTANCE OF 180.26 FEET; 6) N52°55'06"E A DISTANCE OF 132.02 FEET;
7) S38°28'05"W A DISTANCE OF 102.19 FEET; 8) S55°34'27"W A DISTANCE OF 226.57 FEET;
9) S18°42'43"W A DISTANCE OF 77.83 FEET; 10) S22°15'22"W A DISTANCE OF 51.72 FEET;
11) S06°30'23"W A DISTANCE OF 68.57 FEET; 12) S09°10'46"E A DISTANCE OF 99.23 FEET;
13) S13°21'07"W A DISTANCE OF 129.99 FEET; 14) S34°06'14"W A DISTANCE OF 70.25 FEET;
15) S43°13'43"W A DISTANCE OF 187.11 FEET; 16) S55°02'17"W A DISTANCE OF 74.97 FEET;
17) S24°16'14"W A DISTANCE OF 74.95 FEET; 18) S24°06'07"W A DISTANCE OF 85.02 FEET;
19) S00°10'09"E A DISTANCE OF 47.43 FEET; 20) S00°10'52"E A DISTANCE OF 53.79 FEET;
21) S35°03'08"W A DISTANCE OF 299.61 FEET; 22) S88°41'00"W A DISTANCE OF 827.14 FEET TO THE POINT OF BEGINNING;

CONTAINING 1,019,731 SQUARE FEET OR 23.410 ACRES, MORE OR LESS.

HAVE BY THESE PRESENTS LAID OUT, PLATTED, AND SUBDIVIDED THE SAME INTO LOTS, AND DEDICATED ALL EASEMENTS, AS SHOWN ON THIS PLAT, UNDER THE NAME AND STYLE OF LOWELL DEVELOPMENT SUBDIVISION PRELIMINARY PLAT. ALL PUBLIC STREETS ARE HEREBY DEDICATED TO ADAMS COUNTY FOR PUBLIC USE. THE UNDERSIGNED DOES HEREBY DEDICATE, GRANT AND CONVEY TO ADAMS COUNTY THOSE PUBLIC EASEMENTS AS SHOWN ON THE PLAT; AND FURTHER RESTRICTS THE USE OF ALL PUBLIC EASEMENTS TO ADAMS COUNTY AND/OR ITS ASSIGNS, PROVIDED HOWEVER, THAT THE SOLE RIGHT AND AUTHORITY TO RELEASE OR QUIT CLAIM ALL OR ANY SUCH PUBLIC EASEMENTS SHALL REMAIN EXCLUSIVELY VESTED IN ADAMS COUNTY.

EXECUTED THIS _____ DAY OF THE MONTH OF _____ A.D. 20___.

OWNER: LOT 2, SPANO SUBDIVISION
SPANO FAMILY HOLDING, LLC

_____
BY: ANTHONY SPANO

ACKNOWLEDGMENT:

STATE OF COLORADO)
)ss
COUNTY OF _____)

KNOW ALL MEN BY THESE PRESENTS THAT THE FOREGOING DEDICATION WAS ACKNOWLEDGED BEFORE ME THIS _____ DAY OF THE MONTH OF _____, A.D., 20___.

BY ANTHONY SPANO AS MANAGER OF THE SPANO FAMILY HOLDINGS, LLC

MY COMMISSION EXPIRES _____ WITNESS MY HAND AND SEAL

_____.
NOTARY PUBLIC

OWNER: LOTS 1 AND 2, CALABRESE SUBDIVISION
5602 LOWELL, LLC

_____
MARKO S. MACKOVIC

ACKNOWLEDGMENT:

STATE OF COLORADO)
)ss
COUNTY OF _____)

KNOW ALL MEN BY THESE PRESENTS THAT THE FOREGOING DEDICATION WAS ACKNOWLEDGED BEFORE ME THIS _____ DAY OF THE MONTH OF _____, A.D., 20___.

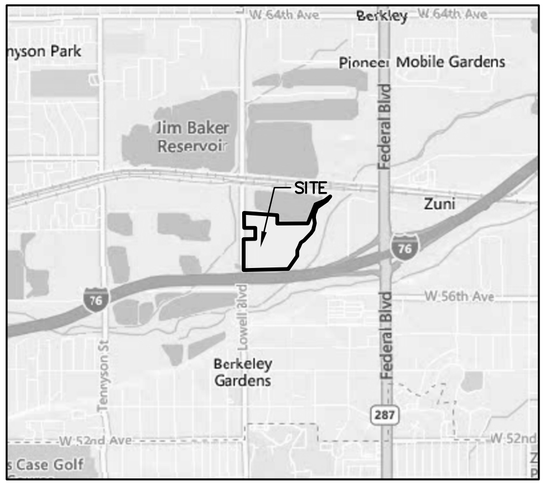
BY MARKO S. MACKOVIC AS MEMBER/MANAGER OF 5602 LOWELL, LLC

MY COMMISSION EXPIRES _____ WITNESS MY HAND AND SEAL

_____.
NOTARY PUBLIC

VICINITY MAP

SCALE: 1" = 2000'



STORM DRAINAGE FACILITIES STATEMENT:

THE POLICY OF THE COUNTY REQUIRES THAT MAINTENANCE ACCESS SHALL BE PROVIDED TO ALL STORM DRAINAGE FACILITIES TO ASSURE CONTINUOUS OPERATIONAL CAPABILITY OF THE SYSTEM. THE PROPERTY OWNERS SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL DRAINAGE FACILITIES INCLUDING INLETS, PIPES, CULVERTS, CHANNELS, DITCHES, HYDRAULIC STRUCTURES, AND DETENTION BASINS LOCATED ON THEIR LAND UNLESS MODIFIED BY THE SUBDIVISION DEVELOPMENT AGREEMENT. SHOULD THE OWNER FAIL TO MAINTAIN SAID FACILITIES, THE COUNTY SHALL HAVE THE RIGHT TO ENTER SAID LAND FOR THE SOLE PURPOSE OF OPERATIONS AND MAINTENANCE. ALL SUCH MAINTENANCE COST WILL BE ASSESSED TO THE PROPERTY OWNERS.

SURVEYOR'S CERTIFICATE:

I, JOHN P. EHRHART, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAT WAS MADE UNDER MY SUPERVISION AND THE MONUMENTS SHOWN HEREON ACTUALLY EXIST AND THIS PLAT ACCURATELY REPRESENTS SAID SURVEY MADE ON JULY 14, 2021.

_____
JOHN P. EHRHART
COLORADO P.L.S. #29414
EHRHART LAND SURVEYING, LLC

PLANNING COMMISSION APPROVAL:

RECOMMENDED FOR APPROVAL BY THE ADAMS COUNTY PLANNING COMMISSION ON THIS _____DAY OF _____,20___.

_____
CHAIR

BOARD OF COUNTY COMMISSIONERS APPROVAL:

APPROVED BY THE ADAMS COUNTY BOARD OF COMMISSIONERS ON THIS _____ _____DAY OF _____,20___.

_____
CHAIR

ADAMS COUNTY ATTORNEY'S OFFICE:

_____
APPROVED AS TO FORM

NOTES:

1) THIS PURPOSE OF THIS PLAT IS TO SUBDIVIDE THE EXISTING PROPERTIES INTO 2 LOTS, AS SHOWN HEREON.

2) THIS PLAT DOES NOT CONSTITUTE A TITLE SEARCH BY EHRHART LAND SURVEYING, LLC TO DETERMINE OWNERSHIP OF THIS TRACT, OR VERIFY EASEMENTS OF RECORD. REFERENCE IS MADE TO FIRST AMERICAN TITLE INSURANCE COMPANY FILE NO. TOC-30364-A REVISION NO. 3 WITH A COMMITMENT DATE OF AUGUST 3, 2021, AND FIDELITY NATIONAL TITLE FILE NO. 100-N0035233-010-TO2, AMENDMENT NO. 4 WITH ANA AMENDMENT DATE OF NOVEMBER 15, 2023, FROM WHICH THIS SURVEY IS BASED. THIS PROPERTY IS SUBJECT TO ALL COVENANTS AND RESTRICTIONS RELATING TO THE USE AND CHARACTER OF THE LAND AND ALL MATTERS APPEARING OF PUBLIC RECORD AND AS MAY BE DISCLOSED BY A MORE RECENT TITLE COMMITMENT OR REPORT.

3) LINEAL UNITS USED ARE U.S. SURVEY FEET. THE U.S. SURVEY FOOT IS DEFINED AS 1200/3937 METERS.

4) BASIS OF BEARINGS: THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 8, BEARING N00°12'28"W (ASSUMED), A DISTANCE OF 2633.71 FEET, MONUMENTED AS SHOWN HEREON.

5) ALL RIGHT-OF-WAY AND LOT AND BLOCK INFORMATION WAS TAKEN FROM THE PLAT OF CALABRESE SUBDIVISION RECORDED FEBRUARY 2, 2005 AT RECEPTION NO. 20050202000110270; AND THE PLAT OF SPANO SUBDIVISION RECORDED FEBRUARY 2, 2005 AT RECEPTION NO. 20050202000110370.

6) NOTICE: ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE SURVEYOR'S STATEMENT SHOWN HEREON.

7) PER THE STATE OF COLORADO BOARD OF LICENSURE FOR ARCHITECTS, PROFESSIONAL ENGINEERS, AND PROFESSIONAL LAND SURVEYORS RULE 1.6.B.2, THE WORD "CERTIFY" AS USED HEREON MEANS AN EXPRESSION OF PROFESSIONAL OPINION AND DOES NOT CONSTITUTE A WARRANTY OR GUARANTEE, EXPRESSED OR IMPLIED. THE SURVEY REPRESENTED HEREON HAS BEEN PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION IN ACCORDANCE WITH APPLICABLE STANDARDS OF PRACTICE AND IS BASED UPON MY KNOWLEDGE, INFORMATION AND BELIEF.

8) CONFLICTING BOUNDARY EVIDENCE: THE CONCRETE PATH CROSSES THE PROPERTY, AS PLATTED, ALONG THE EAST BOUNDARY. THE PLAT DEFINES IT'S BOUNDARY AS RELATED TO TRACTS SHOWN ON A MAP IN A WARRANTY DEED RECORDED NOVEMBER 10, 1930 AT RECEPTION NO. 164420. THE MAP IN QUESTION IS REFERENCED AS BOOK 191, PAGE 471. SOME OF THE NUMBERS ON THE MAP ARE DIFFICULT TO READ AND THE LOCATION OF THE TRACTS IS NOT CERTAIN, WHICH MAY BE THE SOURCE OF SOME OF THESE ENCROACHMENTS. IN ADDITION, MANY EASEMENTS SHOWN ON THE PLAT AND ON THIS SURVEY ARE ALSO REFERENCED TO THESE TRACTS, CREATING A POSSIBLE DISCREPANCY IN THEIR LOCATIONS AS WELL, AND MAY EXPLAIN WHY THE EASEMENTS, AS PLATTED, DO NOT COVER THE UTILITIES THAT THEY ARE INTENDED TO BENEFIT. THE BOUNDARY AND THE EASEMENTS ARE SHOWN AS DELINEATED ON THE PLAT.

9) FLOOD ZONE CLASSIFICATION: CURRENTLY, THE SUBJECT PROPERTY IS LOCATED IN "FLOODWAY AREAS IN ZONE AE (FLOODPLAIN AREA THAT MUST BE KEPT FREE OF ENCROACHMENT SO THAT THE 1% ANNUAL CHANCE FLOOD CAN BE CARRIED WITHOUT SUBSTANTIAL INCREASE IN FLOOD HEIGHTS)", AND "ZONE X (AREAS OF LESS THAN 0.2% ANNUAL CHANCE FLOOD)" PER FLOOD INSURANCE RATE MAP FOR ADAMS COUNTY, COLORADO AND INCORPORATED AREAS, MAP NUMBER 08001C0591H, REVISED MARCH 5, 2007. THE LINES SHOWN HEREON REPRESENT THE NEW LIMITS OF THE FLOODPLAIN AROUND THE SUBJECT PROPERTY, AS DETERMINED FOR THE OWNER BY LOEWEN ENGINEERING INC AND SUBMITTED TO FEMA ON NOVEMBER 18, 2022, FEMA CASE NO. 23-08-0122R.

RECORDER'S CERTIFICATE:

STATE OF COLORADO)
)ss
COUNTY OF ADAMS)

I HEREBY CERTIFY THAT THIS INSTRUMENT WAS FILED FOR RECORD IN MY OFFICE ON THE _____ DAY OF _____, 20___

AT _____ O'CLOCK ___M., RECEPTION No. _____

CLERK AND RECORDER

BY: _____
DEPUTY

BY: _____

REVISIONS	
1	11/16/23
2	1/23/24

EHRHART LAND SURVEYING
P.O. Box 930 • Erie, Colorado 80516
(303) 828-3340 • www.coloradols.com

ELS PROJECT NO.	**S225088**
DATE:	1/23/24
DRAWN BY:	JPE
CHECKED BY:	JMH

LOWELL DEVELOPMENT SUBDIVISION
PRELIMINARY PLAT

A REPLAT OF LOT 2, SPANO SUBDIVISION AND LOTS 1 AND 2, CALABRESE SUBDIVISION
BEING PART OF THE SOUTHWEST QUARTER OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M.
COUNTY OF ADAMS, STATE OF COLORADO
SHEET 2 OF 3

CASE # plt2023-00001

W 1/4 COR. SEC. 8
#6 REBAR WITH 2.5" ALUMINUM CAP IN RANGE BOX, LS 23500

NORTH
SCALE: 1" = 100'
0 50 100 200

OWNER: CAROL HUDAK AND EDDIE ARTHUR BOHN
LAKE
OWNER: GILPIN INDUSTRIAL LLC
UNPLATTED
S85°59'58"E 619.06'(M&P)
FOUND 1.5" ALUMINUM CAP PLS 29414 50' WC
100-YEAR FLOODPLAIN SEE FLOOD ZONE NOTE
N81°00'42"E 9.54'(M) S86°00'32"E 10.03'(P)
N00°12'28"W 280.62'(M)
S01°13'52"E 156.99'(M) 157.00'(P)
OWNER: CAROL HUDAK AND EDDIE ARTHUR BOHN
LAKE
N89°47'39"E 571.37'(M) 571.42'(P)
N52°55'06"E 132.02'(M) 132.08'(P)
N69°04'18"E 180.26'(M) 180.30'(P)
S38°28'05"W 102.19'(M) 102.21'(P)
S55°34'27"W 226.57'(M) 226.67'(P)
N21°27'40"E 385.02'(M) 385.06'(P)
S18°42'43"W 77.83'(M) 77.84'(P)
S22°15'22"W 51.72'(M) 51.73'(P)
S06°30'23"W 68.57'(M) 68.58'(P)
S09°10'46"E 99.23'(M) 99.18'(P)
S13°21'07"W 129.99'(M) 130.02'(P)
S34°06'14"W 70.25'(M) 70.48'(P)
S43°13'43"W 187.11'(M) 187.06'(P)
S55°02'17"W 74.97'(M)
S24°16'14"W 74.95'(M) 74.98'(P)
S24°06'07"W 85.02'(M) 85.03'(P)
S00°10'09"E 47.43'(M) 47.36'(P)
S00°10'52"E 53.79'(M) 53.88'(P)
299.61'(M) 300.76'(P) S35°03'08"W
OWNER: COUNTY OF ADAMS

EXCEPTED PORTION OF LOT 2 REC 2016000038603 5/18/16
76'
90'
LOWELL BLVD. RIGHT OF WAY VARIES
S89°49'04"W 208.72'(M) 208.71'(P)
N00°12'28"W 208.71'(M&P)
LOT 1 SPANO SUBDIVISION NOT A PART
LOT 2, SPANO SUB.
LOT 2 10.559 ACRES 459,968 SQ. FT.
EASEMENT (APPROX.) BK 1099, PG 232 AND REC 20050202000110370 AS SHOWN ON PLAT
40
9.94'
N89°49'04"E 218.66'(M) 218.71'(P)
S89°47'13"W 934.83'
80'
LOT 1 CALABRESE SUB.
LOT LINES VACATED BY THIS PLAT
SEE SHEET 3 FOR EASEMENT DETAILS
PORTION OF LOT 2 SPANO SUB. (VACATED BY THIS PLAT)
EASEMENT (APPROX.) BK 2842, PG 37, 2/21/84 AS SHOWN ON PLAT
EASEMENT (APPROX.) BK 1099, PG 232, 9/25/63 AS SHOWN ON PLAT
EASEMENT (APPROX.) BK 2842, PG 42, 2/21/84 AS SHOWN ON PLAT
BASIS OF BEARINGS W LINE SW 1/4 SEC. 8 N00°12'28"W 2633.71'
LOT 1 12.850 ACRES 559,763 SQ. FT.
N00°12'27"W 577.60'(M) 577.64'(P)
LOT 2, CALABRESE SUB.
100-YEAR FLOODPLAIN SEE FLOOD ZONE NOTE
30'
EASEMENT BK 5188, PG 706, 12/22/97
20' ACCESS & UTILITY EASEMENT BK 5157, PG 658, 11/14/97 BK 5188, PG 706, 12/22/97
POINT OF BEGINNING
827.14'(M)
S88°41'00"W
20' UTILITY EASEMENT BK 2842, PG 42, 2/21/84 AS SHOWN ON PLAT
N88°41'00"E 30.07'
543.31' N00°12'28"W
I-76 RIGHT-OF-WAY
OWNER: STATE OF COLORADO
SW CORNER SEC 8
#6 REBAR WITH 2.5" ALUMINUM CAP IN RANGE BOX, LS 20699
POINT OF COMMENCEMENT

LEGEND

- FOUND SECTION CORNER AS DESCRIBED
- FOUND 0.75" BRASS DISK & NAIL, ILLEGIBLE
- FOUND #5 REBAR WITH 1.25" YELLOW PLASTIC CAP, LS 6973 – UNLESS NOTED OTHERWISE
- FOUND #5 REBAR WITH 1.25" YELLOW PLASTIC CAP, EHRHART PLS 29414
- CHISELED + IN CONCRETE
- (P) PLATTED DISTANCE
- (M) MEASURED DISTANCE
- WC WITNESS CORNER
- EXTERIOR BOUNDARY LINE
- INTERIOR LOT LINE
- EXISTING EASEMENT
- NEW EASEMENT
- 100-YEAR FLOODPLAIN BOUNDARY

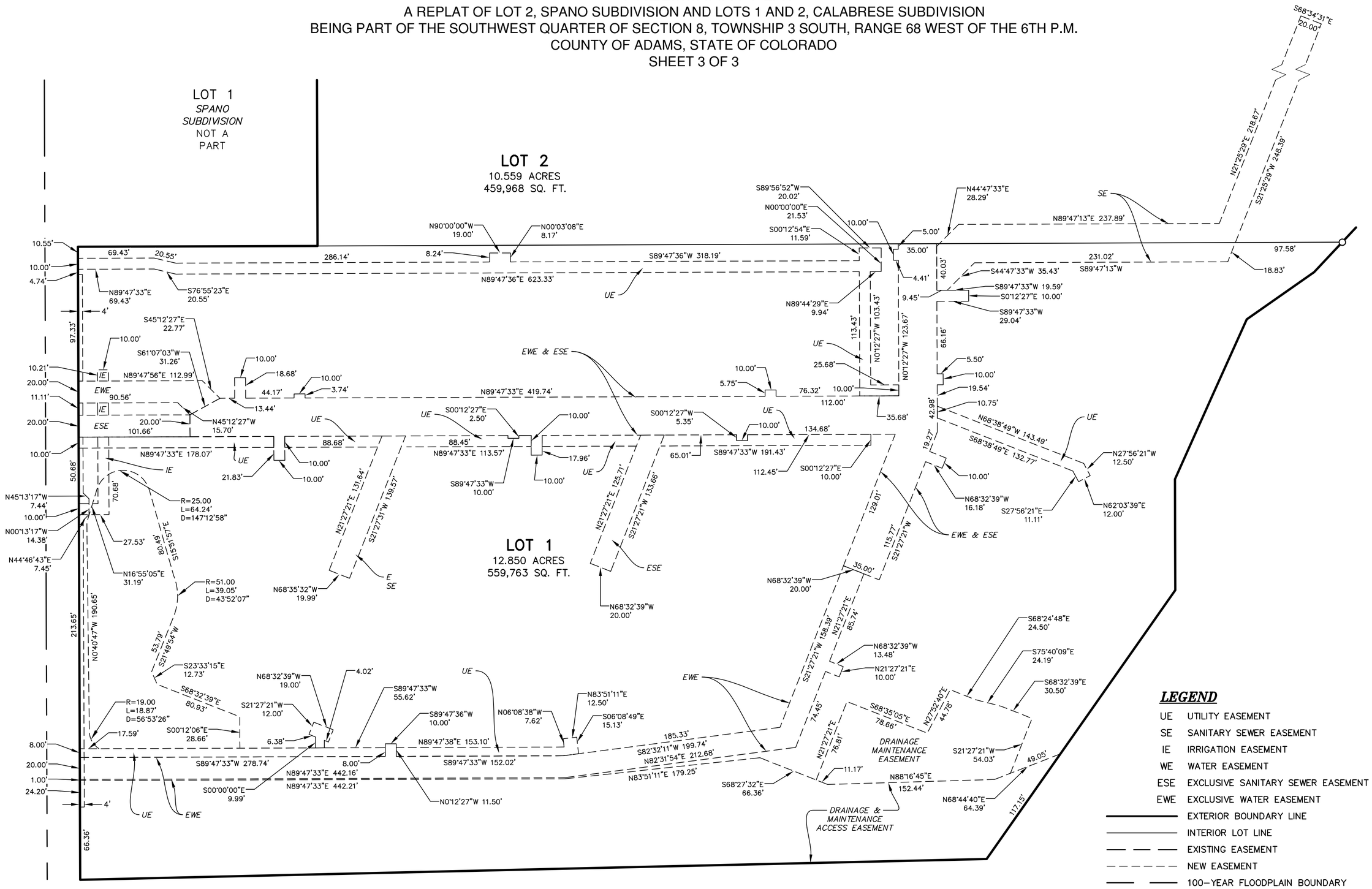
EHRHART LAND SURVEYING
P.O. Box 930 • Erie, Colorado 80516
(303) 828-3340 • www.coloradols.com

ELS PROJECT NO.	S225088
DATE:	1/23/24
DRAWN BY:	JPE
CHECKED BY:	JMH

LOWELL DEVELOPMENT SUBDIVISION
PRELIMINARY PLAT

CASE # plt2023-00001

A REPLAT OF LOT 2, SPANO SUBDIVISION AND LOTS 1 AND 2, CALABRESE SUBDIVISION
BEING PART OF THE SOUTHWEST QUARTER OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M.
COUNTY OF ADAMS, STATE OF COLORADO
SHEET 3 OF 3



LEGEND

UE	UTILITY EASEMENT
SE	SANITARY SEWER EASEMENT
IE	IRRIGATION EASEMENT
WE	WATER EASEMENT
ESE	EXCLUSIVE SANITARY SEWER EASEMENT
EWE	EXCLUSIVE WATER EASEMENT
	EXTERIOR BOUNDARY LINE
	INTERIOR LOT LINE
	EXISTING EASEMENT
	NEW EASEMENT
	100-YEAR FLOODPLAIN BOUNDARY

EHRHART LAND SURVEYING
P.O. Box 930 • Erie, Colorado 80516
(303) 828-3340 • www.coloradols.com

ELS PROJECT NO.	S225088
DATE:	1/23/24
DRAWN BY:	JPE
CHECKED BY:	JMH

CTL|THOMPSON

Founded in 1971

GEOTECHNICAL INVESTIGATION

5602 LOWELL BOULEVARD APARTMENTS
LOT 2 AND A PORTION OF LOT 1, CALABRESE SUBDIVISION, AMENDMENT NO. 1
ADAMS COUNTY, COLORADO

Prepared for:

LOWELL DEVELOPMENT, LLC
5895 West 56th Avenue
Arvada, Colorado 80002

Attention:
TJ Heupel, P.E.

Project No. DN51,902.001-125-R1

June 29, 2023

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SCOPE

This report presents the results of our Geotechnical Investigation for the 5602 Lowell Boulevard Apartments project planned on Lot 2 and a portion of Lot 1, Calabrese Subdivision, Amendment No. 1 in Adams County, Colorado (Fig. 1). The purpose of our investigation was to evaluate the subsurface conditions to provide geotechnical design and construction recommendations for the project. The scope was described in our Service Agreement No. DN 23-0238 dated June 6, 2023. Evaluation of the property for the possible presence of potentially hazardous materials (Environmental Site Assessment) was not included in our scope.

This report was prepared from our understanding of the proposed construction, previous investigation, field exploration and reconnaissance, field and laboratory testing, engineering analysis, and our experience. It includes our opinions and recommendations for design criteria and construction details for foundations, floor systems, pavements, slabs-on-grade, retaining walls, and drainage precautions. The report was prepared for the exclusive use of Lowell Development, LLC in design and construction of the project. Other types of construction may require revision of this report and the recommended design criteria. **Building floor elevations and grading concepts are not known at this time, and will likely impact our recommendations.** A summary of our conclusions and recommendations follows, with the detailed design criteria and construction recommendations being presented within the report.

SUMMARY

1. Strata found in our borings generally consisted of nil to about 23 feet of undocumented fill, nil to 7 feet of native sandy clay, and nil to 16 feet of native sand/gravel underlain by claystone and sandstone bedrock. The fill is believed to be related to export from various CDOT projects over the last decade, and was relatively deeper in borings located on the stockpile outlined on Fig. 2. Bedrock was encountered in 10 borings at depths of about 14 to 33 feet or approximate elevations 5205 to 5210½ feet (Fig. 3). The clay and claystone are considered to be low swelling, and the sand/gravel and sandstone are non-expansive. One natural clay sample from TH-102 showed compressible characteristics. The fill has erratic depth, composition, swell potential and other properties, and is considered compressible and unsuitable for support.

2. Groundwater level was measured in 25 borings at depths of about 5 to 27 feet or approximate elevations 5213½ to 5221½ feet (Fig. 3). Site grades should be designed to avoid creating shallow groundwater conditions. Groundwater will likely be encountered in deep utility excavations. Groundwater levels may fluctuate

seasonally and rise in response to precipitation, landscape irrigation, changes in land-use, and flow in Clear Creek.

3. The presence of expansive and compressible soils and undocumented fill constitutes a geologic hazard. There is risk that slabs-on-grade and foundations may experience heave or settlement, and damage. This site has relatively higher, unquantifiable risk due to uncertainties related to the man-placed fill. We believe the ground improvement techniques recommended in this report will help to reduce risk of damage; they will not eliminate that risk. Slabs-on-grade and, in some instances, foundations may be damaged by soil movements.

4. Helical piles bottomed in bedrock are judged to be the safest foundation system considering the presence of the variable fill. Alternatively, we believe shallow footing or post-tensioned slab-on-grade (PTS) foundations can be used with tolerable post-construction movements provided sub-excavation (removal and recompaction) is performed. At this time, we believe sub-excavation should be performed at least 10 feet below foundations. Existing fill may remain at the base of the sub-excavation, and can be chased at your tolerance and discretion. Leaving fill in-place will increase risk of settlement. The on-site soils are believed to be suitable for re-use as new fill (from a geotechnical standpoint) provided debris, vegetation/organics, and other deleterious materials are removed. Design criteria for footings, PTS, and helical piers foundations are provided in the report.

5. Automobile parking areas can be paved using at least 6½ inches of hot-mix asphalt. Access drives and fire lanes should have at least 7 inches of asphalt. To enhance pavement performance, we advocate sub-excavating and moisture-conditioning at least 5 feet of pavement subgrade. If a less conservative approach is desired, where inches of potential movements are tolerable, 3 feet of sub-excavation can be done. Pavement alternatives and guidelines are provided in the report.

6. Surface drainage should be designed, constructed, and maintained to provide rapid removal of runoff away from the buildings and off pavements and flatwork. Water should not be allowed to pond adjacent to the buildings or on pavements or flatwork. If crawl spaces are used beneath the main floors of the buildings, we recommend installation of perimeter drain systems. A drain is also recommended around the amenity pool.

7. The design and construction criteria for foundations and floor system alternatives in this report were compiled with the expectation that all other recommendations presented related to surface drainage, landscaping irrigation, backfill compaction, etc. will be incorporated into the project and that the owner or property manager will maintain the structures, use prudent irrigation practices and maintain surface drainage. It is critical that all recommendations in this report are followed.

SITE CONDITIONS

The site contains approximately 12.9 acres on Lot 2 and a portion of Lot 1 within Calabrese Subdivision, Amendment No. 1 located northeast of Interstate-76 and Lowell Boulevard in

Adams County, Colorado (Fig. 1 and Photo 1). The site is bordered by a working farm and existing residence to the north, Lowell Boulevard to the west, Clear Creek to the east, and Interstate-76 to the south. The portion of Lot 1 which is not included is currently occupied by a single-family residence at the northwest corner of the site, with detached outbuildings and a flood-irrigated crop field. The majority of the site is an elevated berm or plateau above Clear Creek, and is the result of stockpiling from 2005 to 2020 as export material from CDOT T-Rex/I-25 corridor project and realignment of Sheridan Boulevard. The northwest corner of the stockpile was cut to create a parking lot, and the south half was farmed later. The ground surface across the majority of the site slopes gently to the west, while the east edge slopes moderately down to Clear Creek. Ground cover consists of crops, grasses, weeds, bushes, and small amounts of debris and construction materials. Much of the site was used for agricultural purposes and appear to be irrigated fields.

The parcel previously contained two single-family residences and greenhouses. The residence along the south edge was demolished sometime between 2003 and 2004, while the residence in the middle of the site was demolished in 2008. Two greenhouses were located to the east and west of the central residence. The east structure was demolished sometime between 1999 and 2003, and the west structure between 2003 and 2004. Photo 2 shows the old structures.



Photo 1 – Google Earth© Aerial Site Photo, September 2020



Photo 2 – Google Earth© Aerial Site Photo, October 1999

PROPOSED CONSTRUCTION

According to your Site Plan dated May 9, 2023, the site will be developed with six apartment buildings having footprints of approximately 15,040 square feet, and a clubhouse, pool and maintenance shop at the northeast corner. The apartments will be surrounded by surface parking, access drives, and detached garages, and served by buried utilities and detention at the southeast and southwest corner. Multiple covered structures are planned in the parking areas. The apartment buildings will be four-story, wood-framed structures with no below-grade areas other than potential crawl spaces beneath main floor levels. The clubhouse will be constructed as a two-story, wood-framed structure with the same below-grade condition. Relatively light foundation loads are expected for the buildings. The pool will likely be about 4 to 8 feet deep and be cast-in-place concrete or gunite construction. Tall retaining walls are planned along the east and southeast perimeter of the site. Wall heights will vary from about 5 to 15 feet. Grading plans or building floor elevations have not yet been provided, but we understand finished grades will range from about 5230 to 5235 feet, which implies cut grading at the east end of the stockpile and fill grading to the west of the stockpile. We understand shallow foundation systems with sub-excavation are desired for the structures.

PREVIOUS INVESTIGATIONS

We initially performed a Geotechnical Investigation under Project No. DN43,859-125 and presented results in a report dated December 15, 2008. This study included 11 exploratory borings (TH-1 through TH-3 and S-1 through S-8, with donut shaped boring indicators on Fig. 1). We later provided a Preliminary Geotechnical Investigation under Project No. DN48,539-115 and presented results in a report dated September 23, 2016, which had four additional borings (TH-1 through TH-4). The stockpiles were present on the site during both studies. Strata consisted of nil to 21 feet of undocumented fill and 8 to 15 feet of natural sand and clay, underlain by claystone/sandstone bedrock in three borings. Groundwater was measured at depths of about 5 to 27 feet, shallower outside of the stockpile. The clay and claystone were predominantly low swelling. The primary geologic hazards identified were the presence of undocumented fill and expansive soils/bedrock. It appears additional earthwork operations occurred after our studies, and the site was converted for agricultural uses. For reference, the approximate boring locations from the previous studies are presented on Figs. 1-4, and the summary boring logs are provided in Appendix C.

INVESTIGATION

We investigated subsurface conditions between April 18 and 21, 2023 by drilling and sampling 17 additional exploratory borings at the approximate locations on Fig. 1. The boring locations were selected to provide some spacing from our previous borings. Thirteen borings were drilled for the apartment buildings, and four were located in pavement areas. The building locations shifted, and two additional buildings were added on the latest site plan shown on Fig. 1. Prior to drilling, we contacted the Utility Notification Center of Colorado and local sewer and water districts to identify locations of buried utilities. The building borings were drilled to depths of 25 to 35 feet and the shallow borings in pavement areas were advanced to depths of 5 to 10 feet using 4-inch diameter, continuous-flight solid-stem auger and truck-mounted drill rigs. Frequent bore hole caving occurred within the coarse-grained, native strata, particularly below groundwater.

Samples were obtained at approximate 2 to 5 feet intervals using 2.5-inch diameter (O.D.) modified California barrel samplers or 2.0-inch diameter (O.D.) split-spoon samplers driven by blows from a 140-pound hammer falling 30 inches. Bulk samples of auger cuttings from the upper 5 to 10 feet were also obtained from the shallow pavement borings. The boring locations and elevations were estimated by a representative of our firm using a Leica GS18 GPS unit referencing the NAD83 and NAVD88 systems. Our field representatives were present to observe drilling operations, log the strata encountered, and obtain samples for laboratory testing. Graphical summary logs of the exploratory borings, including results of field penetration resistance tests and a portion of laboratory test results, are presented on Appendix A.

Samples were returned to our laboratory where they were examined, classified, and assigned testing. Laboratory tests included moisture content, dry density, particle-size analysis (gradation, hydrometer, and percent silt and clay-sized particles passing the No. 200 sieve), Atterberg limits, swell-consolidation, soil suction, and water-soluble sulfate concentration. Swell tests were performed by wetting samples under approximate overburden pressure (the pressure exerted by overlying soils). Load-back analysis was performed on select samples to help estimate swelling pressures. Laboratory test results are presented in Appendix B and summarized in Table B-I.

SUBSURFACE CONDITIONS

Strata encountered in our exploratory borings generally consisted of nil to about 23 feet of undocumented fill, nil to 7 feet of native sandy clay, and nil to 16 feet of native sand/gravel underlain by sandstone and claystone bedrock. Some of the pertinent engineering characteristics are described in the following paragraphs.

Undocumented Fill

We believe we encountered about 6 to 23 feet of man-placed fill in 20 borings mostly coinciding with the stockpiled area. The fill depths increased from west-to-east, being about 7 to 12 feet deep in the west portion, and about 14 to 21 feet deep in the east portion. We were informed the fill is likely sourced from the T-Rex/I-25 and Sheridan Boulevard projects, as discussed previously. One boring at the far east edge of the project, S-8, revealed 23 feet of fill, and is east of the stockpiled area; we believe this deep fill is probably related to a deep utility trench adjacent to the Creek, although this is uncertain. The estimated thickness of fill at each boring location and approximate fill-bottom elevations are shown on Fig. 2. The fill depths are based on examination of auger cuttings and drive samples. The fill was difficult to discern from the native clay soils at times, and more or less fill may be present than our borings imply. Although not encountered, existing fill is likely present in the northwest corner of the site, in proximity with the existing residence and farm.

The fill consisted of sandy to very sandy, silty clay with less amounts of clayey sand and gravel, and had erratic composition at times. We believe one fill sample contained an asphalt particle about ½-inch in diameter; no other samples or cuttings had discernable debris materials. The fill was considered to be medium stiff to very stiff or medium dense to dense based on results of field penetration resistance tests. Results from swell-consolidation tests on fill samples were highly variable. Two samples compressed slightly, two did not swell, twelve swelled 2.0 percent or less, and six swelled 2.3 to 7.2 percent when wetted. The average swell of fill samples was about 1.5 percent. Two samples had total suction values of 3.90 and 4.58 pF and developed load-back swelling pressures of approximately 1,800 and 2,400 psf, respectively. Eighteen samples contained 43 to 79 percent silt and clay-sized particles; eight samples showed moderate plasticity and one had high plasticity. One sample contained 60 percent fines and had a clay content of 23 percent (less than about 2-micron particle-size from hydrometer testing).

In many of the borings, the fill showed similar consistency with blow counts ranging from about 20/12 to 40/12. Some of the borings had less stiff fill samples. We believe the fill was placed in an uncontrolled manner due to variable compositions, consistency, and engineering properties. The undocumented fill is considered unsuitable to support proposed construction as-is. For the safest approach, all existing fill present below buildings and other improvements should be mitigated as outlined in **SITE DEVELOPMENT**, unless documentation of fill placement and compaction is provided. The lateral and bottom extents of the fill are likely variable.

Clay

We encountered about 5 to 7 feet of sandy to very sandy clay from the ground surface or below the fill in nine borings. Dark-colored humic bog clay was encountered at a depth of 9 feet in TH-102; we understand this area was flood-irrigated in the past. The clay was medium stiff to very stiff. One sample compressed slightly when wetted. One sample swelled slightly when wetted, and one had a total suction value of 3.68 pF. Three samples contained 51 and 67 percent silt and clay-sized particles, the former sample exhibited moderate plasticity. One sample had a clay content of 26 percent.

Sand and Gravel

We encountered about 4 to 16 feet of clean to silty sand and gravel at the ground surface or below the fill or native soils in all of the borings. The sand/gravel was medium dense to very dense. Thirteen samples contained 3 to 39 percent fines, and three had 46 to 63 percent gravel. The sand/gravel layer caved at in multiple borings near or below groundwater.

Bedrock

Bedrock was encountered in 13 borings at depths ranging from 14 to 33 feet below existing grades, or approximate elevations 5205 to 5210½ (Fig. 3). The bedrock consisted of sandy, silty claystone and clayey sandstone. The bedrock was considered hard to very hard, with two samples having medium hard consistency. A claystone sample swelled slightly when wetted. Two claystone samples contained 65 and 88 percent silt and clay-sized particles and exhibited moderate plasticity. One sandstone sample contained 20 percent silt and clay-sized particles.

Groundwater

Groundwater was encountered during drilling in 23 borings at about 5 to 27 feet below existing grades. When the test holes were checked after drilling, water levels were measured in 26 borings at depths of about 7 to 27 feet or approximate elevations of 5213½ to 5220 (Fig. 4). Relatively shallower water levels were measured in borings located in the west portion of the site, below the stockpile, with depths ranging from about 5 to 13 feet in borings near Buildings 1-4. Water levels in borings on the stockpile were deeper. The groundwater elevation gradient appears to slope gently to the east, toward Clear Creek. Groundwater levels may fluctuate seasonally and rise in response to precipitation, landscape irrigation, changes in land-use, and flow in the adjacent Clear Creek. Site grades should be designed to avoid creating shallow groundwater conditions.

Seismicity

According to the USGS, Colorado's Front Range and eastern plains are considered low seismic hazard zones. The earthquake hazard exhibits higher risk in western Colorado compared to other parts of the state. The Denver Metropolitan area has experienced earthquakes within the past 100 years, shown to be related to deep drilling, liquid injection, and oil/gas extraction. Naturally occurring earthquakes along faults due to tectonic shifts are rare in this area.

The soil and bedrock at this site are not expected to respond unusually to seismic activity. The International Building Code (Section 16.13.2.2) defers the estimation of Seismic Site Classification to ASCE7-22, a structural engineering publication. The table below summarizes ASCE7-22 Site Classification Criteria.

TABLE A
ASCE7-22 SITE CLASSIFICATION CRITERIA

Seismic Site Class	$\bar{v}_s$, Calculated Using Measured or Estimated Shear Wave Velocity Profile (ft/s)
A. Hard Rock	>5,000
B. Medium Hard Rock	>3,000 to 5,000
BC. Soft Rock	>2,100 to 3,000
C. Very Dense Sand or Hard Clay	>1,450 to 2,100
CD. Dense Sand or Very Stiff Clay	>1,000 to 1,450
D. Medium Dense Sand or Stiff Clay	>700 to 1,000
DE. Loose Sand or Medium Stiff Clay	>500 to 700
E. Very Loose Sand or Soft Clay	≥500
F. Soils requiring Site Response Analysis	See Section 20.2.1

Based on the results of our investigation, the reduced, empirically estimated average shear wave velocity values for the upper 100 feet range between 798 and 1264 feet per second, with an average value of 1073 feet per second. We judge a Seismic Site Classification of CD is appropriate. The field penetration test results along with the empirical estimates imply that shear-wave velocity seismic tests to directly measure $\bar{v}_s$ would not likely result in a better Seismic Site Classification. The subsurface conditions indicate moderate susceptibility to liquefaction from a materials and groundwater perspective. Based on the relatively low cyclic stresses and rare earthquake occurrences anticipated at the site, the risk of liquefaction is considered low.

GEOLOGIC HAZARDS

Colorado is a challenging location to practice geotechnical engineering. The climate is relatively dry, and the near-surface soils are typically dry and comparatively stiff. These soils and related sedimentary bedrock formations tend to react to changes in moisture content. Some soils swell as they increase in moisture and are referred to as expansive soils. Other soils can compress significantly upon wetting and are identified as compressible soils. The soils that exhibit compressible behavior are more likely west of the Continental Divide; however, both types of soils occur throughout the state. In older parts of urban Denver-Metro, it is common to encounter fill with debris, which is considered compressible. Landfills are known to exist nearby.

Covering the ground with buildings, streets, parking lots, etc., coupled with landscape irrigation and changing drainage patterns leads to an increase in subsurface moisture conditions. As a result, some soil movement is inevitable. It is critical that all recommendations in this report are followed to increase the chances that the foundations and slabs-on-grade will perform

satisfactorily. Owners and/or property managers must assume responsibility for maintaining structures and use appropriate practices regarding drainage and landscaping.

Based on our previous and current investigations, expansive soils and bedrock and undocumented fill are present at this site, which constitutes a geologic hazard. Expansive materials can swell upon wetting, leading to heave of foundations, slabs, and other ground-supported improvements. Conversely, undocumented or poorly compacted fill can compress upon wetting or additional loading, leading to settlements or differential movements. Because of the unknown geometry, depth, composition, and compaction of the stockpiles and man-placed fill, the site has relatively higher inherent risks compared to other sites, and this cannot be avoided unless the fill is completely removed to uniform elevations and compacted in a controlled manner. The risks can be lessened, but not eliminated, by careful design, construction, and maintenance procedures. Sub-excavation and/or use of deep foundation systems are alternatives to reduce the risk of expansive and compressible materials causing heave or settlement, and damaging buildings. There is risk of damage where unmitigated expansive material and undocumented fill are present below pavements, slabs-on-grade, and ancillary structures. We believe the recommendations in this report will help reduce risk of foundation and/or slab damage; they will not eliminate that risk. Slabs-on-grade, pavements, and, in some instances, foundations may be affected. Ground improvement techniques and maintenance will be required to reduce risk.

Estimated Potential Heave/Settlement

We calculated total potential heave at the existing ground surface for each boring considering a 24 feet depth of wetting. The analysis involves dividing the soil profile into layers and modeling the heave of each layer from representative swell tests. We chose two methods to evaluate potential ground heave, the Thompson Method and partial-wetting technique by Houston et al.[1] The latter study theorizes that the highest degree of wetting occurs near-surface with a gradually decreasing degree of wetting with depth. The Thompson method does not account for partial wetting and assigns a constant 30 percent reduced wetting factor to each layer. This typically results in higher heave estimates at greater depths. Houston, Stauffer, West, Bradford, and Houston's 2017 publication indicates that about 80 to 90 percent of the laboratory meas-

[1]"Use of the Net Partial Wetting Factor (NPWF) Method of Computation of Remaining Heave: A Forensic Study" by Houston, Stauffer, West, Bradford, and Houston, 2017.

ured swell actually occurs in the field in the upper 30 to 40 percent of the depth of wetting, decreasing parabolically from that point to the maximum depth of wetting, i.e., about 50 percent of the laboratory measured swell occurs in the field at 70 percent of the depth of wetting and 10 percent occurs at 90 percent of the depth of wetting. We estimated potential heave by averaging the Thompson method and partial-wetting technique, along with using engineering judgement, to tabulate the estimations below.

TABLE B
ESTIMATED POTENTIAL HEAVE AT EXISTING GRADE

Boring	Estimated Potential Heave (inches)
TH-101	½
TH-102	1½
TH-103	<½
TH-104	1½
TH-105	5
TH-106	2
TH-107	1½
TH-108	4½
TH-109	½
TH-110	4½
TH-111	1½
TH-112	½
TH-113	2

These estimates represent a range of potential heave at the ground surface and do not account for grading plans. The actual heave could be higher or lower. Excessive wetting could lead to more heave. Nearly all of the potential heave is attributed to higher swelling fill samples obtained at 4 feet depth, such as TH-105, TH-106, TH-108 and TH-110. Based on our experience, it is likely the clayey fill has experienced surficial drying since placement, resulting in the lower moisture contents and higher measured swell upon wetting compared to the deeper fill, which has not likely experienced drying to evapotranspiration.

Settlement is more probable than heave where undocumented fill is present, particularly where it extends to more than 10 feet below foundation levels, and where soft humic soils are present, such as TH-102 at 9 feet depth. These soils can compress upon wetting or increase in effective pressure, resulting in settlement. Potential movements due to settlement should be

mitigated as outlined in **Sub-Excavation**, unless deep foundation systems and structural floors are used. Surface improvements can also benefit from sub-excavation.

Radioactivity

It is normal in the Front Range of Colorado and nearby eastern plains area to measure radon gas in poorly ventilated spaces (e.g., crawl spaces) in contact with soil. Radon 222 gas is considered a health hazard and is just one of several radioactive products in the chain of the natural decay of uranium into lead. Radioactive nuclides are common in the soil underlying the subject site. Because these sources exist or will exist on most sites in the area, there is a potential for radon gas accumulation in poorly ventilated spaces. The concentration of radon that can develop is a function of many factors, including the radionuclide activity of the soil, construction methods and materials, soil gas pathways, and accumulation areas. The only reliable method to determine if a hazard exists is to perform radon testing of completed residential structures to determine the level of radon gas accumulation. Typical mitigation methods consist of sealing soil gas entry areas, ventilation of below-grade spaces, and gas venting from foundation drain systems. We recommend provision for ventilation of foundation drain systems if a radon issue is discovered.

SITE DEVELOPMENT

Our study indicates the support soils consist of variable depths of erratic, undocumented fill overlaying non-expansive to low swelling native soils and bedrock. There is some risk of heave affecting foundations of the apartment and clubhouse buildings due to expansive, shallow fill. We believe there is also risk of settlement of the deeper fill which could damage the proposed buildings. The risk is proportional to the depth of the fill (higher risk for deeper fill) and the degree of differential fill depths below the buildings. Ground improvement techniques outlined in the following sections are recommended to reduce potential movements. Based on topography and anticipated grading, it is likely the west portion of the site will be filled, and the east portion will be cut to flatten and provide gently slope to the east leading down to the Creek. Therefore, the final grades are likely to coincide or be slightly above the base of the fill, but this cannot be verified at this time until grading plans are developed.

Demolition

Old residences, greenhouses, and outbuildings were demolished previously. We were not provided with documentation on the demolished structures, or whether foundations, slabs and utilities were removed. Demolition should include the removal of all existing structural members (foundations, foundation walls, grade beams, and floor slabs), exterior flatwork, utilities, and backfill from the site. Soft/loose soils resulting from demolition should be stabilized. Topsoil, large roots and vegetation/organics should be substantially removed under the building footprints. The demolition excavation should be backfilled with moisture conditioned, compacted fill, as described in **Fill and Backfill**. Any existing fill below demolished structures/improvements should be removed down to native soils.

Excavation

We believe the soils penetrated in our exploratory borings can generally be excavated with conventional, heavy-duty excavation equipment. We recommend the owner and the contractor become familiar with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards. We anticipate the clay will classify as Type B soils and the sand, gravel, and existing fill will classify as Type C soil. Type B and C soils require maximum slope inclinations of 1:1 and 1½:1 (horizontal:vertical), respectively, for temporary excavations in dry conditions. Flatter slopes will be required below groundwater and where seepage is present. The contractor's "competent person" is required to review excavation conditions and refer to OSHA Standards when worker exposure is anticipated. Stockpiles of soils and equipment should not be placed within a horizontal distance equal to one-half the excavation depth, from the edge of the excavation. A professional engineer should design excavations deeper than 20 feet. Excavations should not undermine or compromise stability of improvements and utilities.

Groundwater may be encountered in utility excavations, particularly in the west and central portions of the site, and maybe in the retaining wall excavations at the east end. The granular soils are somewhat unstable when saturated. This could impact efficiency of the contractor's work. They should be prepared to deal with soft and/or wet soil conditions. Loose/soft soils may be encountered at the bottom of excavations, particularly for excavations that are close to groundwater. These soils can be stabilized by crowding 1½ to 3-inch crushed rock or recycled concrete into the loose subgrade until the base of the excavation does not deform more than

about an inch when compactive effort is applied. Acceptable rock materials include, but are not limited to, No. 2 and No. 57 rock, or 1 to 3-inch recycled concrete. Geofabric or geogrid can be used and may reduce the amount of rock required to stabilize, and provide a better working platform. Typically, a biaxially woven fabric such as Mirafi 600x (or equal) or geogrid (such as Tensar BX1100 or equal) topped with 6 to 10 inches of 1 to 3-inch crushed rock will provide a stable working surface. The actual need for, and elements of subgrade stabilization should be determined at the time of construction.

If dewatering is necessary, we recommend sumps extend several feet below planned grade. It is best for soil stability to pump water down through the soils rather than collect and pump from the surface. Typically, adjustments are necessary as excavation proceeds. Dewatering permits may be required by Adams County and/or the Colorado Department of Public Health and Environment.

Fill and Backfill

The on-site soil is generally suitable for reuse as new fill, provided debris, organics/vegetation and other deleterious materials are substantially removed. Soil particles larger than 3 inches in diameter should not be used for fill unless broken down. If imported fill is necessary for general site grading purposes, it should ideally consist of soil having similar characteristics as the on-site soils. Potential fill materials should be submitted to our office for approval prior to importing to the site.

Prior to fill placement, debris, organics/vegetation and deleterious materials should be substantially removed from areas to receive fill. The surface to be filled should be scarified to a depth of at least 8 inches, moisture conditioned and compacted to the criteria below. Subsequent fill should be placed in thin (8 inches or less) loose lifts, moisture conditioned to within 2 percent of optimum moisture content for sand/gravel and between optimum and 3 percent above optimum for clay, and compacted to a minimum of 95 percent of standard Proctor maximum dry density (ASTM D 698). If more than 20 feet of fill is planned, compaction of fill placed more than 20 feet below proposed grade should be increased to at least 100 percent of standard Proctor compaction.

Our experience indicates fill and backfill can settle, even if properly compacted to the criteria provided above. Factors that influence the amount of settlement are depth of fill, soil type, degree of compaction, and time. The length of time for the compression to occur can be a few weeks to several years. The degree of compression of the recommended fill under its own weight will likely range from low for granular soils (½ percent or less), to moderate for clay mixtures (1 percent). Any improvements placed over backfill should be designed to accommodate movement.

Utilities

Water, storm sewer and sanitary sewer lines are often constructed beneath slabs and pavements. Compaction of utility trench backfill can have a significant effect on the life and serviceability of floor slabs, pavements and exterior flatwork. Our experience indicates use of self-propelled compactors results in more reliable performance compared to fill compacted by an attachment on a backhoe or trackhoe. The upper portion of the trenches should be widened to allow the use of a self-propelled compactor. During construction, careful attention should be paid to compaction at curblines and around manholes and water valves.

Special attention should be paid to backfill placed adjacent to manholes as we have observed conditions where settlement in excess of 1 percent has occurred after completion of construction. Flowable fill may be considered at critical utility crossings where it would be difficult to achieve adequate compaction. Fill should be moisture-conditioned and compacted to the specifications outlined in **Fill and Backfill**. The placement and compaction of utility trench backfill should be observed and tested by a representative of our firm during construction.

Sub-Excavation

Undocumented, expansive fill and compressible soils are present at this site. We have estimated potential ground heave of up to 5 inches, most of which is attributed to the soils within the upper 5-7 feet from the ground surface. Settlement is possible where soft soils are present (e.g., TH-102 at 9 feet depth) and where deep fill and/or differential thickness of fill is present below buildings or other improvements. After the anticipated site grading, it is possible that little to no fill remains beneath the buildings, but this is uncertain at this time. We judge the deeper fill and natural soils are more likely to compress than swell, leading to settlement.



In order to reduce potential movements for foundations, slabs-on-grade, retaining walls, pavements, and other surface improvements, we recommend sub-excavating and placing the on-site materials as moisture conditioned, compacted fill. The sub-excavation should be performed at least 10 feet below foundations for the apartment buildings, clubhouse, pool and maintenance shop. This sub-excavation depth should remove and replace the majority of the fill. If fill remains present at the base of the sub-excavation, you may consider chasing the fill. We should be provided with building floor elevations to evaluate our sub-excavation recommendations, once available. The sub-excavation can be terminated if natural sand/gravel or moist natural clay are encountered. This implies relatively shallow sub-excavation for Buildings 1 through 4.

We recommend performing sub-excavation to a depth of 5 feet below pavements, retaining walls, carport/garage foundations, ancillary structure foundations, and other surface improvements where less movements are desired. If a less conservative approach is desired for these surface improvements, the sub-excavation can be reduced to 3 feet.

The safest approach to reduce potential movements caused by the undocumented fill is complete removal and replacement. This may be impractical and cause more severe settlement-related concerns due to the presence of creating new, deep fill below the footings, which is difficult to compact to a more consolidated state than that of the existing fill considering the fill has been underneath the overburden stresses caused by the fill above over a period of time. Nearly all of the existing fill samples present deeper than about 9 feet appears to be reasonably stiff/dense and compact, with acceptable dry densities and consistencies, and showed relatively low swell or compression when wetted. This leads us to judge the deeper fill is relatively consolidated and metastable. Still, there is risk of ground movements by leaving the existing fill in place. You may consider performing deeper sub-excavation if desired. Provided that sub-excavation is successful, potential movements should reduce to about 2 inches or less, with about 1 inch or less being more probable unless excessive wetting occurs.

Sub-excavation has been used in the Denver area with satisfactory performance for the large majority of the sites where this ground modification method has been completed. The base of the sub-excavation across a building should be at a uniform elevation or step-down consistent with the building foundations, which could be problematic for earthwork equipment such

as scrapers. The sub-excavation should extend laterally at least 5 feet outside of foundations. A conceptual sub-excavation profile is presented on Fig. 5.

In order for the sub-excavation procedure to be performed properly, close control of fill placement to specifications is required. The extent and depth of sub-excavation should be surveyed, and an “as-built” plan of the sub-excavated areas should be prepared. We have seen isolated instances where settlement of sub-excavation fill has led to damage. In most cases, the settlement was caused by wetting associated with poor surface drainage and/or poorly compacted fill placed at the horizontal limits of the sub-excavation. Special precautions should be taken for compaction of fill at corners, access ramps and edges of the sub-excavation due to equipment access constraints. The contractor should have the appropriate equipment to reach and compact these areas.

The excavation contractor should be chosen carefully to assure they have experience with fill placement at over-optimum moisture and have the necessary compaction equipment. They should provide a construction disc to break down fill materials and anticipate use of push-pull scraper operations and dozer assistance. The operation will be relatively slow. Soil chunks should be broken down to 3 inches and less. Sub-excavation fill should be moisture-conditioned between 0 and 3 percent above optimum moisture content for clay or within 2 percent of optimum for sand/gravel, and compacted at least 95 percent of standard Proctor maximum dry density. If you pursue removing deeper fill, if present, new fills placed deeper than 12 feet below foundations should be compacted to 100 percent of optimum moisture content, and within 2 percent of optimum moisture content. Our representative should observe and test compaction of fill during placement.

FOUNDATIONS

Our investigation indicates undocumented fill and expansive soils and bedrock are present at depths likely to influence the performance of shallow foundations. We believe PTS or footings designed to maintain minimum deadload are appropriate foundations for the residential buildings, clubhouse, and pool provided the recommended ground improvement is performed as described previously. There will still be risk of foundation movements after sub-excavation, and these potential movements cannot be eliminated. Cosmetic distress should be expected, particularly if poor surface drainage practices are implemented. Deep foundations systems, such as

helical piles, can be used if ground improvement techniques are not performed for the apartment buildings, club house, or pool. Although we did not encounter cobbles or boulders in our exploratory borings, they may exist. The presence of cobbles or boulders may make the installation of helical piles difficult or impractical. Design criteria for PTS, footing foundations, and helical piers are presented below. The criteria presented below were developed from analysis of field and laboratory data and our experience.

Post-Tensioned Slab-On-Grade Foundation

PTS foundation design is based on a method developed by the Post-Tensioning Institute (PTI) and is outlined in PTI's third edition of *Design of Post-Tensioned Slabs-On-Ground* (2004 with 2008 Supplement). Various climate and relevant soil factors are required to evaluate the PTI design criteria. These include Thornthwaite Moisture Index (I_m), suction compression index (γ_h), unsaturated diffusion coefficient (α), depth of probable moisture variation, initial and final soil suction profiles, and percent clay fraction and predominant clay mineral. In the project area, I_m is about -25.

The PTS foundation design method is based on the potential differential movement of the slab edges (y_m) over a specified edge distance (e_m). Further, the PTI design method, evaluates two mechanisms of soil movement (edge lift and center lift) based on assumptions that wetting and drying of the foundation soils are primarily affected by seasonal climate changes. In the 2004 design manual, PTI recommends evaluating movements for a minimum depth of wetting of 9 feet below the ground surface. This value can be reasonable for a seasonal moisture variation; however, our experience indicates the foundation soils will normally undergo an increase in moisture due to covering the ground surface with buildings and flatwork, coupled with the introduction of landscape irrigation around the buildings. Based on our experience and the subsurface conditions at the site, the depth of wetting can be about 15 to 20 feet or more below the ground surface.

The wetting may not penetrate this deep; however, we believe it is a reasonable design assumption when evaluating the edge lift for this site. For the deeper depths of wetting, ground movements can be estimated based on swell or suction profiles, or using a computer program (such as "VOLFLO" by Geostructural Tool Kit, Inc.). The PTI design method does not predict soil movement caused by site conditions such as excessive irrigation or poor surface drainage



that may lead to differential foundation movement in excess of the movements estimated by the PTI design method. These conditions may also increase the edge moisture variation distance above the design values provided in the PTI manual.

Depending upon the surface drainage or the amount of available water, the differential soil movement for both edge and center lift could approach total heave. Considering the limitations of the current PTI design method, we believe a conservative approach with reasonable engineering judgement is merited in PTS foundation design. Design criteria for PTS foundations are presented below. Criteria were developed from analysis of field and laboratory data, the PTS design method outlined in PTI's third edition of *Design and Construction of Post-Tensioned Slabs-On-Ground* (2004 with 2008 Supplement), and our experience.

1. PTS foundations should be constructed on at least 10 feet of moisture-conditioned and compacted fill. If soft/loose soils are exposed in excavations or result from the excavation/forming and tendon-placing process, these soils should be removed and compacted, as discussed previously.

2. PTS foundations should be designed for a maximum allowable soil pressure of 2,000 psf. For design of uniform thickness PTS foundations or point loads, a modulus of subgrade reaction (K_s) of 75 pci can be used.

3. A differential soil movement (y_m) of 2 inches for the edge lift condition and 1½ inches for the center lift condition can be used.

4. The PTI 3rd Edition includes two methods for determining the edge moisture variation distance (em) and states that the higher values should be used. Based on the method using the Thornthwaite Index, the moisture variation distances for center lift and edge lift (em) of 5½ feet and 2½ feet are indicated, respectively. Based on the unsaturated diffusion coefficient, center lift and edge lift em values of 9 feet and 4½ feet are indicated, respectively. Based on the subsurface conditions and experience with PTS foundation use in Denver, we believe it is probable that use of the average values (center lift of 7 feet and edge lift of 3½ feet) may yield acceptable performance. We can consult with the structural engineer further as design progresses, if desired.

5. We understand the PTI design method assumes the slab is somewhat flexible. The above-grade construction, such as framing, drywall, brick and stucco should be considered when determining the appropriate slab stiffness. We are aware of situations where minor differential slab movement has caused distress to finish materials. One way to enhance performance would be to place reinforcing steel in the bottoms of stiffening beams. The structural engineer should evaluate the merits of this approach, as well as other potential alternatives to reduce damage to finish materials. The slab stiffness should be evaluated per section 6.10 of the PTI 2008 Supplement as it relates to different superstructure materials.

6. Stiffening beams and edge beams may be poured “neat” into excavated trenches. Soil may cave or slough during trench excavation for the stiffening beams. Disturbed soil should be removed from trench bottoms prior to placement of concrete. Formwork or other methods may be required for proper stiffening beam installation.

7. Exterior stiffening beams should be protected from frost action. Normally, 3 feet of frost cover is assumed in the area. If exterior patios are incorporated into the PTS, we believe the stiffening beams around the patios should be as deep as those around the building exterior to increase the likelihood they will perform similarly to the rest of the PTS.

8. For slab tensioning design, a coefficient of friction value of 0.75 or 1.0 can be assumed for slabs on polyethylene sheeting or a sand layer, respectively. A coefficient of friction of 2.0 should be used for slabs on clay soils. We believe use of polyethylene is preferable because it serves as a vapor retarder which helps to control moisture migration up through the slabs.

9. A representative of our firm should observe the completed excavations. A representative of the structural engineer or our firm should observe the placement of the reinforcing tendons and any mild reinforcement prior to pouring the slabs and beams, and observe the tendon stressing.

Footings with Minimum Deadload

1. Footings should be constructed on at least 10 feet of moisture conditioned, compacted fill. Where soils are loosened during excavation or in the forming process, or if any loose, soft, or dry soils are exposed in excavations, the soils should be removed and re-compacted as recommended in **Fill and Backfill**, or stabilized, prior to placing concrete.

2. A maximum allowable soil pressure of 2,000 psf can be used. No deadload is required.

3. No void form is required for expansive soil purposes.

4. Footings should have a minimum width of 16 inches. Foundations for isolated columns should have minimum dimensions of 18 inches by 18 inches. Larger sizes may be required depending upon the loads and structural system used.

5. Foundation walls should be well-reinforced. We recommend reinforcement sufficient to span an unsupported distance of at least 10 feet. Reinforcement should be designed by the structural engineer.

6. Exterior footings must be protected from frost action. Normally, 3 feet of frost cover is assumed in the area.

7. The completed excavation should be observed by a representative of our firm to confirm subsurface conditions are as anticipated from our borings. Placement



and compaction of fill/backfill should be observed and tested by our representative.

Helical Piles

1. Helical piers should bottom in bedrock. We anticipate helical pier lengths of at least 30 to 35 feet (down to about elevations 5200 to 5205) will be required. Bedrock may be deeper in some areas and require longer piles. Total length should be measured from the top of the pile to the top helical plate. The piles should be installed as close to vertical as possible.

2. The ultimate capacity of helical piles should be calculated based on the manufacturer's recommendations. We recommend calculation of the installation torque using a factor of safety of at least 2 when converting ultimate values to working (allowable) capacity. Helical pile capacity should be verified in the field using manufacturer recommended capacity torque ratios.

3. Contractors should use the number and size of helical blades required to achieve depth, torque and capacity. Helical piles with a dual cutting edge blade could prove more effective at penetrating potential cobble.

4. The helical pile cap and the connection between the pile and grade beam should be able to resist both tension and compression and be designed to resist lateral earth pressure. A structural engineer should design this connection.

5. We recommend contacting the manufacturer or the manufacturer's representative concerning corrosion protection of the steel. Manufacturer's recommendations should be followed.

6. Twisting of the shaft can occur during the installation process. We recommend the structural engineer evaluate the effect(s) twisting of the shaft may have on the capacity of the helical pile.

7. Grade beams should be well reinforced; the reinforcement should be designed by the structural engineer. Lateral earth pressure and the effects of large openings within grade beams (if any) should be considered.

8. Installation of helical piles should be observed by a representative of our firm to confirm the depth and installation torque of helical piles are adequate.

Laterally Loaded Piles

Lateral load analysis of piers can be performed with the software analysis package LPILE by Ensoft, Inc. We believe this method of analysis is appropriate for piers with a pier length-to-diameter ratio of seven or greater. Suggested criteria for LPILE analysis are presented in the following table.

SOIL INPUT DATA FOR “LPILE”

Soil Type	Existing Fill	Clay	Sand and Gravel (above water)	Sand and Gravel (below water)	Bedrock
Effective Unit Weight (pci)	0.068	0.068	0.069	0.035	0.074
Cohesive Strength, c (psi)	5	15	-	-	50
Friction Angle, ø (degrees)	-	-	34	34	-
Soil Strain, ε_{50} (in/in)	0.005	0.007	-	-	0.004
p-y Modulus k_s (pci)	150	500	90	60	2,000
p-y Modulus k_c (pci)	-	200	-	-	800

The ε50 value represents the strain corresponding to 50 percent of the maximum principal stress difference.

Closely Spaced Pier Reduction Factors

For axial loading, no reduction is needed for a minimum spacing of three diameters (center to center). At one diameter (piers touching), the skin friction reduction factor for both piers would be 0.5. End pressure values would not be reduced provided the bases of the piers are at similar elevations. Interpolation can be used between one and three diameters.

For lateral loading, no reduction is needed for piers in-line with the direction of lateral loads with a minimum spacing of six diameters (center-to-center) based upon the larger pier. If a closer spacing is required, the modulus of subgrade reaction for initial and trailing piers should be reduced. At a spacing of three diameters, the effective modulus of subgrade reaction of the first pier can be estimated by multiplying the given modulus by 0.6; for trailing piers in a line at three-diameter spacing, the factor is 0.4. Linear interpolation can be used for spacing between three and six diameters.

Reductions to the modulus of subgrade reaction can be accomplished in LPILE by inputting the appropriate modification factors for p-y curves. Reducing the modulus of subgrade reaction in trailing piers will result in greater computed deflections on these piers. In practice, a grade beam can force deflections of all piers to be equal. Load-deflection graphs can be generated for each pier by using the appropriate p-multiplier values. The sum of the piers lateral load

resistance at selected deflections can be used to develop a total lateral load versus deflection graph for the system of piers.

For lateral loads perpendicular to the line of piers, a minimum spacing of three diameters can be used with no capacity reduction. At one diameter (piers touching) the piers should be analyzed as one unit. Interpolation can be used for intermediate conditions.

The above method has been used by our firm for years with success, but sometimes results in overly conservative values. We believe the prediction equations proposed by Reese and Van Impe[2] result in more practical solutions for group efficiency. They were formulated by fitting curves to data representing group efficiency versus pile spacing. No differentiation was made between soil type, pile diameter, or penetration. The data indicates that for side-by-side piers, group efficiency becomes unity at spacing of about 4 pier diameters. For in-line piers, the lead piers were found to have efficiency of unity with spacing of about 4 diameters, and the trailing piers were unity efficiency with spacing of 7 diameters. The equations for solving group efficiency for side-by-side, leading and trailing piers are shown below, where the variable "s" is the pile spacing and "b" is the pile diameter.

Side-by-side piers:

$$e = 0.64(\frac{s}{b})^{0.34}\ for\ 1 \leq \frac{s}{b} \leq 3.75, e = 1.0, \frac{s}{b} \geq 3.75 \qquad \textit{(Equation 5.39)}$$

Leading piers:

$$e = 0.7(\frac{s}{b})^{0.26}\ for\ 1 \leq \frac{s}{b} \leq 4.0, e = 1.0, \frac{s}{b} \geq 4.0 \qquad \textit{(Equation 5.40)}$$

Trailing piers:

$$e = 0.48(\frac{s}{b})^{0.38}\ for\ 1 \leq \frac{s}{b} \leq 7.0, e = 1.0, \frac{s}{b} \geq 7.0 \qquad \textit{(Equation 5.41)}$$

For piers that are skewed at an angle (i.e. between in-line and side-by-side), the group efficiency is taken as a modification to shadow and edge effects. The efficiency can be estimated by:

[2]"Single Piles and Pile Groups Under Lateral Loading," Authored by Lymon C. Reese and William F. Van Impe, 2001; Section 5.7.5, Pages 158 and 159

$e = (e_i^2 \cos^2 \emptyset + e_s^2 \sin^2 \emptyset)^2$; where e_i = efficiency of pile in-line,

e_s = efficiency of pier side-by-side, and

$\emptyset$ = angle between piers (Reese & Wang, 1996)

FLOOR SYSTEMS AND SLABS-ON-GRADE

With post-construction wetting, expansive soil and bedrock can heave and damage slab-on-grade floors, if used. This heave cannot be resisted by concentrating slab loads. Heave will deform and crack floor slabs and can damage interior partitions. While these are not concerns for PTS floors, slabs-on-grade will have this risk. For PTS, the foundations are structurally integral with the floor and should perform better than a conventional slab-on-grade floor.

With the recommended sub-excavation, we estimate potential movements of about 2 inches or less are probable for slab-on-grade floors. More heave or settlement may occur if excessive wetting occurs. Conventional slab-on-grade floors are suitable provided risk of heave and distress is acceptable to the owner. There will likely be distress to sensitive finishes. It is imperative that foundations, finishes and other items are isolated from slab floors to prevent transferring slab movements to the structure. <u>If floor movement cannot be tolerated, then a structurally supported floor should be used.</u>

Where conventional slabs-on-grade are used, we recommend the following design and construction criteria. These recommendations will not prevent movement. Rather, they tend to reduce damage if movement occurs.

1. Slabs that are not part of a PTS foundation system should be separated from exterior walls and interior bearing members with a slip joint that allows free vertical movement of the slabs. This detail can reduce cracking when movement occurs.

2. Slabs should be placed directly on properly moisture conditioned, well-compacted fill. The International Building Code (IBC) requires a vapor retarder between the base course or subgrade soils and the concrete slab-on-grade floor. The merits of installation of a vapor retarder below floor slabs depend on the sensitivity of floor coverings and building use to moisture. A properly installed vapor retarder (10 mil minimum) is more beneficial below concrete slab-on-grade floors where floor coverings, painted floor surfaces or products stored on the floor will be sensitive to moisture. The vapor retarder is most effective when concrete is placed directly on top of it, rather than placing a sand or gravel leveling course between the vapor retarder and the floor slab. The placement of concrete on the vapor retarder may increase the risk of shrinkage cracking and curling. Use of

concrete with reduced shrinkage characteristics including minimized water content, maximized coarse aggregate content, and reasonably low slump will reduce the risk of shrinkage cracking and curling. Considerations and recommendations for the installation of vapor retarders below concrete slabs are outlined in Section 5.2.3.2 of the 2015 report of American Concrete Institute (ACI) Committee 302, "Guide for Concrete Floor and Slab Construction (ACI 302.1R-15)".

3. Slab-bearing partition walls over conventional slabs (if any) should be designed and constructed to allow at least 2 inches of slab movement. If the slip joint is provided at the top of partitions, the connection between the slab-supported partitions and foundation-supported walls should be detailed to allow differential movement. The owner should monitor partition voiding and other connections and re-establish the gap when it closes to less than ½-inch.

4. Plumbing and utilities that pass through the conventional slabs (if any) should be isolated from the slabs and constructed with flexible couplings. Utilities, as well as electrical and mechanical equipment should be constructed with sufficient flexibility to allow for movement.

5. HVAC systems supported by the slabs (if any) should be provided with flexible connections capable of withstanding at least 2 inches of movement.

6. Exterior flatwork and sidewalks should be separated from the structures, or made part of the PTS foundation. Otherwise, these slabs should be detailed to function as independent units. Movement of these slabs should not be transmitted to the foundations.

7. The American Concrete Institute (ACI) recommends frequent control joints be provided in slabs to reduce problems associated with shrinkage cracking and curling. To reduce curling, the concrete mix should have a high aggregate content and a low slump. If desired, a shrinkage compensating admixture could be added to the concrete to reduce the risk of shrinkage cracking. We can perform a mix design or assist the design team in selecting a pre-existing mix.

Structurally Supported Floors

The clubhouse and apartment buildings will be finished and may have sensitive floor and wall coverings. These coverings and finishes can be damaged by slab movements. To our knowledge, there are no soil treatments combined with slab-on-grade floors that will result in the same reduction in risk of floor movement (relative to the risk inherent for a floor slab placed directly on the natural soils), as would be provided by a structural floor. If floor movement cannot be tolerated, then a structurally supported floor should be used.



A structural floor is supported by the foundation system. Design and construction issues associated with structural floors include ventilation and lateral loads. Where structurally supported floors are installed over a crawl space, the required air space depends on the materials used to construct the floor and the potential expansion of the underlying soils. Building codes require a clear space of 18 inches between exposed earth and untreated wood floor components. For non-organic floor systems, we recommend a minimum clear space of 8 inches. This minimum clear space should be maintained between any point on the underside of the floor system (including beams and floor drain traps) and the soils.

A slab-on-void system may also be considered. We recommend a minimum 4-inch void. Void form should be chosen to break down quickly after the slab is placed and should not transmit heave to the floor. A sand or gravel leveling base below the void form should not be used. We recommend against the use of wax or plastic-coated boxes unless provisions are made to allow softening of the boxes.

Where structurally supported floors are used, utility connections including water, gas, air duct, and exhaust stack connections to floor supported appliances should be capable of absorbing some deflection of the floor. Plumbing that passes through the floor should ideally be hung from the underside of the structural floor and not lain on the bottom of the excavation. It is prudent to maintain the minimum clear space below all plumbing lines; this configuration may not be achievable for some parts of the installation.

Control of humidity in crawl spaces is important for indoor air quality and performance of wood floor systems. We believe the best current practices to control humidity involve the use of a vapor retarder or vapor barrier (10 mil) placed on the soils below accessible subfloor areas. The vapor retarder/barrier should be sealed at joints and attached to concrete foundation elements.

Exterior Flatwork

We recommend exterior flatwork and sidewalks around the buildings be isolated to reduce the risk of transferring slab movement to the structures. One alternative would be to construct the inner edges of the flatwork on haunches or steel angles bolted to the foundation walls

and detailing the connections such that movement will cause less distress to the buildings, rather than tying the slabs directly into the buildings' foundations. Construction on haunches or steel angles and reinforcing the sidewalks and other exterior flatwork will reduce the potential for differential settlement and better allow them to span across foundation wall backfill. Frequent control joints should be provided to reduce problems associated with shrinkage. Panels that are approximately square perform better than rectangular areas.

SUBSURFACE DRAINAGE

Water from surface irrigation of lawns and landscaping frequently flows through relatively permeable backfill placed adjacent to a building and collects on the surface of less permeable soils occurring at the bottom of foundation excavations. This process can cause wet or moist below grade conditions (if any). To reduce the likelihood water pressure will develop outside foundation walls and the risk of accumulation of water at the crawl space level, we recommend provision of a foundation drain along the perimeter of below-grade crawl space areas. The provision of a drain will not eliminate slab movement or prevent moist conditions. Typical crawl space drain details are presented on Figs. 6, 7, 9, and 10. For reference, a post-tensioned slab-on-grade foundation wall drain is presented on Fig. 8. We can work with the design team to refine these details to represent the construction better.

DETENTION POND

Detention ponds are planned at the southeast and southwest corners of the site. Based on TH-106, the bottom of the southeast pond is expected to be cut into native clay or fill consisting of sandy clay or clayey sand. Based on TH-103, the bottom of the southeast pond is expected to cut into fill or native sand and gravel. The permeability of the native clay is low. The permeability of the fill is impossible to quantify and will depend on how well consolidated the fill is locally and the percent fines present in the matrix. The fill, clay and claystone are expected to have little to no permeability, less than 1 inch per hour of infiltration. The permeability of the native sand and gravel is anticipated to be high. We can conduct infiltration testing near the planned detention bottoms if desired.

POOL AND DECK

We anticipate the pool will be about 4 to 8 feet deep and be cast-in-place concrete or gunite. Rigid concrete or gunite pools are brittle and can crack from shrinkage or movement. Use of a well-reinforced gunite or concrete pool can reduce potential cracking. Ground improvements, as recommended in this report, should be performed to reduce potential movements. Deep foundations, such as helical piles, may be elected in leu of ground improvements.

The pool deck is normally constructed as a slab-on-grade. The most common problem with swimming pool deck performance in this area is heave or settlement and cracking of the deck slabs surrounding the pool. Infiltration of surface water from precipitation or pool splash can cause moisture seepage through cracks in the pool deck and the joints between the deck and pool. This wetting causes the underlying soils to swell or compress and results in cracking and distress of the deck, and potentially the nearby building foundations. In our opinion, the hazard can be reduced, but not prevented, by construction considerations and maintenance.

The deck and surrounding areas should be sloped to provide positive drainage. We recommend slabs be isolated from the pool shell, and well-reinforced to function as independent units. Cracking of the pool deck may occur and will require maintenance. Cracks and joints in the deck should be assessed and sealed seasonally, at a minimum. Cracking of the pool and pool deck can allow water to infiltrate the subgrade soils which leads to soil movement problems and possibly hydrostatic uplift of the pool shell. A drain board installed around the perimeter of the pool walls is recommended to facilitate drainage of free water within the subsoil. This free water should be captured in a gravel drain. The drain should be sloped to a sump where the water can be removed by pumping. Impermeable PVC sheeting (20 mil or thicker) should be placed between the gravel drain and the subgrade. The PVC sheeting should be adequately sealed at the joints. A conceptual detail for the pool drainage is shown on Fig. 11.

RETAINING WALLS

Mechanically stabilized earth retaining walls are anticipated to accommodate grade differentials along the south, north, and east boundaries of the site. We understand a cast-in-place concrete wall may be used for the relatively tall east/southeast retaining wall. The maximum exposed height of the walls will range from about 5 to 15 feet. Retaining walls should be designed

to resist lateral earth pressures. The lateral earth pressure will depend on the height of the wall, retained soil, type of backfill, slope of backfill surface, surcharge loads and allowable horizontal movement at the top of the wall. Where multiple walls are closely spaced (if any), the lower wall design should consider surcharge from upper walls. Internal and global stability of the walls should be considered.

Soils at the foundation levels are expected to consist of existing fill, or new clayey fill or natural clay/sand/gravel soils. We recommend sub-excavation to a depth of 5 feet below retaining wall foundations to provide uniform support conditions. Differential fill thickness below the walls should not differ by more than 5 feet. The magnitude of heave or settlement realized after construction will be directly related to the amount of fill and the depth and degree of wetting below the retaining wall system. Wetting will be directly influenced by irrigation practices and the design and maintenance of surface grades. Irrigation should ideally be avoided in the retaining wall area to reduce the potential magnitude of movement. Design and construction criteria for retaining walls are provided below.

1. We recommend 5 feet of sub-excavation below retaining wall foundations to provide uniform support conditions. Where loose or soft soils are present at the foundation levels, the subgrade should be observed by our representative stabilized.

2. Retaining walls can be designed for a maximum allowable soil pressure of 2,000 psf. A coefficient of friction between soil and cast-in-place concrete foundation elements of 0.30 can be used in design. Lateral earth pressures can be calculated using the values provided in the following section.

3. Soil pressure on top of footings can be calculated using a unit weight of 125 pcf, provided that backfill is compacted. For overturning, the weight of the soil can be included, if the soil will never be removed.

4. Footings should have a minimum width equal to one-half the exposed height of the wall.

5. Retaining walls should be well reinforced. The size and amount of reinforcement should be evaluated by the structural engineer. Frequent control joints in the wall face are recommended to help guide shrinkage and heave related cracks. The joint spacing should not exceed an approximate 10 foot spacing.

6. Footings must be protected from frost action. Normally 3 feet of frost cover is assumed in this area.

7. The completed foundation excavation should be observed by a representative of our firm to confirm subsurface conditions are as anticipated from our borings.

Mechanically Stabilized Earth (MSE) Retaining Walls

Some movement of MSE walls must occur to mobilize the shear strength of the soil. We assume retained soil and backfill above the reinforced zone will be on-site soils or similar soils. The on-site soil should not be used in the reinforced zone. We recommend the reinforced zone of the MSE Walls be constructed with imported sand and gravel meeting CDOT Class 5 or 6 Aggregate Road Base Specification or CDOT Class1 structural fill. Angular gravel meeting AASHTO No. 57 or 67 Specification may be used for the reinforced soil (if desired) and is recommended for the leveling pad and drainage material. Most MSE block retaining wall design require input of soil parameters for foundation soil, leveling pad, reinforced soil and retained soil. We recommend the parameters presented below be used for the design of the wall.

MSE SOIL INPUT PARAMETERS

Material Use	Material Description & Classification	Cohesion (psf)	Internal Friction Angle (degrees)	Unit Weight (pcf)
Foundation Soil	On-Site Material used as Fill	50	25	125
Leveling Pad	Gravel (imported) AASHTO #57 or #67 Coarse Concrete Aggregate	0	34	140
Reinforced Soil (import recommended)	Sand, Gravelly, Silty, CDOT Class 6 Road Base or Class I Structural Fill	0	34	140
Retained Soil	Sandy Clay	100	23	120

Lateral Earth Pressures

Retaining walls should be designed to resist lateral earth pressures. The amount of pressure on a wall is a function of the wall height, type of backfill, drainage conditions, slope of the backfill surface, and the allowable rotation of the wall. “Active” earth pressure can be used for retaining walls that are free to rotate slightly. If some movement is not tolerable, the walls should be designed for the “at-rest” earth pressure condition. A “passive” earth pressure resistance can be used to resist sliding and overturning. Passive resistance requires movement to generate resistance. We anticipate lateral movement on the order of 0.02 to 0.04 times the wall height will be required to mobilize the full passive resistance. Passive resistance should only be used when the soil is well compacted and will never be removed. We have tabulated equivalent fluid density values for on-site soil used as backfill and import fill for use in lateral earth pressure restraint design below. These values assume that backfill will be moisture-conditioned and compacted as described previously and is well drained with a foundation drainage system or weep

holes. The values do not include allowances for surcharge loads such as adjacent foundations, detention ponds, sloping backfill, vehicle traffic, swell pressures, or hydrostatic pressure.

LATERAL EQUIVALENT FLUID DENSITY

Load Condition	On-Site Backfill	Import Fill (Class I Structural Fill)
Active Equivalent Fluid Density (pcf)	50	35
At Rest Equivalent Fluid Density (pcf)	70	55
Passive Equivalent Fluid Density (pcf)*	300*	375*

*Assumes backfill will never be removed. Does not include safety factors or reductions to limit deflection.

Retaining Wall Drains

Free draining granular backfill should be used adjacent to the wall. We recommend a free-draining sand and gravel material with less than 5 percent fines (passing No. 200 sieve) within at least 1-foot behind the wall. Imported backfill should be tested and approved by our firm prior to importing. The free-draining gravel layer behind the wall should be placed in thin, loose lifts, and compacted to at least 70 percent of maximum relative dry density (ASTM D 4253 and ASTM D 4254). The upper 2 feet of wall backfill should be derived from the on-site clayey soils. Fill should be placed and compacted to the criteria provided in **Fill and Backfill**. Special precautions should be taken to avoid over-stressing the wall during compaction. We recommend small, hand-operated compactors be used.

We recommend a drainpipe be installed beneath the free draining backfill zone. Typical earth retaining wall drain details are provided on Figs. 12 and 13. The drain should consist of a 4-inch perforated PVC pipe encased in at least 1-foot of free draining gravel. The drain should slope to a positive gravity outlet. Any pipe installed beneath the wall should be solid and strong enough to resist the overburden pressure from the weight of the wall. Drain discharge in front of the wall should occur to well drained areas. The retaining wall drain discharge should be routed to the storm sewer system. We do not recommend discharging water from the retaining wall drains onto the ground surface.

PAVEMENTS

The project will include automobile parking and access drives/fire lanes accessible via Lowell Boulevard. The performance of a pavements is dependent upon the characteristics of the subgrade soil, traffic loading and frequency, climatic conditions, drainage and pavement materials.

Pavement subgrade soils generally consisted of sandy clay and classified as A-6 or A-7-6 according to AASHTO criteria. Clayey soils are considered poor subgrade. Swell tests indicate the subgrade soils have variable expansion potential, with clayey soils swelling up to 7.2 percent when wetted. We recommend sub-excavating pavement areas to a depth of 5 feet below pavements to improve performance. If a less conservative approach is desired, this can be reduced to 3 feet. A layer of geosynthetic grid or woven fabric should be placed over the top lift to achieve stable subgrade. Subgrade should be proof-rolled with a loaded, tandem-axle dump truck to disclose soft/loose areas. These areas should be reworked and compacted. Subgrade areas that pass proof-roll should be stable enough to pave.

Alternatives that include each material are provided below. We followed MGPEC Pavement Design Standards, using Nomographs to develop our pavement thickness calculations for both flexible and rigid pavements. Minimum pavement sections based on soil types and expected traffic are tabulated below. Flexible and rigid pavement materials, construction and maintenance guidelines are presented in Appendix D.

SUMMARY OF RECOMMENDED MINIMUM PAVEMENT ALTERNATIVES

Traffic Classification	Hot Mix Asphalt (HMA) + Aggregate Base (ABC)	Hot Mix Asphalt (HMA)	Portland Cement Concrete (PCC)
Automobile Parking	4" HMA + 7" ABC	6½” HMA	5½” PCC
Access Drives/ Fire Lanes	4½" HMA + 8" ABC	7” HMA	6" PCC

Our experience indicates problems with asphalt pavements can occur where heavy trucks drive into loading and unloading zones and turn at low speeds. In areas of concentrated loading and turning movements by heavy trucks, such as at entrances and trash collection areas, we recommend a 6 or 7-inch or thicker Portland cement concrete pad be constructed at any loading docks and dumpster locations, or other areas where trucks will stop or turn. The

concrete pads should be of sufficient size to accommodate truck turning, trash pickup and delivery/loading areas.

The design of a pavement system is as much a function of paving materials as supporting characteristics of the subgrade. All soils that will support pavements should be scarified, moisture conditioned, and compacted prior to paving. The quality of each construction material is reflected by the strength coefficient used in the calculations. If the pavement system is constructed of inferior material, then the life and serviceability of the pavement will be substantially reduced. Materials and placement methods should conform to the requirements of Adams County. All materials planned for construction should be tested to confirm their compliance with project specifications.

Control joints should separate concrete pavements into panels as recommended by ACI. No de-icing salts should be used on paving concrete for at least one year after placement. Routine maintenance, such as sealing and repair of cracks and overlays at 5 to 7-year intervals, are necessary to achieve long-term performance of an asphalt system. We recommend application of a rejuvenating sealant such as fog seal after the first year. Deferring maintenance usually results in accelerated deterioration of pavements leading to higher future maintenance costs.

A primary cause of early pavement deterioration is water infiltration into the pavement system. The addition of moisture usually results in softening of the subgrade and eventual failure of the pavement. We recommend drainage be designed for rapid removal of surface runoff. Curb and gutter should be backfilled and the backfill compacted to reduce ponding adjacent to the pavements. Final grading of the subgrade should be carefully controlled so that design cross-slope is maintained and low spots in the subgrade which could trap water are eliminated. Seals should be provided between curb and pavement and at all joints to reduce moisture infiltration. Landscaped areas and detention ponds in pavements should be avoided.

Recommended material properties and construction criteria for pavements are provided in Appendix D. These criteria were developed from analysis of the field and laboratory data and our experience. If the materials cannot meet these recommendations, then the pavement design should be re-evaluated based upon available materials.

CONCRETE

Concrete in contact with soil can be subject to sulfate attack. We measured water-soluble sulfate concentrations of less than 0.01 to 0.14 percent in three samples from this investigation. Our previous investigation (DN43,859-125-R1) measured water-soluble sulfate concentrations of less than 0.01 in one sample. As indicated in our tests and ACI 318-19, the sulfate exposure class is at this site is *Not Applicable*/*S0* or *Moderate*/*S1*.

SULFATE EXPOSURE CLASSES PER ACI 318-19

Exposure Classes		Water-Soluble Sulfate (SO_4) in Soil [A] (%)
Not Applicable	S0	< 0.10
Moderate	S1	0.10 to 0.20
Severe	S2	0.20 to 2.00
Very Severe	S3	> 2.00

A) Percent sulfate by mass in soil determined by ASTM C1580

For the *S1* level of sulfate concentration, ACI 318-19 *Code Requirements* indicates there are special cement type requirements for sulfate resistance as indicated in the table below. There are no special cement type requirements for *S0* level of sulfate concentration.

CONCRETE DESIGN REQUIREMENTS FOR SULFATE EXPOSURE PER ACI 318-19

Exposure Class		Maximum Water/ Cement Ratio	Minimum Compressive Strength (psi)	Cementitious Material Types[A]			Calcium Chloride Admixtures
				ASTM C150/ C150M	ASTM C595/ C595M	ASTM C1157/ C1157M	
S0		N/A	2500	No Type Restrictions	No Type Restrictions	No Type Restrictions	No Restrictions
S1		0.50	4000	II[B]	Type with (MS) Designation	MS	No Restrictions
S2		0.45	4500	V [B]	Type with (HS) Designation	HS	Not Permitted
S3	Option 1	0.45	4500	V + Pozzolan or Slag Cement [C]	Type with (HS) Designation plus Pozzolan or Slag Cement [C]	HS + Pozzolan or Slag Cement [C]	Not Permitted
S3	Option 2	0.4	5000	V [D]	Type with (HS) Designation	HS	Not Permitted

A) Alternate combinations of cementitious materials shall be permitted when tested for sulfate resistance meeting the criteria in section 26.4.2.2(c).
B) Other available types of cement such as Type III or Type I are permitted in Exposure Classes S1 or S2 if the C3A contents are less than 8 or 5 percent, respectively.
C) The amount of the specific source of pozzolan or slag to be used shall not be less than the amount that has been determined by service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan or slab to be used shall not be less than the amount tested in accordance with ASTM C1012 and meeting the criteria in section 26.4.2.2(c) of ACI 318.
D) If Type V cement is used as the sole cementitious material, the optional sulfate resistance requirement of 0.040 percent maximum expansion in ASTM C150 shall be specified.

Superficial damage may occur to the exposed surfaces of highly permeable concrete. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious materials ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high-water tables. Concrete should have a total air content of 6 percent ± 1.5 percent. We advocate damp-proofing of all foundation walls and grade beams in contact with the subsoils.

SURFACE DRAINAGE

Performance of foundations, flatwork, retaining walls, and other surface improvements is influenced by the moisture conditions existing within the foundation or subgrade soils. The risk of wetting the foundation, floor, and retaining wall subgrade soils can be reduced by carefully planned and maintained surface grades and drainage. Excessive wetting before, during and/or after construction may cause movement of foundations, slabs-on-grade, and retaining walls. We recommend the following precautions be observed during construction and maintained at all times after construction is completed.

1. Wetting or drying of open foundation, utility and earthwork excavations should be avoided.

2. Positive drainage should be provided away from the buildings and retaining walls. Paved surfaces should be sloped to drain away from the buildings. A minimum slope of 5 percent is recommended in the first 5 to 10 feet away from the foundations and retaining walls in landscaped areas. More slope is desirable. Concrete curbs and sidewalks may “dam” surface runoff and disrupt proper flow. Use of “chase” drains or weep holes at low points in the curb should be considered to promote proper drainage.

3. Backfill around foundations and retaining walls should be moistened and compacted according to criteria presented in **Fill and Backfill**. Areas behind curb and gutter should be backfilled and well compacted to reduce ponding of surface water. Seals should be provided between the curb and pavement to reduce infiltration.

4. Landscaping should be carefully designed to minimize irrigation. Plants used close to buildings and retaining walls should be limited to those with low moisture requirements. Irrigation should be limited to the minimum amount sufficient to maintain vegetation. Application of more water will increase likelihood of slab and foundation movements and associated damage. Landscaped areas should be adequately sloped to direct flow away from the improvements. Use of area drains can assist draining areas that cannot be provided with adequate slope.

5. Impervious plastic membranes should not be used to cover the ground surface immediately surrounding foundations and retaining walls. These membranes tend to trap moisture and prevent normal evaporation from occurring. Geotextile fabrics can be used to control weed growth and allow evaporation.

6. Roof drains should be directed away from the structures and discharge beyond backfill zones or into appropriate storm sewer or detention area. Downspout extensions and splash blocks should be provided at all discharge points. Roof drains can also be connected to buried, solid pipe out-lets. Roof drains should not be directed below slab-on-grade floors. Roof drain outlets should be maintained.

SUPPLEMENTAL ANALYSIS

The complexity of this project may result in additional questions in both the design and construction phases. Plans for the project are in the conceptual stages. We can provide additional analyses or consultation upon request, as necessary. We can conduct infiltration testing near the planned detention pond bottom if requested.

We would like to have the opportunity to review plans and specifications once they are more developed. By review of these documents prior to beginning construction, we may notice details that should be clarified or added in order to provide better agreement between our recommendations and construction documents. **We should review building, foundation, and retaining wall plans once available to determine if our recommendations need to be revised.**

This project will involve activities that should be monitored during the construction phase by a geotechnical engineering firm. To provide continuity between design and construction we recommend that CTL|Thompson, Inc. provide these services. If others perform these services, they must accept responsibility to evaluate whether conditions exposed during construction are consistent with the findings in this report and judge whether the recommendations in this report remain appropriate.

GEOTECHNICAL RISK

The concept of risk is an important aspect with any geotechnical evaluation, primarily because the methods used to develop geotechnical recommendations do not comprise an exact science. We never have complete knowledge of subsurface conditions. Our analysis must be

tempered with engineering judgment and experience. Therefore, the recommendations presented in any geotechnical evaluation should not be considered risk-free. Our recommendations represent our judgment of those measures that are necessary to increase the chances that the structures and improvements will perform satisfactorily. It is critical that all recommendations in this report are followed during construction. Owners or property managers must assume responsibility for maintaining the structures and use appropriate practices regarding drainage and landscaping. Improvements after construction should be completed in accordance with recommendations provided in this report and may require additional soil investigation and consultation.

LIMITATIONS

This report has been prepared for the exclusive use of Lowell Development, LLC and the design team for the purpose of providing geotechnical design and construction criteria for the proposed 5602 Lowell Boulevard Apartments project. The information, conclusions and recommendations presented herein are based upon consideration of many factors including, but not limited to, the type of structures proposed and the subsurface conditions encountered. Grading plans and building floor elevations are not available at this time, and should be reviewed to evaluate our recommendations.

The conclusions and recommendations contained in the report are not valid for use by others. The recommendations provided are appropriate for about three years. If the proposed project is not constructed within about three years, we should be contacted to determine if we should update this report.

Our borings were spaced to obtain a reasonably accurate picture of subsurface conditions below the proposed project. The borings are representative of conditions encountered only at the boring locations. Subsurface variations not indicated by our borings are likely. We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing under similar conditions. No warranty, express or implied, is made. If we can be of further service in discussing the contents of this report, or in

the analysis of the influence of the subsurface conditions on the design of the additions and improvements, or any other aspect of the proposed construction, please call or email.

CTL|THOMPSON, INC.



Robert J. Brown
Staff Geologist

Reviewed By:

Benny I. Lujan, P.E.
Senior Geotechnical Engineer, Associate

Via e-mail: tj@asherarch.com

LEGEND:

TH–101 ● APPROXIMATE LOCATION OF EXPLORATORY BORING

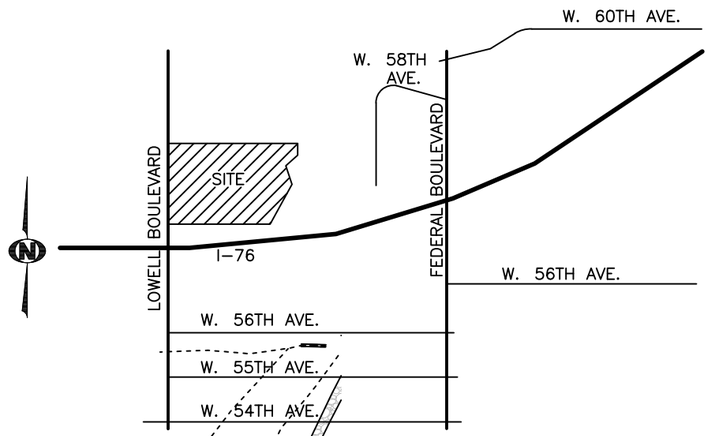
S–101 ◉ APPROXIMATE LOCATION OF PAVEMENT BORING

TH–1 ● INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING FROM PREVIOUS INVESTIGATION (PROJECT NO. DN48,539–115)

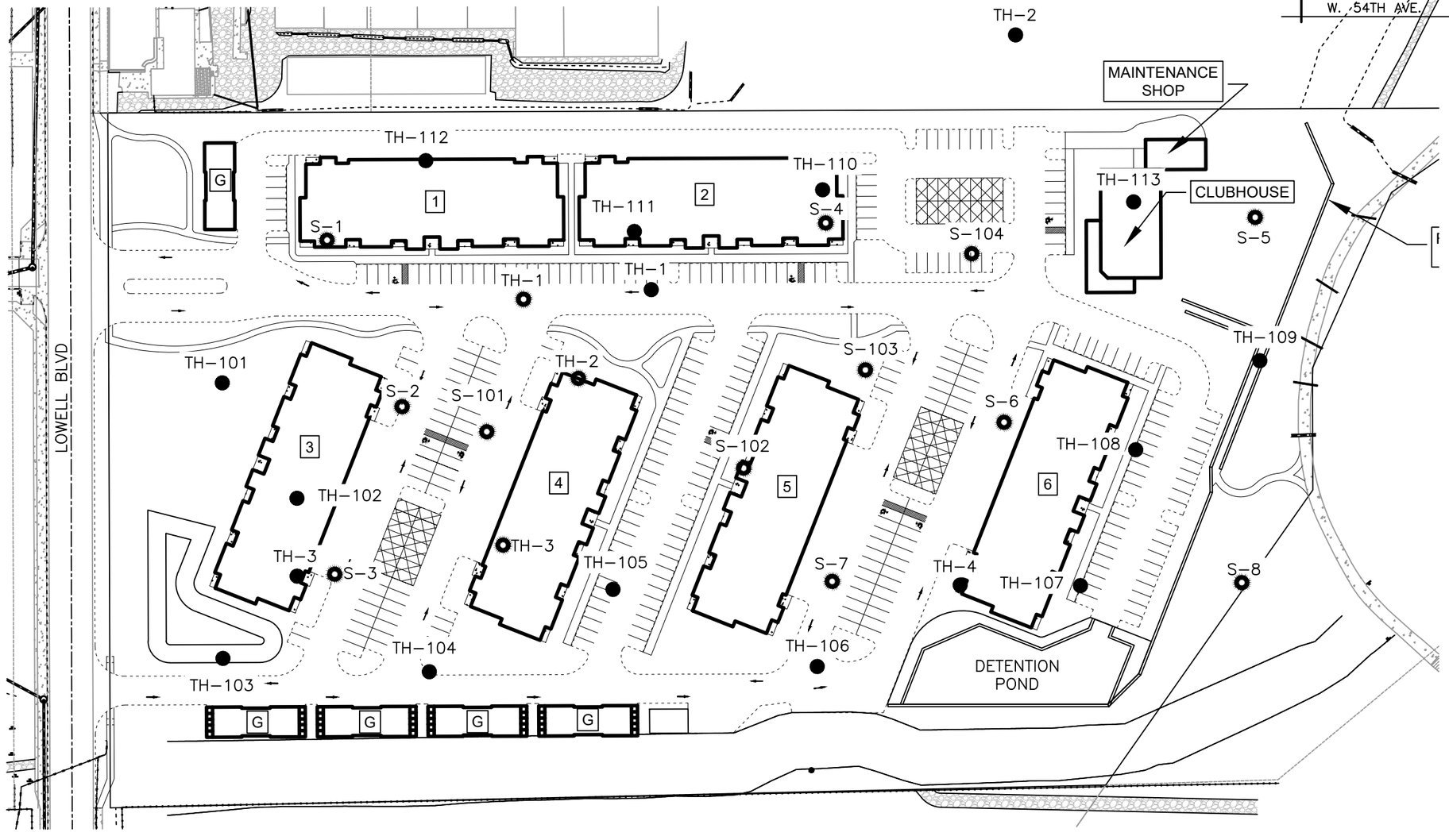
S–1 ○ INDICATES APPROXIMATE LOCATION OF PAVEMENT BORING FROM PREVIOUS INVESTIGATION (PROJECT NO. DN43,859–125)

0 50 100

SCALE: 1" = 100'



VICINITY MAP
NOT TO SCALE



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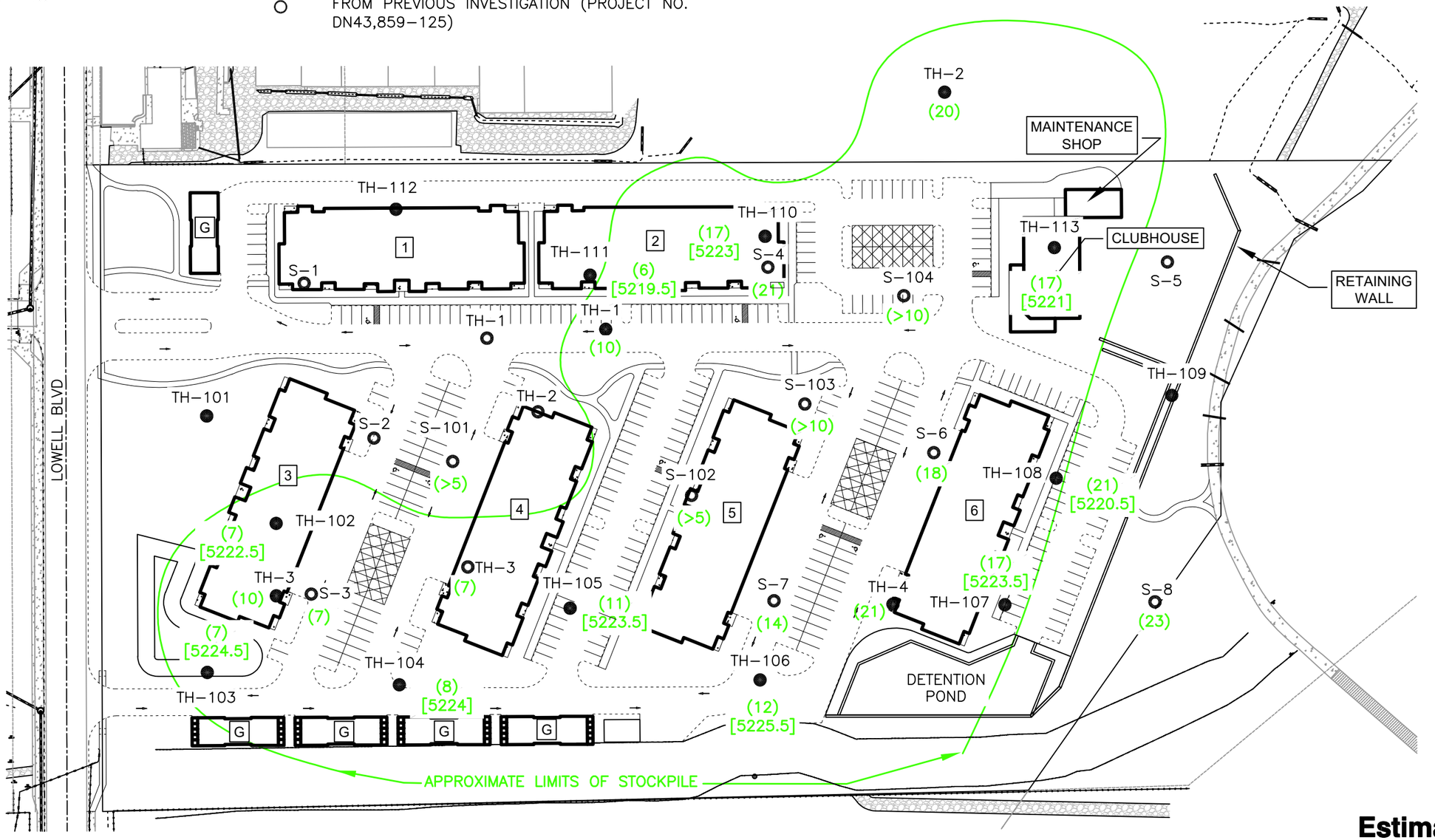
Locations of Exploratory Borings Fig. 1

LEGEND:

TH–101 ●	APPROXIMATE LOCATION OF EXPLORATORY BORING
S–101 ○	APPROXIMATE LOCATION OF PAVEMENT BORING
TH–1 ●	INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING FROM PREVIOUS INVESTIGATION (PROJECT NO. DN48,539–115)
S–1 ○	INDICATES APPROXIMATE LOCATION OF PAVEMENT BORING FROM PREVIOUS INVESTIGATION (PROJECT NO. DN43,859–125)
(7)	INDICATES ESTIMATED DEPTH OF FILL (FEET)
[5222.5]	INDICATES ESTIMATED FILL BOTTOM ELEVATION (FEET)

NOTE: THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS. THE EXTENTS OF THE FILL ARE BELIEVED TO BE ERRATIC DUE TO SITE HISTORY, REFER TO REPORT.

0 50 100
SCALE: 1" = 100'



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CTL|T Project No. DN51,902.001-125-R1

Estimated Fill Thickness and Bottom Elevation Fig. 2

LEGEND:

TH–101 ● APPROXIMATE LOCATION OF EXPLORATORY BORING

S–101 ◉ APPROXIMATE LOCATION OF PAVEMENT BORING

TH–1 ● INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING FROM PREVIOUS INVESTIGATION (PROJECT NO. DN48,539–115)

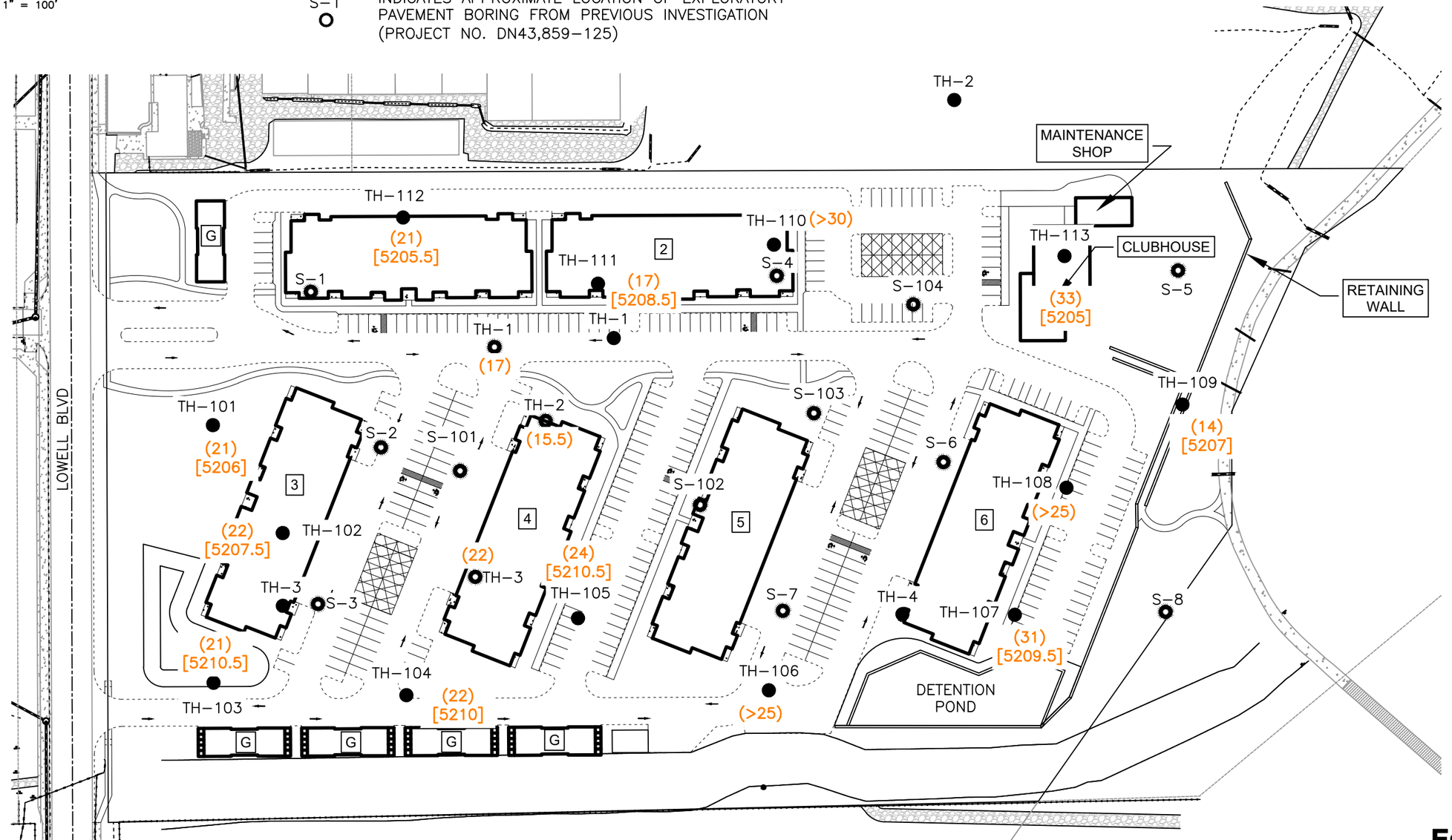
S–1 ◉ INDICATES APPROXIMATE LOCATION OF EXPLORATORY PAVEMENT BORING FROM PREVIOUS INVESTIGATION (PROJECT NO. DN43,859–125)

(7) INDICATES ESTIMATED DEPTH TO BEDROCK (FEET)

[5222.5] INDICATES ESTIMATED BEDROCK ELEVATION (FEET)

NOTE: THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS.

0 50 100
SCALE: 1" = 100'



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Estimated Depth and Elevation of Bedrock Fig. 3

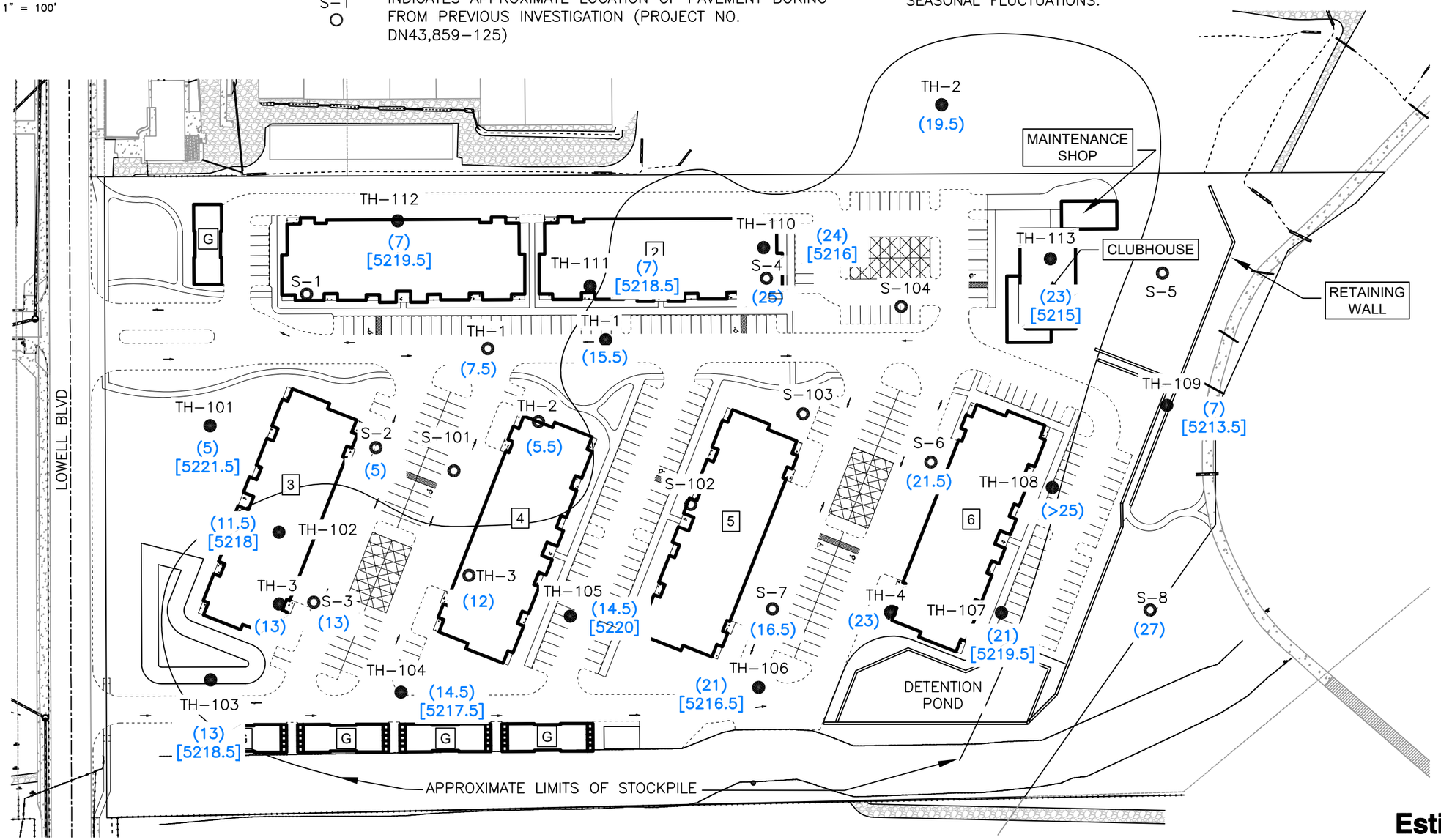
LEGEND:

TH–101 ●	APPROXIMATE LOCATION OF EXPLORATORY BORING	(7)	INDICATES ESTIMATED DEPTH TO GROUNDWATER (FEET)
S–101 ○	APPROXIMATE LOCATION OF PAVEMENT BORING	[5222.5]	INDICATES ESTIMATED GROUNDWATER ELEVATION (FEET)
TH–1 ●	INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING FROM PREVIOUS INVESTIGATION (PROJECT NO. DN48,539–115)	NOTE:	THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS AND SEASONAL FLUCTUATIONS.
S–1 ○	INDICATES APPROXIMATE LOCATION OF PAVEMENT BORING FROM PREVIOUS INVESTIGATION (PROJECT NO. DN43,859–125)		

N

0 50 100

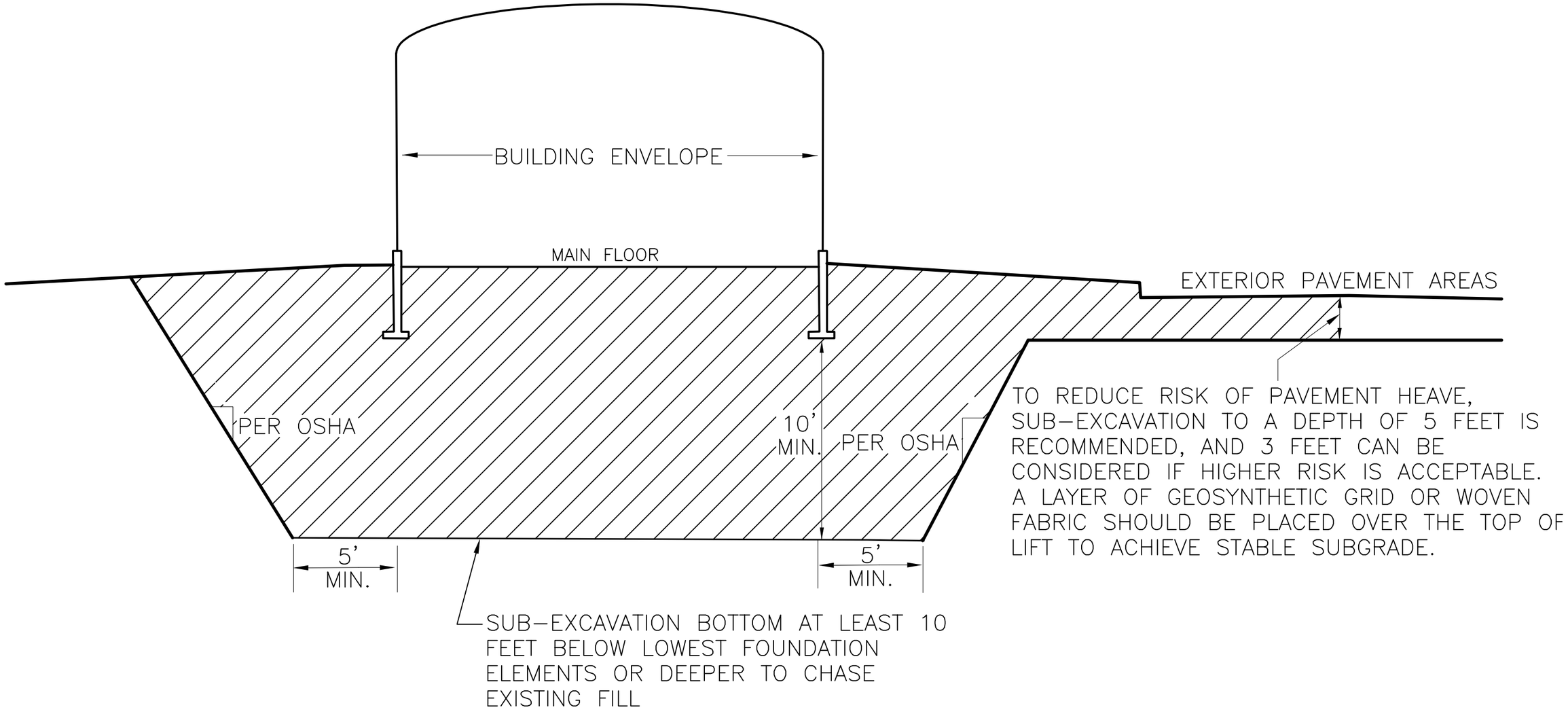
SCALE: 1" = 100'



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Estimated Depth and Elevation of Groundwater

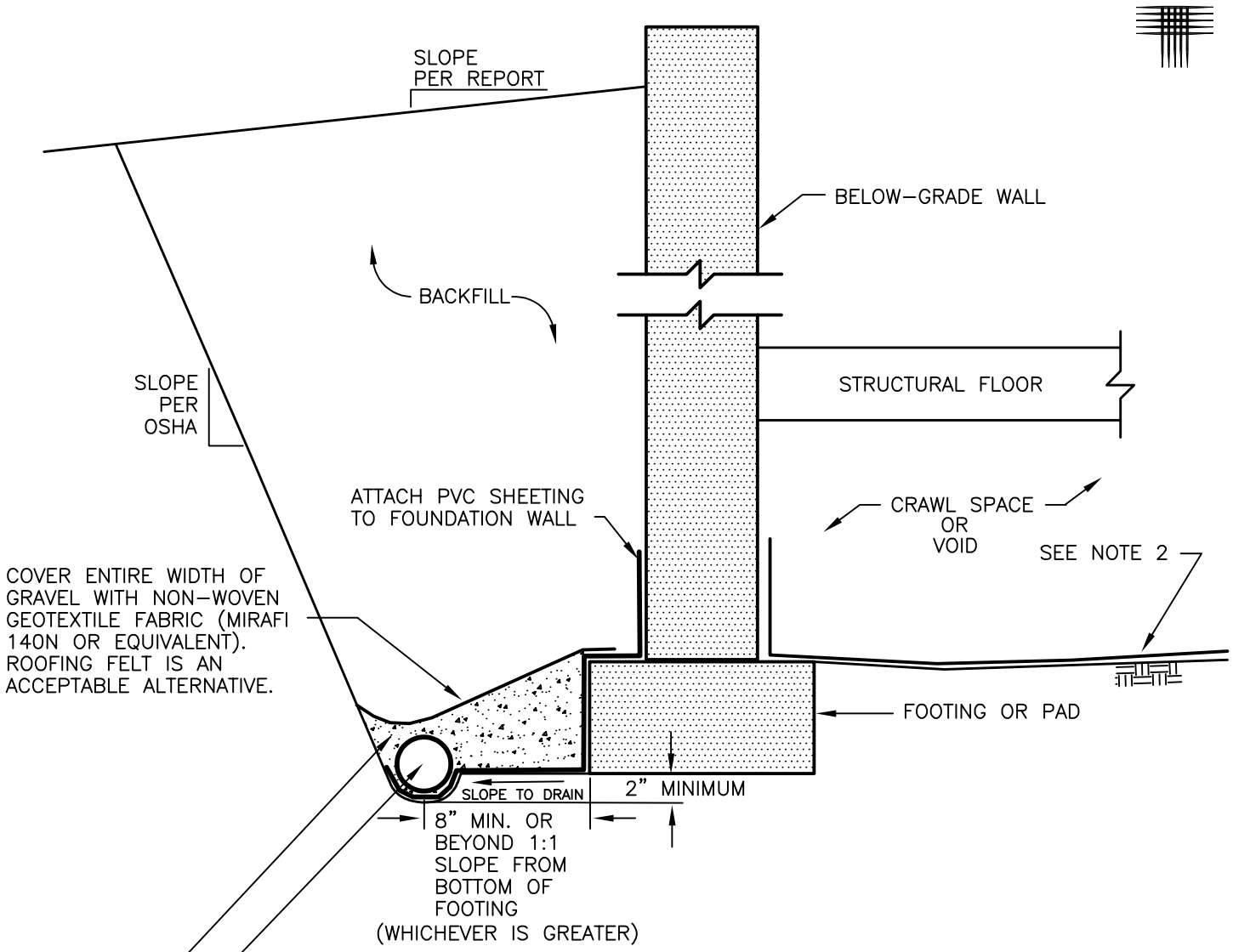
Fig. 4



NOTES: NOT TO SCALE. IF SUB–EXCAVATION IS PERFORMED DEEPER THAN 12 FEET BELOW FOUNDATIONS TO CHASE EXISTING FILL, WE RECOMMEND COMPACTING THE DEEPER FILL TO HIGHER DEGREE TO REDUCE POTENTIAL SETTLEMENT.

Conceptual Sub-Excavation Profile Fig. 5

06-FTG-XTR-STF-01



NOTES:

1) THE BOTTOM OF THE DRAIN SHOULD BE AT LEAST 2 INCHES BELOW BOTTOM OF FOOTING AT THE HIGHEST POINT AND SLOPE DOWNWARD TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING.

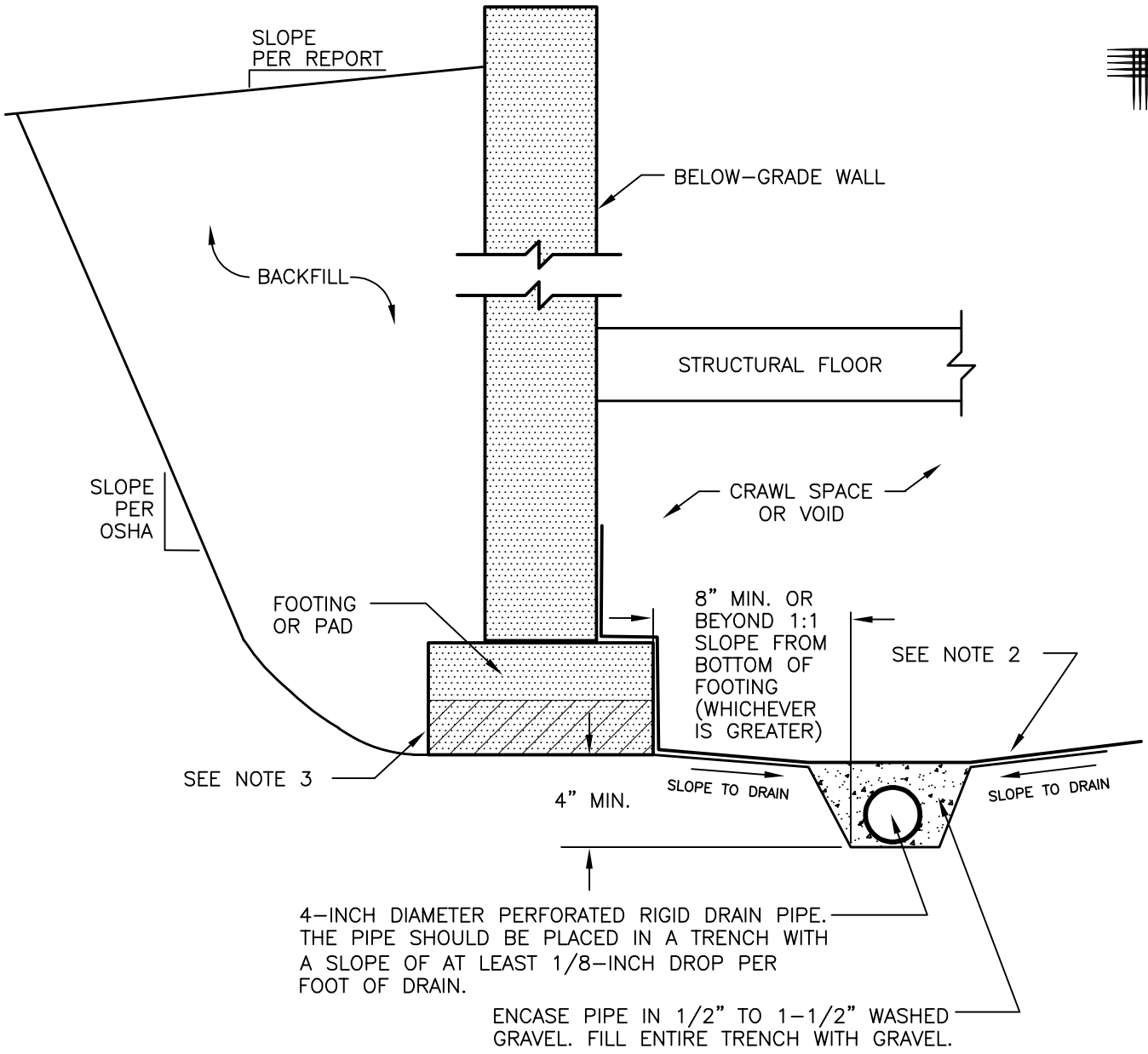
2) TO HELP CONTROL THE HUMIDITY IN THE CRAWL SPACE, A MINIMUM 10-MIL POLYETHYLENE VAPOR RETARDER SHOULD BE PLACED OVER THE CRAWL SPACE SOILS. THE RETARDER SHOULD BE ATTACHED TO CONCRETE FOUNDATION ELEMENTS AND EXTEND UP FOUNDATION WALLS AT LEAST 8 INCHES ABOVE TOP OF FOOTING. OVERLAP JOINTS 3 FEET AND SEAL.

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Exterior Foundation Wall Drain

Fig. 6

06-FTG-INT-STF-01



NOTES:

1) THE BOTTOM OF THE DRAIN SHOULD BE AT LEAST 4 INCHES BELOW BOTTOM OF FOOTING AT THE HIGHEST POINT AND SLOPE DOWNWARD TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING.

2) TO HELP CONTROL THE HUMIDITY IN THE CRAWL SPACE, A MINIMUM 10-MIL POLYETHYLENE VAPOR RETARDER SHOULD BE PLACED OVER THE CRAWL SPACE SOILS. THE RETARDER SHOULD BE ATTACHED TO CONCRETE FOUNDATION ELEMENTS AND EXTEND UP FOUNDATION WALLS AT LEAST 8 INCHES ABOVE TOP OF FOOTING. OVERLAP JOINTS 3 FEET AND SEAL.

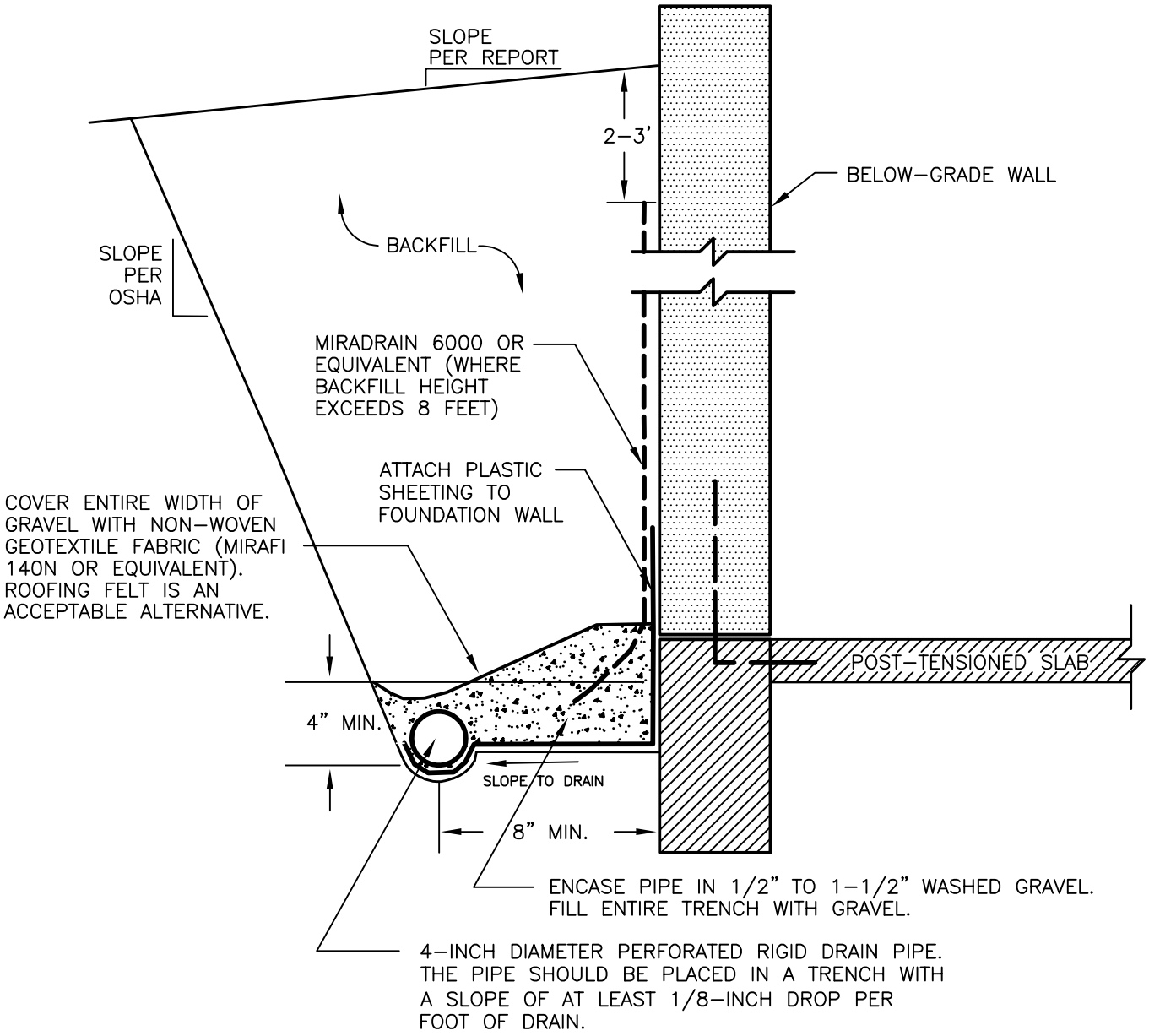
3) FOR FOOTINGS IN BASEMENT AREAS, WE RECOMMEND PLACING AN 4-INCH THICK, 4-INCH WIDE SECTION OF VOID FORM PERPENDICULAR TO FOOTING ABOUT EVERY 10 TO 15 FEET AND AT WINDOW WELLS, TO ALLOW WATER IN WALL BACKFILL TO PASS BENEATH THE FOOTING INTO THE INTERIOR DRAIN. THIS CAN ALSO BE ACCOMPLISHED BY "TUNNELING" UNDER FOOTINGS AT THE TIME OF DRAIN INSTALLATION. THIS DETAIL SHOULD BE REVIEWED BY THE STRUCTURAL ENGINEER DURING FOUNDATION DESIGN AND INCORPORATED INTO THE FOUNDATION PLAN. ALTERNATIVELY, AN EXTERIOR FOUNDATION DRAIN CAN BE USED.

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Interior Foundation Wall Drain

Fig. 7

01-POST-TENSIONED-XTR-SOG-01



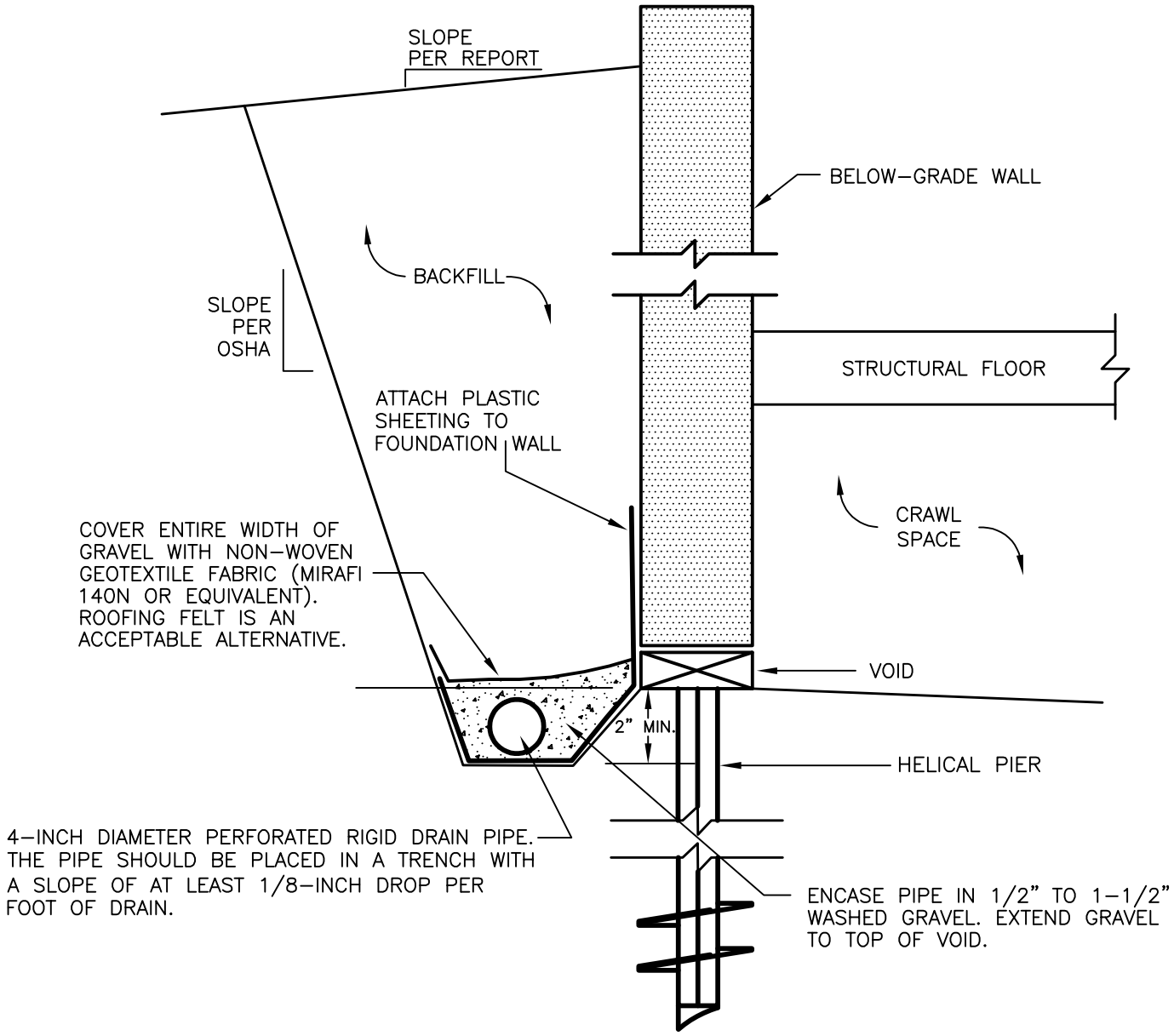
NOTE:
THE BOTTOM OF THE DRAIN SHOULD BE AT LEAST 4 INCHES BELOW BOTTOM OF POST-TENSIONED SLAB AT THE HIGHEST POINT AND SLOPE DOWNWARD TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING.

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Exterior Foundation Wall Drain

Fig. 8

01-HELICAL-XTR-STF-01



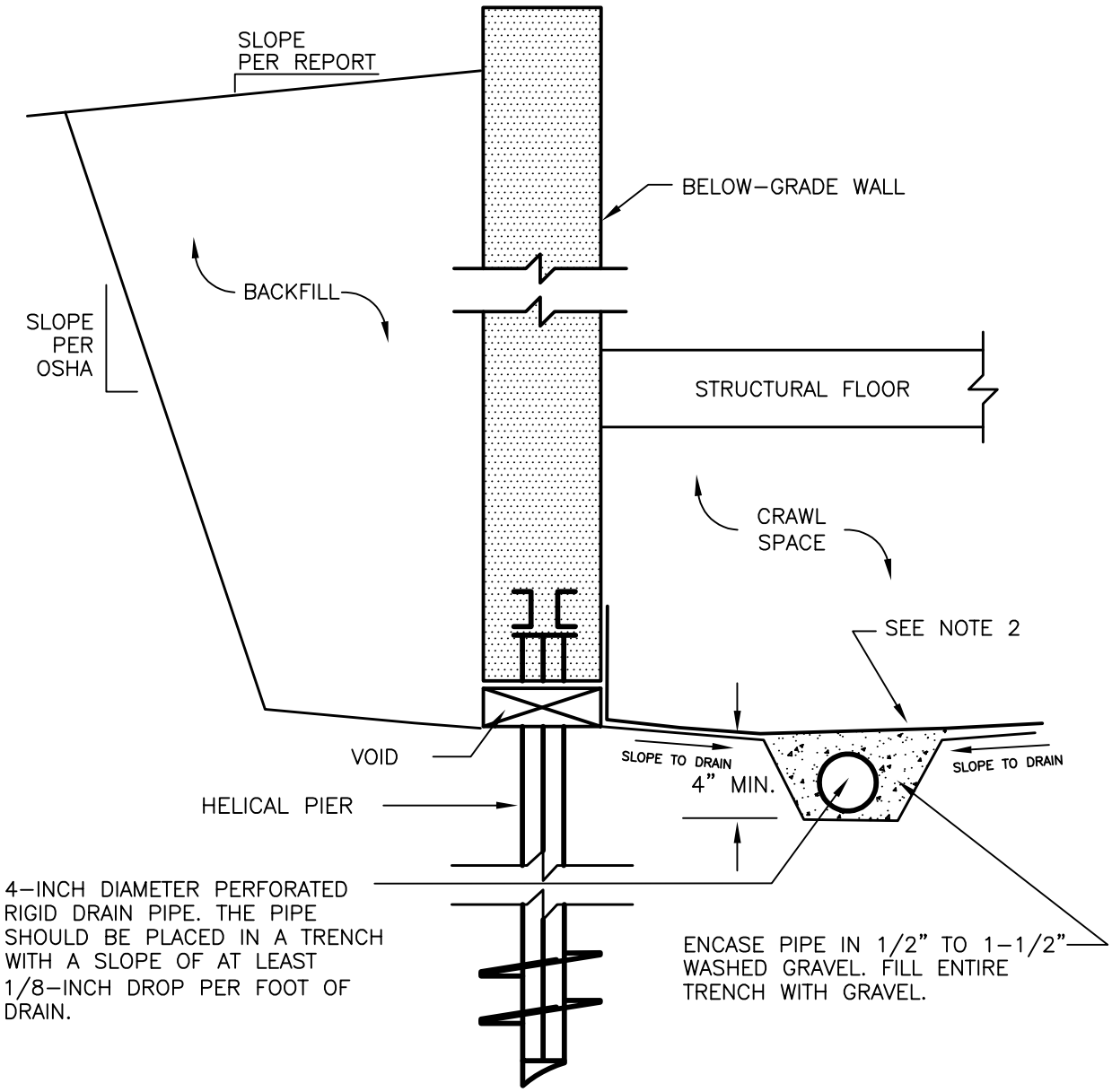
NOTE:
THE BOTTOM OF THE DRAIN SHOULD BE AT LEAST 2 INCHES BELOW BOTTOM OF VOID AT THE HIGHEST POINT AND SLOPE DOWNWARD TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING.

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Exterior Foundation Wall Drain

Fig. 9

01-HELICAL-INT-STF-01



NOTES:

1) THE BOTTOM OF THE DRAIN SHOULD BE AT LEAST 4 INCHES BELOW BOTTOM OF VOID AT THE HIGHEST POINT AND SLOPE DOWNWARD TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING.

2) TO HELP CONTROL THE HUMIDITY IN THE CRAWL SPACE, A MINIMUM 6-MIL POLYETHYLENE VAPOR RETARDER SHOULD BE PLACED OVER THE CRAWL SPACE SOILS. THE RETARDER SHOULD BE ATTACHED TO CONCRETE FOUNDATION ELEMENTS AND EXTEND UP FOUNDATION WALLS AT LEAST 8 INCHES ABOVE TOP OF PIER. OVERLAP JOINTS 3 FEET AND SEAL.

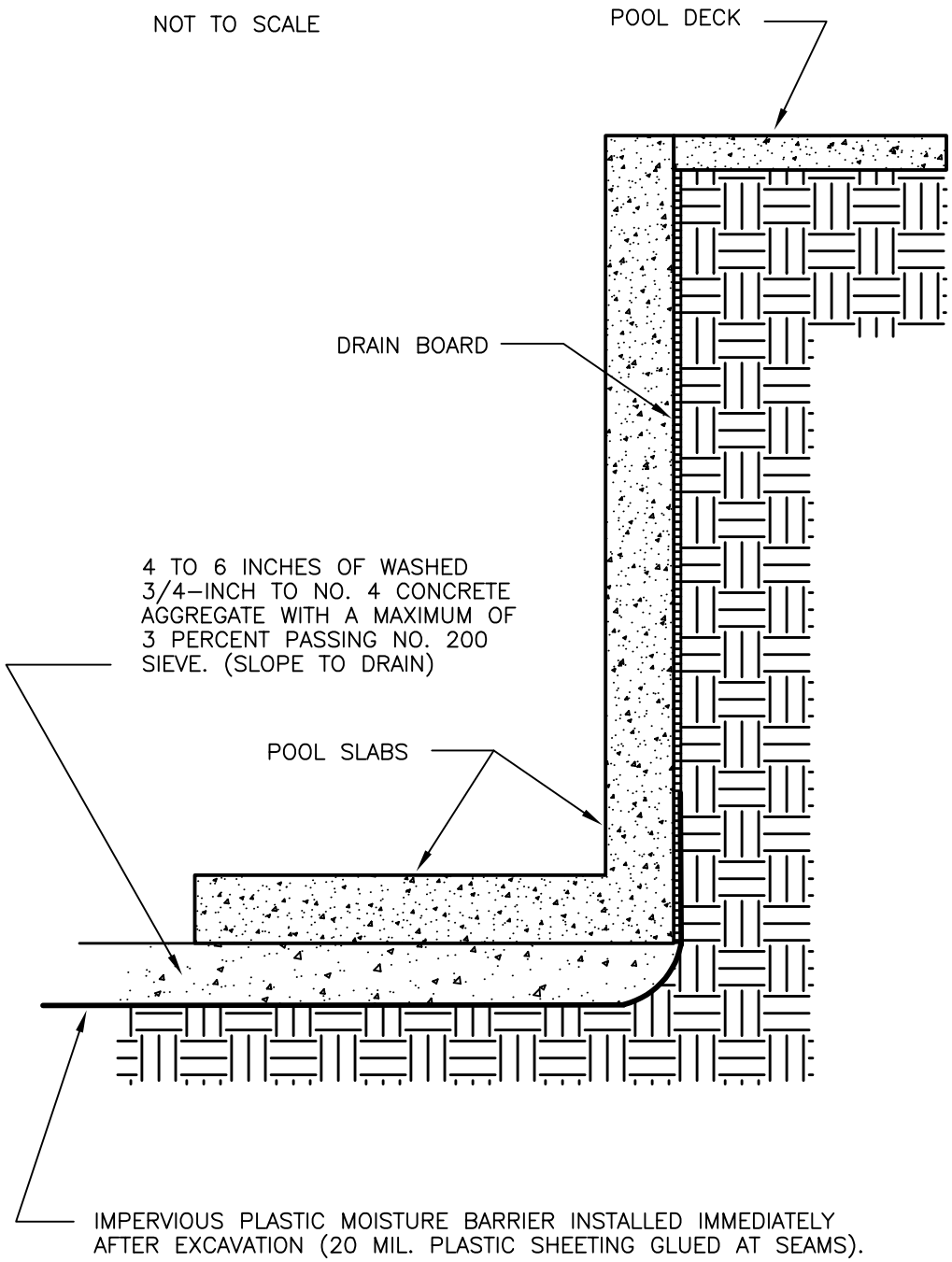
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Interior Foundation Wall Drain

Fig. 10

30-POOL_01

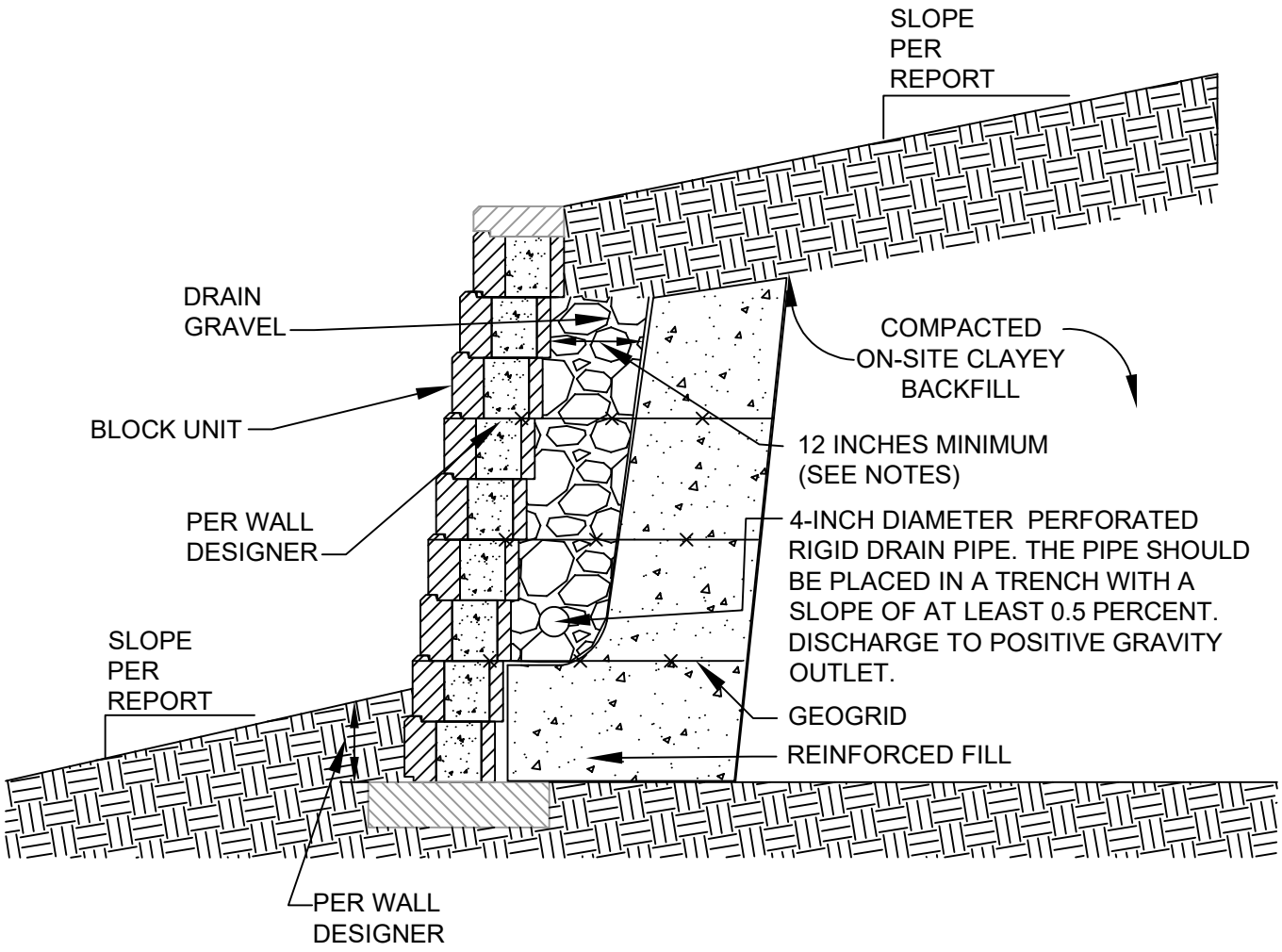
NOT TO SCALE



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Conceptual Pool Drain Detail

Fig. 11



NOT TO SCALE

NOTES:

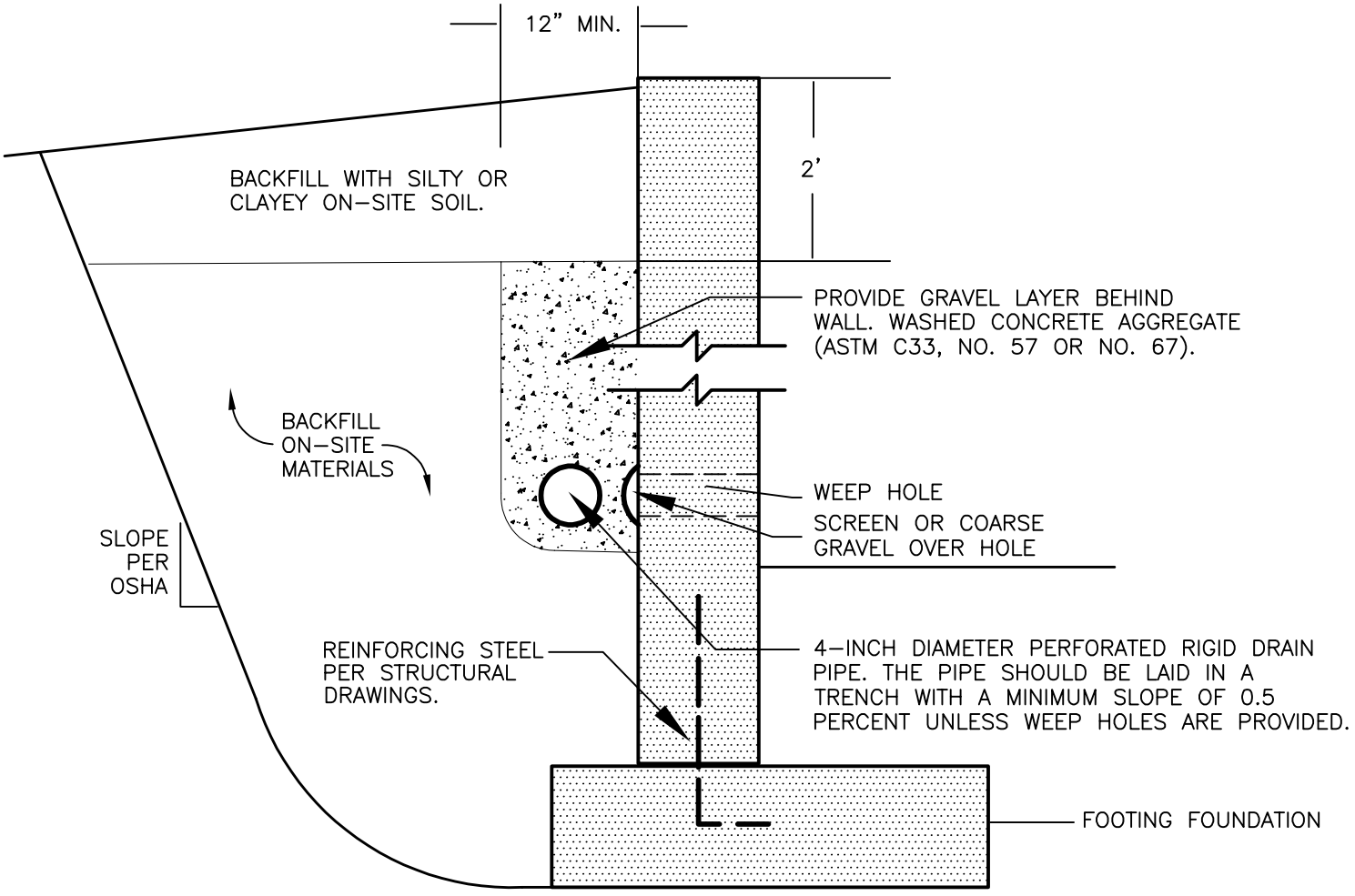
1. EXTEND DRAIN GRAVEL FROM 12 INCHES BELOW TOP GRADE TO BOTTOM GRADE AT FRONT FACE OF WALL.

2. DRAIN GRAVEL TO BE WASHED CONCRETE AGGREGATE (ASTM C33, NO. 57 OR NO. 67).

3. THE MERITS OF GEOGRID MUST BE EVALUATED BY A STRUCTURAL ENGINEER.

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Typical MSE Retaining Wall Drain Fig. 12



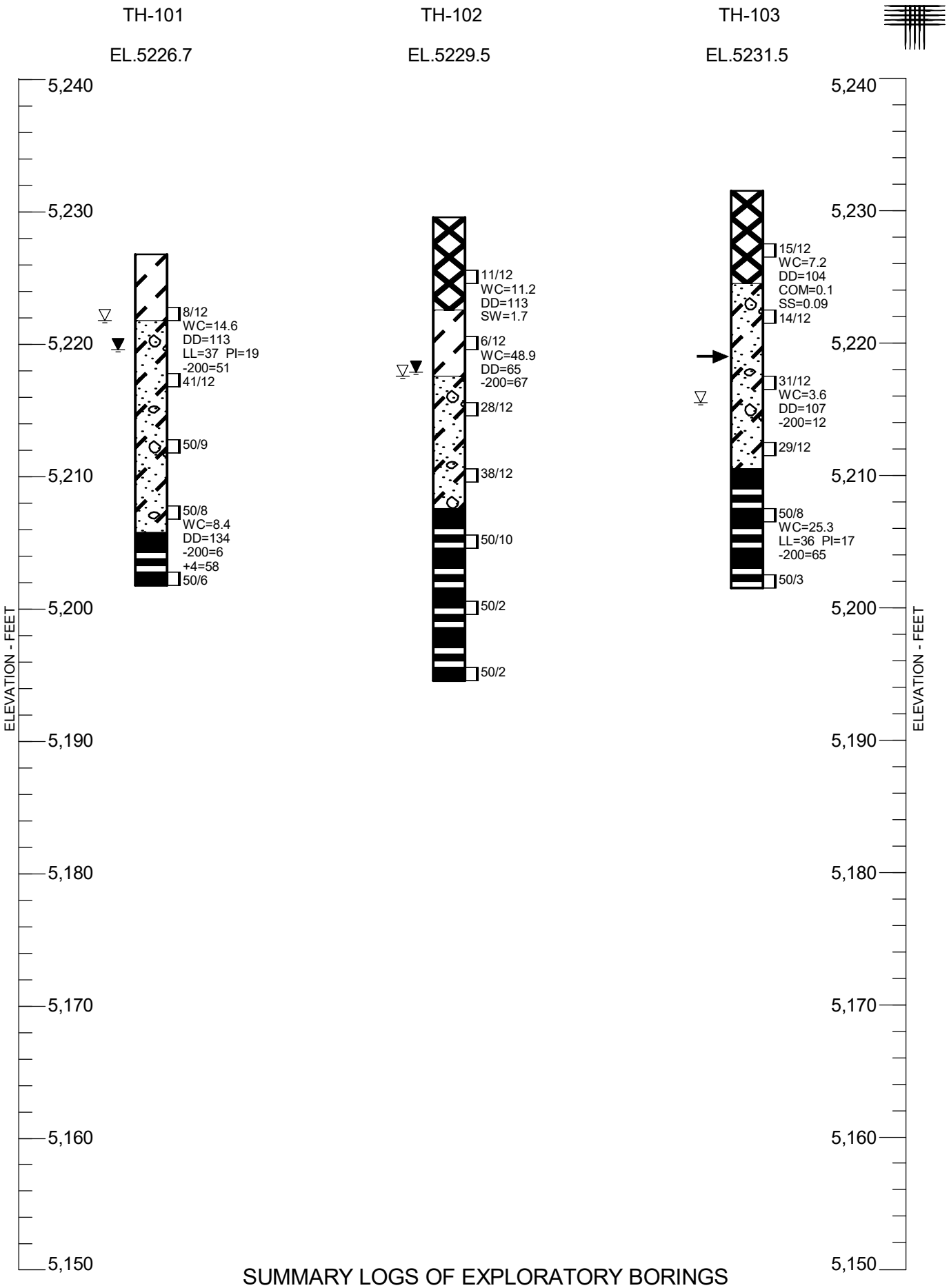
NOTE:
DRAIN PIPE TO GRAVITY OUTLET OR WEEP HOLES MAY BE USED.

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Typical Earth Retaining Wall Detail

Fig. 13

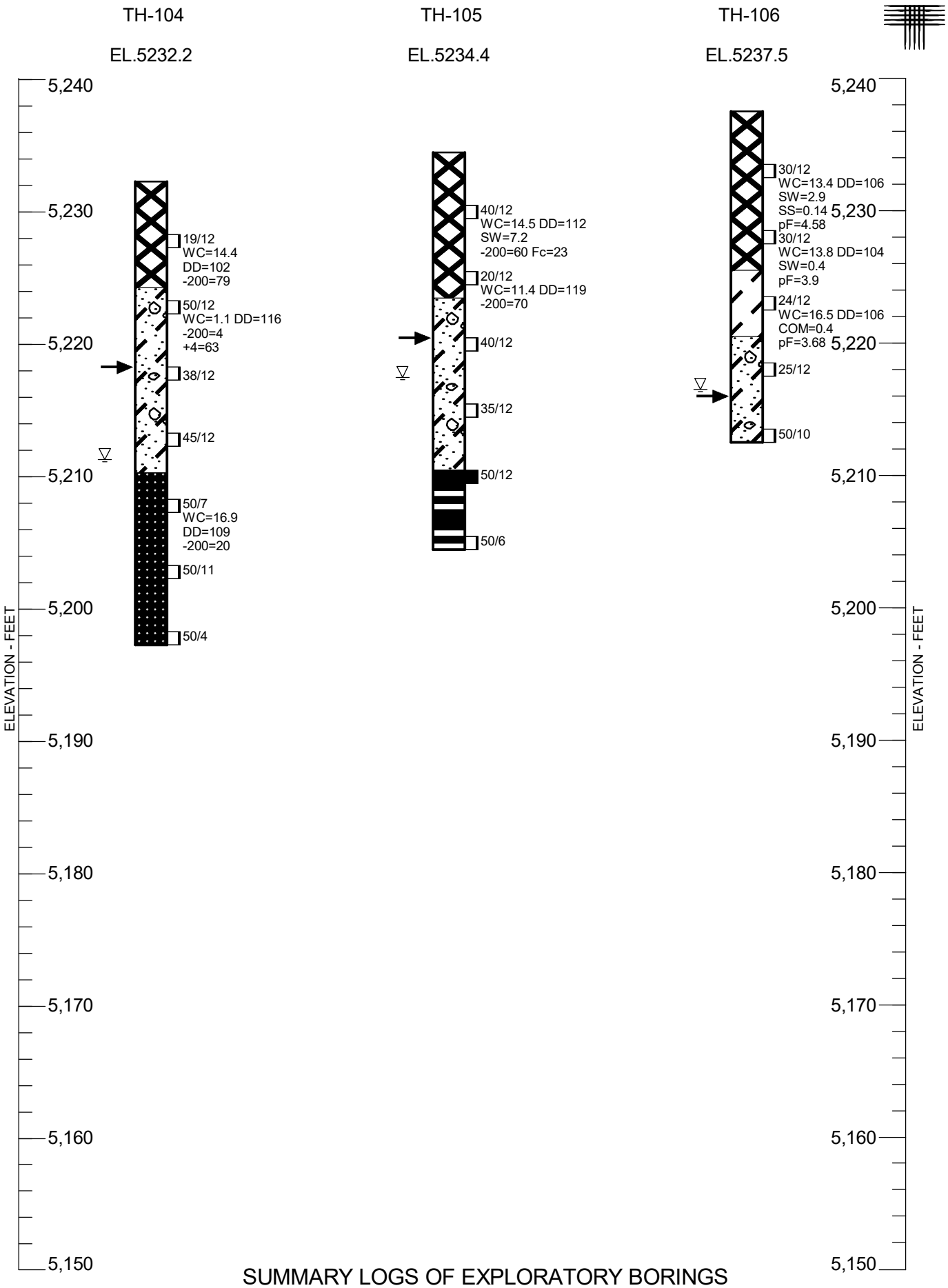
APPENDIX A
SUMMARY LOGS OF EXPLORATORY BORINGS



SUMMARY LOGS OF EXPLORATORY BORINGS

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

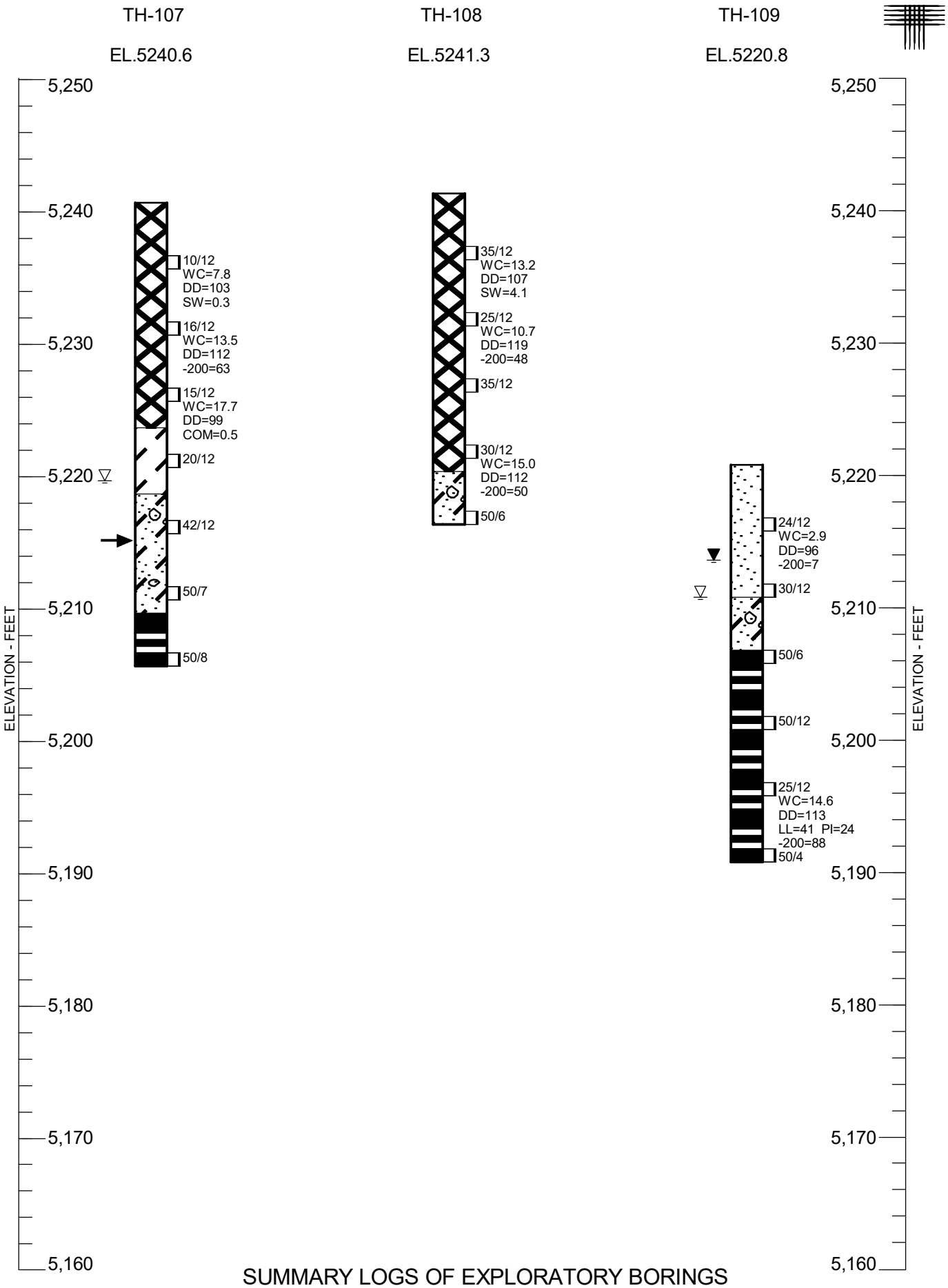
FIG. A-1



SUMMARY LOGS OF EXPLORATORY BORINGS

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

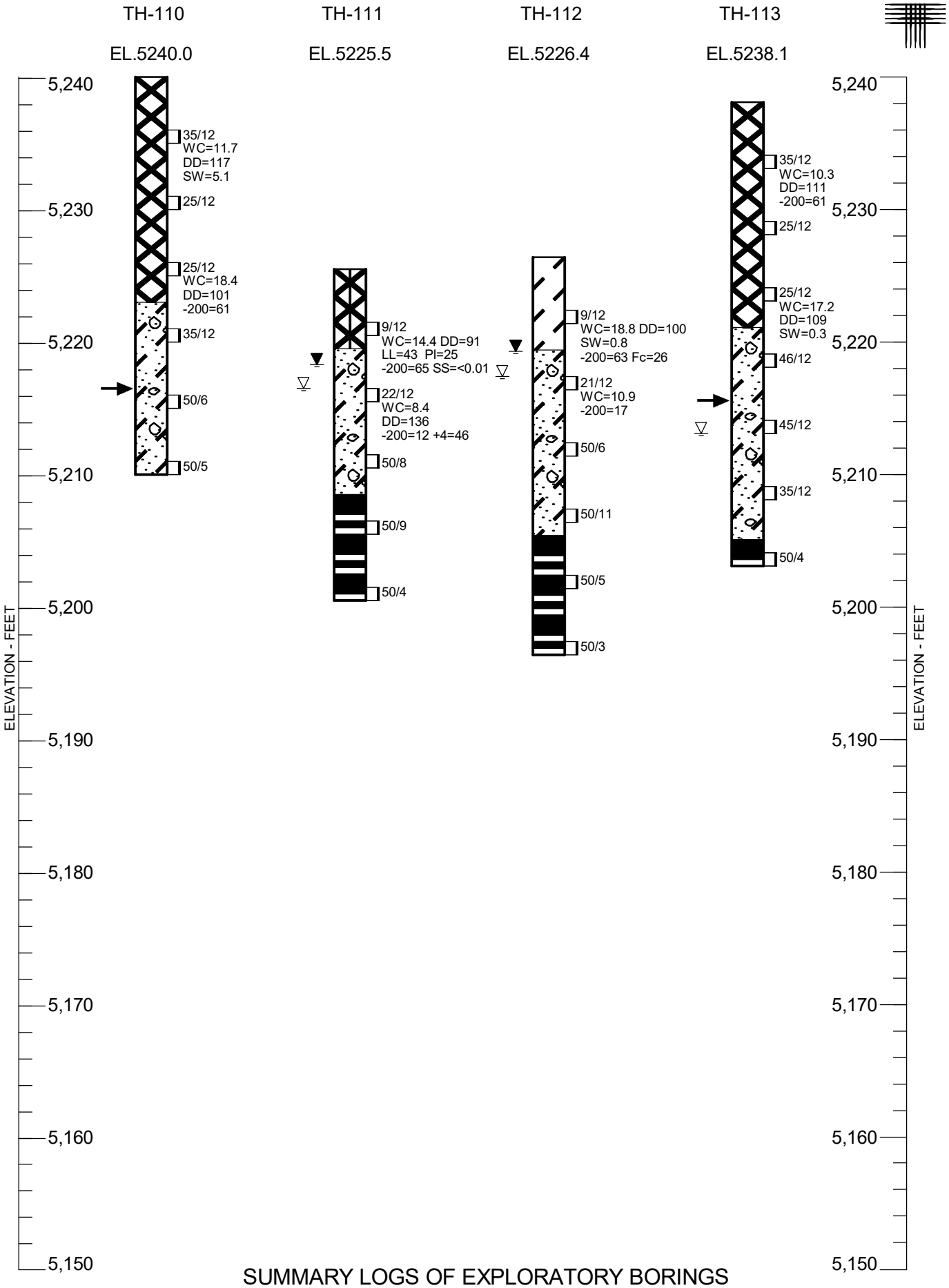
FIG. A-2



SUMMARY LOGS OF EXPLORATORY BORINGS

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

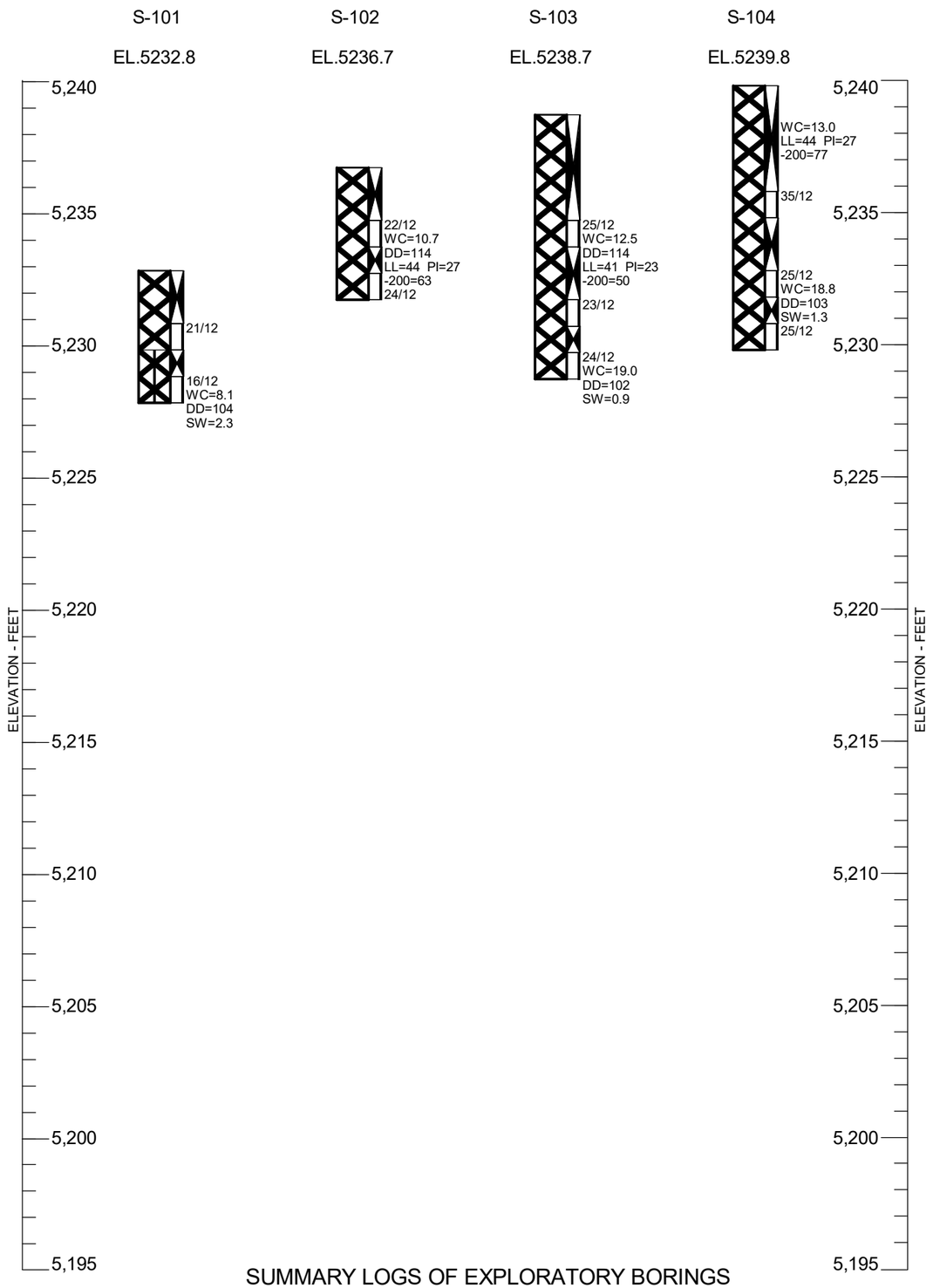
FIG. A-3



SUMMARY LOGS OF EXPLORATORY BORINGS

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FIG. A-4



SUMMARY LOGS OF EXPLORATORY BORINGS

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LEGEND:

FILL RELATED TO T-REX/I-25 CORRIDOR PROJECT AND SHERIDAN BOULEVARD REALIGNMENT, CLAY, SANDY TO VERY SANDY, SILTY TO VERY SILTY, OCCASIONAL GRAVEL, SOME CLAYEY SAND, STIFF TO VERY STIFF OR MEDIUM DENSE TO DENSE, SLIGHTLY MOIST TO MOIST, BROWN, TAN, BLACK, WHITE, GRAY, RUST, OLIVE, BROWNISH-GRAY.

FILL PREDATING T-REX/I-25 CORRIDOR PROJECT AND SHERIDAN BOULEVARD REALIGNMENT, CLAY, SANDY, STIFF TO VERY STIFF, MOIST, BROWN, TAN, WHITE.

POSSIBLE FILL MATERIAL, CLAY, SANDY TO VERY SANDY, SILTY TO VERY SILTY, SOME GRAVEL, MEDIUM STIFF TO VERY STIFF, SLIGHTLY MOIST TO MOIST, DARK BROWN, BROWN, RUST (CL).

SAND AND GRAVEL, CLEAN TO SILTY/CLAYEY, OCCASIONAL SILTY SAND LENSES, MEDIUM DENSE TO VERY DENSE, SLIGHTLY MOIST TO WET, BROWN, TAN, GRAY (GP, GP-GM, GM, GC, SP, SP-SM, SM, SC).

SAND, CLEAN TO SLIGHTLY SILTY, MINOR GRAVEL, MEDIUM DENSE TO DENSE, SLIGHTLY MOIST, TAN, LIGHT BROWN (SP, SP-SM).

BEDROCK, CLAYSTONE, SILTY, SANDY, HARD TO VERY HARD, MOIST TO VERY MOIST, WEATHERED ZONE WITHIN THE STRATUM, BLUISH-GRAY, GRAY, BLACK.

BEDROCK, SANDSTONE, CLAYEY, HARD TO VERY HARD, MOIST TO WET, GRAY.

DRIVE SAMPLE. THE SYMBOL 8/12 INDICATES 8 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

DRIVE SAMPLE. THE SYMBOL 50/12 INDICATES 50 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.0-INCH O.D. SAMPLER 12 INCHES.

BULK SAMPLE COLLECTED FROM AUGER CUTTINGS.

WATER LEVEL MEASURED AT TIME OF DRILLING.

WATER LEVEL MEASURED AFTER DRILLING ON APRIL 27, 2023

INDICATES DEPTH WHERE THE TEST HOLE CAVED DURING DELAYED WATER CHECKS.

NOTES:

1. THE BORINGS WERE DRILLED BETWEEN APRIL 18 AND 21, 2023 USING A 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND TRUCK-MOUNTED DRILL RIGS.

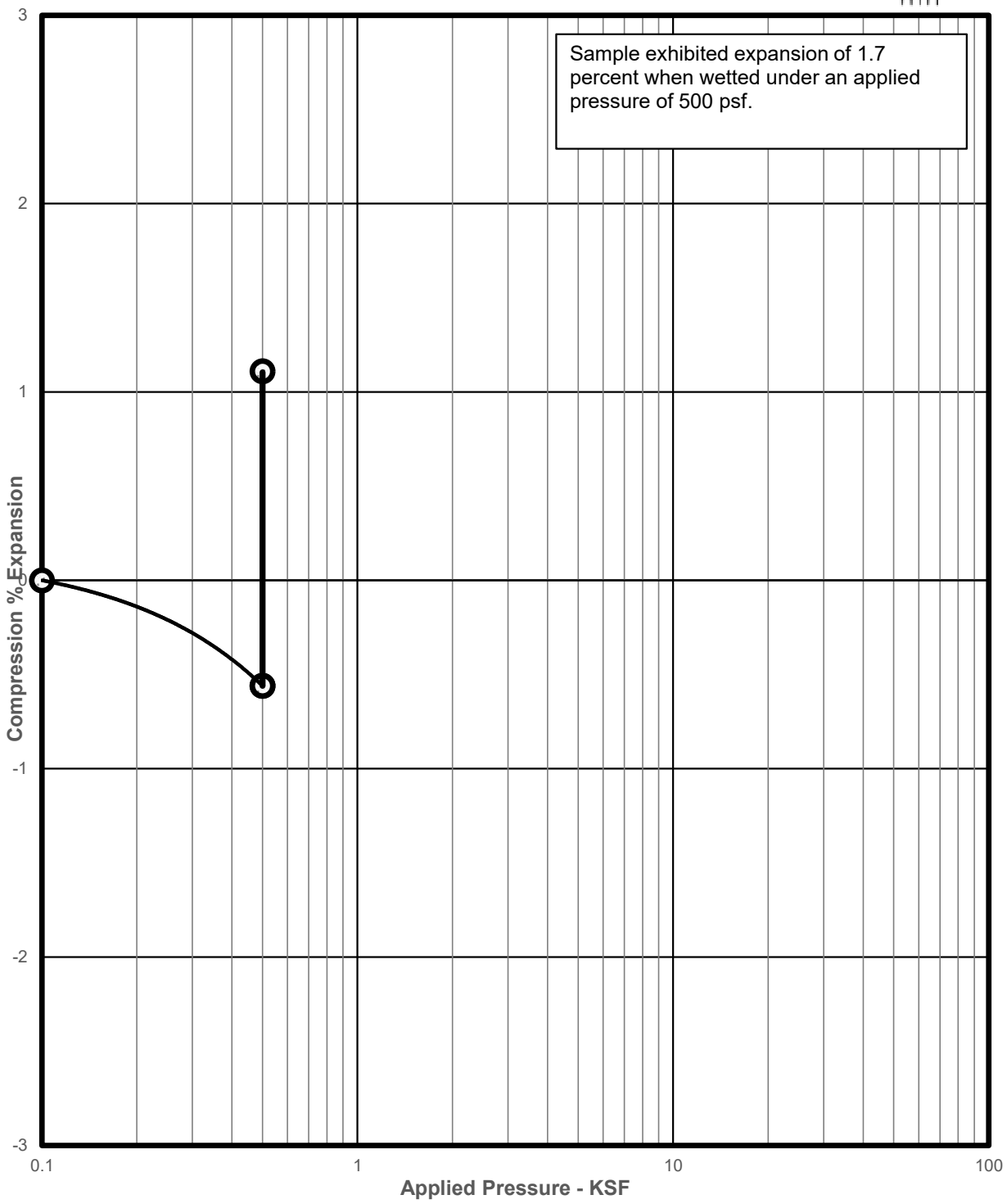
2. BORING LOCATIONS AND ELEVATIONS ARE APPROXIMATE AND WERE DETERMINED BY A REPRESENTATIVE OF OUR FIRM USING A LEICA GS18 GPS UNIT REFERENCING THE NORTH AMERICAN DATUM OF 1983 (NAD83).

3. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   SW - INDICATES SWELL WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).
   COM - INDICATES COMPRESSION WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).
   LL - INDICATES LIQUID LIMIT.
   PI - INDICATES PLASTICITY INDEX.
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
   +4 - INDICATES RETAINED ON NO. 4 SIEVE (%).
   Fc - INDICATES CLAY CONTENT (%).
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
   pF - INDICATES SOIL SUCTION VALUE (PSF).

4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS, AND CONCLUSIONS AS CONTAINED IN THIS REPORT.

APPENDIX B

LABORATORY TEST RESULTS AND TABLE B-I

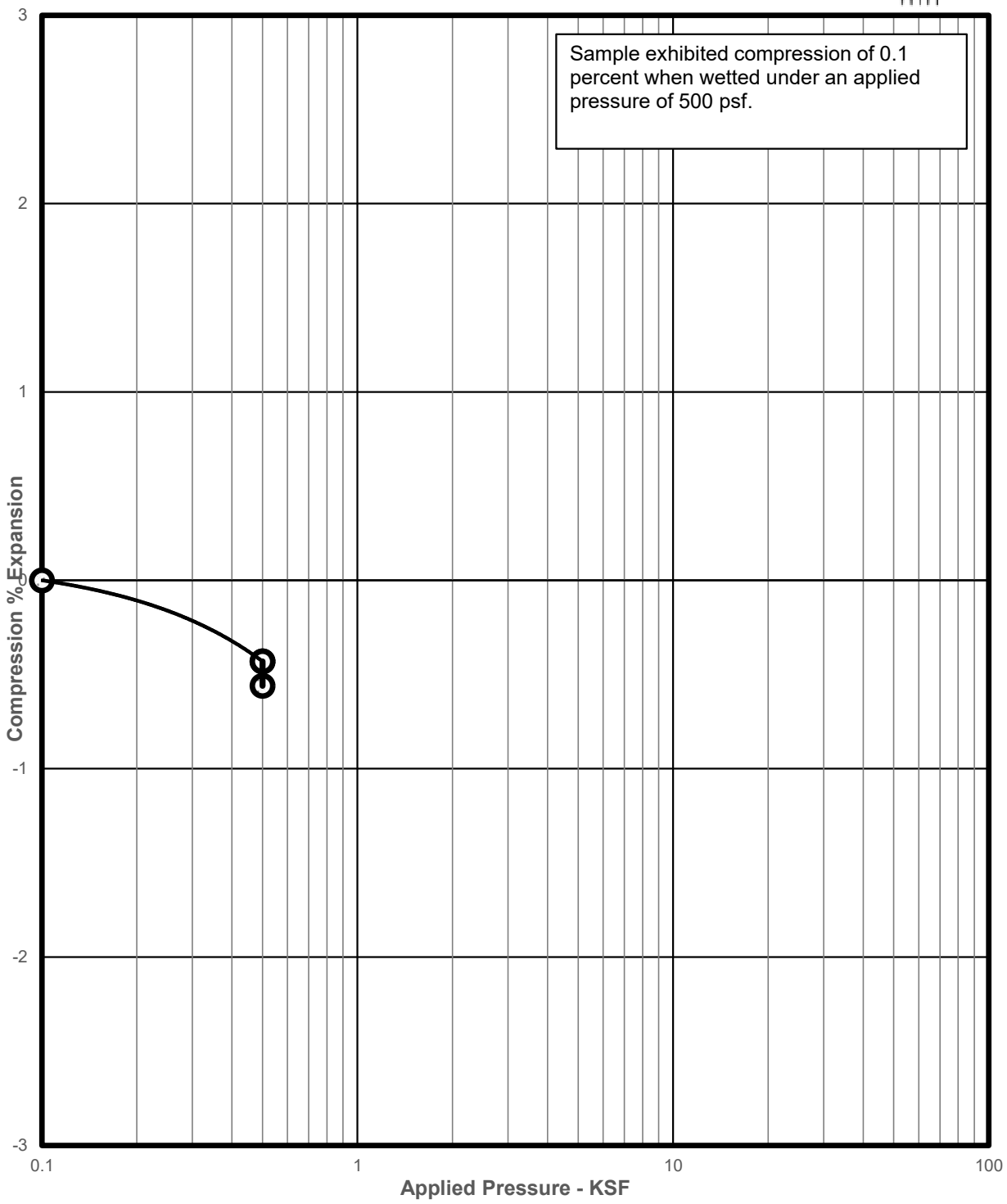


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-102 AT 4 FEET

DRY UNIT WEIGHT: 113 pcf
MOISTURE CONTENT: 11.2 %

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Swell Consolidation Test Results FIG. B- 1

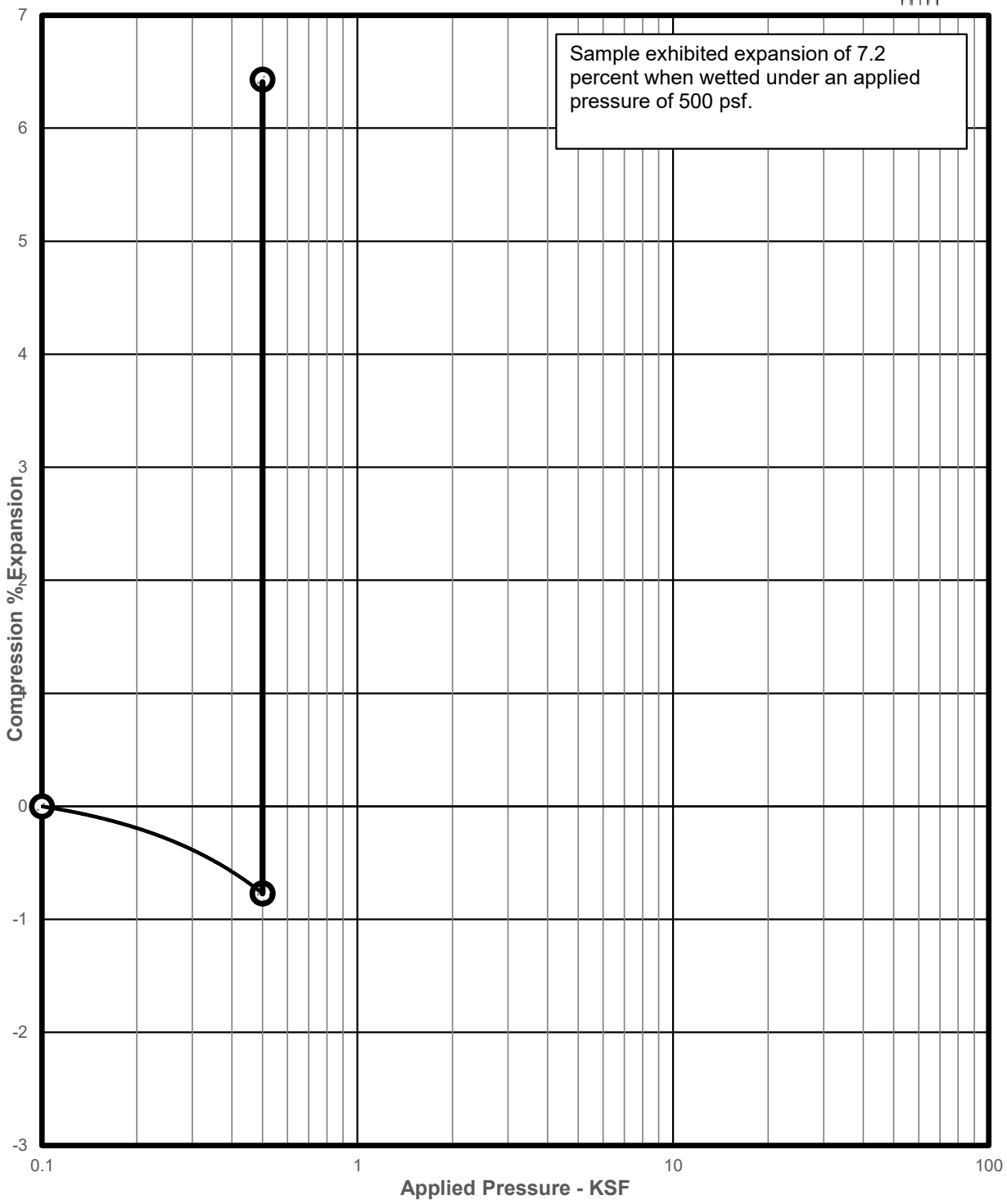


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-103 AT 4 FEET

DRY UNIT WEIGHT: 104 pcf
MOISTURE CONTENT: 7.2 %

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5602 LOWELL BOULEVARD APARTMENTS
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Swell Consolidation Test Results FIG. B- 2

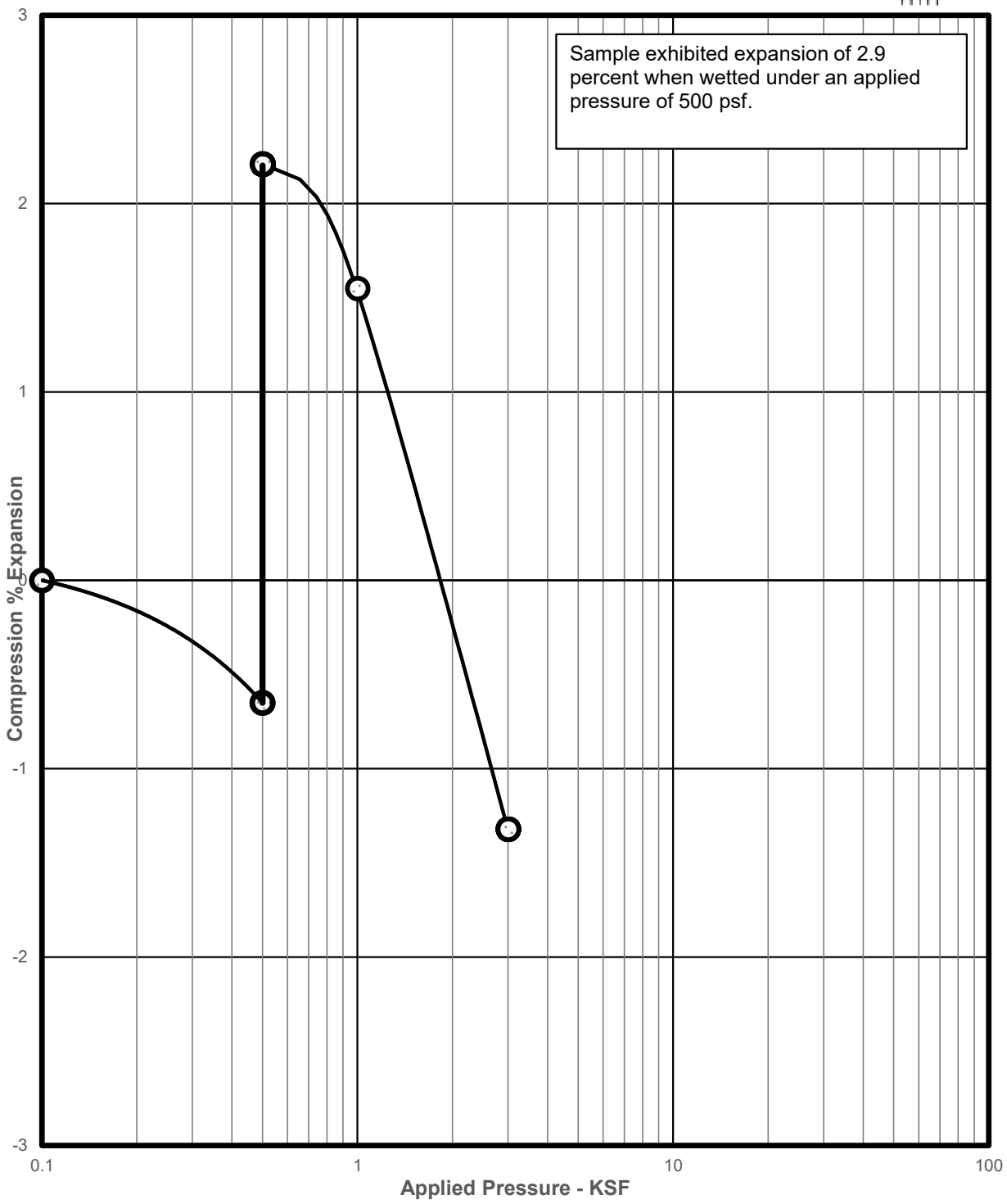


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-105 AT 4 FEET

DRY UNIT WEIGHT: 112 pcf
MOISTURE CONTENT: 14.5 %

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Swell Consolidation Test Results FIG. B- 3

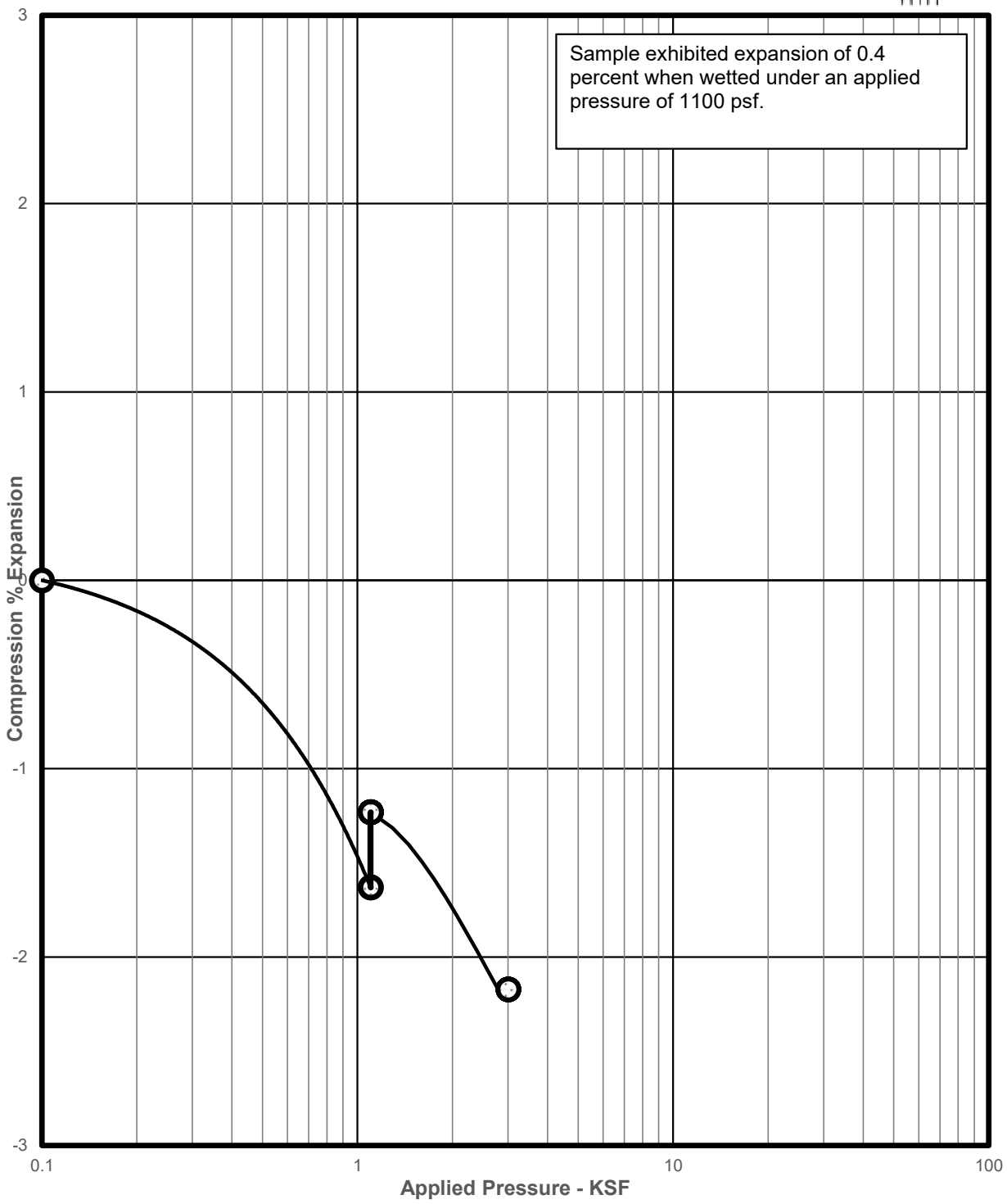


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-106 AT 4 FEET

DRY UNIT WEIGHT: 106 pcf
MOISTURE CONTENT: 13.4 %

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Swell Consolidation Test Results FIG. B- 4

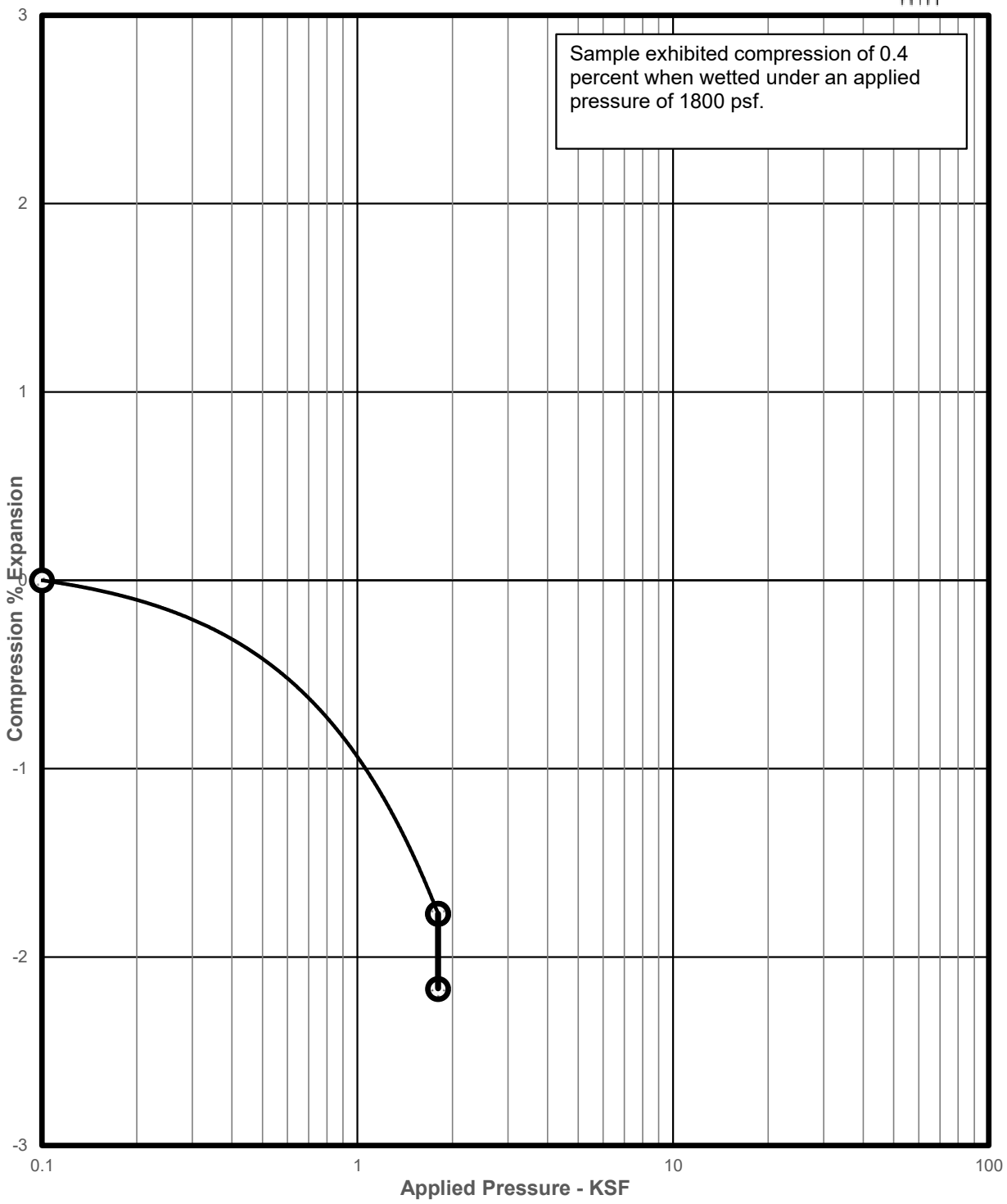


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-106 AT 9 FEET

DRY UNIT WEIGHT: 104 pcf
MOISTURE CONTENT: 13.8 %

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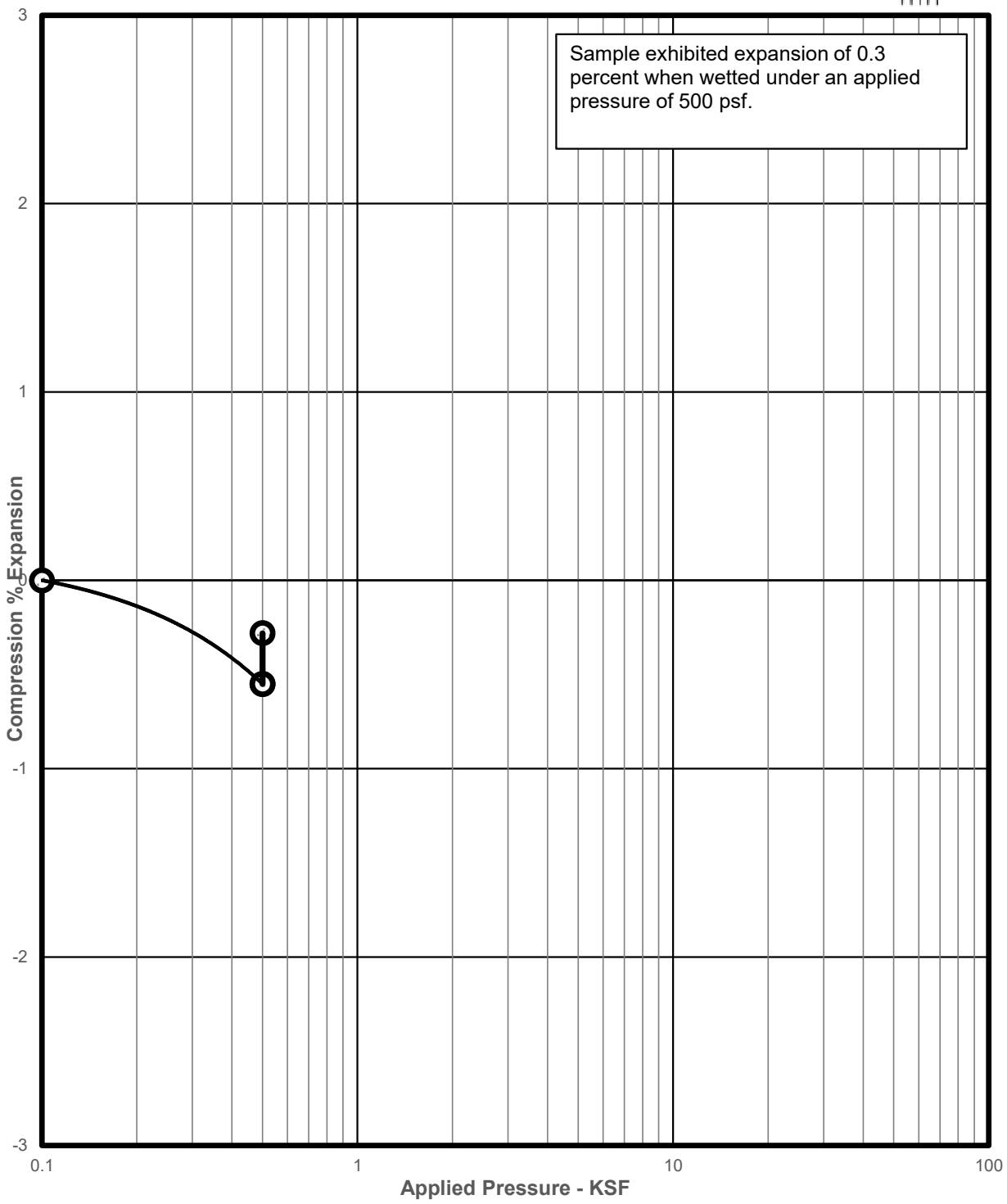
Swell Consolidation Test Results FIG. B- 5



SAMPLE OF: CLAY, SANDY (CL) DRY UNIT WEIGHT: 106 pcf
FROM: TH-106 AT 14 FEET MOISTURE CONTENT: 16.5 %

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Swell Consolidation Test Results FIG. B- 6

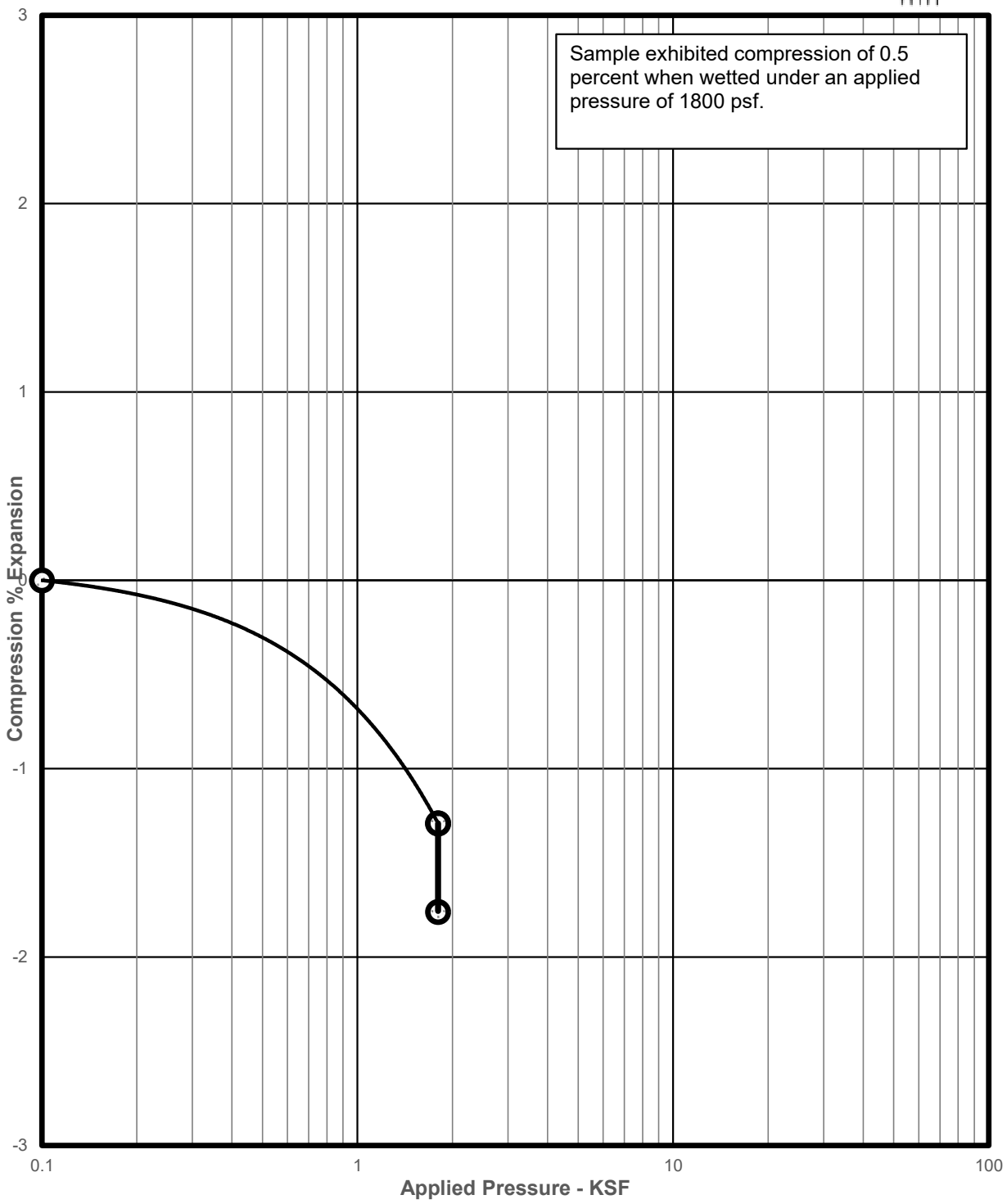


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-107 AT 4 FEET

DRY UNIT WEIGHT: 103 pcf
MOISTURE CONTENT: 7.8 %

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Swell Consolidation Test Results FIG. B- 7

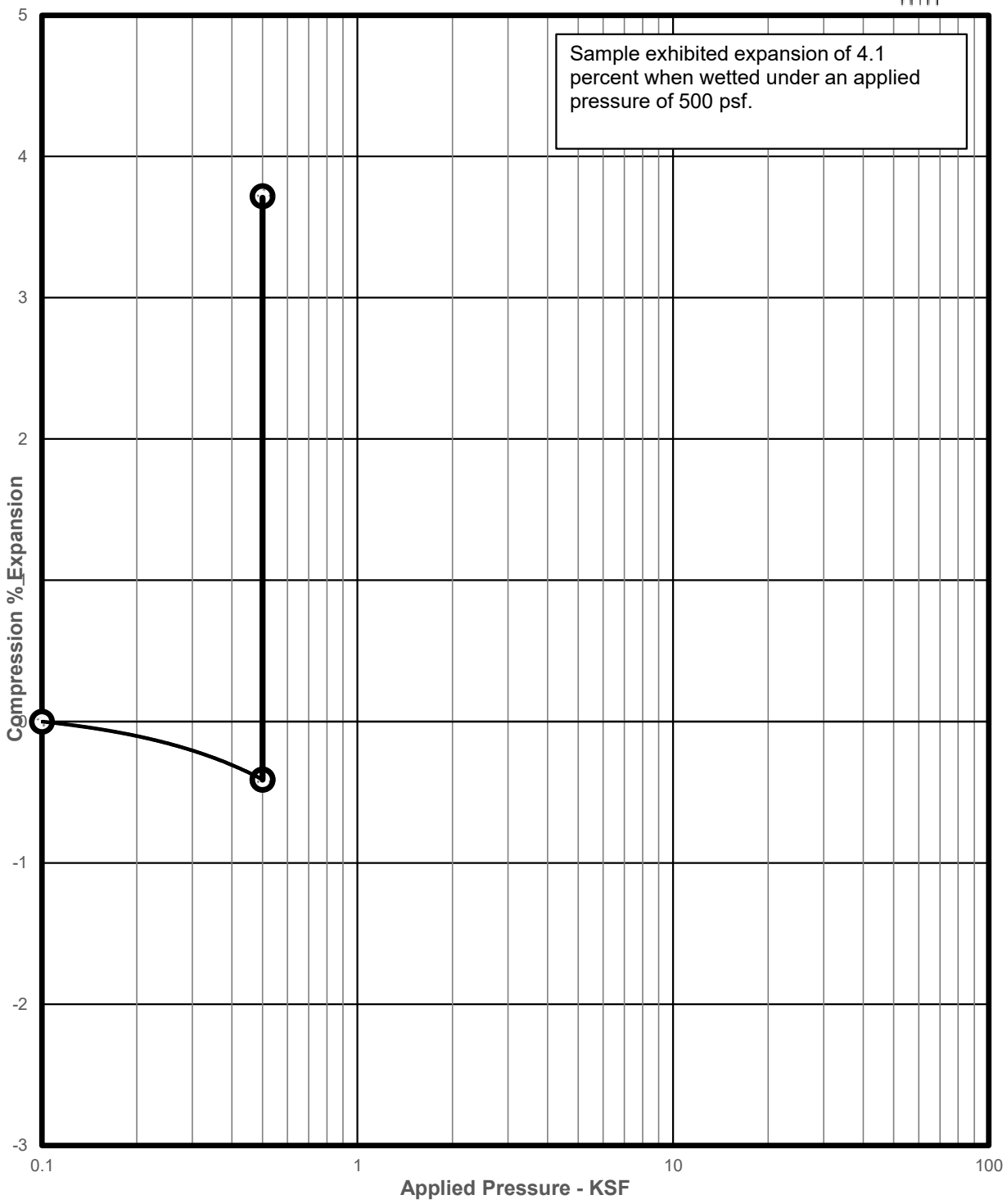


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-107 AT 14 FEET

DRY UNIT WEIGHT: 99 pcf
MOISTURE CONTENT: 17.7 %

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Swell Consolidation Test Results FIG. B- 8

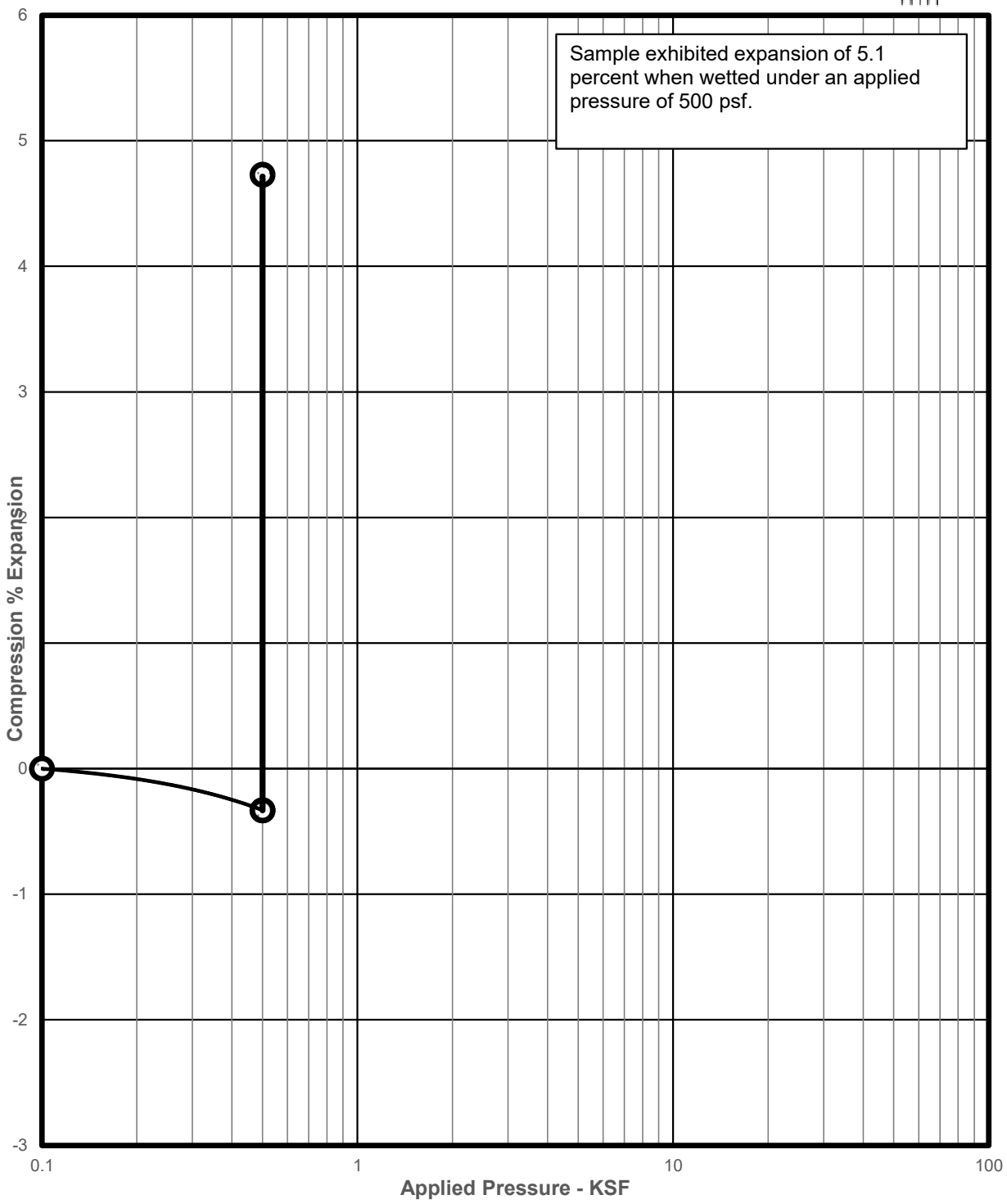


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-108 AT 4 FEET

DRY UNIT WEIGHT: 107 pcf
MOISTURE CONTENT: 13.2 %

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Swell Consolidation Test Results FIG. B- 9

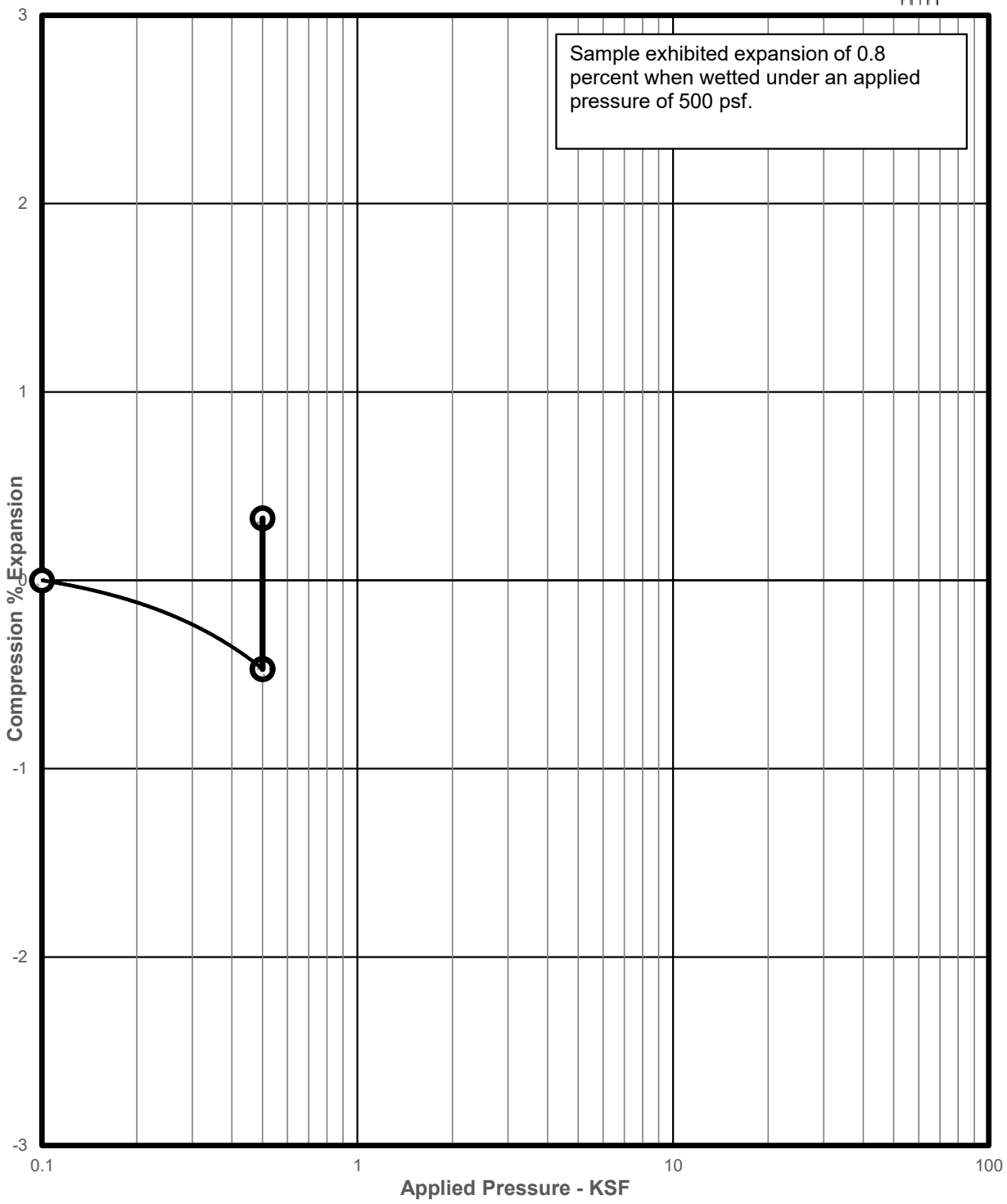


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-110 AT 4 FEET

DRY UNIT WEIGHT: 117 pcf
MOISTURE CONTENT: 11.7 %

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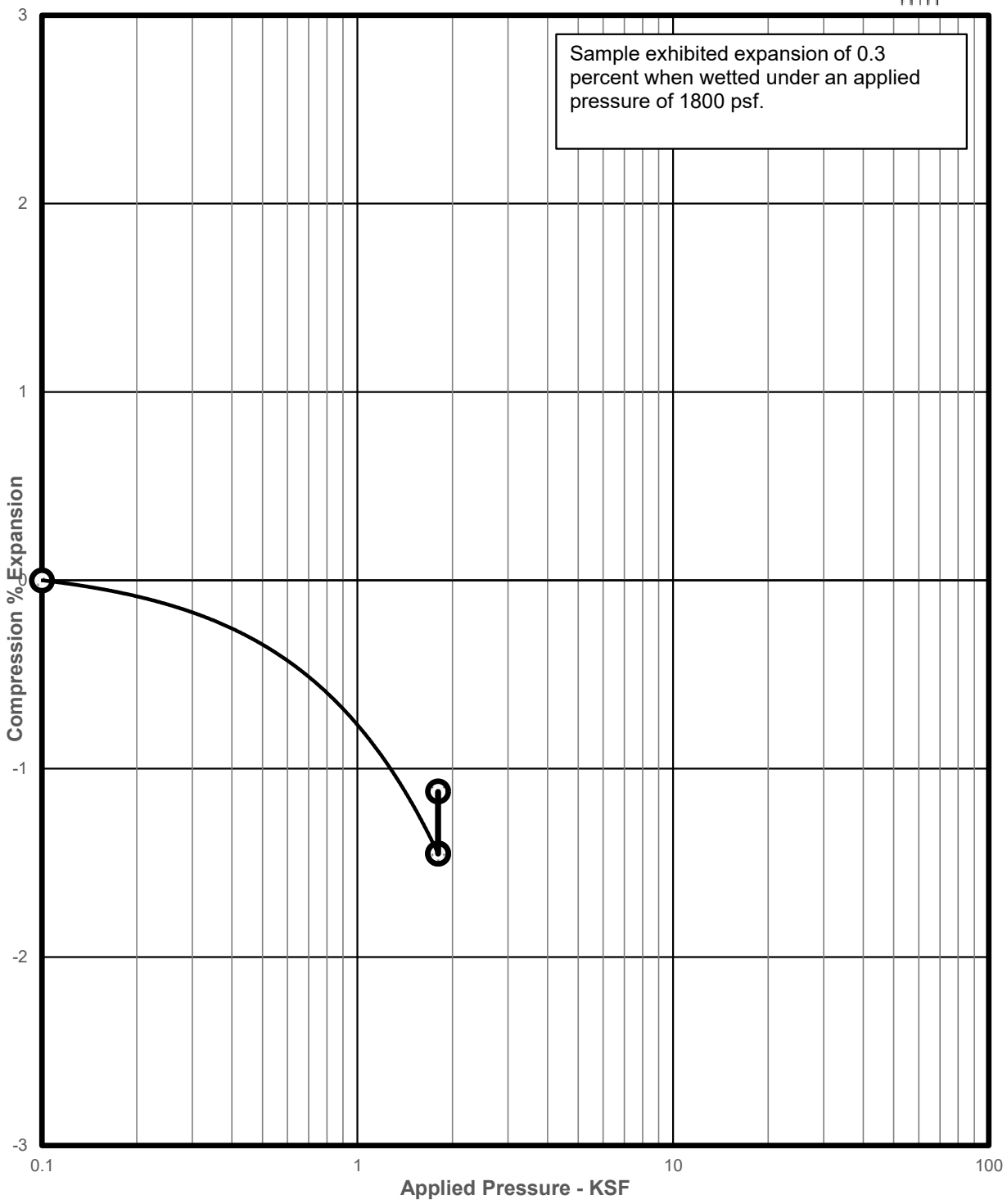
Swell Consolidation Test Results FIG. B- 10



SAMPLE OF: CLAY, SANDY (CL) DRY UNIT WEIGHT: 100 pcf
FROM: TH-112 AT 4 FEET MOISTURE CONTENT: 18.8 %

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Swell Consolidation Test Results FIG. B- 11

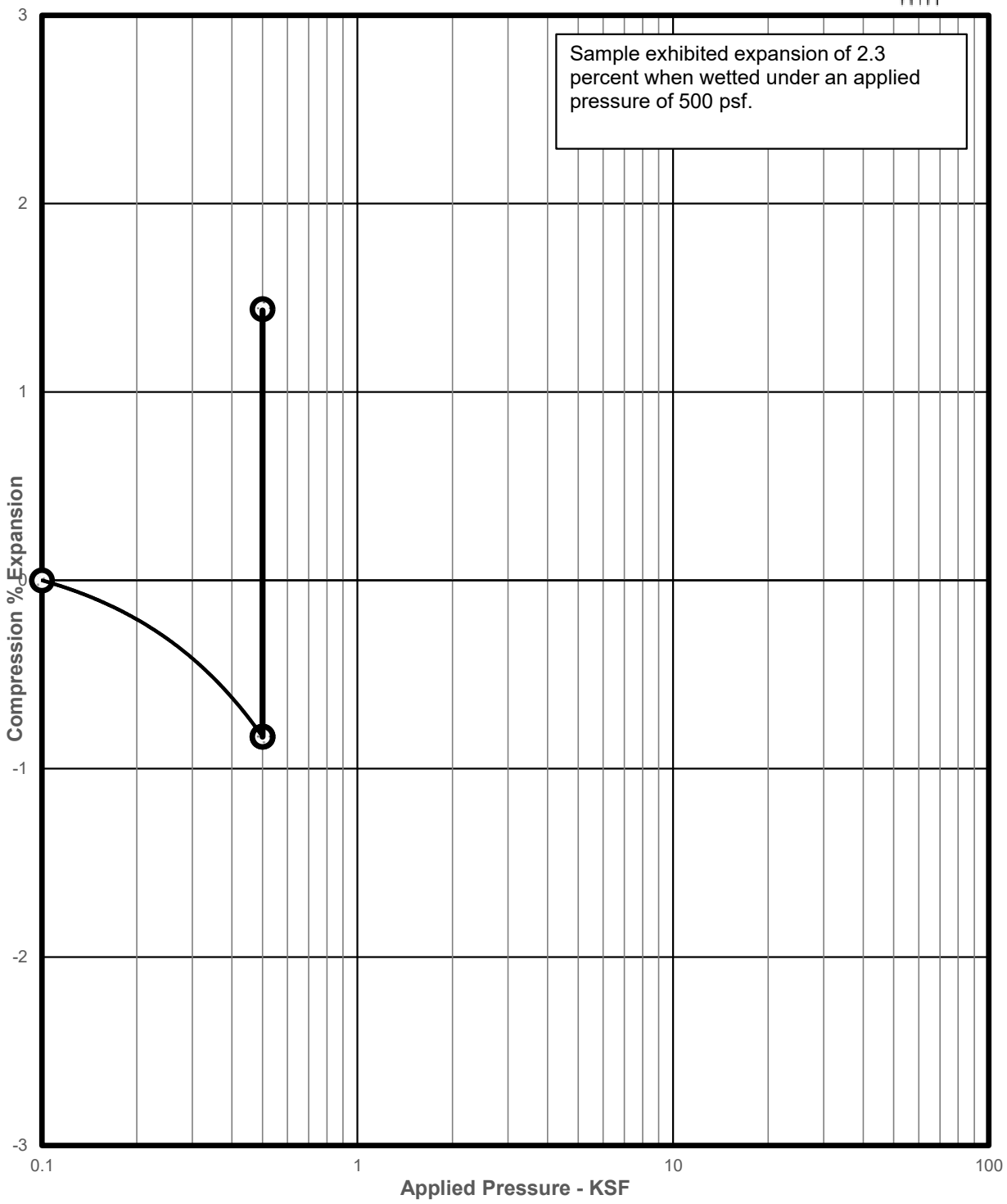


SAMPLE OF: FILL, CLAY, SANDY
FROM: TH-113 AT 14 FEET

DRY UNIT WEIGHT: 109 pcf
MOISTURE CONTENT: 17.2 %

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Swell Consolidation Test Results FIG. B- 12

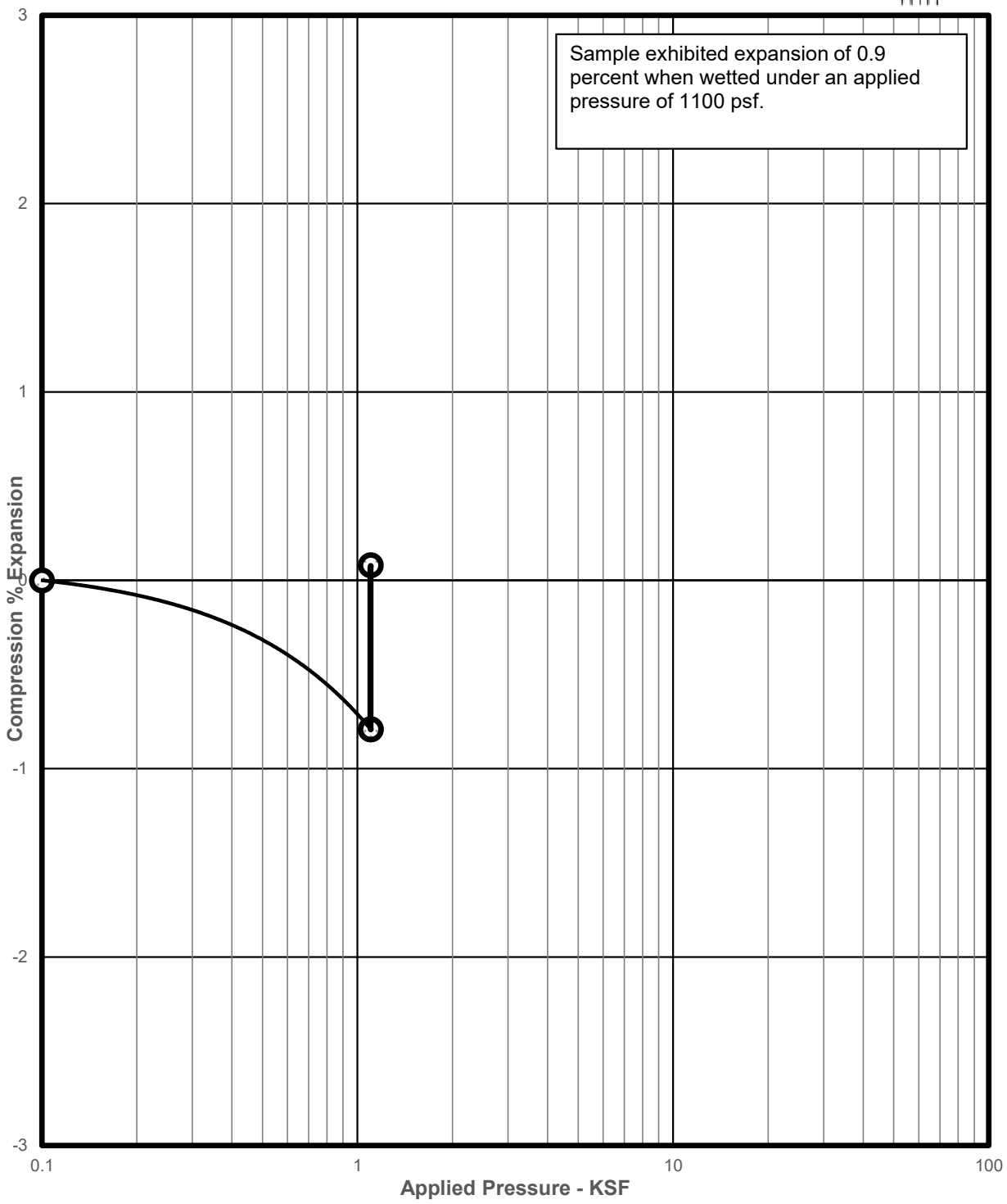


SAMPLE OF: FILL, CLAY, SANDY
FROM: S-101 AT 4 FEET

DRY UNIT WEIGHT: 104 pcf
MOISTURE CONTENT: 8.1 %

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
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Swell Consolidation Test Results FIG. B- 13

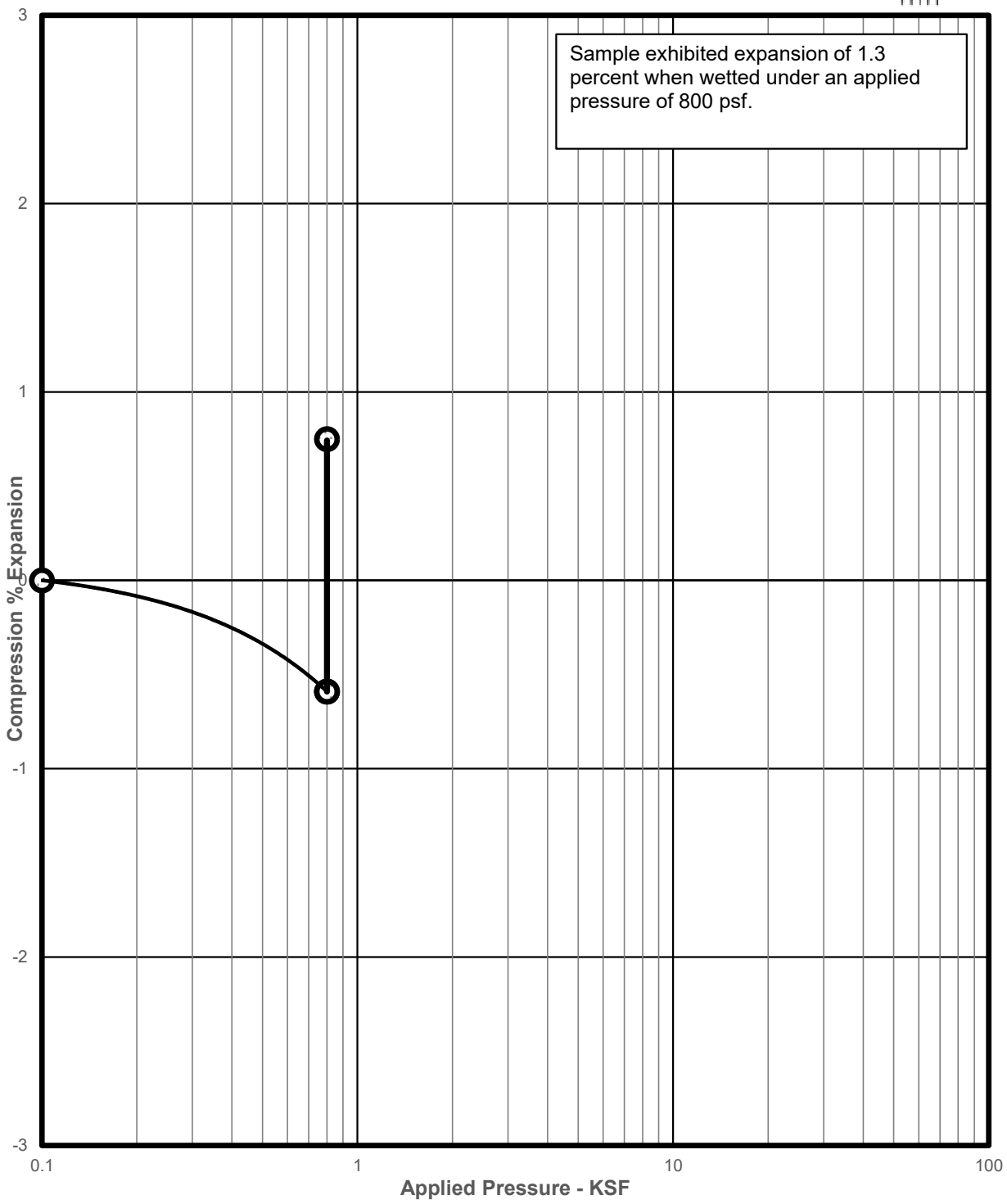


SAMPLE OF: FILL, CLAY, SANDY
FROM: S-103 AT 9 FEET

DRY UNIT WEIGHT: 102 pcf
MOISTURE CONTENT: 19.0 %

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Swell Consolidation Test Results FIG. B- 14

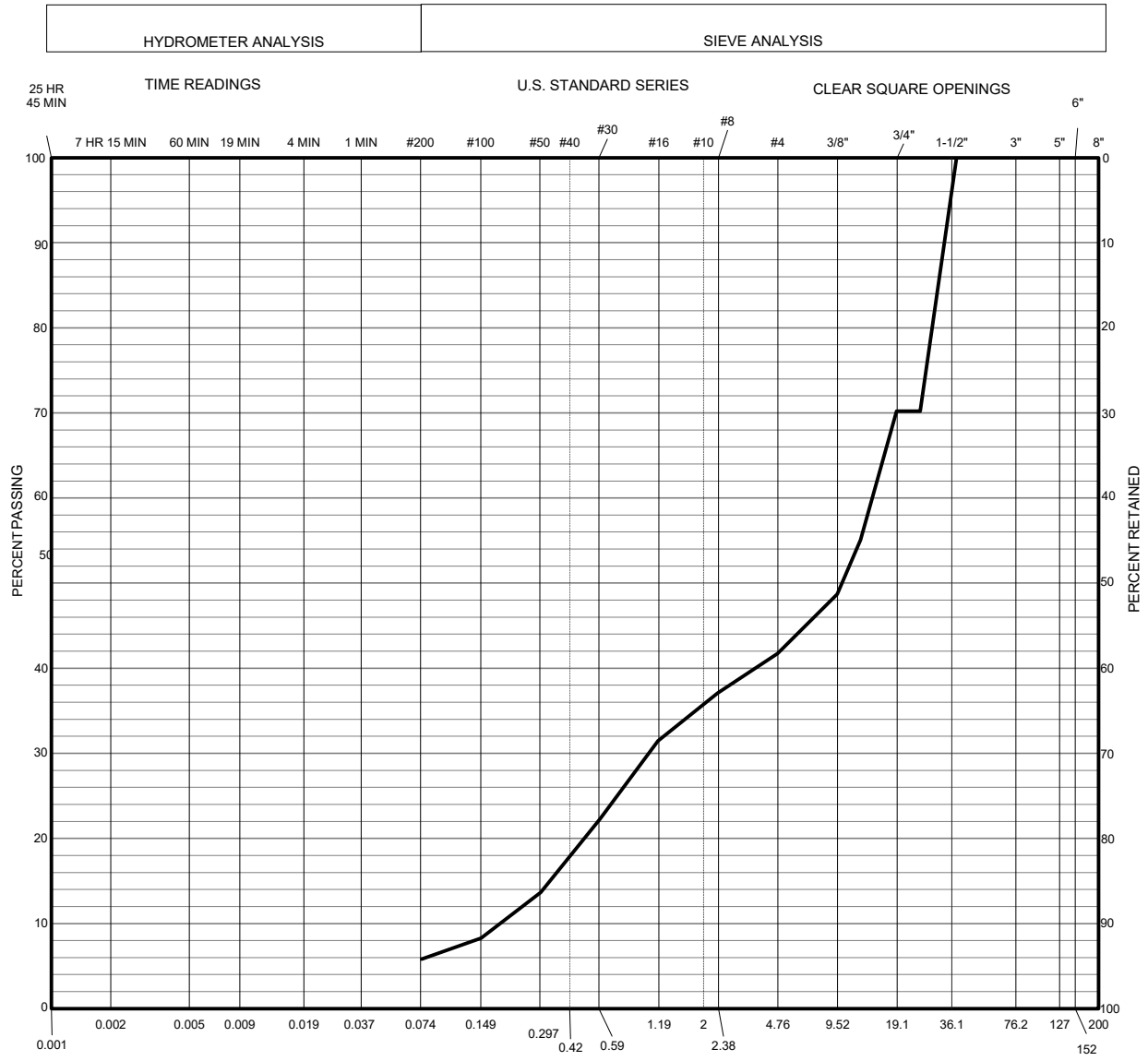


SAMPLE OF: FILL, CLAY, SANDY
FROM: S-104 AT 7 FEET

DRY UNIT WEIGHT: 103 pcf
MOISTURE CONTENT: 18.8 %

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Swell Consolidation Test Results FIG. B- 15



SAMPLE OF: GRAVEL, SANDY (GP-GM)
FROM: TH-101 AT 19 FEET

GRAVEL: 58.3%
SILT & CLAY: 5.8%
PLASTIC INDEX: -

SAND: 35.9%
LIQUID LIMIT: -

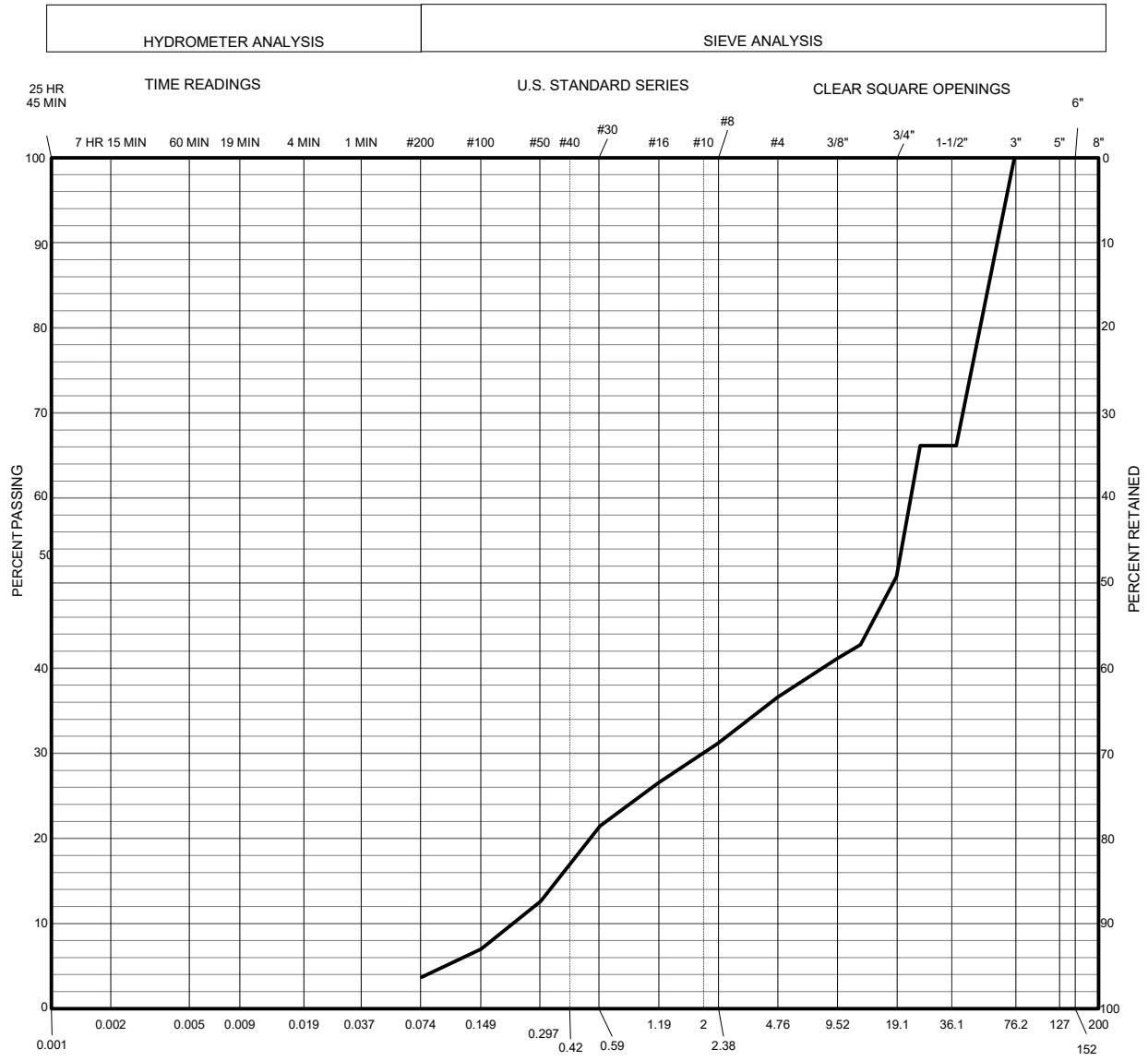
D10 0.198 D30 1.088 D60: 14.617 CU: 73.9 CC: 0.4

Size (mm)	-	38.1	25.0	19.0	12.5	9.5	4.8	2.4	1.2	0.6	0.3	0.2	0.1	-	-	-	-	-	-
% Passing	-	####	70.2	70.2	55.1	48.7	41.7	37.1	31.5	22.3	13.7	8.3	5.8	-	-	-	-	-	-

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Gradation Test Results

FIG. B- 16



SAMPLE OF:	GRAVEL, SANDY (GP)	GRAVEL:	63.4%	SAND:	32.9%
FROM:	TH-104 AT 9 FEET	SILT & CLAY:	3.7%	LIQUID LIMIT:	-
		PLASTIC INDEX:	-		

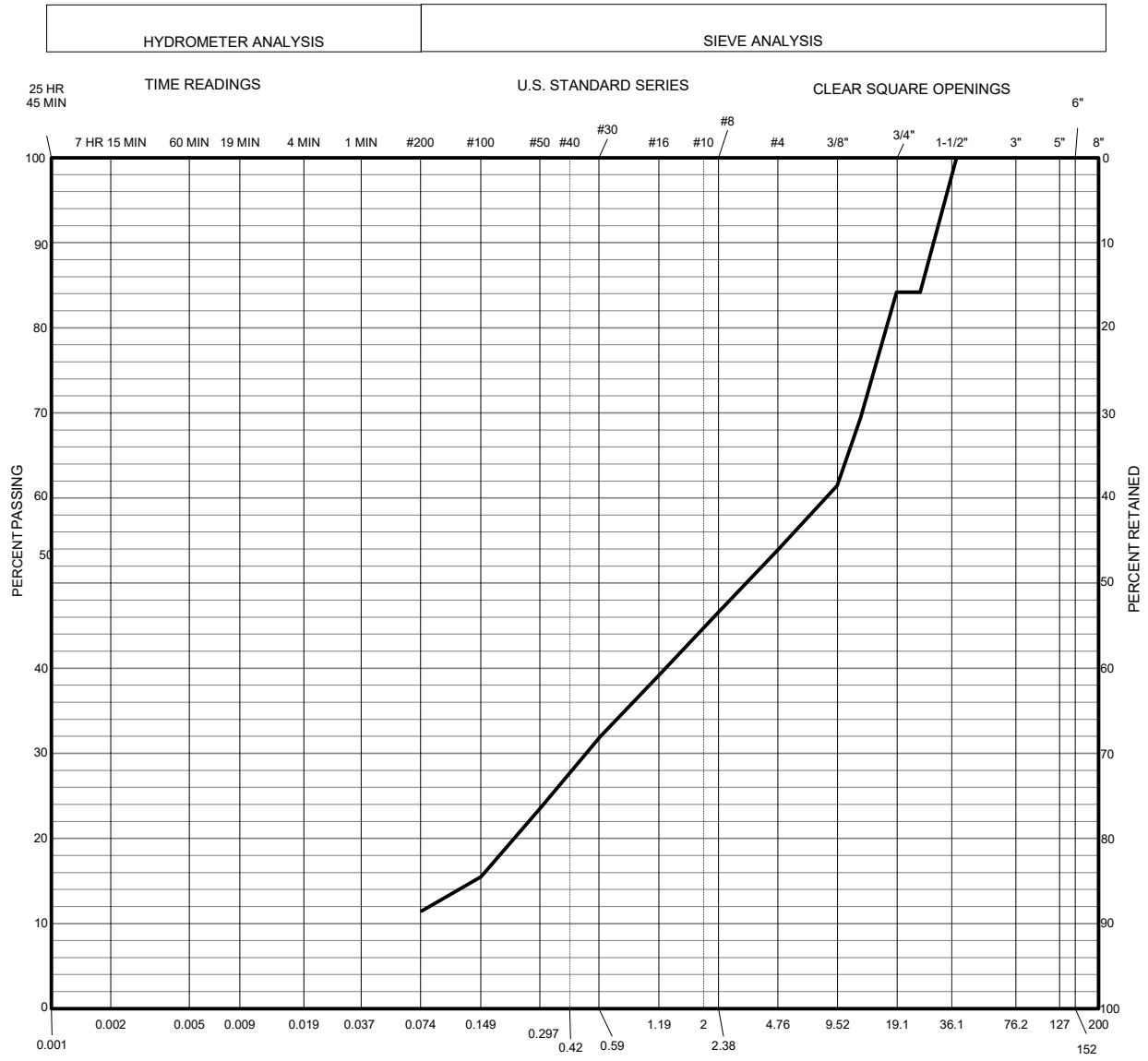
D10 0.230 D30 2.070 D60: 22.598 CU: 98.2 CC: 0.8

Size (mm)	75.0	38.1	25.0	19.0	12.5	9.5	4.8	2.4	1.2	0.6	0.3	0.2	0.1	-	-	-	-	-	-
% Passing	100.0	66.2	66.2	50.8	42.8	41.1	36.6	31.1	26.5	21.5	12.6	7.0	3.7	-	-	-	-	-	-

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Gradation Test Results

FIG. B- 17



SAMPLE OF:	GRAVEL, SILTY, SANDY (GM)	GRAVEL:	46.1%	SAND:	42.4%
FROM:	TH-111 AT 9 FEET	SILT & CLAY:	11.5%	LIQUID LIMIT:	-
		PLASTIC INDEX:	-		

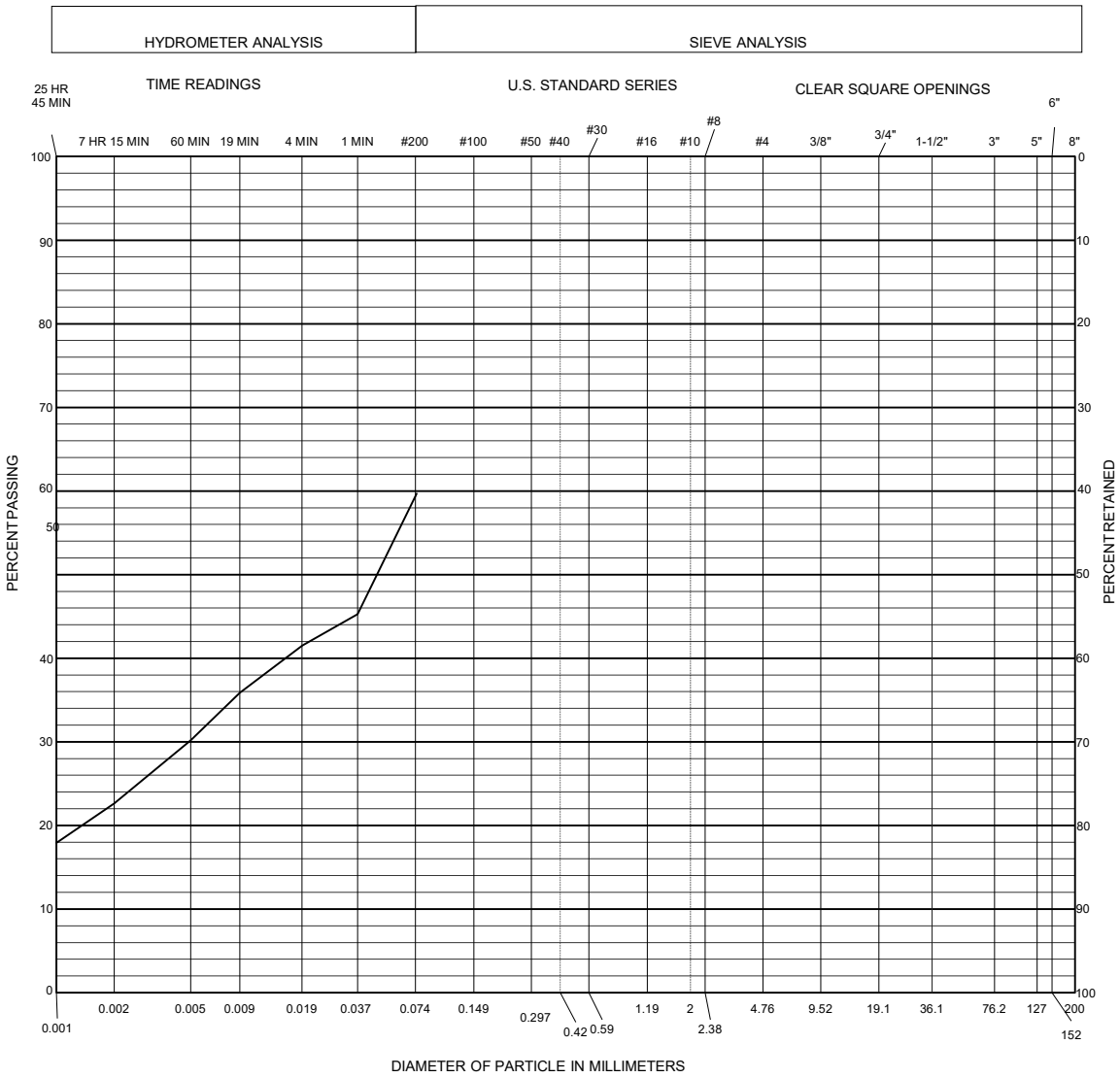
D10 -- D30 0.530 D60: 8.585 CU: -- CC: --

Size (mm)	-	38.1	25.0	19.0	12.5	9.5	4.8	2.4	1.2	0.6	0.3	0.2	0.1	-	-	-	-	-	-
% Passing	-	####	84.2	84.2	69.4	61.5	53.9	46.5	39.1	31.9	23.6	15.5	11.5	-	-	-	-	-	-

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Gradation Test Results

FIG. B- 18



CLAY (PLASTIC)	SILT (NON-PLASTIC)	SANDS			GRAVEL		
		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLES

Sample of: FILL, CLAY, SANDY
From: TH-105 AT 4 FEET

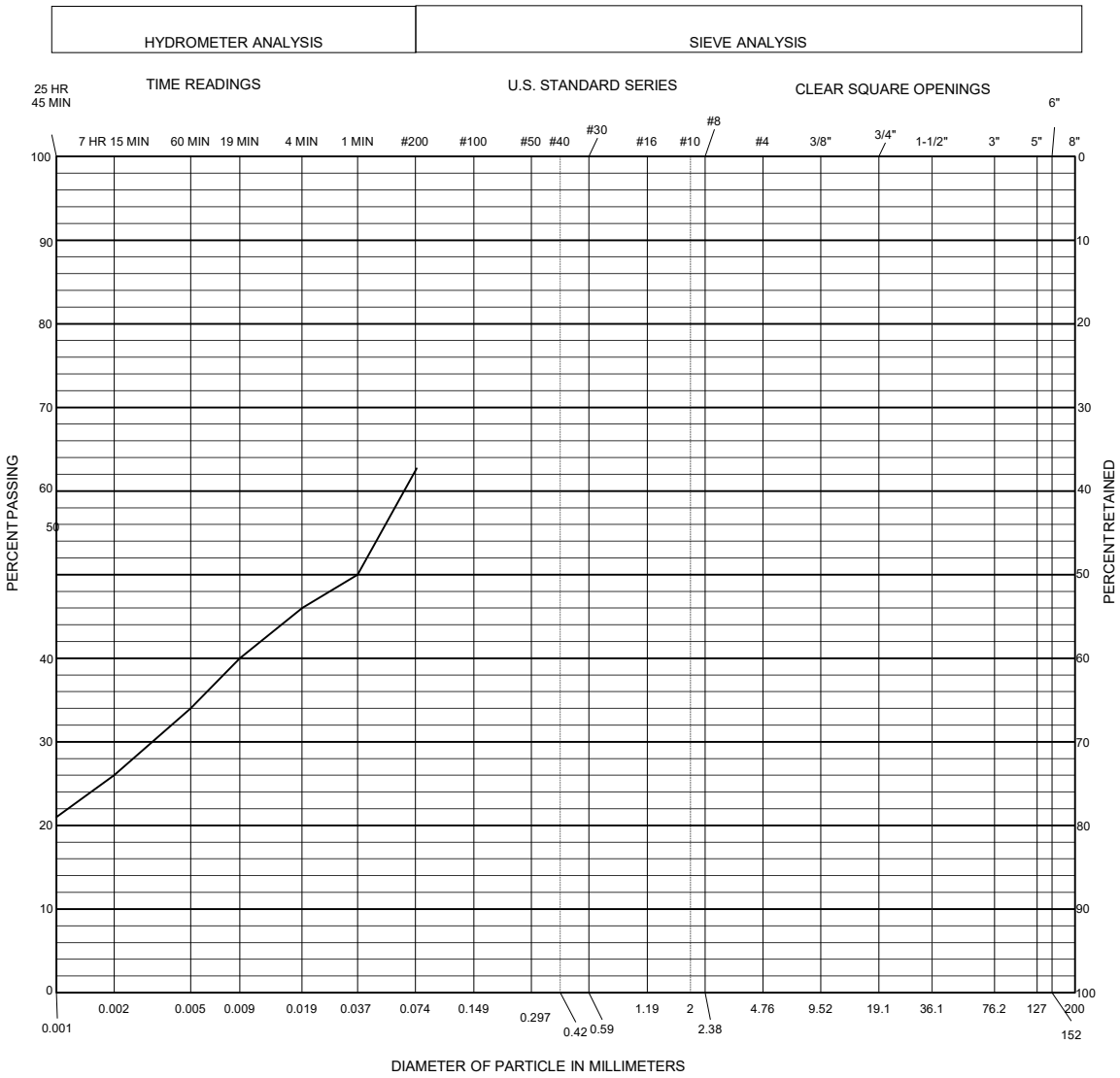
Sand & Gravel: 40.3 %
Clay: 22.6 %
Plasticity Index: - %
Silt: 37.1 %
Liquid Limit: - %

Size (mm)	-	-	-	-	-	-	-	-	-	-	-	-	0.075	0.037	0.019	0.009	0.005	0.002	0.001
% Passing	-	-	-	-	-	-	-	-	-	-	-	-	59.7	45	42	36	30	23	18

Hydrometer Test Results

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

FIG. B-19



CLAY (PLASTIC)	SILT (NON-PLASTIC)	SANDS			GRAVEL		
		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLES

Sample of: CLAY, SANDY (CL)
From: TH-112 AT 4 FEET

Sand & Gravel: 37.3 %
Clay: 26.0 %
Plasticity Index: - %
Silt: 36.7 %
Liquid Limit: - %

Size (mm)	-	-	-	-	-	-	-	-	-	-	-	-	0.075	0.037	0.019	0.009	0.005	0.002	0.001
% Passing	-	-	-	-	-	-	-	-	-	-	-	-	62.7	50	46	40	34	26	21

Hydrometer Test Results

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

FIG. B-20

TABLE B - I

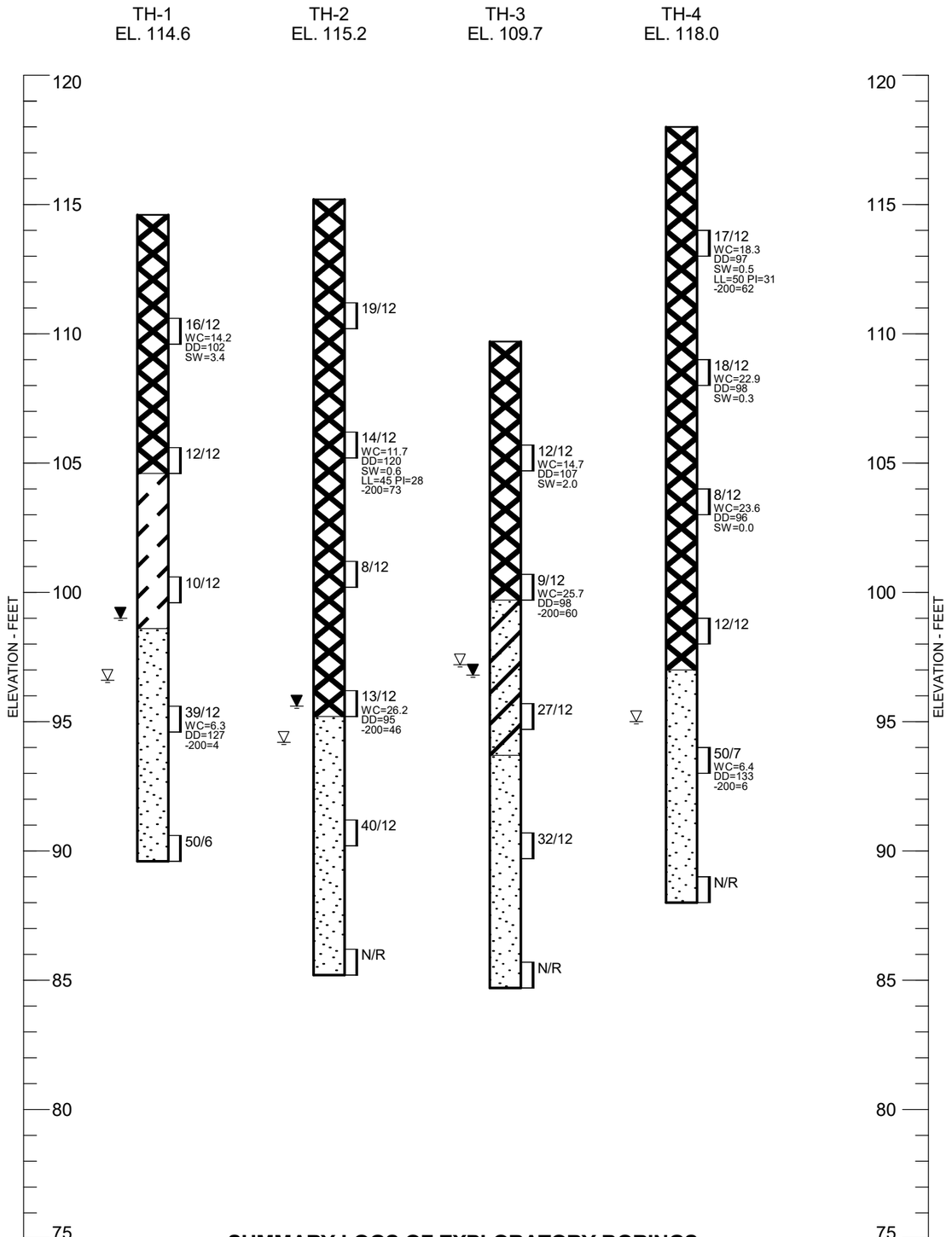
SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA				SOIL SUCTION VALUE (pF)	ATTERBERG LIMITS		SOLUBLE SULFATE CONTENT (%)	RETAINED NO. 4 SIEVE (%)	PASSING NO. 200 SIEVE (%)	CLAY CONTENT (%)	SOIL TYPE
				SWELL (%)	COMPRESSION (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)		LIQUID LIMIT	PLASTICITY INDEX					
S-104	0-10	13.0							44	27			77		FILL, CLAY, SANDY
S-102	2	10.7	114						44	27			63		FILL, CLAY, SANDY
S-101	4	8.1	104	2.3		500									FILL, CLAY, SANDY
S-103	4	12.5	114						41	23			50		FILL, CLAY, SANDY
S-104	7	18.8	103	1.3		800									FILL, CLAY, SANDY
S-103	9	19.0	102	0.9		1,100									FILL, CLAY, SANDY
TH-101	4	14.6	113						37	19			51		CLAY, VERY SANDY (CL)
TH-101	19	8.4	134									58	6		SAND AND GRAVEL, CLAYEY (SC, GC)
TH-102	4	11.2	113	1.7		500									FILL, CLAY, SANDY
TH-102	9	48.9	65										67		CLAY, SANDY (CL)
TH-103	4	7.2	104		0.1	500					0.09				FILL, CLAY, SANDY
TH-103	14	3.6	107										12		SAND AND GRAVEL, SL. SILTY (SP-SM, GP-GM)
TH-103	24	25.3							36	17			65		CLAYSTONE
TH-104	4	14.4	102										79		FILL, CLAY, SANDY
TH-104	9	1.1	116									63	4		SAND AND GRAVEL, CLEAN (SP, GP)
TH-104	24	16.9	109										20		SANDSTONE
TH-105	4	14.5	112	7.2		500							60	23	FILL, CLAY, SANDY
TH-105	9	11.4	119										70		FILL, CLAY, SANDY
TH-106	4	13.4	106	2.9		500	2,400	4.58			0.14				FILL, CLAY, SANDY
TH-106	9	13.8	104	0.4		1,100	1,800	3.90							FILL, CLAY, SANDY
TH-106	14	16.5	106		0.4	1,800		3.68							CLAY, SANDY (CL)
TH-107	4	7.8	103	0.3		500									FILL, CLAY, SANDY
TH-107	9	13.5	112										63		FILL, CLAY, SANDY
TH-107	14	17.7	99		0.5	1,800									FILL, CLAY, SANDY
TH-108	4	13.2	107	4.1		500									FILL, CLAY, SANDY
TH-108	9	10.7	119										48		FILL, SAND, CLAYEY
TH-108	19	15.0	112										50		FILL, CLAY, VERY SANDY
TH-109	4	2.9	96										7		SAND, SLIGHTLY SILTY (SP-SM)
TH-109	24	14.6	113						41	24			88		CLAYSTONE
TH-110	4	11.7	117	5.1		500									FILL, CLAY, SANDY
TH-110	14	18.4	101										61		FILL, CLAY, SANDY
TH-111	4	14.4	91						43	25	<0.01		65		FILL, CLAY, SANDY
TH-111	9	8.4	136									46	12		SAND AND GRAVEL, CLAYEY (SC, GC)
TH-112	4	18.8	100	0.8		500							63	26	CLAY, SANDY (CL)
TH-112	9	10.9											17		SAND AND GRAVEL, SILTY (SM, GM)
TH-113	4	10.3	111										61		FILL, CLAY, SANDY
TH-113	14	17.2	109	0.3		1,800									FILL, CLAY, SANDY
TH-1	4	14.2	102	3.4		500									FILL, CLAY, SANDY
TH-1	19	6.3	127										4		SAND, CLEAN (SP)
TH-2	9	11.7	120	0.6		1,100			45	28			73		FILL, CLAY, SANDY
TH-2	19	26.2	95										46		FILL, SAND, CLAYEY
TH-3	4	14.7	107	2.0		500									FILL, CLAY, SANDY
TH-3	9	25.7	98										60		FILL, CLAY, SANDY
TH-4	4	18.3	97	0.5		500			50	31			62		FILL, CLAY, SANDY
TH-4	9	22.9	98	0.3		1,100									FILL, CLAY, SANDY
TH-4	14	23.6	96	0.0		1,800									FILL, CLAY, SANDY
TH-4	24	6.4	133										6		SAND, SLIGHTLY SILTY (SP-SM)
TH-1	4	23.5	101								0.01				CLAY, SANDY (CL)
TH-2	4	23.2	102												CLAY, SANDY (CL)
TH-2	9	21.6	106										8		SAND, SLIGHTLY SILTY (SP-SM)
TH-2	19	23.8	102	0.5		1,000									CLAYSTONE
TH-2	29	15.5	116												CLAYSTONE
TH-3	4	12.2	115						39	25			43		FILL, SAND, CLAYEY
S-1	0-5	5.9							25	11			23		SAND, SILTY (SM)
S-4	9	13.0	111	0.0		1,000									FILL, CLAY, SANDY
S-4	21-26	12.6							35	23			39		SAND, CLAYEY (SC)
S-5	0-5	1.2							NL	NP			3		SAND, CLEAN (SP)
S-6	4	16.6	107	0.4		1,000									FILL, CLAY, SANDY
S-7	9	12.3	117	0.3		1,000			35	22			44		FILL, SAND, CLAYEY
S-8	24-29	2.2							NL	NP			9		SAND, SLIGHTLY SILTY (SP-SM)

APPENDIX C

SUMMARY LOGS OF EXPLORATORY BORINGS FROM PREVIOUS INVESTIGATIONS

PROJECT NOS. DN43,859-125 AND DN48,539-115



SUMMARY LOGS OF EXPLORATORY BORINGS

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

LEGEND:

FILL, CLAY, SANDY, STIFF TO VERY STIFF, SLIGHTLY MOIST TO MOIST, BROWN.

CLAY, SANDY, STIFF, SLIGHTLY MOIST, BROWN, WHITE (CL).

SAND, CLEAN TO SLIGHTLY SILTY, GRAVELLY, DENSE, VERY MOIST TO WET, BROWN, RUST, GRAY, LIGHT BROWN (SP, SP-SM).

SAND, SILTY, GRAVELLY, MEDIUM DENSE, VERY MOIST TO WET, BROWN, GRAY (SM).

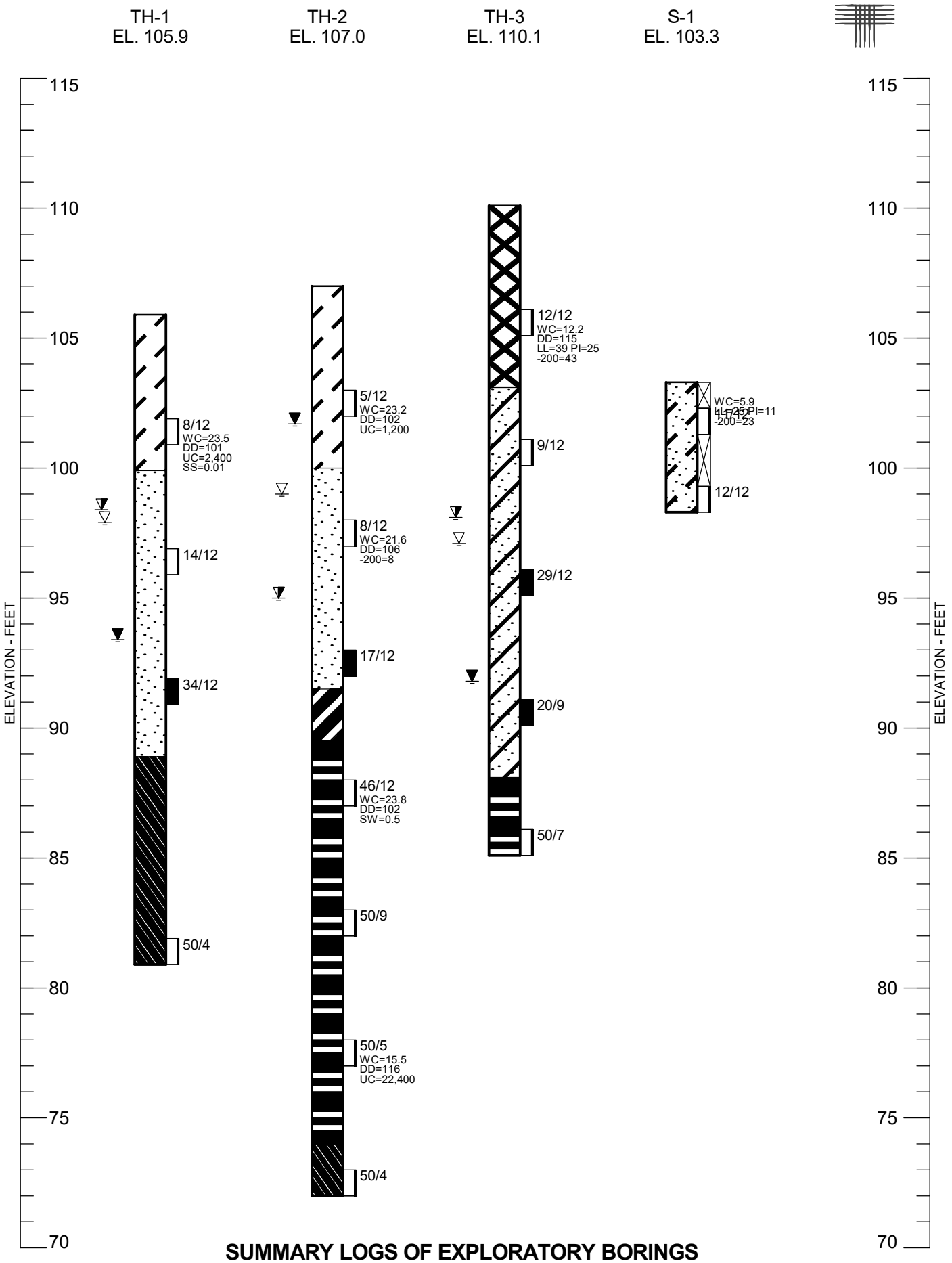
DRIVE SAMPLE. THE SYMBOL 16/12 INDICATES 16 BLOWS OF AN AUTOMATIC 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

WATER LEVEL MEASURED AT TIME OF DRILLING.

WATER LEVEL MEASURED AFTER DRILLING ON AUGUST 31, 2016.

NOTES:

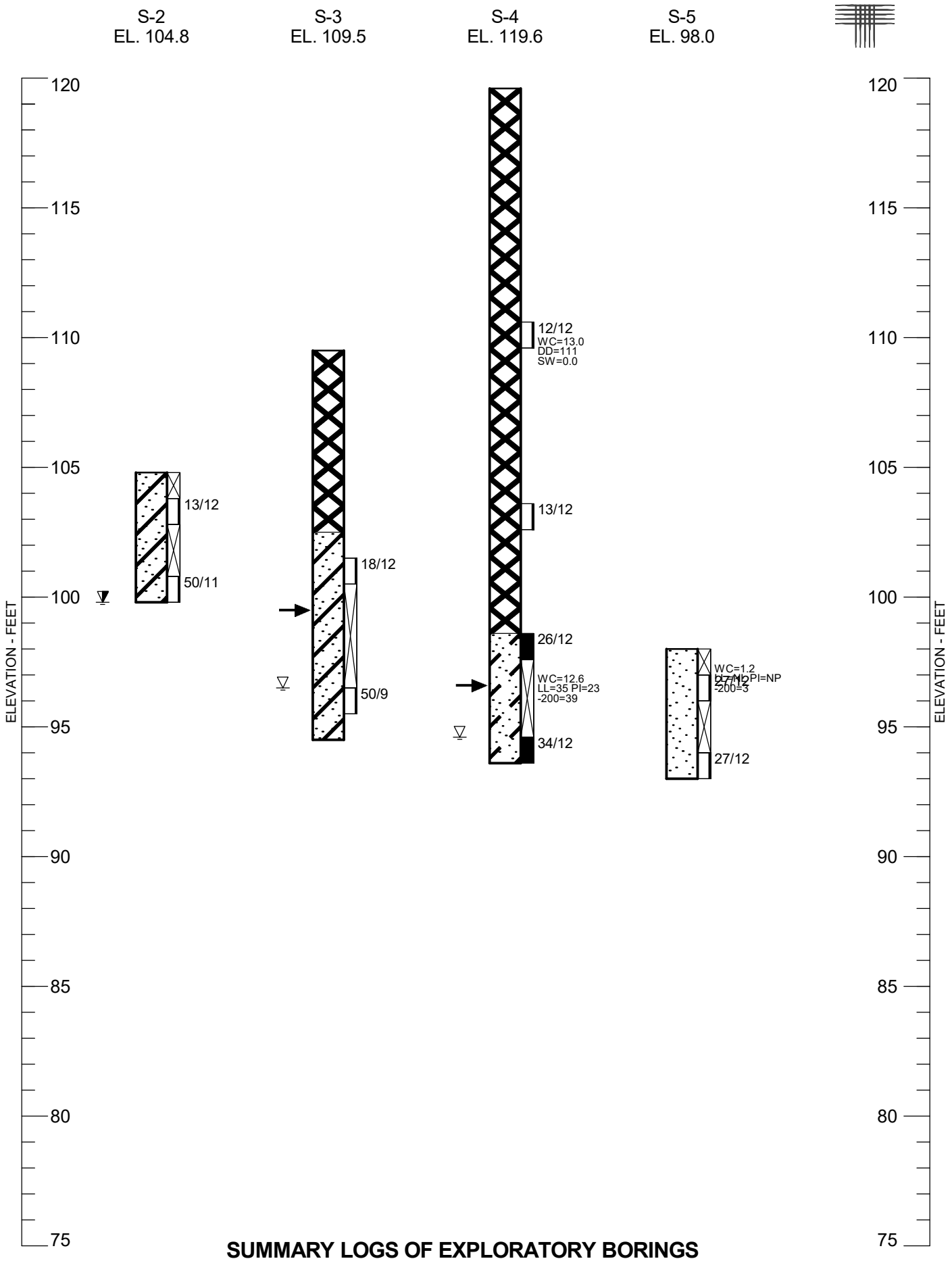
1. THE BORINGS WERE DRILLED ON AUGUST 29, 2016 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT SOLID-STEM AUGER AND A TRUCK-MOUNTED CME-45 DRILL RIG.
2. BORING LOCATIONS AND ELEVATIONS WERE DETERMINED BY A REPRESENTATIVE OF OUR FIRM REFERENCING THE TEMPORARY BENCHMARK SHOWN ON FIG. 1.
3. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   SW - INDICATES SWELL WHEN WETTED UNDER APPLIED PRESSURE (%).
   LL - INDICATES LIQUID LIMIT.
   PI - INDICATES PLASTICITY INDEX.
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.



SUMMARY LOGS OF EXPLORATORY BORINGS

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

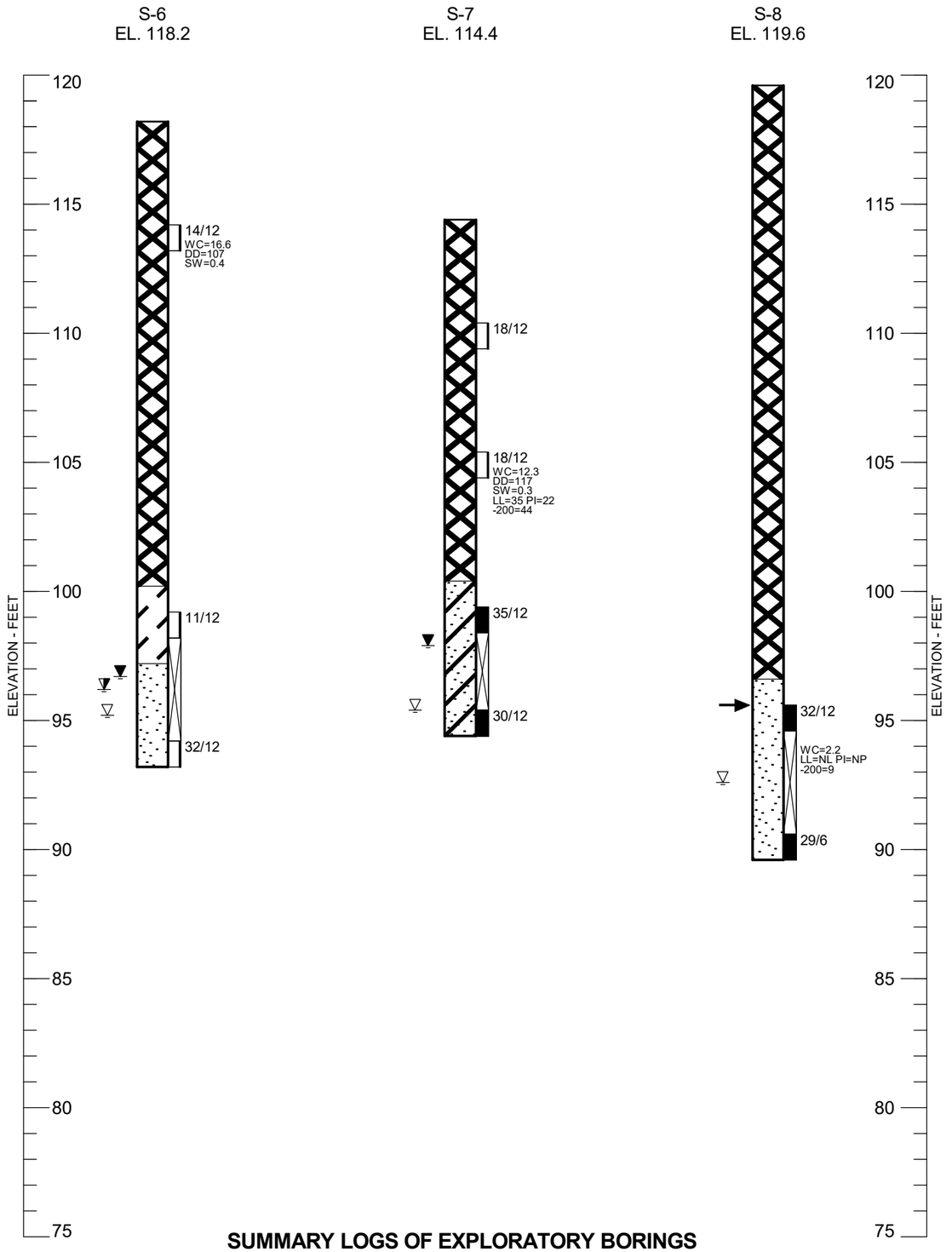
FIG. C- 2



SUMMARY LOGS OF EXPLORATORY BORINGS

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

FIG. C- 3



SUMMARY LOGS OF EXPLORATORY BORINGS

LOWELL DEVELOPMENT, LLC
5602 LOWELL BOULEVARD APARTMENTS
CTL|T PROJECT NO. DN51,902.001-125-R1

LEGEND:

- FILL, CLAY, SANDY OR SAND, CLAYEY WITH BEDROCK FRAGMENTS, STIFF TO VERY STIFF OR MEDIUM DENSE, MOIST, BROWN, BLACK, RUST.
- CLAY, SANDY, MEDIUM STIFF TO STIFF, MOIST TO VERY MOIST, BROWN, RUST (CL).
- SAND, SILTY WITH OCCASIONAL GRAVEL, LOOSE TO VERY DENSE, MOIST TO WET, BROWN, RUST, GRAY (SP, SP-SM).
- SAND, CLAYEY, WITH OCCASIONAL GRAVEL, MEDIUM DENSE TO DENSE, MOIST TO WET, BROWN, REDDISH BROWN, GRAY (SC).
- SAND, CLEAN TO SLIGHTLY SILTY WITH OCCASIONAL GRAVEL, MEDIUM DENSE, SLIGHTLY MOIST TO WET, BROWN, GRAY, RUST (SP, SP-SM).
- WEATHERED CLAYSTONE OR SANDSTONE, MOIST TO VERY MOIST, BLUISH-GRAY.
- BEDROCK, CLAYSTONE, MEDIUM HARD TO VERY HARD, MOIST, BLUE, GRAY.
- BEDROCK, INTERBEDDED CLAYSTONE/SANDSTONE, VERY HARD, MOIST, BLUE, GRAY.

DRIVE SAMPLE. THE SYMBOL 8/12 INDICATES 8 BLOWS OF AN AUTOMATIC 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

DRIVE SAMPLE. THE SYMBOL 34/12 INDICATES 34 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.0-INCH O.D. SAMPLER 12 INCHES.

WATER LEVEL MEASURED AT TIME OF DRILLING.

WATER LEVEL MEASURED SEVERAL DAYS AFTER DRILLING.

INDICATES DEPTH WHERE HOLE CAVED.

NOTES:

1. THE BORINGS WERE DRILLED ON AUGUST 26 AND 27, 2008 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND A TRUCK-MOUNTED DRILL RIG.

2. BORING LOCATIONS AND ELEVATIONS WERE DETERMINED BY A REPRESENTATIVE OF OUR FIRM REFERENCING THE TEMPORARY BENCHMARK SHOWN ON FIG. 1.

3. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   SW - INDICATES SWELL WHEN WETTED UNDER APPLIED PRESSURE (%).
   COM - INDICATES COMPRESSION WHEN WETTED UNDER APPLIED PRESSURE (%).
   LL - INDICATES LIQUID LIMIT.
   PI - INDICATES PLASTICITY INDEX.
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
   UC - INDICATES UNCONFINED COMPRESSIVE STRENGTH (psf).
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
   pF - INDICATES SOIL SUCTION VALUE (pF).

4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

APPENDIX D

FLEXIBLE AND RIGID PAVEMENT MATERIALS, CONSTRUCTION AND MAINTENANCE GUIDELINES

MATERIAL GUIDELINES FOR FLEXIBLE AND RIGID PAVEMENTS

Aggregate Base Course (ABC)

1. A Class 5 or 6 Colorado Department of Transportation (CDOT) specified aggregate base course should be used. A recycled concrete alternative which meets the Class 5 or 6 designation is also acceptable.

2. Aggregate base course should have a minimum Hveem stabilometer value of 78. Aggregate base course or recycled concrete material must be moisture stable. The change in R-value from 300 psi to 100 psi exudation pressure should be 12 points or less.

3. Aggregate base course or recycled concrete should be laid in thin lifts not to exceed 6 inches, moisture treated to within 2 percent of optimum moisture content, and compacted to at least 95 percent of maximum modified Proctor dry density (ASTM D 1557, AASHTO T 180). The material should be placed without segregation.

4. Placement and compaction of aggregate base course or recycled concrete should be observed and tested by a representative of our firm. Placement should not commence until the underlying subgrade is properly prepared and tested.

Hot-Mix Asphalt (HMA)

1. HMA should be composed of a mixture of aggregate, filler, hydrated lime and asphalt cement. Mixes shall be designed with 1 percent lime. Some mixes may require polymer modified asphalt cement, or make use of up to 20 percent reclaimed asphalt pavement (RAP). A project mix design is recommended and periodic checks on the project site should be made to verify compliance with specifications.

2. HMA should be relatively impermeable to moisture and should be designed with crushed aggregates that have a minimum of 80 percent of the aggregate retained on the No. 4 sieve with two mechanically fractured faces.

3. Gradations that approach the maximum density line (within 5 percent between the No. 4 and 50 sieves) should be avoided. A gradation with a nominal maximum size of 1 or 2 inches developed on the fine side of the maximum density line should be used.

4. Total void content, voids in the mineral aggregate (VMA) and voids filled should be considered in the selection of the optimum asphalt cement content. The optimum asphalt content should be selected at a total air void content of about 4 percent. The mixture should have a minimum VMA of 14 percent and between 65 percent and 80 percent of voids filled.

5. Asphalt cement should be PG 58-28 for local streets and PG 64-22 for collectors and arterials.

6. Hydrated lime should be added at the rate of 1 percent by dry weight of the aggregate and should be included in the amount passing the No. 200 sieve. Hydrated lime for aggregate pretreatment should conform to the requirements of ASTM C 207, Type N.

7. Paving should only be performed when subgrade temperatures are above 40˚F and air temperature is at least 40˚F and rising.

8. HMA should not be placed at a temperature lower than 245˚F for mixes containing PG 58-28 and PG 64-22 asphalt, and 290˚F for mixes containing polymer modified asphalt. The breakdown compaction should be completed before the mixture temperature drops 20˚F.

9. The maximum compacted lift should be 3 inches and joints should be staggered. No joints should be placed within wheel paths.

10. HMA should be compacted to between 92 and 96 percent of Maximum Theoretical Density. The surface shall be sealed with a finish roller before the mix cools to 185˚F.

11. Placement and compaction of HMA should be observed and tested by a representative of our firm. Placement should not commence until the subgrade is properly prepared, tested and proof-rolled.

Portland Cement Concrete (PCC)

1. Portland cement concrete should meet CDOT Class P concrete and have a minimum compressive strength of 4,500 psi at 28 days and a minimum modulus of rupture (flexural strength) of 600 psi. A job mix design is recommended and periodic checks on the job site should be made to verify compliance with specifications.

2. Portland cement should be Type II “low alkali” and should conform to ASTM C 150. Portland cement should conform to ASTM C 150.

3. Portland cement concrete should not be placed when the subgrade or air temperature is below 40ºF.

4. Free water should not be finished into the concrete surface. Atomizing nozzle pressure sprayers for applying finishing compounds are recommended whenever the concrete surface becomes difficult to finish.

5. Curing of the portland cement concrete should be accomplished by the use of a curing compound. The curing compound should be applied in accordance with manufacturer recommendations.

6. Curing procedures should be implemented, as necessary, to protect the pavement against moisture loss, rapid temperature change, freezing, and mechanical injury.

7. Construction joints, including longitudinal joints and transverse joints, should be formed during construction or sawed after the concrete has begun to set, but prior to uncontrolled cracking.

8. All joints should be properly sealed using a rod back-up and approved epoxy sealant.

9. Traffic should not be allowed on the pavement until it has properly cured and achieved at least 80 percent of the design strength, with saw joints already cut.

10. Placement of portland cement concrete should be observed and tested by a representative of our firm. Placement should not commence until the subgrade is properly prepared and tested.

FLEXIBLE PAVEMENT CONSTRUCTION GUIDELINES

Experience has shown that construction methods can significantly affect the life and serviceability of a pavement system. A site-specific mix design is recommended and periodic checks during the project should be made to verify compliance with specifications. We recommend the proposed pavement be constructed in the following manner:

1. The subgrade should be stripped of organic matter, scarified, moisture conditioned and compacted. Subgrade soils should be moisture conditioned to within 2 percent of optimum moisture content, and compacted to at least 95 percent of maximum modified Proctor dry density (ASTM D 1557).

2. Utility trenches and all subsequently placed fill should be moisture conditioned, compacted, and tested prior to paving. As a minimum, fill should be compacted to 95 percent of maximum standard Proctor dry density.

3. After final subgrade elevation has been reached and the subgrade compacted, the resulting subgrade should be checked for uniformity and all soft or yielding materials should be replaced prior to paving. Concrete should not be placed on soft, spongy, frozen, or otherwise unsuitable subgrade.

4. If areas of soft or wet subgrade are encountered, the material should be sub-excavated and replaced with properly compacted structural backfill. Where extensively soft, yielding subgrade is encountered, we recommend the excavation be inspected by a representative of our office.

5. Aggregate base course should be laid in thin, loose lifts no more than 6 inches, moisture treated to within 2 percent of optimum moisture content, and compacted to at least 95 percent of modified Proctor maximum dry density (ASTM D 1557).

6. Asphaltic concrete should be hot plant-mixed material compacted to between 92 and 96 percent of maximum Theoretical density. The temperature at laydown time should be at least 245°F. The surface shall be sealed with a finish roller prior to the mix cooling to 185°F.

7. The maximum compacted lift should be 3 inches and joints should be staggered. No joints should be within wheel paths.

8. Paving should only be performed when subgrade temperatures are above 40°F and air temperature is at least 40°F and rising.

9. Subgrade preparation and placement and compaction of all pavement material should be observed and tested. Compaction criteria should be met prior to the placement of the next paving lift. The additional requirements of Adams County should apply.

RIGID PAVEMENT CONSTRUCTION GUIDELINES

Rigid pavement sections are not as sensitive to subgrade support characteristics as flexible pavement. Due to the strength of the concrete, wheel loads from traffic are distributed over a large area and the resulting subgrade stresses are relatively low. The critical factors affecting the performance of a rigid pavement are the strength and quality of the concrete, and the uniformity of the subgrade. We recommend subgrade preparation and construction of the rigid pavement section be completed in accordance with the following recommendations:

1. The subgrade should be stripped of organic matter, scarified, moisture conditioned and compacted. Subgrade soils should be moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of maximum modified Proctor dry density (ASTM D 1557).

2. After final subgrade elevation has been reached and the subgrade compacted, the resulting subgrade should be checked for uniformity and all soft or yielding materials should be replaced prior to paving. Concrete should not be placed on soft, spongy, frozen, or otherwise unsuitable subgrade.

3. The subgrade should be kept moist prior to paving.

4. Curing procedures should protect the concrete against moisture loss, rapid temperature change, freezing, and mechanical injury for at least 3 days after placement. Traffic should not be allowed on the pavement for at least one week.

5. Curing of the portland cement concrete should be accomplished by use of a curing compound in accordance with manufacturer recommendations.

6. Construction joints, including longitudinal joints and transverse joints, should be formed during construction or should be sawed shortly after the concrete has begun to set, but prior to uncontrolled cracking. All joints should be sealed.

7. Construction control and inspection should be performed during the subgrade preparation and paving procedures. Concrete should be carefully monitored for quality control. The additional requirements of Adams County should apply.

The design sections are based upon 10-year and 20-year periods. Experience in the Denver area indicates virtually no maintenance or overlays are necessary for a 20-year design period. We believe some maintenance and sealing of concrete joints will help pavement performance by helping to keep surface moisture from wetting and softening or heaving subgrade. To avoid problems associated with scaling and to continue the strength gain, we recommend deicing salts not be used for the first year after placement.

MAINTENANCE GUIDELINES FOR FLEXIBLE PAVEMENTS

A primary cause for deterioration of pavements is oxidative aging resulting in brittle pavements. Tire loads from traffic are necessary to "work" or knead the asphalt concrete to keep it flexible and rejuvenated. Preventive maintenance treatments will typically preserve the original or existing pavement by providing a protective seal or rejuvenating the asphalt binder to extend pavement life.

Annual Preventive Maintenance

- Visual pavement evaluations should be performed each year.
- Reports documenting the progress of distress should be kept current to provide information on effective times to apply preventive maintenance treatments.
- Crack sealing should be performed annually as new cracks appear.

3 to 5-Year Preventive Maintenance

- The owner should budget for a preventive treatment (e.g. chip seal, fog seal, slurry seal) at approximate intervals of 3 to 5 years to reduce oxidative embrittlement problems.

5 to 10-Year Corrective Maintenance

- Corrective maintenance (e.g. full-depth patching, milling and overlay) may be necessary, as dictated by the pavement condition, to correct rutting, cracking and structurally failed areas.

MAINTENANCE GUIDELINES FOR RIGID PAVEMENTS

High traffic volumes create pavement rutting and smooth, polished surfaces. Preventive maintenance treatments will typically preserve the original or existing pavement by providing a protective seal and improving skid resistance through a new wearing course.

Annual Preventive Maintenance

- Visual pavement evaluations should be performed each spring or fall.
- Reports documenting the progress of distress should be kept current to provide information of effective times to apply preventive maintenance.
- Crack sealing should be performed annually as new cracks appear.

4 to 8 Year Preventive Maintenance

- The owner should budget for a preventive treatment at approximate intervals of 4 to 8 years to reduce joint deterioration.
- Typical preventive maintenance for rigid pavements includes patching, crack sealing and joint cleaning and sealing.
- Where joint sealants are missing or distressed, resealing is mandatory.

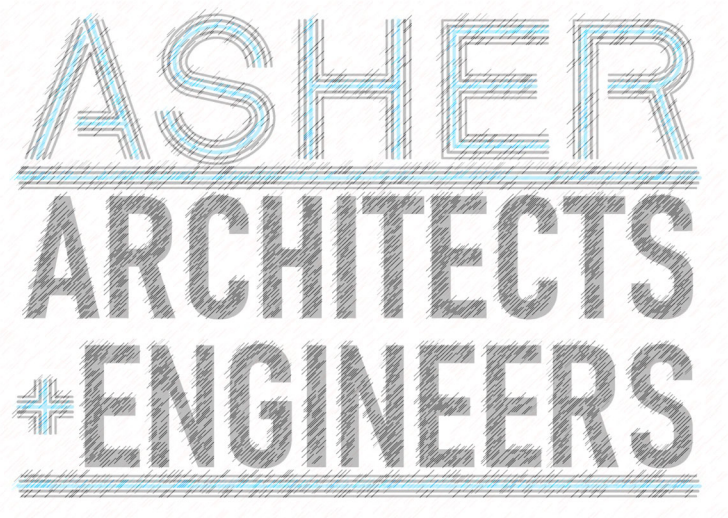
15 to 20 Year Corrective Maintenance

- Corrective maintenance for rigid pavements includes patching and slab replacement to correct subgrade failures, edge damage and material failure.
- Asphalt concrete overlays may be required at 15 to 20 year intervals to improve the structural capacity of the pavement.

Lowell Boulevard Apartments - Preliminary Drainage Report

Lot 1 of Spano-Calabrese Subdivision Amendment No. 1
Located in part of the Southwest Quarter of Section 8, Township 3 South, Range 68 West of the 6th Principal Meridian, County of Adams, Colorado

5602 Lowell Boulevard
Denver, Colorado 80221



Prepared For: Lowell Development, LLC

Prepared By: Diana Springett, E.I.

November 17, 2023

Project No. 22-C14

Engineer's Certification of Drainage Report

I hereby certify that this report for the Preliminary Drainage design of the 5602 Lowell Boulevard Apartment project was prepared by me or under my direct supervision in accordance with the provisions of Adams County Storm Drainage Design and Technical Criteria for the owners thereof. I understand that Adams County does not and will not assume liability for drainage facilities designed by others.

_____ Date:_____

TJ Heupel, P.E.
State of Colorado No. 58284
tj@asherarch.com

Developer Certification of Drainage Facilities

Lowell Development, LLC hereby certifies that the drainage facilities for 5602 Lowell Boulevard Apartments shall be constructed according to the design presented in this report. I understand that Adams County does not and will not assume liability for the drainage facilities designed and/or certified by my engineer. I understand that Adams County reviews drainage plans pursuant to Colorado Revised Statues Title 30, Article 28; but cannot, on behalf of Lowell Development, LLC, guarantee that final drainage design review will absolve Lowell Development, LLC and/or their successors and/or assigns the future liability for improper design. I further understand that approval of the Final Plat and/or Final Development Plan does not imply approval of my engineer's drainage design.

_____ Date:_____

For and on behalf of Lowell Development, LLC
Marko Mackovic, Owner

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General Location and Description

The subject property is a part of Lot 2 of the Spano Subdivision, recorded with Adams County Clerk & Recorded at Reception No. 20050202000110370 on February 2, 2005, and Lot 2 of the Calabrese Subdivision, recorded with Adams County Clerk & Recorder at Reception No. 20050202000110270 on February 2, 2005. The proposed development includes a major subdivision to replat the properties to create two lot. Development is only proposed on one of the new lots, Lot 1 of the Lowell Development Subdivision (LDS), recorded with Adams County Clerk & Recorded at Reception No. xxxx, dated xx (Lot 1, LDS).

Lot 1, LDS is ±12.850 acres of agricultural land located on the east side of Lowell Boulevard, just north of Interstate-76 (I-76), and west of Clear Creek. Directly north of the site is another agricultural property made up of two parcels, Lot 1 of the Spano Subdivision (Lot 1, Spano) and Lot 2, LDS. West of Lowell Boulevard is a large public park, Clear Creek Valley Park, on property reclaimed from gravel mining and owned by the Hyland Hills Park & Recreation District. There are several large ponds to the west and north of the site created by past mining activity in the area. Reference the Property Vicinity Map with Lot 1, LDS outlined in blue in Figure 1 below.

The property is currently used for agriculture and has a single-family house in the northwest corner of the lot, irrigated fields to the south and east of the house, and a public trail along the eastern property line going through the Clear Creek Natural Area. At some point in the last several decades as much as 20 feet of sandy clay soil was imported and placed on Lot 1 and Lot 2, LDS with the bulk of the fill being placed in the east half of Lot 1. The property naturally slopes from the west to east at a 0-3% slopes, but in the filled area grades slope from the east to the west at 1-5%.

The subject property is within FIRM Panel Number 08001C0591H, effective March 5, 2007, with Risk Hazard Zone AE covering a majority of the property. However, due to impact from development in the area, and flood mitigation/waterway restoration efforts, the floodplain along this stretch of the Clear Creek has changed considerably. As a result, separate Certified Letters of Map Revision (CLOMR's) have been submitted to FEMA by MAC Investment Group, LLC and the Hyland Hills Park & Recreation District that take into account all of the ponds and the changes in topography between I-76 and the Union Pacific railroad on both sides of Lowell since the effective study was conducted. The new limits of the floodplain around the subject property, as determined for the owner by Loewen Engineering Inc and submitted to FEMA on November 18, 2022, FEMA Case No. 23-08-0122R, are represented on the Drainage Plan included in Appendix C of this report.

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Per NRCS Web Soil Survey data the western half of the site is made up of a Loamy Alluvial soil, hydrologic group C, and a sand-gravel complex type soil, hydrologic group A, in the east. Reference Appendix A for the USDA Web Soil Survey information for the site. The native soils and fill placed on the site was explored and analyzed by CTL Thompson, Inc. in 2023 for the development project. Their findings are presented in a report for 5602 Lowell Boulevard Apartments dated June 29, 2023, Project No. DN51, 902.001-125-R1, prepared for Lowell Development, LLC.



Figure 1. Property Vicinity Map

Historic Sub-basins

Historic drainage sub-basins have been delineated and are shown on the Historic Drainage Plan in Appendix C of this report. Historic drainage patterns across the subject property generally flow from the west to the east into a network of culverts and poorly defined swales discharging into Clear Creek. Due to farming activities, there are large areas that were set-up for flood irrigation with very little slope or intentional ponding areas. Within the filled area, the ground slopes west where water generally ponds to a shallow depth (<6”) before spilling into the irrigation ditch and culvert network along the northern property line. Both Lot 1 and Lot 2, LDS share the culvert network since they were historically one property. Lowell Boulevard, along the western edge of the site, was recently improved by Adams County to elevate the road 3 to 4 feet above historic ground elevations and remove portions

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of the road from the current effective floodplain. A concrete retaining wall was constructed to achieve this grade difference in the road behind the eastern sidewalk, along the west side of the site. This is also the general area where runoff ponds on Lot 1, LDS.

A network of inlets and storm pipes conveys runoff from Lowell Boulevard into Clear Creek either to the north or south of Lot 1, LDS. On the east side of the site there is a 20-foot embankment dropping into the Clear Creek Open Space west of a 10-foot-wide concrete trail running north-south along the western bank of the creek. The trail crosses over to the eastern bank of Clear Creek via a steel pedestrian bridge near the southeast corner of the subject property. At the southern property line is the toe of the northern embankment for the grade separated crossing of I-76 over Lowell Boulevard. Between the interstate embankment and the southern edge of the on-site filled area is a dirt road used for access to a billboard at the center of the southern property line.

The subject property was delineated into four separate on-site sub-basins and six off-site basins based on the existing property boundaries and drainage patterns across Lot 1, LDS and adjacent roads and properties. Due to the historical use of the site as a part of Spano Subdivision property there is a network of irrigation channels and culverts conveying stormwater into Clear Creek throughout the Clear Creek Open Space. Reference the drainage plans in Appendix C for the delineated sub-basin boundaries, sub-basin runoff calculations are presented in Appendix B. The historic sub-basins are more specifically described below.

Sub-basin H-1

Runs along the northern one-third of the site, containing 4.168-acres. The catchment includes the area of the subject property that flows north-northeast into Lot 2, LDS. The northern boundary of the catchment is the northern property line, and the southern boundary runs along a ridge line at the top of the on-site fill on the western edge of the fill embankment to the south side of the house area extending to the western property line. Including a narrow strip of Right-of-Way (ROW) between the retaining wall on the east side of Lowell Boulevard and the western property line. Within the catchment is the existing farm house with driveway, garage, and irrigated fields around the house and on top of the fill. Runoff generated within the catchment will sheet flow, with minor channelization due to farming, to the northeast where it enters the existing network of culverts and irrigation channels along the common property line with Lot 2, LDS where it will combine with flows from Sub-basin HOS-3 before entering the south side of Sub-basin HOS-4 which ultimately discharges to Clear Creek via culverts going under the open space trail. The historic runoff rates and coefficients determined for Sub-basin H-1 using an imperviousness of 2% and Time of Concentration (Tc) of 35 minutes are listed below.

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- Q_5 = 0.27 cfs
- Q_{10} = 1.00 cfs
- Q_{100} = 5.98 cfs
- C_5 = 0.04
- C_{10} = 0.12
- C_{100} = 0.41

Sub-basin H-2

Sits south of Sub-basin H-1 and contains the middle of the site, generally between the northern and southern tops of the on-site fill embankment, containing 5.275-acres. This catchment contains all sprinkler irrigated areas between Lowell Boulevard and the eastern top of the fill embankment. Runoff in this catchment sheet flows, with some channelization due to farming, to the west side of the property where it ponds against the Lowell Boulevard retaining wall at the center of the western property line until it gets deep enough, <6", to spill into the south side of Sub-basin H-1. There is a narrow strip of ROW between the retaining wall on the east side of Lowell Boulevard and the western property line included in the catchment area. There is a sub-catchment at the southwest corner of H-2, delineated as Sub-basin H-2A, that slopes south into a 30" Reinforced Concrete Pipe (RCP) culvert installed under the billboard access road along the southern property line. Per the elevation data this area doesn't discharge to any one location, but instead ponds until spilling to the north and backing up into the culvert. The historic runoff rates and coefficients determined for Sub-basin H-2 using an imperviousness of 2% and Tc of 31 minutes are listed below.

- Q_5 = 0.36 cfs
- Q_{10} = 1.11 cfs
- Q_{100} = 7.20 cfs
- C_5 = 0.04
- C_{10} = 0.10
- C_{100} = 0.37

Sub-basin H-3

Is in the northeast corner of Lot 1, LDS to the east of Sub-basins H-1 and H-2, and north of Sub-basin H-4, containing 1.032-acres. The western boundary of the catchment is the eastern top of the fill embankment from the northern property line south to a minor ridgeline created by a wheel-track road in the fill embankment and the southernmost culvert that conveys runoff under the open space trail and out of the property to Clear Creek. The eastern catchment boundary is the eastern property line of the site. Runoff in this catchment general sheet flows down the eastern fill embankment before pooling in the relatively flat area at the toe of the fill where several poorly defined channels lead to one of the six culverts installed under the open space trail. Runoff ultimately continues east into Clear Creek through the open space bordering the site on the east. The historic runoff rates and coefficients determined for Sub-basin H-3 using an imperviousness of 2% and Tc of 5 minutes are listed below.

- Q_5 = 0.04 cfs
- Q_{10} = 0.05 cfs
- Q_{100} = 1.21 cfs
- C_5 = 0.01
- C_{10} = 0.01
- C_{100} = 0.13

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Sub-basin H-4

Is a long and narrow catchment between the southern top of the fill embankment and the southern property line of the site, containing 2.349-acres. The catchment extends from the western property line to the eastern property line and north up to Sub-basin H-3. There is a small depression at the southeast corner of on-site fill that catches and retains any precipitation that falls within this area, delineated as Sub-basin H-4A. Any runoff caught in this depression will evaporate or infiltrate through the fill embankment and combine with surface flows within Sub-basin H-4. For this reason, the pond area was included as a part of H-4. Runoff in the catchment will generally sheet flow, with minor channelization due to farming, along the toe of the fill embankment until moving into the west side of Sub-basin HOS-5. The historic runoff rates and coefficients determined for Sub-basin H-4 using an imperviousness of 2% and Tc of 31 minutes are listed below.

- Q_5 = 0.20 cfs
- Q_{10} = 0.60 cfs
- Q_{100} = 3.78 cfs
- C_5 = 0.04
- C_{10} = 0.10
- C_{100} = 0.36

Sub-basin HOS-1

Is part of the eastern half of Lowell Boulevard, bordering the west side of Lot 1, LDS, containing 0.162-acres. The catchment starts at a high point in Lowell Boulevard, near the middle of the site, and runs south to an inlet beyond the limits of this study. Runoff will sheet flow a short distance from the crown of Lowell Boulevard to the eastern gutter flowline and then south into an inlet. The historic runoff rates and coefficients determined for Sub-basin HOS-1 using an imperviousness of 2% and Tc of 10 minutes are listed below.

- Q_5 = 0.02 cfs
- Q_{10} = 0.09 cfs
- Q_{100} = 0.52 cfs
- C_5 = 0.05
- C_{10} = 0.15
- C_{100} = 0.49

Sub-basin HOS-2

Is part of the eastern half of Lowell Boulevard bordering the west side of Lot 1, LDS, containing 0.266-acres. The catchment starts at a high point in Lowell Boulevard, near the middle of the site, and runs north to an inlet beyond the limits of this study. Runoff will sheet flow a short distance from the crown of Lowell Boulevard to the eastern gutter flowline and then north into an inlet. The historic runoff rates and coefficients determined for Sub-basin HOS-2 using an imperviousness of 2% and Tc of 24 minutes are listed below.

- Q_5 = 0.03 cfs
- Q_{10} = 0.10 cfs
- Q_{100} = 0.57 cfs
- C_5 = 0.05

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- C_{10} = 0.15
- C_{100} = 0.49

Sub-basin HOS-3

Is the southwestern corner of Lot 1, Spano which includes a farm house, greenhouses, and other various agricultural use structures, collectively referred to as the Spano farm house area, containing 2.209-acres. The catchment extends from the northern property line of Lot 1, Spano-Calabrese to the north edge of the Spano farm house area where an irrigated field and network of irrigation ditches act as a low point in the property. Then from Lowell Boulevard along the western property line to the east side of the Spano farm house area. Runoff generated within the catchment will sheet flow, with minor channelization due to farming, to the southeast where it will enter a network of culverts and irrigation channels along the common property line with Lot 1, LDS where it will combine with flows from Sub-basin H-1 before entering into Sub-basin HOS-4 which ultimately discharges to Clear Creek via culverts going under the open space trail. The historic runoff rates and coefficients determined for Sub-basin HOS-3 using an imperviousness of 2% and Tc of 35 minutes are listed below.

- Q_5 = 0.18 cfs
- Q_{10} = 0.66 cfs
- Q_{100} = 3.79 cfs
- C_5 = 0.05
- C_{10} = 0.15
- C_{100} = 0.49

Sub-basin HOS-4

Is the remainder of the Spano property, Lot 2, LDS, to the north of Lot 1, LDS and east of Sub-basins HOS-3, containing approximately 7.933-acres. A majority of the area within this catchment is beyond the limits of this study so the basin characteristics are based on field observation along with partial survey data at pertinent locations. This catchment is mainly irrigated fields at the bottom end of the existing irrigation and culvert network connecting the overall area to Clear Creek. Runoff from both Sub-basins H-1 and HOS-3 will combine at the southwest corner of Sub-basin HOS-4 where it enters the existing irrigation network. The historic runoff rates and coefficients determined for Sub-basin HOS-4 using an imperviousness of 2% and Tc of 29 minutes are listed below.

- Q_5 = 0.57 cfs
- Q_{10} = 1.91 cfs
- Q_{100} = 11.91 cfs
- C_5 = 0.04
- C_{10} = 0.11
- C_{100} = 0.39

Sub-basin HOS-5

Is the relatively small open space area between the southeast corner of Lot 1, LDS and Clear Creek, containing 0.805-acres. The area gently slopes towards a minor channel running down the western bank of Clear Creek. Runoff from Sub-basins H-4 and HOS-6 will combine at the western boundary of this catchment and sheet flow towards the channel and into Clear Creek. The historic runoff rates and

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coefficients determined for Sub-basin HOS-5 using an imperviousness of 2% and Tc of 22 minutes are listed below.

- Q_5 = 0.02 cfs
- Q_{10} = 0.02 cfs
- Q_{100} = 0.48 cfs
- C_5 = 0.01
- C_{10} = 0.01
- C_{100} = 0.13

Sub-basin HOS-6

Is the catchment south of Sub-basin H-4 extending south to the top of the northern embankment of I-76, from Lowell Boulevard on the west to Sub-basin HOS-5 on the east, containing 1.806-acres. Sub-basin HOS-6 is also the only off-site catchment that directs flows onto the subject property. Runoff sheet flows north off of the interstate embankment where it will combine with flows from Sub-basin H-4 before routing east into Sub-basin HOS-5 and ultimately into Clear Creek. The historic runoff rates and coefficients determined for Sub-basin HOS-6 using an imperviousness of 2% and Tc of 31 minutes are listed below.

- Q_5 = 0.12 cfs
- Q_{10} = 0.46 cfs
- Q_{100} = 2.80 cfs
- C_5 = 0.04
- C_{10} = 0.12
- C_{100} = 0.42

Proposed Development

The Lowell Boulevard Apartments Project is a 348-unit apartment complex split between six 4-story buildings on Lot 1, LDS. The project will include a club house with an outdoor pool, five detached garage buildings, landscape buffers around the perimeter of the buildings and site, and a connection to the existing trail and common open space to the east. Internal drive aisles are planned between buildings with the main drive aisles running east from Lowell Boulevard along the north and south sides of the development from two access points to Lowell Boulevard. Parking will be provided perpendicular to the drive aisles as well as in the garage units. One 4-story building, one detached garage, and adjacent drive aisle located near the northwest corner of the site, will be developed in a later phase due to this area being encumbered by a portion of the flood fringe from the floodway to the north of the site. The drainage design discussed in this report accounts for the full build out of the site. The overall lot coverage and imperviousness are presented below.

Lot 1, LDS Coverage

- Buildings = 117,015 ft^2 @ 90%
- Site Concrete/Sidewalks = 72,165 ft^2 @ 90%
- Pavement = 161,358 ft^2 @ 100%
- Packed Gravel = 18,653 ft^2 @ 40%
- Landscape Area = 190,571 ft^2 @ 2%

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- Total Impervious Area = 342,893 ft^2, 61.3%

The proposed grading design for the development will change the existing post-fill drainage pattern from an east to west flow into a uniform north to south slope with flows routing east into Clear Creek along the northern and southern property lines the same way it does currently. The internal drive aisles will serve as the main conduits for runoff. The stormwater generated on-site will surface flow directly away from the proposed structures and into the adjacent gutter network within the drive aisles. From there a series of valley pans will convey runoff to inlets that will discharge directly into one of the two Extended Detention Basin (EDB) type ponds. Each pond will discharge directly south into the flood channel along the southern boundary of Lot 1, LDS constructed as a part of the current CLOMR process with FEMA. The channel will convey the detention pond discharge east into Clear Creek via a new culvert going under the open space trail and into the western bank of Clear Creek. The existing culverts under the open space trail along the eastern property line will be left in place to preserve existing drainage patterns for Lot 2, LDS which will not be changed with the proposed development.

Proposed Sub-Basins

Sub-basin P-1

Is at the northwest corner of Lot 1, LDS with a total area of 1.429-acres. This catchment is bordered on the north by a 5-foot-wide strip of Sub-basin P-11, on the west by the eastern ROW of Lowell Boulevard extending south to the southern edge of the north access from Lot 1 to Lowell Boulevard. The catchment extends east to the approximate middle of Building 6 and further south into the northwest corner of the parking lot between Buildings 1 & 2. Per the CLOMR analysis, a portion of the flood fringe will occupy the northwest corner of Lot 1, LDS. For this reason, development in this area was split into two phases. In phase 1, north or the northern access road will remain undisturbed and at existing elevations approximately 3 to 4 feet below Lowell Boulevard. Existing drainage patterns will also be maintained in this area. The ultimate build-out within the sub-basin routes all runoff through the various drive aisles and parking lots to a curb inlet at Design Point (DP) 1 which discharges into the West Detention Pond via a storm drain. The ultimate developed condition was used to calculate the imperviousness of 72.2% for the sub-basin with a Tc of 11 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 2.64 cfs
- Q_{10} = 3.40 cfs
- Q_{100} = 7.09 cfs
- C_5 = 0.63
- C_{10} = 0.66
- C_{100} = 0.78

Sub-basin P-2

Sits along the west property between the north and south site connections to Lowell Boulevard, going east to the middle of Building 1 and containing 0.971-acres. The West Detention Pond will be

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incorporated into the large landscape area between Building 1 and the western property line. The catchment does not include any of the paved drive aisles or parking areas. Runoff from the building and sidewalks will sheet flow through the landscape area and into the West Detention Pond. The developed imperviousness was calculated as 25.5% with a Tc of 16 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 0.56 cfs
- Q_{10} = 0.97 cfs
- Q_{100} = 3.02 cfs
- C_5 = 0.24
- C_{10} = 0.32
- C_{100} = 0.59

Sub-basin P-3

Is directly east of Sub-basin P-2 containing 0.618-acres. The catchment includes the east half of Building 1, half of the parking lot between Buildings 1 & 2, and the south drive aisle up to a ridgeline centered between the two drive aisles going through the parking lot. Runoff will sheet flow away from Building 1 and the center of the parking lot to a gutter on the east side of the building leading to a curb inlet at the southeast corner of the West Detention Pond designated DP 2 on the drainage plan. Runoff in the south drive aisle will also flow into the gutter on the north side of the road and into the inlet. The developed imperviousness was calculated as 91.2% with a Tc of 5 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 2.00 cfs
- Q_{10} = 2.53 cfs
- Q_{100} = 4.75 cfs
- C_5 = 0.78
- C_{10} = 0.80
- C_{100} = 0.85

Sub-basin P-4

Is directly east of Sub-basin P-3 containing the east half of the parking lot between Buildings 1 & 2, a portion of the south drive aisle, the southwest corner of Building 2, and a detached garage building for a total area of 0.596-acres. Runoff will flow away from Building 2 and the center of the parking lot to a gutter on the west side of the building leading to a curb inlet on the west side of the garage building designated DP 3 on the drainage plan. Runoff from the south drive aisle flows to DP 3 from the ridgeline with Sub-basin P-3 and a ridgeline with Sub-basin P-7 on the east side of the garage. The inlet drains into the West Detention Pond through DP 2 via a storm drain. The developed imperviousness was calculated as 84.1% with a Tc of 5 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 1.78 cfs
- Q_{10} = 2.29 cfs
- Q_{100} = 4.47 cfs
- C_5 = 0.72
- C_{10} = 0.75
- C_{100} = 0.83

Sub-basin P-5

Is a small, 0.380-acre, area north of Buildings 5 & 6 and south of Sub-basin P-11 containing approximately half of the alleyway on the north side of the buildings. The catchment includes the area

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between the middle of two buildings and the northern retaining wall sitting between two ridgelines at the middle of the northern face of each building. Runoff will flow into a channel in the middle of the alleyway that leads to a type C inlet at a low point between the buildings designated DP 4. The inlet is connected to a storm drain going south between the buildings to DP 5, then west to DP 1 and south into the West Detention Pond. The developed imperviousness was calculated as 79.7% with a Tc of 5 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 1.09 cfs
- Q_{10} = 1.40 cfs
- Q_{100} = 2.78 cfs
- C_5 = 0.69
- C_{10} = 0.72
- C_{100} = 0.81

Sub-basin P-6

Is the north half of the center of the developed area on-site, sitting north of Sub-basins P-4 & P-7, south of Sub-basin P-5 between P-1 & P-8, containing 1.359-acres. The catchment contains portions of the north drive aisle, Buildings 2, 3, 5, and 6, and portions of the adjacent parking areas around the buildings. Runoff from the buildings will go into gutters in the dive aisles and parking areas that lead to a curb inlet to the northwest of Building 2 designated DP 5. Runoff combines with flows from DP 4 at the inlet before going west to DP 1 and into the West Detention Pond. The developed imperviousness was calculated as 81.1% with a Tc of 10 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 2.89 cfs
- Q_{10} = 3.72 cfs
- Q_{100} = 7.28 cfs
- C_5 = 0.70
- C_{10} = 0.73
- C_{100} = 0.81

Sub-basin P-7

Is the south half of the center of the developed area on-site, sitting south of Sub-basins P-6 & P-8, north of Sub-basin P-11 between P-4 & P-9, containing 1.586-acres. The catchment contains the east end of the south drive aisle, Buildings 2, 3, and 4, the trash compactor enclosure, a detached garage building on the south side of Building 3, and portions of the adjacent parking areas around the buildings. Runoff from the buildings will go into gutters in the dive aisles and parking areas that lead to one of two inlets west of the northwest corner of the East Detention Pond designated DP 6. Flows will combine with runoff from DP 7 before entering the northwest corner of the East Detention Pond. The developed imperviousness was calculated as 83.1% with a Tc of 10 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 3.38 cfs
- Q_{10} = 4.28 cfs
- Q_{100} = 8.39 cfs
- C_5 = 0.70
- C_{10} = 0.72
- C_{100} = 0.80

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Sub-basin P-8

Is a 2.338-acre area located near the northeast corner of the developed area on-site. The catchment includes the east one-third of Building 5, small portions of Buildings 3 & 6, the clubhouse/pool area, the east end of the north drive aisle, and the parking lots adjacent to the buildings. Runoff from the buildings will go into gutters in the dive aisles and parking areas that lead to one of two inlets between the southwest corner of the clubhouse and northwest corner of Building 6 designated DP 7 before routing south to DP 6. The developed imperviousness was calculated as 80.8% with a Tc of 10 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 4.69 cfs
- Q_{10} = 5.96 cfs
- Q_{100} = 11.59 cfs
- C_5 = 0.66
- C_{10} = 0.68
- C_{100} = 0.75

Sub-basin P-9

Is the 0.911-acre area east of Sub-basin P-7 containing the east half of Building 6, two detached garage buildings, the drive aisle and parking between the buildings, and the East Detention Pond. Extending from the center of Building 6 east to the site retaining wall at the east edge of the developed area on-site, and from the south edge of the pool area to the south edge of East Detention Pond on the northern boundary of the flood diversion channel. Runoff from Building 6 will flow into the parking area and drive aisle to the east where valley pans will route the flows south into the detention pond via the slope reinforced pond access road. The developed imperviousness was calculated as 61.8% with a Tc of 10 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 1.30 cfs
- Q_{10} = 1.64 cfs
- Q_{100} = 3.55 cfs
- C_5 = 0.47
- C_{10} = 0.48
- C_{100} = 0.59

Sub-basin P-10

Sits along the south property line, extending from the west property line and south of the south drive aisle and retaining wall of the East Detention Pond to the east property line and north to the proposed sidewalk connection with the open space trail, containing 1.889-acres. The area contains the proposed flood diversion channel from the CLOMR analysis, a gravel maintenance access required by MHFD for the flood channel, and landscaped area between the eastern retaining wall and the east property line. Runoff from the area will all be captured in the flood diversion channel and routed into Clear Creek through a new culvert at the east end of the channel. Runoff from Sub-basin HOS-6 and the detained flows from the two proposed detention ponds will combine in Sub-basin P-11 before ultimately routing into Clear Creek. The area will be planted with grasses and other landscape material serving as a vegetative buffer between the cumulative site runoff and Clear Creek after the detention ponds. The

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developed imperviousness was calculated as 11.7% with a Tc of 7 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 0.77 cfs
- Q_{10} = 1.47 cfs
- Q_{100} = 6.71 cfs
- C_5 = 0.11
- C_{10} = 0.17
- C_{100} = 0.44

Sub-basin P-11

Sits along the north property line, extending from the northwest property corner to the northeast corner where it extends south to the proposed sidewalk access to the open space trail, containing 0.772-acres. The west half of the catchment is a small strip of landscape area between the north property line and the retaining wall north of Buildings 5 & 6, clubhouse/pool area, and the north back of curb of the parking lot between the clubhouse and Building 5. This area will flow north into Lot 2, LDS and into the existing drainage network in Sub-Basins HOS-3 & HOS-4. The area of the catchment to the east of the pool is within the proposed 100-yr floodplain from the CLOMR analysis and will continue to sheet flow through landscape area towards the open space trail that is also within the sub-basin. The existing network of ditches and culverts in Lot 2, LDS ultimately goes to one of the several existing culverts under the open space trial along the east property lines of both Lots 1 & 2 that discharge into the Clear Creek open space. The existing drainage pattern will remain unchanged with this development. The developed imperviousness was calculated at 17.5% with a Tc of 10 minutes. Calculated runoff rates and coefficients are provided below.

- Q_5 = 0.68 cfs
- Q_{10} = 0.93 cfs
- Q_{100} = 2.40 cfs
- C_5 = 0.13
- C_{10} = 0.20
- C_{100} = 0.49

Drainage Design

Runoff

Design rainfall intensities from MHFD may be used per Chapter 9 – Storm Drainage Design and Stormwater Quality Regulations published December 8, 2020, §9-01-04-04. Per Volume 1, Chapter 5, Section 2 of the Urban Storm Drainage Criteria Manual (USDCM) NOAA Atlas 14 should be used to determine the rainfall depth-duration-frequency values for the UDFCD region. The 5-year, 10-year and 100-year storm events were used to determine the intensity (i) of the design storms from NOAA Atlas 14.

The one-hour duration intensities are:

- i_5= 1.07 in/hr
- i_{10}= 1.32 in/hr
- i_{100}= 2.31 in/hr

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The rainfall intensities were adjusted based on the times of concentration calculated for each sub-basin, which vary from 5 minutes to 16 minutes, and using the Rational Method design runoff flow rates were calculated for each sub-basin. Reference the sub-basin calculations in Appendix B. The proposed drainage pattern for the developed site will capture all on-site generated flows in the proposed detention ponds with the exception of the areas within the new floodplain boundaries on the east and west sides of the property.

Per Adams County Code Chapter 9 – Stormwater Drainage Design and Stormwater Quality Control Regulations (SDR)

§9-01-03-12,
"The minimum capacity and maximum release rates for the 5-year and 100-year recurrence interval storms will be determined by procedures and criteria presented in this Chapter."

§9-01-11,
"The detention storage facility shall be sized to hold the 5-year and the 100-year runoff, and water quality capture volumes. Refer to Section 9-04 for additional water quality treatment requirements for applicable projects within the County's MS4 Permitted area (urbanized area). Post-development flows from the site cannot be greater than the pre-development flows. Surface water shall not be released from the development at rates greater than provided for in Table 9.16."

Table 9.16 – Allowable Release Rates (cfs/acre)

Control Frequency	*Dominate Soil Group*		
	A	*B*	*C & D*
5-year	*0.07*	*0.13*	*0.17*
100-year	*0.50*	*0.85*	*1.00*

The cumulative historic runoff flow rates from the on-site sub-basins are:

- Q_5= 0.87 cfs
- Q_{10}= 2.76 cfs
- Q_{100}= 18.18 cfs

The allowable release rates for the 12.85-acres property with Type C soils dominate (63.4%) based on Table 9.16 are:

- Q_5= 2.18 cfs
- Q_{100}= 12.85 cfs

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The 5-year and 100-year historic runoff rates shown above will be used for the maximum allowable release rate out of the detention pond per Adams County criteria.

The runoff from Sub-basin HOS-6 will flow directly into the flood diversion ditch within Sub-basin P-11 on the south side of the site and will not be captured in the proposed detention ponds. All other off-site basins drain to existing infrastructure without entering Lot 1, LDS. The West and East Pond will discharge directly into the flood diversion channel, from there flows will be routed to Clear Creek via a new culvert under the open space trail with an erosion protected outlet within Clear Creek's western bank constructed with the CLOMR improvements. The pond outlet pipes have erosion protected outlets with lower sloped pipes to keep flow energies low during the peak storm and prevent gradual erosion damage from minor storm events within the channel.

Detention Ponds & Release Structures

Two EDB type detention ponds were selected to attenuate developed flows and treat runoff generated by the proposed development. MHFD provided Detention Basin Design Workbook, UD-Detention, Version 3.07, Published February, 2017, and the Empirical Formula Method given in SDR §9-01-11-01-01 were used to calculate the required detention volume for the proposed development based on the calculated overall imperviousness and preliminary grading information. The design storage volume for the proposed development includes the Water Quality Control Volume (WQCV), minor storm (5-year) plus the WQCV, and major storm (100-year) plus 50% of the WQCV volumes. Based on the overall property characteristics, estimated post-development imperviousness, and Adams County maximum release rate criteria preliminary pond sizes were determined and are shown on the drainage plan in Appendix B of this report. The total required detention volume for the developed on-site area will be split between the two proposed detention ponds. Summaries of the preliminary sizing of both ponds are provided below.

East Detention Pond

The East Detention Pond is situated at the southeast corner of the on-site developed area within Lot 1, LDS. The pond will capture Sub-basins P-7 to P-9 with a combined area of 4.835-acres and overall imperviousness of 78.0% accounting for 47.5% of the developed area on-site. The pond will be approximately 7-feet deep with retaining walls of 3 feet to 7 feet tall on three sides. A reinforced slope access road will be provided at the northeast corner of the pond that will also serve as a rundown for flows from Sub-basin 9. The storm drain from DP 6 will discharge into the northwest corner of the pond area. The bottom of the pond will have a 2% slope to an outlet box at the southeast corner of the pond area. The outlet structure will be designed to release flows for the required WQCV, 5-yr minor, and 100-yr major events through a storm drain discharging into the flood overflow channel on the

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south side of the property. An overflow weir will protect the southern edge of the pond from overtopping. The weir will have a rip-rap reinforced rundown for the spillway. The maximum release rate for the pond will be proportional to the area detained.

- Allowable Release Rate Q_5= 0.82 cfs
- Allowable Release Rate Q_{100}= 4.84 cfs
- WQCV = 5,532 ft^3 (0.127 ac-ft)
- 5-yr Volume (Including 100% WQCV) = 13,373 ft^3 (0.307 ac-ft)
- 100-yr Volume (Including 50% WQCV) = 16,466 ft^3 (0.378 ac-ft)
- Required Volume = 35,371 ft^3 (0.812 ac-ft)
- Preliminary Volume Provided = 41,675 ft^3 (0.957 ac-ft)

The outlet structure will discharge directly into the flood overflow channel on the south edge of the site via a 24" RCP pipe. The pipe will have a Flared End Section (FES) with headwall per MHFD Figure 9-29, and Rip-Rap reinforced side slopes sized by Loewen Engineering for the floodplain flows extending to the bottom of the pond. The outlet invert elevation for the pipe was set ~1' above the bottom of the channel to minimize erosion potential. Below is a summary of the pipe hydraulic analysis using the 100-yr allowable release rate.

- Pipe Diameter = 24"
- Pipe Length = 35' + 6' FES
- Pipe Slope = 1.00%
- Flow Depth = 0.63'
- Flow Velocity = 5.74 fps
- Froude No = 1.50, supercritical
- Percent of Full Flow = 21.3%

West Detention Pond

The West Detention Pond is located near the center of the west property line of Lot 1, LDS. The pond will capture Sub-basins P-1 to P-6 with a combined area of 5.354-acres and overall imperviousness of 70.0% accounting for 52.5% of the developed area on-site. The pond will be approximately 6-feet deep with side embankments sloped at 4H:1V and a bottom slope of 2% leading to the outlet structure at the southwest corner of the pond area. The outlet structure will be designed to release flows for the WQCV, 5 and 100-year events, and a drop-box emergency spillway will be designed with an unrestricted outlet drain large enough to handle the 100-yr developed flow going to the pond. The maximum release rate for the pond will be proportional to the area detained.

- Allowable Release Rate Q_5= 0.91 cfs
- Allowable Release Rate Q_{100}= 5.35 cfs
- WQCV = 5,358 ft^3 (0.123 ac-ft)
- 5--yr Volume (Including 100% WQCV) = 14,200 ft^3 (0.326 ac-ft)
- 100-yr Volume (Including 50% WQCV) = 13,155 ft^3 (0.302 ac-ft)
- Required Volume = 32,714 ft^3 (0.751 ac-ft)

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- Preliminary Volume Provided = 37,549 ft^3 (0.862 ac-ft)

The outlet structure will discharge directly into the flood overflow channel on the south edge of the site via a 24" RCP pipe. The pipe will have a FES with headwall per MHFD Figure 9-29, and Rip-Rap reinforced side slopes sized by Loewen Engineering for the floodplain flows extending to the bottom of the pond. The outlet invert elevation for the pipe was set ~1' above the bottom of the channel to minimize erosion potential. Below is a summary of the pipe hydraulic analysis using the 100-yr allowable release rate.

- Pipe Diameter = 24"
- Pipe Length = 100' + 6' FES
- Pipe Slope = 1.00%
- Flow Depth = 0.66'
- Flow Velocity = 5.91 fps
- Froude No = 1.50, supercritical
- Percent of Full Flow = 23.6%

Detention Pond Maintenance

The pond maintenance requirements below are provided in the UDFCM Chapter 6, Volume 3. EDB have low to moderate routine maintenance requirements, and may require significant maintenance once every 15 to 25 years. Reference the MHFD Fact Sheets in Appendix C for information on common maintenance practices. The approved grading and drainage plans are provided in Appendix D of this report. Below is a summary list of the recommended maintenance schedule.

Routine Maintenance

- Routine site walks should be conducted by the owner or maintenance staff to collect wind blow debris and litter around the property as a preventative measure.
- Inspect the detention pond at least twice annually for erosion and sediment or debris build-up in the of the detention pond, around the outlet structure, in the micro-pool/well screen, in the outlet pipe, and at the discharge point into the ditch along the southern property line.
- Until the permanent ground cover is established across the whole property it will be necessary to inspect the detention pond after every precipitation event for erosion/sediment build-up. Any damage or build-up observed should be repaired or removed immediately.
- Sediment build-up should be removed from the trickle channel and micro-pool annually. Dispose of the sediment at a local dump or gravel mine. Do not spread the sediment out within the detention pond or on-site.
- Repair any damage to the detention pond structural elements if observed. Fill and regrade eroded areas per the approved grading plans and revegetate to protect from further erosion. If the problem persists in specific areas, a Rolled Erosion Control Product can be used to fortify the area. Reference Appendix C for more information.
- Check the outlet orifice plates for damage or clogging. Clean any debris or sediment away from the plate immediately when noticed. If the plate is replaced it must conform to the configuration detailed in the approved drainage plans.

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- Streets and paved surfaces that drain into the detention pond should be kept clean with periodic (1-2 times annually) sweeping and weekly trash removal.
- Sediment build-up may be removed by hand with a shovel to avoid damaging the ground with heavy equipment. If heavy equipment is used all rutting should be repaired by hand prior to reseeding or laying sod.
- All areas disturbed by erosion or during repair efforts must be reseeded or new sod laid and established before considering the issue resolved. Constant monitoring, targeted irrigating, and restricting access will be required until the final ground cover is established (70% coverage for seeded areas, 3-4 weeks for sod).
- Native/drought tolerant grasses should be used for the final ground cover within the pond. Mowing should be kept to the minimum needed for weed control. A minimum grass height of 6" should be kept within the pond area.
- If manicured or turf grasses are used, the outlet structure should be inspected after each mowing and grass clippings removed to prevent clogging. Turf grasses should be aerated annually to keep the grass healthy and increase infiltration.

Major Maintenance

- The bottom of the detention pond should be checked for conformance with the approved grading plan once every 10-15 years, or if excessive sediment build-up or erosion is observed. The depth of the pond relative to the emergency spillway, slope of the trickle channel, and uniformity of grades within the bottom of the pond (trickle channel, perpendicular to trickle channel, and along toe of embankment) should be surveyed by a qualified professional using an optical transit or GPS system. Regrade the detention pond as necessary to reestablish design grades if:
  - more than 6" of build-up is measured over the bottom of the pond,
  - the trickle channel is excessively cracked (<1/2") or broken,
  - or uniformity of grades within the bottom of the pond deviate by more than 0.10%.
- Inspect the outlet pipe for erosion or structural damage (spalling, exposed rebar, collapse) using a pipe camera. Consult with an underground utility service for possible repair options if structural damage is observed.

Sediment & Erosion Control

Construction BMP's

Construction Best Management Practices (BMP) will be utilized to control sediment travel and construction debris during grading operations on-site as well as prevent contamination of storm water or dirty storm water from exiting the site during the construction process. These methods will include:

Erosion Control (EC) BMP's

- Temporary and Permanent Seeding
- Mulching
- Rolled Erosion Control Products
- Temporary Outlet Protection

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- Earth Dikes and Drainage Swales
- Wind Erosion-Dust Control

Source Control (S) BMP's

- Covering Outdoor Storage and Handling Areas
- Spill Prevention, Containment and Control
- Vehicle Maintenance, Fueling and Storage

Sediment Control (SC) BMP's

- Silt Fence
- Sediment Control Logs and Rock Socks
- Inlet Protection
- Sediment Basin/Sediment Traps
- Vegetative Buffer

Material Management (MM) BMP's

- Concrete Washout Area (Earthen and Eco-pan type)
- Stockpile Management
- Good Housekeeping Practices

Site Management (SM) BMP's

- Construction Fence
- Vehicle Tracking Control
- Stabilized Staging Area
- Street Sweeping and Vacuuming
- Paving and Grinding Operations

Permanent BMP's

Permanent structural BMP's will be utilized to continue to treat storm water runoff generated on-site and prevent contamination from common development sources.

Treatment (T) BMP's

- Grass Buffer
- Grass Swale
- Extended Detention Basin
- Outlet Structure

Source Control (S) BMP's

- Disposal of Household Waste
- Preventative Maintenance
- Use of Pesticides, Herbicides and Fertilizers
- Landscape Maintenance
- Snow and Ice Management
- Steet Sweeping and Cleaning
- Storm Sewer System Cleaning

Conclusions

As outlined in this report, the drainage design for the proposed development generally conforms to Adams County criteria as defined. On-site flow will be routed to the proposed detention pond via the internal road network and released into the Clear Creek via a flood diversion ditch planned along the

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southern property line. This report presents the preliminary drainage design for the proposed apartment development. Temporary BMP's will be used during construction to mitigate issues common with grading activities and will stay in place until final stabilization is complete.

References

- Adams County Code Chapter 9 – Stormwater Drainage Design and Stormwater Quality Control Regulations effective December 8th, 2020
- United States Department of Agriculture Web Soil Survey, accessed December, 2022
- NOAA Atlas 14, Volume 8, Version 2, downloaded January 24, 2023
- Mile High Flood District, Volume I and II. Revised January 2016
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- FEMA FIRM Panel 08001C0591H, Accessed January 22, 2023, effective date March 5th, 2007

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Appendix A

USGS Web Soil Survey

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 Adams County Area, Parts of Adams and Denver Counties, Colorado



September 22, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,350 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Adams County Area, Parts of Adams and Denver Counties, Colorado
Survey Area Data: Version 18, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 1, 2020—Jul 2, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
EgA	Ellicott-Glenberg complex, 0 to 3 percent slopes, occasionally flooded	6.4	36.0%
Lw	Loamy alluvial land, moderately wet	10.3	57.5%
W	Water	1.2	6.5%
Totals for Area of Interest		**17.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Adams County Area, Parts of Adams and Denver Counties, Colorado

EgA—Ellicott-Glenberg complex, 0 to 3 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2x0j6
Elevation: 3,950 to 5,960 feet
Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 135 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Ellicott, occasionally flooded, and similar soils: 65 percent
Glenberg, rarely flooded, and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott, Occasionally Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Noncalcareous, stratified sandy alluvium

Typical profile

A - 0 to 4 inches: sand
AC - 4 to 13 inches: sand
C1 - 13 to 30 inches: sand
C2 - 30 to 44 inches: sand
C3 - 44 to 80 inches: coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 39.96 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Description of Glenberg, Rarely Flooded

Setting

Landform: Ephemeral streams, flood-plain steps
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified, calcareous alluvium

Typical profile

A - 0 to 6 inches: sandy loam
AC - 6 to 18 inches: sandy loam
C1 - 18 to 45 inches: sandy loam
C2 - 45 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: A
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Minor Components

Las animas, occasionally flooded

Percent of map unit: 10 percent
Landform: Flood plains, ephemeral streams
Down-slope shape: Linear
Across-slope shape: Linear, concave
Ecological site: R067BY038CO - Wet Meadow
Hydric soil rating: No

Ellicott sandy-skeletal, occasionally flooded

Percent of map unit: 5 percent
Landform: Channels, flood plains
Down-slope shape: Linear
Across-slope shape: Concave, linear
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Lw—Loamy alluvial land, moderately wet

Map Unit Setting

National map unit symbol: 34w5
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Loamy alluvial land: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loamy Alluvial Land

Setting

Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 36 inches: stratified loam to clay loam
H3 - 36 to 60 inches: sand

Properties and qualities

Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: OccasionalNone
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Nunn
Percent of map unit: 12 percent
Hydric soil rating: No

Satanta
Percent of map unit: 12 percent
Landform: Paleoterraces
Hydric soil rating: No

Fluvaquentic haplustolls
Percent of map unit: 6 percent
Landform: Sloughs
Hydric soil rating: Yes

W—Water

Map Unit Setting
National map unit symbol: wdnx
Mean annual precipitation: 12 to 14 inches
Farmland classification: Not prime farmland

Map Unit Composition
Water: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

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

Aquolls
Percent of map unit: 10 percent
Landform: Marshes
Hydric soil rating: Yes

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Building Site Development

This folder contains a collection of tabular reports that present soil interpretations related to building site development. The reports (tables) include all selected map units and components for each map unit, limiting features and interpretive ratings. Building site development interpretations are designed to be used as tools for evaluating soil suitability and identifying soil limitations for various construction purposes. As part of the interpretation process, the rating applies to each soil in its described condition and does not consider present land use. Example interpretations can include corrosion of concrete and steel, shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping.

Dwellings and Small Commercial Buildings

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect dwellings and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally

cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Dwellings and Small Commercial Buildings

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Dwellings and Small Commercial Buildings–Adams County Area, Parts of Adams and Denver Counties, Colorado							
Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
EgA—Ellicott-Glenberg complex, 0 to 3 percent slopes, occasionally flooded							
Ellicott, occasionally flooded	65	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Glenberg, rarely flooded	20	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Las animas, occasionally flooded	10	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Subsidence risk	0.01	Subsidence risk	0.01	Subsidence risk	0.01
Ellicott sandy-skeletal, occasionally flooded	5	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Lw—Loamy alluvial land, moderately wet							
Loamy alluvial land	70	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	0.07	Depth to saturated zone	1.00	Depth to saturated zone	0.07
Nunn	12	Not rated		Not rated		Not rated	
Satanta	12	Not rated		Not rated		Not rated	
Fluvaquentic haplustolls	6	Not rated		Not rated		Not rated	

Dwellings and Small Commercial Buildings–Adams County Area, Parts of Adams and Denver Counties, Colorado							
Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
W—Water							
Water	80	Not rated		Not rated		Not rated	
Aquolls	10	Not rated		Not rated		Not rated	
Other soils	10	Not rated		Not rated		Not rated	

Construction Materials

This folder contains a collection of tabular reports that present soil interpretations related to sources of construction materials. The reports (tables) include all selected map units and components for each map unit, limiting features and interpretive ratings. Construction materials interpretations are tools designed to provide guidance to users in selecting a site for potential source of various materials. Individual soils or groups of soils may be selected as a potential source because they are close at hand, are the only source available, or they meets some or all of the physical or chemical properties required for the intended application. Example interpretations include roadfill, sand and gravel, topsoil and reclamation material.

Source of Reclamation Material, Roadfill, and Topsoil

This table gives information about the soils as potential sources of reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

The soils are rated *good*, *fair*, or *poor* as potential sources of reclamation material, roadfill, and topsoil. The features that limit the soils as sources of these materials are specified in the table. Numerical ratings between 0.00 and 0.99 are given after the specified features. These numbers indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments. The ratings are for the whole soil, from the

surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Source of Reclamation Material, Roadfill, and Topsoil

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation]

Source of Reclamation Material, Roadfill, and Topsoil–Adams County Area, Parts of Adams and Denver Counties, Colorado							
Map symbol and soil name	Pct. of map unit	Potential as a source of reclamation material		Potential as a source of roadfill		Potential as a source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
EgA—Ellicott-Glenberg complex, 0 to 3 percent slopes, occasionally flooded							
Ellicott, occasionally flooded	65	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00			Exchange capacity	0.22
		Droughty	0.00				
		Low content of organic matter	0.13				
		Too acid	0.99				
Glenberg, rarely flooded	20	Fair		Good		Fair	
		Low content of organic matter	0.50			Exchange capacity	0.96
						Rock fragments	0.97
Las animas, occasionally flooded	10	Fair		Poor		Poor	
		Low content of organic matter	0.13	Wetness	0.00	Wetness	0.00
		Salinity	0.88			Salinity	0.50
		Too sandy	0.99			Exchange capacity	0.81
						Rock fragments	0.92
						Too sandy	0.99
Ellicott sandy-skeletal, occasionally flooded	5	Poor		Good		Poor	
		Too sandy	0.00			Rock fragments	0.00
		Wind erosion	0.00			Too sandy	0.00
		Droughty	0.00			Hard to reclaim (rock fragments)	0.01
		Low content of organic matter	0.13			Exchange capacity	0.13
		Too acid	0.99				

Source of Reclamation Material, Roadfill, and Topsoil–Adams County Area, Parts of Adams and Denver Counties, Colorado							
Map symbol and soil name	Pct. of map unit	Potential as a source of reclamation material		Potential as a source of roadfill		Potential as a source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Lw—Loamy alluvial land, moderately wet							
Loamy alluvial land	70	Good		Not rated		Fair	
						Hard to reclaim (rock fragments)	0.68
						Wetness	0.76
						Exchange capacity	0.86
						Rock fragments	0.97
Nunn	12	Not rated		Not rated		Not rated	
Satanta	12	Not rated		Not rated		Not rated	
Fluvaquentic haplustolls	6	Not rated		Not rated		Not rated	
W—Water							
Water	80	Not rated		Not rated		Not rated	
Aquolls	10	Not rated		Not rated		Not rated	
Other soils	10	Not rated		Not rated		Not rated	

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be

maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At

the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Adams County Area, Parts of Adams and Denver Counties, Colorado														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
EgA—Ellicott-Glenberg complex, 0 to 3 percent slopes, occasionally flooded														
Ellicott, occasionally flooded	65	A	0-4	Sand	SP-SM	A-3	0- 0- 0	0- 0- 0	100-100 -100	92-100-100	70-77-79	7- 9- 11	0-0 -17	NP-0 -1
			4-13	Coarse sand, sand, loamy sand	SP-SM	A-3	0- 0- 0	0- 0- 0	100-100 -100	92-100-100	70-77-79	7- 9- 11	0-0 -17	NP-0 -1
			13-30	Sand, coarse sand, loamy sand	SP-SM	A-3	0- 0- 0	0- 0- 0	100-100 -100	85-100-100	65-77-80	8- 9- 12	0-0 -17	NP-0 -1
			30-44	Coarse sand, sand, loamy sand	SP-SM	A-3	0- 0- 0	0- 0- 0	100-100 -100	85-97-100	65-75-80	8- 9- 12	0-0 -16	NP-0 -1
			44-80	Sand, coarse sand, gravelly sand, gravelly coarse sand, loamy sand, gravelly loamy sand	SP-SM	A-1-b	0- 0- 0	0- 0- 0	100-100 -100	66-85-100	29-38-47	5- 7- 11	0-0 -16	NP-0 -1
Glenberg, rarely flooded	20	A	0-6	Sandy loam	SC	A-2-4	0- 0- 0	0- 0- 0	95-97-100	81-89-100	59-68-81	29-35-44	22-26 -30	6-9 -12
			6-18	Sandy loam, fine sandy loam	SC	A-4	0- 0- 0	0- 0- 0	95-97-100	90-93-100	65-72-82	31-36-44	20-25 -30	4-8 -12
			18-45	Fine sandy loam, loamy sand, sandy loam	SC	A-2-4	0- 0- 0	0- 0- 0	92-95-100	79-84-100	54-65-82	24-33-44	16-25 -30	2-8 -12
			45-80	Sandy loam, loamy sand, loamy coarse sand, very gravelly loamy coarse sand	SM	A-1-b	0- 0- 0	0- 0- 0	93-95-100	53-85-100	29-47-67	11-18-33	16-18 -30	2-3 -12
Las animas, occasionally flooded	10	A/D	0-6	Sandy loam	SC	A-4	0- 0- 0	0- 0- 0	95-97-100	86-92-100	60-71-80	28-37-43	19-27 -33	3-8 -11

Engineering Properties–Adams County Area, Parts of Adams and Denver Counties, Colorado														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
			6-12	Stratified loamy sand to sandy loam to loam	SM	A-2-4	0- 0- 0	0- 0- 0	94-95-100	79-85-100	58-64-86	26-30-46	16-18-29	1-3 -12
			12-80	Stratified loamy sand to sandy loam to loam	SM	A-2-4	0- 0- 0	0- 0- 0	94-95-100	79-85-100	58-64-86	26-30-46	16-18-29	1-3 -12
Ellicott sandy-skeletal, occasionally flooded	5	A	0-4	Very gravelly coarse sand	SP	A-1-b	0- 0- 0	6- 6- 6	52-57-62	45-51-57	20-22-26	3- 4- 6	0-0 -17	NP-0 -1
			4-13	Very gravelly sand, very gravelly coarse sand, very gravelly loamy sand	SP-SM	A-1-b	0- 0- 0	6- 6- 6	52-57-62	46-52-58	35-40-46	4- 5- 6	0-0 -17	NP-0 -1
			13-30	Very gravelly loamy sand, very gravelly coarse sand, very gravelly sand	SP-SM	A-1-b	0- 0- 0	6- 6- 6	52-57-62	46-51-57	35-40-46	4- 5- 7	0-0 -17	NP-0 -1
			30-44	Very gravelly loamy sand, very gravelly sand, very gravelly coarse sand	SP-SM	A-1-b	0- 0- 0	6- 6- 6	52-57-62	46-51-57	35-40-46	4- 5- 7	0-0 -16	NP-0 -1
			44-80	Very gravelly loamy sand, very gravelly sand, very gravelly coarse sand	SP	A-1-b	0- 0- 0	6- 6- 6	53-58-63	47-52-58	20-23-27	4- 4- 6	0-0 -16	NP-0 -1

Engineering Properties–Adams County Area, Parts of Adams and Denver Counties, Colorado														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
Lw—Loamy alluvial land, moderately wet														
Loamy alluvial land	70	C	0-6	Variable	—	—	0- 0- 0	0- 0- 0	—	—	—	—	—	—
			6-36	Stratified loam to clay loam	CL-ML, CL	A-4	0- 0- 0	0- 0- 0	85-93-100	80-90-100	70-85-100	50-65-80	25-28-30	5-8 -10
			36-60	Sand, very gravelly sand	GP-GM, SP-SM, GP, SP	A-1	0- 0- 0	0- 0- 0	35-68-100	30-65-100	20-45-70	0- 8- 15	—	NP

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

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United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

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Appendix B

Hydraulic Computations

NOAA Atlas 14, Volume 8, Version 2
Location name: Denver, Colorado, USA*
Latitude: 39.7992°, Longitude: -105.0347°
Elevation: 5232.18 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**2.48** (1.93-3.19)	**3.08** (2.40-3.97)	**4.15** (3.22-5.36)	**5.12** (3.94-6.64)	**6.56** (4.93-8.88)	**7.75** (5.68-10.6)	**9.04** (6.38-12.6)	**10.4** (7.07-14.8)	**12.3** (8.06-17.9)	**13.9** (8.82-20.3)
10-min	**1.82** (1.41-2.34)	**2.26** (1.75-2.91)	**3.04** (2.35-3.93)	**3.75** (2.89-4.86)	**4.80** (3.61-6.50)	**5.68** (4.16-7.75)	**6.61** (4.68-9.20)	**7.62** (5.17-10.8)	**9.04** (5.90-13.1)	**10.2** (6.46-14.9)
15-min	**1.48** (1.15-1.90)	**1.84** (1.43-2.37)	**2.47** (1.91-3.20)	**3.05** (2.34-3.95)	**3.90** (2.93-5.28)	**4.62** (3.38-6.30)	**5.38** (3.80-7.48)	**6.20** (4.21-8.80)	**7.35** (4.80-10.7)	**8.28** (5.25-12.1)
30-min	**1.05** (0.814-1.35)	**1.30** (1.01-1.67)	**1.74** (1.34-2.24)	**2.13** (1.64-2.76)	**2.72** (2.05-3.68)	**3.21** (2.35-4.38)	**3.74** (2.64-5.20)	**4.30** (2.92-6.11)	**5.10** (3.33-7.40)	**5.74** (3.64-8.38)
60-min	**0.649** (0.504-0.835)	**0.801** (0.622-1.03)	**1.07** (0.829-1.38)	**1.32** (1.01-1.71)	**1.68** (1.26-2.27)	**1.98** (1.45-2.70)	**2.31** (1.63-3.20)	**2.65** (1.80-3.77)	**3.14** (2.05-4.56)	**3.54** (2.24-5.16)
2-hr	**0.387** (0.304-0.492)	**0.478** (0.375-0.608)	**0.638** (0.500-0.814)	**0.782** (0.609-1.00)	**0.999** (0.759-1.34)	**1.18** (0.872-1.59)	**1.37** (0.980-1.88)	**1.58** (1.08-2.21)	**1.87** (1.23-2.68)	**2.10** (1.35-3.03)
3-hr	**0.279** (0.221-0.353)	**0.344** (0.272-0.435)	**0.459** (0.361-0.581)	**0.562** (0.440-0.715)	**0.716** (0.548-0.951)	**0.845** (0.629-1.13)	**0.982** (0.707-1.34)	**1.13** (0.781-1.57)	**1.34** (0.889-1.90)	**1.51** (0.972-2.15)
6-hr	**0.166** (0.133-0.208)	**0.203** (0.162-0.254)	**0.268** (0.214-0.336)	**0.327** (0.259-0.411)	**0.414** (0.321-0.543)	**0.487** (0.367-0.644)	**0.565** (0.411-0.761)	**0.649** (0.453-0.892)	**0.767** (0.515-1.08)	**0.861** (0.562-1.22)
12-hr	**0.102** (0.083-0.126)	**0.124** (0.100-0.153)	**0.161** (0.130-0.200)	**0.195** (0.156-0.242)	**0.245** (0.191-0.316)	**0.286** (0.218-0.372)	**0.330** (0.243-0.438)	**0.377** (0.266-0.511)	**0.443** (0.301-0.614)	**0.496** (0.328-0.692)
24-hr	**0.063** (0.052-0.077)	**0.076** (0.062-0.092)	**0.098** (0.080-0.120)	**0.117** (0.095-0.144)	**0.146** (0.115-0.185)	**0.169** (0.130-0.216)	**0.193** (0.144-0.252)	**0.219** (0.156-0.292)	**0.254** (0.175-0.347)	**0.282** (0.189-0.389)
2-day	**0.037** (0.031-0.044)	**0.044** (0.037-0.053)	**0.057** (0.047-0.069)	**0.068** (0.056-0.082)	**0.084** (0.067-0.104)	**0.096** (0.075-0.121)	**0.109** (0.082-0.140)	**0.122** (0.088-0.160)	**0.140** (0.097-0.188)	**0.154** (0.104-0.209)
3-day	**0.027** (0.022-0.032)	**0.032** (0.027-0.038)	**0.041** (0.034-0.049)	**0.048** (0.040-0.058)	**0.059** (0.047-0.073)	**0.067** (0.053-0.084)	**0.076** (0.058-0.097)	**0.085** (0.062-0.111)	**0.098** (0.068-0.130)	**0.107** (0.073-0.144)
4-day	**0.021** (0.018-0.025)	**0.025** (0.021-0.030)	**0.032** (0.027-0.038)	**0.038** (0.031-0.045)	**0.046** (0.037-0.056)	**0.052** (0.041-0.065)	**0.059** (0.045-0.075)	**0.066** (0.048-0.086)	**0.075** (0.053-0.100)	**0.083** (0.057-0.111)
7-day	**0.014** (0.012-0.016)	**0.016** (0.014-0.019)	**0.020** (0.017-0.024)	**0.024** (0.020-0.028)	**0.028** (0.023-0.035)	**0.032** (0.026-0.040)	**0.036** (0.028-0.045)	**0.040** (0.030-0.052)	**0.046** (0.033-0.060)	**0.050** (0.035-0.067)
10-day	**0.011** (0.009-0.013)	**0.013** (0.011-0.015)	**0.015** (0.013-0.018)	**0.018** (0.015-0.021)	**0.021** (0.017-0.026)	**0.024** (0.019-0.029)	**0.027** (0.021-0.033)	**0.030** (0.022-0.038)	**0.034** (0.024-0.044)	**0.037** (0.026-0.048)
20-day	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.010** (0.008-0.011)	**0.011** (0.009-0.013)	**0.013** (0.011-0.015)	**0.014** (0.012-0.017)	**0.016** (0.012-0.019)	**0.017** (0.013-0.022)	**0.019** (0.014-0.025)	**0.021** (0.015-0.027)
30-day	**0.006** (0.005-0.006)	**0.006** (0.006-0.007)	**0.008** (0.007-0.009)	**0.009** (0.007-0.010)	**0.010** (0.008-0.012)	**0.011** (0.009-0.013)	**0.012** (0.010-0.015)	**0.013** (0.010-0.016)	**0.015** (0.011-0.019)	**0.016** (0.011-0.020)
45-day	**0.004** (0.004-0.005)	**0.005** (0.004-0.006)	**0.006** (0.005-0.007)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.007-0.010)	**0.010** (0.008-0.012)	**0.010** (0.008-0.013)	**0.011** (0.008-0.014)	**0.012** (0.009-0.015)
60-day	**0.004** (0.003-0.004)	**0.004** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.005-0.007)	**0.007** (0.006-0.008)	**0.008** (0.006-0.009)	**0.008** (0.007-0.010)	**0.009** (0.007-0.011)	**0.010** (0.007-0.012)	**0.010** (0.007-0.013)

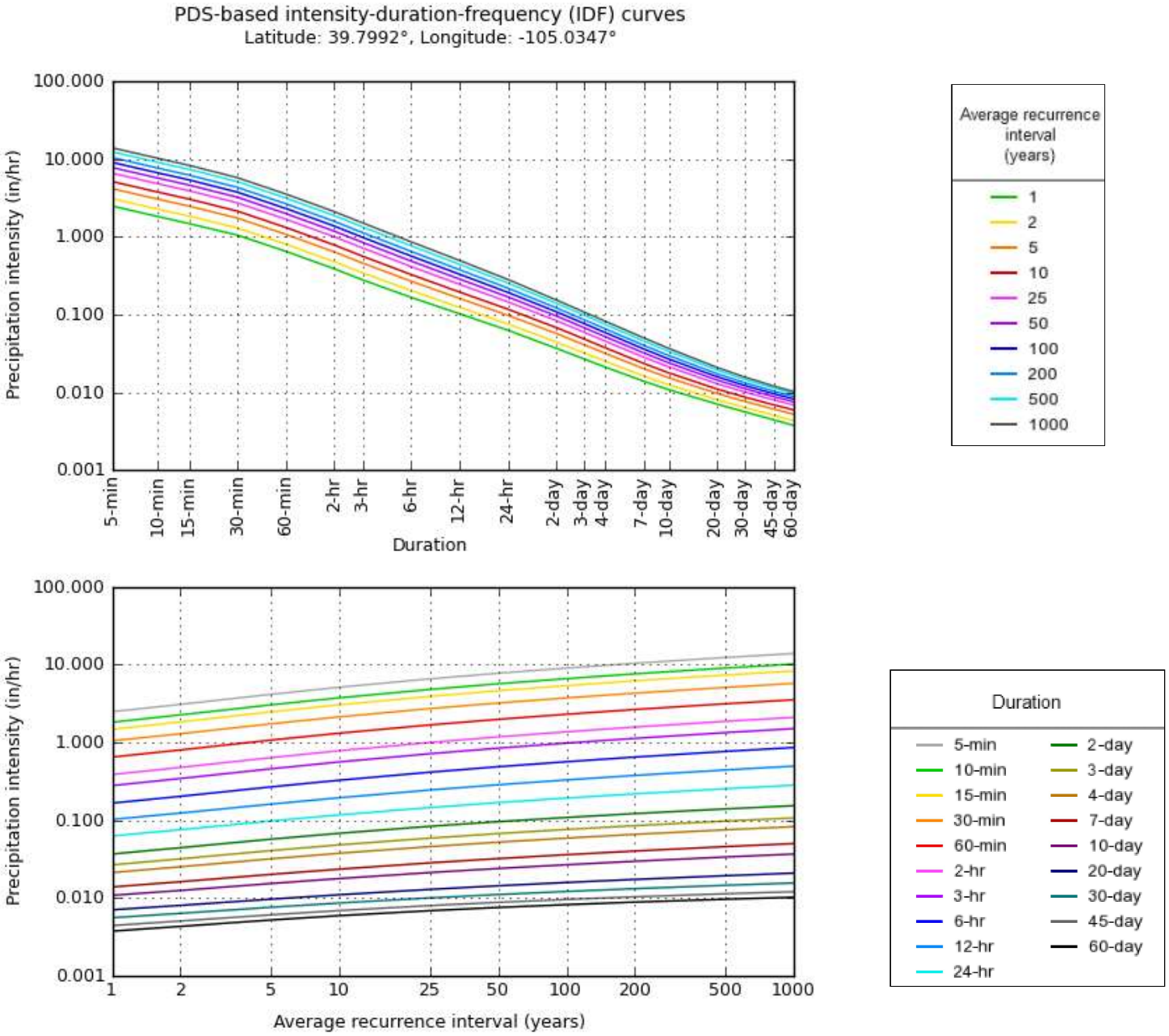
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



NOAA Atlas 14, Volume 8, Version 2

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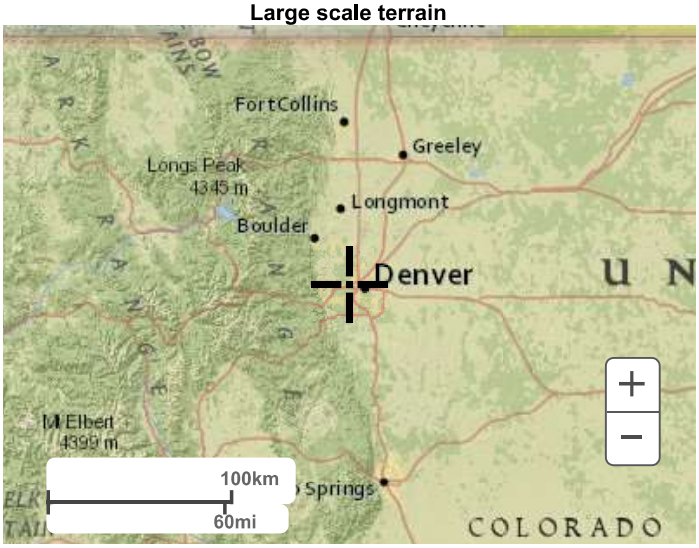
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Maps & aerials

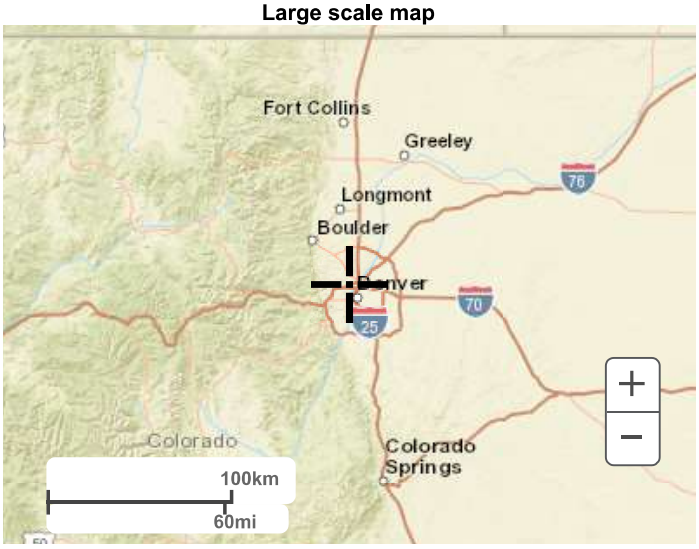
Small scale terrain



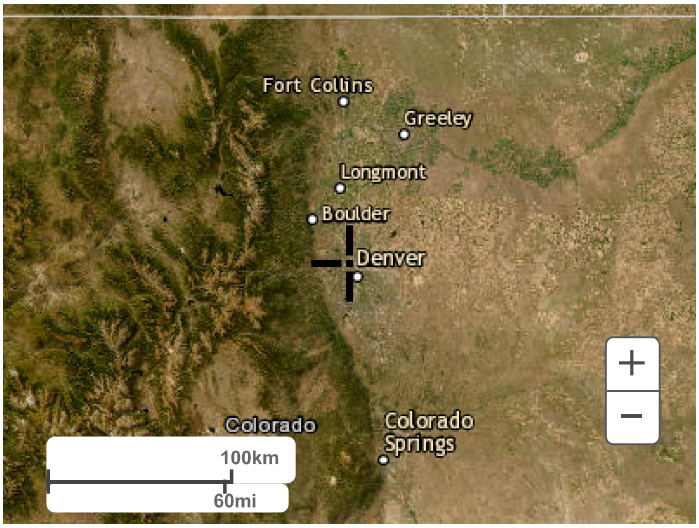
Large scale terrain



Large scale map



Large scale aerial



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Disclaimer

SUB-BASIN CALCULATIONS

Job Name Lowell Blvd Apts - 5602 Lowell Blvd
Job No. 22-C14
Date November 16, 2023

Table 1. Historic Sub-Basin Summary

Basin ID	Basin Parameters						Runoff Coefficients, C			Runoff, Q			Conveyance
	Area (acre)	L (ft)	Δ (ft)	Avg S_o	I	t_{use} (min)	C_5	C_{10}	C_{100}	Q_5 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	
H-1	4.168	561.3	1.8	0.3%	2%	35	0.04	0.12	0.41	0.27	1.00	5.98	Sheet Flow/Channelization
H-2	5.275	800.7	9.5	1.2%	2%	31	0.04	0.10	0.37	0.36	1.11	7.20	Sheet Flow
H-3	1.032	194.3	20.6	10.6%	2%	5	0.01	0.01	0.13	0.04	0.05	1.21	Sheet Flow/Channelization
H-4	2.847	650.6	10.8	1.7%	2%	31	0.04	0.10	0.36	0.20	0.60	3.78	Sheet Flow/Channelization
HOS-1	0.162	184.9	1.0	0.5%	2%	10	0.05	0.15	0.49	0.02	0.09	0.52	Sheet Flow/Curb & Gutter
HOS-2	0.266	416.8	1.6	0.4%	2%	24	0.05	0.15	0.49	0.03	0.10	0.57	Sheet Flow/Curb & Gutter
HOS-3	2.209	505.6	3.5	0.7%	2%	35	0.05	0.15	0.49	0.18	0.66	3.79	Sheet Flow/Channelization
HOS-4	7.933	634.1	6.1	1.0%	2%	29	0.04	0.11	0.39	0.57	1.91	11.91	Sheet Flow/Channelization
HOS-5	0.805	188.4	3.4	1.8%	2%	22	0.01	0.01	0.13	0.02	0.02	0.48	Sheet Flow
HOS-6	1.806				2%	31	0.04	0.12	0.42	0.12	0.46	2.80	Sheet Flow/Channelization
Hist. Site	13.323								Total Historic On-Site Generated Runoff	0.87	2.76	18.18	
Hist. Off-Site	1.806								Total Historic Off-Site Runoff Coming On-site	0.12	0.46	2.80	

Table 2. Proposed Sub-Basin Summary

Basin ID	Basin Parameters						Runoff Coefficients, C			Runoff, Q			Conveyance
	Area (acre)	L (ft)	Δ (ft)	Avg S_o	I	t_{use} (min)	C_5	C_{10}	C_{100}	Q_5 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	
P-1	1.429	319	5.4	1.7%	71.9%	11	0.63	0.66	0.78	2.64	3.40	7.09	Sheet Flow/Curb & Gutter
P-2	0.971	157	3.0	1.9%	25.5%	16	0.24	0.32	0.59	0.56	0.93	3.02	Sheet Flow/Channelization
P-3	0.618	233	2.5	1.1%	91.2%	5	0.78	0.80	0.85	2.00	2.53	4.75	Sheet Flow/Curb & Gutter
P-4	0.596	201	2.3	1.1%	84.1%	5	0.72	0.75	0.83	1.78	2.29	4.47	Sheet Flow/Curb & Gutter
P-5	0.380	137	1.4	1.0%	79.7%	5	0.69	0.72	0.81	1.09	1.40	2.78	Sheet Flow/Channelization
P-6	1.359	295	3.7	1.3%	81.1%	10	0.70	0.73	0.81	2.89	3.72	7.28	Sheet Flow/Curb & Gutter
P-7	1.586	412	6.0	1.5%	83.1%	10	0.70	0.72	0.80	3.38	4.28	8.39	Sheet Flow/Curb & Gutter
P-8	2.338	338	4.1	1.2%	80.8%	10	0.66	0.68	0.75	4.69	5.96	11.59	Sheet Flow/Curb & Gutter
P-9	0.911	269	2.7	1.0%	61.8%	10	0.47	0.48	0.59	1.30	1.64	3.55	Sheet Flow/Curb & Gutter
P-10	1.889	362	21.5	5.9%	11.7%	7	0.11	0.17	0.44	0.77	1.47	6.71	Flood Diversion Channel/Culvert
P-11	0.772	250	21.1	8.4%	17.5%	10	0.29	0.32	0.47	0.68	0.93	2.40	Sheet Flow/Ex Culverts
Captured	10.189			On-Site Developed Imp %	77%				Total Captured Runoff	20.33	26.16	52.92	
Un-Captured	2.662								Total Un-captured Runoff	1.45	2.39	9.11	

Table 3. Design Point and Conveyance Summary

Design Point	Conveyance Parameters						Stormwater Flow				Contributing Flows
	Type	L (ft)	S_o (ft/ft)	Depth (ft)	Manning's n	Material	Required (cfs)	Flow Depth y_n (ft)	Froude No.	Max Velocity V_n (ft/s)	

Sub-Basin H-1

Sub-basin Area =	181579	ft^2	4.168	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	181579	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

Soil Type

A/C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.04
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.12
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.41

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	265.1	ft
Delta =	0.8	ft
S_o =	0.003	ft/ft
C_5 =	0.04	
t_i =	46	minutes
L_t =	296.2	ft
Delta =	1.0	ft
S_w =	0.003	ft/ft
K =	5	Table 6-2
t_t =	17	minutes
Therefore; t_c =	63	minutes

Q_5, 5-YR

C_5 =	0.04	
I_5 =	1.63	in/hr
A =	4.168	acre
Q_5 =	0.272	cfs
	0.065	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.12	
I_{10} =	2.00	in/hr
A =	4.168	acre
Q_{10} =	1.000	cfs
	0.240	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.41	
I_{100}=	3.50	in/hr
A =	4.168	acre
Q_{100} =	5.982	cfs
	1.435	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.02	
L_t =	296.2	ft
Delta =	1.0	ft
S_t =	0.003	ft/ft
t_c =	35	minutes
Use t_c =	35	minutes

Sub-Basin H-2

Sub-basin Area =	229761	ft^2	5.275	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	229761	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

		Soil Type
C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.04	A/C
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.10	
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.37	

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	504.1	ft
Delta =	6.0	ft
S_o =	0.012	ft/ft
C_5 =	0.04	Table 6-5
t_i =	41	minutes
L_t =	296.6	ft
Delta =	3.5	ft
S_w =	0.012	ft/ft
K =	5	Table 6-2
t_t =	9.10	minutes
Therefore; t_c =	50	minutes

Q_5, 5-YR

C_5 =	0.04	
I_5 =	1.72	in/hr
A =	5.275	acre
Q_5 =	0.363	cfs
	0.069	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.10	
I_{10} =	2.10	in/hr
A =	5.275	acre
Q_{10} =	1.108	cfs
	0.210	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.37	
I_{100}=	3.69	in/hr
A =	5.275	acre
Q_{100} =	7.201	cfs
	1.365	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.02	
L_t =	296.6	ft
Delta =	3.5	ft
S_t =	0.012	ft/ft
t_c =	31	minutes
Use t_c =	31	minutes

Sub-Basin H-3

Sub-basin Area =	44972	ft^2	1.032	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	44972	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.01
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.01
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.13

Soil Type

A

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	30.8	ft
Delta =	5.9	ft
S_o =	0.192	ft/ft
C_5 =	0.01	Table 6-5
t_i =	4	minutes
L_t =	163.5	ft
Delta =	14.7	ft
S_w =	0.090	ft/ft
K =	7	Table 6-2
t_t =	1.30	minutes
Therefore; t_c =	5	minutes

Q_5, 5-YR

C_5 =	0.01	
I_5 =	4.15	in/hr
A =	1.032	acre
Q_5 =	0.043	cfs
	0.042	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.01	
I_{10} =	5.12	in/hr
A =	1.032	acre
Q_{10} =	0.053	cfs
	0.051	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.13	
I_{100}=	9.04	in/hr
A =	1.032	acre
Q_{100} =	1.213	cfs
	1.175	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.02	
L_t =	163.5	ft
Delta =	14.7	ft
S_t =	0.090	ft/ft
t_c =	27	minutes
Use t_c =	5	minutes

Sub-Basin H-4

Sub-basin Area =	124019	ft^2	2.847	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	124019	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

		Soil Type
C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.04	A/C
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.10	
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.36	

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr		
L_i =	416.8	ft
Delta =	9.4	ft
S_o =	0.023	ft/ft
C_5 =	0.04	Table 6-5
t_i =	30	minutes
L_t =	233.8	ft
Delta =	1.4	ft
S_w =	0.006	ft/ft
K =	7	Table 6-2
t_t =	7.2	minutes
Therefore; t_c =	37	minutes

Q_5, 5-YR		
C_5 =	0.04	
I_5 =	1.72	in/hr
A =	2.847	acre
Q_5 =	0.196	cfs
	0.069	cfs/acre

Q_{10}, 10-YR		
C_{10} =	0.10	
I_{10} =	2.10	in/hr
A =	2.847	acre
Q_{10} =	0.598	cfs
	0.210	cfs/acre

Q_{100}, 100-YR		
C_{100} =	0.36	
I_{100}=	3.69	in/hr
A =	2.847	acre
Q_{100} =	3.782	cfs
	1.328	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.02	
L_t =	233.8	ft
Delta =	1.4	ft
S_t =	0.006	ft/ft
t_c =	31	minutes
Use t_c =	31	minutes

Sub-Basin HOS-1

Sub-basin Area =	7047	ft^2	0.162	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	7047	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.05
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.15
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.49

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation R6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	16.1	ft
Delta =	0.5	ft
S_o =	0.030	ft/ft
C_5 =	0.05	Table 6-5
t_i =	5	minutes
L_t =	168.8	ft
Delta =	0.5	ft
S_w =	0.003	ft/ft
K =	10	Table 6-2
t_t =	5	minutes
Therefore; t_c =	10	minutes

Q_5, 5-YR

C_5 =	0.05	
I_5 =	3.04	in/hr
A =	0.162	acre
Q_5 =	0.025	cfs
	0.152	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.15	
I_{10} =	3.75	in/hr
A =	0.162	acre
Q_{10} =	0.091	cfs
	0.563	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.49	
I_{100}=	6.61	in/hr
A =	0.162	acre
Q_{100} =	0.524	cfs
	3.239	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.02	
L_t =	168.8	ft
Delta =	0.5	ft
S_t =	0.003	ft/ft
t_c =	31	minutes
Use t_c =	10	minutes

Sub-Basin HOS-2

Sub-basin Area =	11573	ft^2	0.266	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	11573	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.05
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.15
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.49

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	16.1	ft
Delta =	0.5	ft
S_o =	0.030	ft/ft
C_5 =	0.05	Table 6-5
t_i =	5	minutes
L_t =	400.7	ft
Delta =	1.1	ft
S_w =	0.003	ft/ft
K =	7	Table 6-2
t_t =	18	minutes
Therefore; t_c =	24	minutes

Q_5, 5-YR

C_5 =	0.05	
I_5 =	2.03	in/hr
A =	0.266	acre
Q_5 =	0.027	cfs
	0.102	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.15	
I_{10} =	2.50	in/hr
A =	0.266	acre
Q_{10} =	0.100	cfs
	0.375	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.49	
I_{100}=	4.40	in/hr
A =	0.266	acre
Q_{100} =	0.573	cfs
	2.156	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.02	
L_t =	400.7	ft
Delta =	1.1	ft
S_t =	0.003	ft/ft
t_c =	39	minutes
Use t_c =	24	minutes

Sub-Basin HOS-3

Sub-basin Area =	96228	ft^2	2.209	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	96228	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.05
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.15
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.49

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	207.3	ft
Delta =	2.5	ft
S_o =	0.012	ft/ft
C_5 =	0.05	Table 6-5
t_i =	26	minutes
L_t =	298.3	ft
Delta =	1.0	ft
S_w =	0.003	ft/ft
K =	7	Table 6-2
t_t =	12	minutes
Therefore; t_c =	38	minutes

Q_5, 5-YR

C_5 =	0.05	
I_5 =	1.63	in/hr
A =	2.209	acre
Q_5 =	0.180	cfs
	0.082	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.15	
I_{10} =	2.00	in/hr
A =	2.209	acre
Q_{10} =	0.663	cfs
	0.300	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.49	
I_{100}=	3.50	in/hr
A =	2.209	acre
Q_{100} =	3.789	cfs
	1.715	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.02	
L_t =	298.3	ft
Delta =	1.0	ft
S_t =	0.003	ft/ft
t_c =	35	minutes
Use t_c =	35	minutes

Sub-Basin HOS-4

Sub-basin Area =	345560	ft^2	7.933 acre
Paved		ft^2	
Packed Gravel		ft^2	
Roofs/Concrete		ft^2	
Landscaping/Undeveloped	345560	ft^2	
Imp =	2.0%		

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

		Soil Type
C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.04	A/C
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.11	
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.39	

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	519.2	ft
Delta =	5.6	ft
S_o =	0.011	ft/ft
C_5 =	0.04	Table 6-5
t_i =	43	minutes
L_t =	114.9	ft
Delta =	0.5	ft
S_w =	0.004	ft/ft
K =	7	Table 6-2
t_t =	4	minutes
Therefore; t_c =	47	minutes

Q_5, 5-YR

C_5 =	0.04	
I_5 =	1.79	in/hr
A =	7.933	acre
Q_5 =	0.568	cfs
	0.072	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.11	
I_{10} =	2.19	in/hr
A =	7.933	acre
Q_{10} =	1.911	cfs
	0.241	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.39	
I_{100}=	3.85	in/hr
A =	7.933	acre
Q_{100} =	11.911	cfs
	1.502	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.02	
L_t =	114.9	ft
Delta =	0.5	ft
S_t =	0.004	ft/ft
t_c =	29	minutes
Use t_c =	29	minutes

Sub-Basin HOS-5

Sub-basin Area =	35082	ft^2	0.805	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	35082	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

Soil Type

A

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.01
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.01
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.13

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	188.4	ft
Delta =	3.4	ft
S_o =	0.018	ft/ft
C_5 =	0.01	Table 6-5
t_i =	22	minutes
L_t =		ft
Delta =		ft
S_w =		ft/ft
K =	7	Table 6-2
t_t =		minutes
Therefore; t_c =	22	minutes

Q_5, 5-YR

C_5 =	0.01	
I_5 =	2.13	in/hr
A =	0.805	acre
Q_5 =	0.017	cfs
	0.021	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.01	
I_{10} =	2.62	in/hr
A =	0.805	acre
Q_{10} =	0.021	cfs
	0.026	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.13	
I_{100}=	4.61	in/hr
A =	0.805	acre
Q_{100} =	0.483	cfs
	0.599	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =		
L_t =		ft
Delta =		ft
S_t =		ft/ft
t_c =		minutes
Use t_c =	22	minutes

Sub-Basin HOS-6

Sub-basin Area =	78665	ft^2	1.806	acre
Paved		ft^2		
Packed Gravel		ft^2		
Roofs/Concrete		ft^2		
Landscaping/Undeveloped	78665	ft^2		
Imp =	2.0%			

Percent Imperviousness from Table 6-3

Paved	1.00
Gravel	0.40
Roofs/Concrete	0.90
Greenbelts/Landscaping	0.02

Soil Type

A/C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.04
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.12
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.42

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =		ft
Delta =		ft
S_o =		ft/ft
C_5 =	0.04	Table 6-5
t_i =		minutes
L_t =		ft
Delta =		ft
S_w =		ft/ft
K =		Table 6-2
t_t =		minutes
Therefore; t_c =		minutes

Q_5, 5-YR

C_5 =	0.04	
I_5 =	1.72	in/hr
A =	1.806	acre
Q_5 =	0.124	cfs
	0.069	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.12	
I_{10} =	2.10	in/hr
A =	1.806	acre
Q_{10} =	0.455	cfs
	0.252	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.42	
I_{100}=	3.69	in/hr
A =	1.806	acre
Q_{100} =	2.799	cfs
	1.550	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =		
L_t =		ft
Delta =		ft
S_t =		ft/ft
t_c =		minutes
Use t_c =	31	minutes

Sub-Basin P-1

Sub-basin Area =	62245	ft^2	1.429 acre
Paved	25472	ft^2	
Buildings/Roof	15341	ft^2	
Site Concrete	5749	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	15683	ft^2	
Impervious =	71.9%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.63
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.66
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.78

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	183.0	ft
Delta =	2.7	ft
S_o =	0.015	ft/ft
C_5 =	0.63	
t_i =	10	minutes
L_t =	136.0	ft
Delta =	2.7	ft
S_w =	0.020	ft/ft
K =	20	Table 6-2
t_t =	1	minutes
Therefore; t_c =	11	minutes

Q_5, 5-YR

C_5 =	0.63	
I_5 =	2.93	in/hr
A =	1.429	acre
Q_5 =	2.638	cfs
	1.846	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.66	
I_{10} =	3.61	in/hr
A =	1.429	acre
Q_{10} =	3.405	cfs
	2.383	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.78	
I_{100}=	6.36	in/hr
A =	1.429	acre
Q_{100} =	7.089	cfs
	4.961	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.72	
L_t =	136.0	ft
Delta =	2.7	ft
S_t =	0.020	ft/ft
t_c =	15	minutes
Use t_c =	11	minutes

Sub-Basin P-2

Sub-basin Area =	42292	ft^2	0.971 acre
Paved	0	ft^2	
Buildings/Roof	7694	ft^2	
Site Concrete	3593	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	31005	ft^2	
Impervious =	25.5%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.24
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.32
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.59

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	157.0	ft
Delta =	3.0	ft
S_o =	0.019	ft/ft
C_5 =	0.24	
t_i =	16	minutes
L_t =		ft
Delta =		ft
S_w =		ft/ft
K =	15	Table 6-2
t_t =		minutes
Therefore; t_c =	16	minutes

Q_5, 5-YR

C_5 =	0.24	
I_5 =	2.42	in/hr
A =	0.971	acre
Q_5 =	0.564	cfs
	0.581	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.32	
I_{10} =	2.99	in/hr
A =	0.971	acre
Q_{10} =	0.929	cfs
	0.957	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.59	
I_{100}=	5.27	in/hr
A =	0.971	acre
Q_{100} =	3.019	cfs
	3.109	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =		
L_t =		ft
Delta =		ft
S_t =		ft/ft
t_c =		minutes
Use t_c =	16	minutes

Sub-Basin P-3

Sub-basin Area =	26927	ft^2	0.618 acre
Paved	14619	ft^2	
Buildings/Roof	6589	ft^2	
Site Concrete	4419	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	1300	ft^2	
Impervious =	91.2%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.78
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.80
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.85

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	31.0	ft
Delta =	0.45	ft
S_o =	0.015	ft/ft
C_5 =	0.78	
t_i =	3	minutes
L_t =	202.0	ft
Delta =	2.0	ft
S_w =	0.010	ft/ft
K =	20	Table 6-2
t_t =	2	minutes
Therefore; t_c =	5	minutes

Q_5, 5-YR

C_5 =	0.78	
I_5 =	4.15	in/hr
A =	0.618	acre
Q_5 =	2.001	cfs
	3.237	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.80	
I_{10} =	5.12	in/hr
A =	0.618	acre
Q_{10} =	2.532	cfs
	4.096	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.85	
I_{100}=	9.04	in/hr
A =	0.618	acre
Q_{100} =	4.750	cfs
	7.684	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.91	
L_t =	202.0	ft
Delta =	2.0	ft
S_t =	0.010	ft/ft
t_c =	12	minutes
Use t_c =	5	minutes

Sub-Basin P-4

Sub-basin Area =	25974	ft^2	0.596 acre
Paved	13778	ft^2	
Buildings/Roof	6216	ft^2	
Site Concrete	2681	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	3299	ft^2	
Impervious =	84.1%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.72
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.75
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.83

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	25.0	ft
Delta =	0.5	ft
S_o =	0.020	ft/ft
C_5 =	0.72	
t_i =	3	minutes
L_t =	176.0	ft
Delta =	1.8	ft
S_w =	0.010	ft/ft
K =	20	Table 6-2
t_t =	1	minutes
Therefore; t_c =	4	minutes

Q_5, 5-YR

C_5 =	0.72	
I_5 =	4.15	in/hr
A =	0.596	acre
Q_5 =	1.782	cfs
	2.988	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.75	
I_{10} =	5.12	in/hr
A =	0.596	acre
Q_{10} =	2.290	cfs
	3.840	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.83	
I_{100}=	9.04	in/hr
A =	0.596	acre
Q_{100} =	4.474	cfs
	7.503	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.84	
L_t =	176.0	ft
Delta =	1.8	ft
S_t =	0.010	ft/ft
t_c =	13	minutes
Use t_c =	5	minutes

Sub-Basin P-5

Sub-basin Area =	16559	ft^2	0.380 acre
Paved	5396	ft^2	
Buildings/Roof	7767	ft^2	
Site Concrete	853	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	2543	ft^2	
Impervious =	79.7%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.69
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.72
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.81

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	20.0	ft
Delta =	0.2	ft
S_o =	0.010	ft/ft
C_5 =	0.69	
t_i =	3	minutes
L_t =	117.0	ft
Delta =	1.2	ft
S_w =	0.010	ft/ft
K =	20	Table 6-2
t_t =	1	minutes
Therefore; t_c =	4	minutes

Q_5, 5-YR

C_5 =	0.69	
I_5 =	4.15	in/hr
A =	0.380	acre
Q_5 =	1.089	cfs
	2.864	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.72	
I_{10} =	5.12	in/hr
A =	0.380	acre
Q_{10} =	1.401	cfs
	3.686	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.81	
I_{100}=	9.04	in/hr
A =	0.380	acre
Q_{100} =	2.784	cfs
	7.322	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.80	
L_t =	117.0	ft
Delta =	1.2	ft
S_t =	0.010	ft/ft
t_c =	13	minutes
Use t_c =	5	minutes

Sub-Basin P-6

Sub-basin Area =	59216	ft^2	1.359 acre
Paved	22509	ft^2	
Buildings/Roof	20633	ft^2	
Site Concrete	7549	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	8525	ft^2	
Impervious =	81.1%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.70
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.73
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.81

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	152.0	ft
Delta =	1.5	ft
S_o =	0.010	ft/ft
C_5 =	0.70	
t_i =	9	minutes
L_t =	143.0	ft
Delta =	2.2	ft
S_w =	0.015	ft/ft
K =	20	Table 6-2
t_t =	1	minutes
Therefore; t_c =	10	minutes

Q_5, 5-YR

C_5 =	0.70	
I_5 =	3.04	in/hr
A =	1.359	acre
Q_5 =	2.893	cfs
	2.128	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.73	
I_{10} =	3.75	in/hr
A =	1.359	acre
Q_{10} =	3.721	cfs
	2.738	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.81	
I_{100}=	6.61	in/hr
A =	1.359	acre
Q_{100} =	7.278	cfs
	5.354	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.81	
L_t =	143.0	ft
Delta =	2.2	ft
S_t =	0.015	ft/ft
t_c =	13	minutes
Use t_c =	10	minutes

Sub-Basin P-7

Sub-basin Area =	69088	ft^2	1.586 acre
Paved	30488	ft^2	
Buildings/Roof	20117	ft^2	
Site Concrete	9564	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	8919	ft^2	
Impervious =	83.1%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

A/C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.70
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.72
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.80

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	165.0	ft
Delta =	2.4	ft
S_o =	0.015	ft/ft
C_5 =	0.70	
t_i =	8	minutes
L_t =	247.0	ft
Delta =	3.6	ft
S_w =	0.015	ft/ft
K =	20	Table 6-2
t_t =	2	minutes
Therefore; t_c =	10	minutes

Q_5, 5-YR

C_5 =	0.70	
I_5 =	3.04	in/hr
A =	1.586	acre
Q_5 =	3.375	cfs
	2.128	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.72	
I_{10} =	3.75	in/hr
A =	1.586	acre
Q_{10} =	4.282	cfs
	2.700	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.80	
I_{100}=	6.61	in/hr
A =	1.586	acre
Q_{100} =	8.387	cfs
	5.288	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.83	
L_t =	247.0	ft
Delta =	3.6	ft
S_t =	0.015	ft/ft
t_c =	14	minutes
Use t_c =	10	minutes

Sub-Basin P-8

Sub-basin Area =	101827	ft^2	2.338 acre
Paved	40191	ft^2	
Buildings/Roof	20249	ft^2	
Site Concrete	26206	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	15181	ft^2	
Impervious =	80.8%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

A/C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.66
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.68
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.75

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	160.0	ft
Delta =	2.4	ft
S_o =	0.015	ft/ft
C_5 =	0.66	
t_i =	9	minutes
L_t =	178.0	ft
Delta =	1.7	ft
S_w =	0.010	ft/ft
K =	20	Table 6-2
t_t =	2	minutes
Therefore; t_c =	10	minutes

Q_5, 5-YR

C_5 =	0.66	
I_5 =	3.04	in/hr
A =	2.338	acre
Q_5 =	4.690	cfs
	2.006	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.68	
I_{10} =	3.75	in/hr
A =	2.338	acre
Q_{10} =	5.961	cfs
	2.550	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.75	
I_{100}=	6.61	in/hr
A =	2.338	acre
Q_{100} =	11.589	cfs
	4.958	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.81	
L_t =	178.0	ft
Delta =	1.7	ft
S_t =	0.010	ft/ft
t_c =	14	minutes
Use t_c =	10	minutes

Sub-Basin P-9

Sub-basin Area =	39691	ft^2	0.911 acre
Paved	8905	ft^2	
Buildings/Roof	12409	ft^2	
Site Concrete	4354	ft^2	
Packed Gravel	640	ft^2	
Landscaping/Undeveloped	13383	ft^2	
Impervious =	61.8%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

A

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.47
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.48
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.59

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	56.0	ft
Delta =	0.56	ft
S_o =	0.010	ft/ft
C_5 =	0.47	
t_i =	9	minutes
L_t =	213.0	ft
Delta =	2.1	ft
S_w =	0.010	ft/ft
K =	20	Table 6-2
t_t =	2	minutes
Therefore; t_c =	10	minutes

Q_5, 5-YR

C_5 =	0.47	
I_5 =	3.04	in/hr
A =	0.911	acre
Q_5 =	1.302	cfs
	1.429	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.48	
I_{10} =	3.75	in/hr
A =	0.911	acre
Q_{10} =	1.640	cfs
	1.800	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.59	
I_{100}=	6.61	in/hr
A =	0.911	acre
Q_{100} =	3.554	cfs
	3.900	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.62	
L_t =	213.0	ft
Delta =	2.1	ft
S_t =	0.010	ft/ft
t_c =	18	minutes
Use t_c =	10	minutes

Sub-Basin P-10

Sub-basin Area =	82303	ft^2	1.889 acre
Paved	0	ft^2	
Buildings/Roof	0	ft^2	
Site Concrete	1265	ft^2	
Packed Gravel	18013	ft^2	
Landscaping/Undeveloped	63025	ft^2	
Impervious =	11.7%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

A/C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.11
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.17
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.44

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	62.0	ft
Delta =	15.5	ft
S_o =	0.250	ft/ft
C_5 =	0.11	
t_i =	5	minutes
L_t =	300.0	ft
Delta =	6.0	ft
S_w =	0.020	ft/ft
K =	15	Table 6-2
t_t =	2	minutes
Therefore; t_c =	7	minutes

Q_5, 5-YR

C_5 =	0.11	
I_5 =	3.71	in/hr
A =	1.889	acre
Q_5 =	0.771	cfs
	0.408	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.17	
I_{10} =	4.57	in/hr
A =	1.889	acre
Q_{10} =	1.468	cfs
	0.777	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.44	
I_{100}=	8.07	in/hr
A =	1.889	acre
Q_{100} =	6.709	cfs
	3.551	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

*T_c not to exceed equation 6-5 at first design pt

i =	0.12	
L_t =	300.0	ft
Delta =	6.0	ft
S_t =	0.020	ft/ft
t_c =	27	minutes
Use t_c =	7	minutes

Sub-Basin P-11

Sub-basin Area =	33640	ft^2	0.772 acre
Paved	0	ft^2	
Buildings/Roof	0	ft^2	
Site Concrete	5932	ft^2	
Packed Gravel	0	ft^2	
Landscaping/Undeveloped	27708	ft^2	
Impervious =	17.5%		

Percent Imperviousness from Table 6-3

Paved	1.00
Buildings/Roof	0.90
Site Concrete	0.90
Packed Gravel	0.40
Greenbelts/Landscaping	0.02

Soil Type

A/C

C_5 = runoff coefficient for 5-year frequency (from Table 6-5)	0.29
C_{10} = runoff coefficient for 10-year frequency (from Table 6-5)	0.32
C_{100} = runoff coefficient for 100-year frequency (from Table 6-5)	0.47

TIME OF CONCENTRATION, t_c

t_c = computed time of concentration (minutes)

$t_c = t_i + t_t$ Equation 6-2

t_i = overland (initial) flow time (minutes)

$t_i = (0.395(1.1-Cy)(L_i^{0.5}))/S_o^{0.33}$ Equation 6-3

Cy = runoff coefficient for storm frequency frequency (from Table 6-4)

L_i = length of overland flow (ft), not greater than 300' (urban) or 500' (rural)

S_o = average slope along overland flow path (ft/ft)

t_t = channelized flow time (minutes)

$t_t = L_t/((60*C_v)*(S_w^{0.5})) = L_t/60V_t$ Equation 6-4

L_t = length of channelized flow (ft)

S_w = average slope along channelized flow path (ft/ft)

C_v = Conveyance Coefficient (Table 6-5)

Developed Flow Rates, Q

Q=CIA Equation 6-1

Q = peak rate of runoff (CFS)

C = Runoff coefficient

I = avg intensity of rainfall

A = area (AC)

t_c, 5-yr

L_i =	198.0	ft
Delta =	20.0	ft
S_o =	0.101	ft/ft
C_5 =	0.29	
t_i =	10	minutes
L_t =	52.0	ft
Delta =	1.1	ft
S_w =	0.020	ft/ft
K =	7	Table 6-2
t_t =	1	minutes
Therefore; t_c =	10	minutes

Q_5, 5-YR

C_5 =	0.29	
I_5 =	3.04	in/hr
A =	0.772	acre
Q_5 =	0.681	cfs
	0.882	cfs/acre

Q_{10}, 10-YR

C_{10} =	0.32	
I_{10} =	3.75	in/hr
A =	0.772	acre
Q_{10} =	0.927	cfs
	1.200	cfs/acre

Q_{100}, 100-YR

C_{100} =	0.47	
I_{100}=	6.61	in/hr
A =	0.772	acre
Q_{100} =	2.399	cfs
	3.107	cfs/acre

t_c Check for Urbanized Catchments

$t_c = (26-17i)+(L_t / (60(14i+9)S_t\text{^}0.5))$ Equation 6-5

t_c = computed time of concentration (minutes)

L_t = length of flow path (ft)

i = imperviousness in decimal

S_t = average slope along channelized flow path (ft/ft)

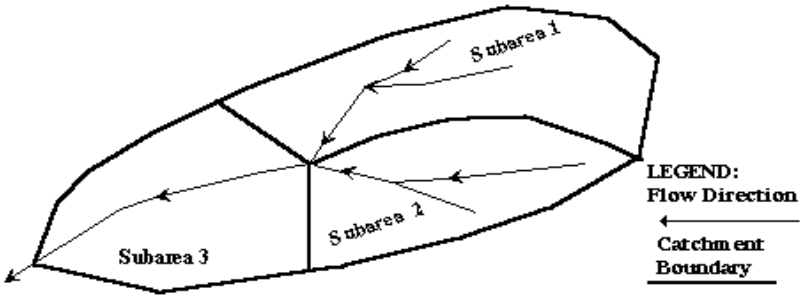
*T_c not to exceed equation 6-5 at first design pt

i =	0.18	
L_t =	52.0	ft
Delta =	1.1	ft
S_t =	0.020	ft/ft
t_c =	24	minutes
Use t_c =	10	minutes

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: DS
Company: Asher Architects + Engineers
Date: 11/16/2023
Project: Lowell Blvd Apartments
Location: 5602 Lowell Blvd



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Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

Subcatchment Name
P-7

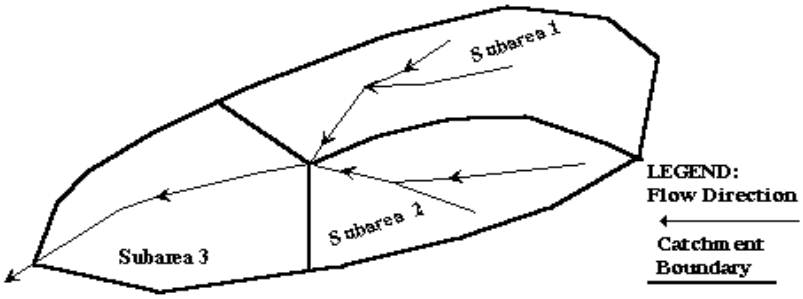
See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
	0.98	C	83.1	0.68	0.71	0.74	0.78	0.80	0.82	0.85
	0.61	A	83.1	0.66	0.68	0.69	0.72	0.73	0.76	0.79
Total Area (ac)	1.59		Area-Weighted C	0.67	0.70	0.72	0.76	0.78	0.80	0.83
			Area-Weighted Override C	0.67	0.70	0.72	0.76	0.78	0.80	0.83

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: DS
Company: Asher Architects + Engineers
Date: 11/16/2023
Project: Lowell Blvd Apartments
Location: 5602 Lowell Blvd



Subcatchment Name
P-8

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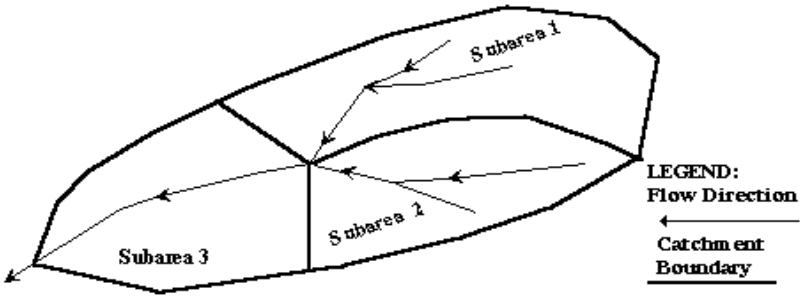
See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
	0.39	C	80.8	0.66	0.69	0.73	0.77	0.79	0.81	0.84
	1.95	A	80.8	0.64	0.66	0.67	0.70	0.72	0.74	0.78
Total Area (ac)	2.34		Area-Weighted C	0.64	0.66	0.68	0.71	0.73	0.75	0.79
			Area-Weighted Override C	0.64	0.66	0.68	0.71	0.73	0.75	0.79

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: DS
Company: Asher Architects + Engineers
Date: 11/16/2023
Project: Lowell Blvd Apartments
Location: 5602 Lowell Blvd



Subcatchment Name
P-10

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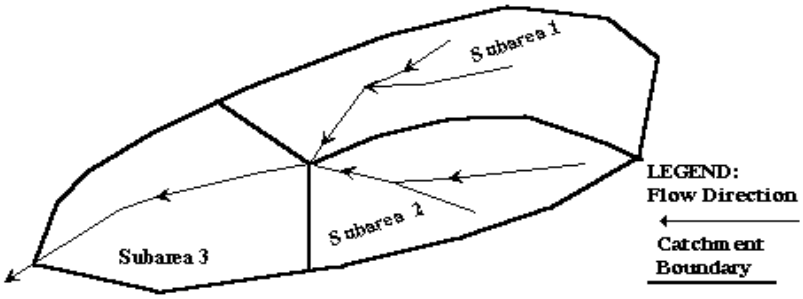
See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
	1.36	C	11.7	0.08	0.13	0.22	0.38	0.45	0.53	0.62
	0.53	A	11.7	0.05	0.06	0.06	0.08	0.12	0.20	0.33
Total Area (ac)	1.89		Area-Weighted C	0.07	0.11	0.17	0.30	0.36	0.44	0.54
			Area-Weighted Override C	0.07	0.11	0.17	0.30	0.36	0.44	0.54

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: DS
Company: Asher Architects + Engineers
Date: 11/16/2023
Project: Lowel Blvd Apartments
Location: 5602 Lowell Blvd



Subcatchment Name
P-11

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Cells of this color are for calculated results based on overrides

See sheet "Design Info" for imperviousness-based runoff coefficient values.

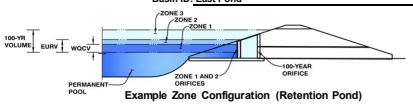
Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
	0.09	C	3.8	0.02	0.07	0.16	0.34	0.41	0.50	0.60
	0.67	A	46.3	0.31	0.32	0.34	0.37	0.42	0.47	0.55
Total Area (ac)	0.76		Area-Weighted C	0.27	0.29	0.32	0.37	0.42	0.47	0.56
			Area-Weighted Override C	0.27	0.29	0.32	0.37	0.42	0.47	0.56

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lowell Boulevard Apartment - Preliminary Pond Sizing

Basin ID: East Pond



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	4.835	acres
Watershed Length =	530	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	78.00%	percent
Percentage Hydrologic Soil Group A =	71.7%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	28.3%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.127	acre-feet
Excess Urban Runoff Volume (EURV) =	0.458	acre-feet
2-yr Runoff Volume (P1 = 0.8 in.) =	0.232	acre-feet
5-yr Runoff Volume (P1 = 1.07 in.) =	0.324	acre-feet
10-yr Runoff Volume (P1 = 1.32 in.) =	0.414	acre-feet
25-yr Runoff Volume (P1 = 1.68 in.) =	0.552	acre-feet
50-yr Runoff Volume (P1 = 1.98 in.) =	0.668	acre-feet
100-yr Runoff Volume (P1 = 2.31 in.) =	0.808	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	1.153	acre-feet
Approximate 2-yr Detention Volume =	0.219	acre-feet
Approximate 5-yr Detention Volume =	0.307	acre-feet
Approximate 10-yr Detention Volume =	0.384	acre-feet
Approximate 25-yr Detention Volume =	0.492	acre-feet
Approximate 50-yr Detention Volume =	0.555	acre-feet
Approximate 100-yr Detention Volume =	0.621	acre-feet

Optional User Override 1-hr Precipitation

0.80	inches
1.07	inches
1.32	inches
1.68	inches
1.98	inches
2.31	inches
3.14	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.127	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.180	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.378	acre-feet
Total Detention Basin Volume =	0.685	acre-feet
Initial Surcharge Volume (ISV) =	36	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	7.00	ft
Depth of Trickle Channel (H_{TC}) =	0.33	ft
Slope of Trickle Channel (S_{TC}) =	0.010	ft/ft
Slopes of Main Basin Sides (S_{main}) =	0	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	

Vertical Walls

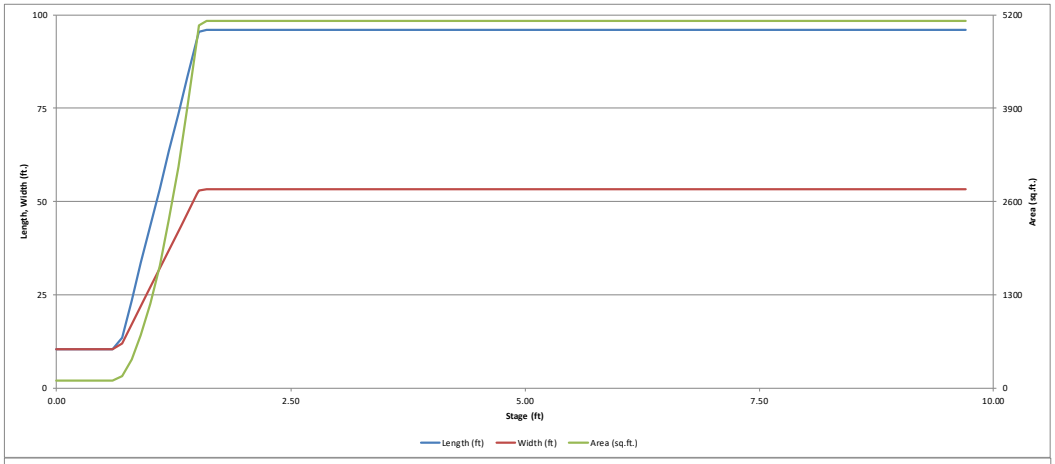
Initial Surcharge Area (A_{ISV}) =	109	ft^2
Surcharge Volume Length (L_{ISV}) =	10.4	ft
Surcharge Volume Width (W_{ISV}) =	10.4	ft
Depth of Basin Floor (H_{FLOOR}) =	0.86	ft
Length of Basin Floor (L_{FLOOR}) =	96.1	ft
Width of Basin Floor (W_{FLOOR}) =	53.3	ft
Area of Basin Floor (A_{FLOOR}) =	5,118	ft^2
Volume of Basin Floor (V_{FLOOR}) =	1,705	ft^3
Depth of Main Basin (H_{MAIN}) =	5.48	ft
Length of Main Basin (L_{MAIN}) =	96.1	ft
Width of Main Basin (W_{MAIN}) =	53.3	ft
Area of Main Basin (A_{MAIN}) =	5,118	ft^2
Volume of Main Basin (V_{MAIN}) =	28,065	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.685**	acre-feet

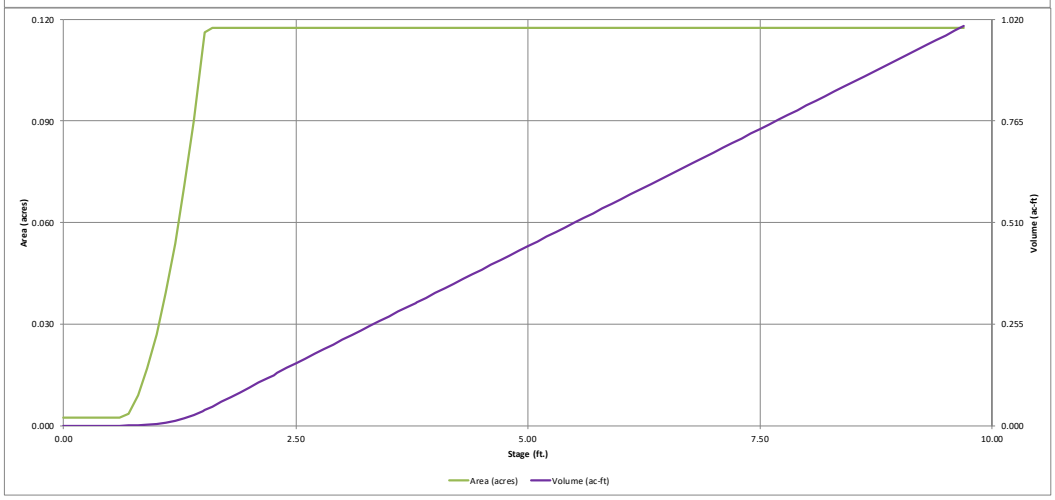
Depth Increment = 0.1 ft

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		10.4	10.4	109		0.003		
ISV	0.33		10.4	10.4	109		0.003	35	0.001
	0.40		10.4	10.4	109		0.003	43	0.001
	0.50		10.4	10.4	109		0.003	53	0.001
	0.60		10.4	10.4	109		0.003	64	0.001
	0.70		13.4	11.9	161		0.004	76	0.002
	0.80		23.4	16.9	397		0.009	103	0.002
	0.90		33.4	21.9	734		0.017	159	0.004
	1.00		43.4	26.9	1,171		0.027	253	0.006
	1.10		53.4	31.9	1,707		0.039	396	0.009
	1.20		63.4	36.9	2,344		0.054	598	0.014
	1.30		73.4	41.9	3,081		0.071	868	0.020
	1.40		83.4	46.9	3,917		0.090	1,217	0.028
	1.50		93.4	51.9	4,854		0.111	1,655	0.038
Floor	1.52		95.4	52.9	5,053		0.116	1,754	0.040
	1.60		96.1	53.3	5,118		0.117	2,163	0.050
	1.70		96.1	53.3	5,118		0.117	2,675	0.061
	1.80		96.1	53.3	5,118		0.117	3,187	0.073
	1.90		96.1	53.3	5,118		0.117	3,699	0.085
	2.00		96.1	53.3	5,118		0.117	4,211	0.097
	2.10		96.1	53.3	5,118		0.117	4,773	0.110
	2.20		96.1	53.3	5,118		0.117	5,285	0.121
Zone 1 (WQCV)	2.26		96.1	53.3	5,118		0.117	5,592	0.128
	2.30		96.1	53.3	5,118		0.117	5,797	0.133
	2.40		96.1	53.3	5,118		0.117	6,309	0.145
	2.50		96.1	53.3	5,118		0.117	6,821	0.157
	2.60		96.1	53.3	5,118		0.117	7,332	0.168
	2.70		96.1	53.3	5,118		0.117	7,844	0.180
	2.80		96.1	53.3	5,118		0.117	8,356	0.192
	2.90		96.1	53.3	5,118		0.117	8,868	0.204
	3.00		96.1	53.3	5,118		0.117	9,380	0.215
	3.10		96.1	53.3	5,118		0.117	9,891	0.227
	3.20		96.1	53.3	5,118		0.117	10,403	0.239
	3.30		96.1	53.3	5,118		0.117	10,915	0.251
	3.40		96.1	53.3	5,118		0.117	11,427	0.262
	3.50		96.1	53.3	5,118		0.117	11,939	0.274
	3.60		96.1	53.3	5,118		0.117	12,450	0.286
	3.70		96.1	53.3	5,118		0.117	12,962	0.298
Zone 2 (5-year)	3.79		96.1	53.3	5,118		0.117	13,423	0.308
	3.80		96.1	53.3	5,118		0.117	13,474	0.309
	3.90		96.1	53.3	5,118		0.117	13,986	0.321
	4.00		96.1	53.3	5,118		0.117	14,498	0.333
	4.10		96.1	53.3	5,118		0.117	15,009	0.345
	4.20		96.1	53.3	5,118		0.117	15,521	0.356
	4.30		96.1	53.3	5,118		0.117	16,033	0.368
	4.40		96.1	53.3	5,118		0.117	16,545	0.380
	4.50		96.1	53.3	5,118		0.117	17,056	0.392
	4.60		96.1	53.3	5,118		0.117	17,568	0.403
	4.70		96.1	53.3	5,118		0.117	18,080	0.415
	4.80		96.1	53.3	5,118		0.117	18,592	0.427
	4.90		96.1	53.3	5,118		0.117	19,104	0.439
	5.00		96.1	53.3	5,118		0.117	19,615	0.450
	5.10		96.1	53.3	5,118		0.117	20,127	0.462
	5.20		96.1	53.3	5,118		0.117	20,639	0.474
	5.30		96.1	53.3	5,118		0.117	21,151	0.486
	5.40		96.1	53.3	5,118		0.117	21,663	0.497
	5.50		96.1	53.3	5,118		0.117	22,174	0.509
	5.60		96.1	53.3	5,118		0.117	22,686	0.521
	5.70		96.1	53.3	5,118		0.117	23,198	0.533
	5.80		96.1	53.3	5,118		0.117	23,710	0.544
	5.90		96.1	53.3	5,118		0.117	24,222	0.556
	6.00		96.1	53.3	5,118		0.117	24,733	0.568
	6.10		96.1	53.3	5,118		0.117	25,245	0.580
	6.20		96.1	53.3	5,118		0.117	25,757	0.591
	6.30		96.1	53.3	5,118		0.117	26,269	0.603
	6.40		96.1	53.3	5,118		0.117	26,781	0.615
	6.50		96.1	53.3	5,118		0.117	27,292	0.627
	6.60		96.1	53.3	5,118		0.117	27,804	0.638
	6.70		96.1	53.3	5,118		0.117	28,316	0.650
	6.80		96.1	53.3	5,118		0.117	28,828	0.662
	6.90		96.1	53.3	5,118		0.117	29,339	0.674
Z3 (100+1/2WQCV)	7.00		96.1	53.3	5,118		0.117	29,851	0.685
	7.10		96.1	53.3	5,118		0.117	30,363	0.697
	7.20		96.1	53.3	5,118		0.117	30,875	0.709
	7.30		96.1	53.3	5,118		0.117	31,387	0.721
	7.40		96.1	53.3	5,118		0.117	31,898	0.732
	7.50		96.1	53.3	5,118		0.117	32,410	0.744
	7.60		96.1	53.3	5,118		0.117	32,922	0.756
	7.70		96.1	53.3	5,118		0.117	33,434	0.768
	7.80		96.1	53.3	5,118		0.117	33,946	0.779
	7.90		96.1	53.3	5,118		0.117	34,457	0.791
	8.00		96.1	53.3	5,118		0.117	34,969	0.803
	8.10		96.1	53.3	5,118		0.117	35,481	0.815
	8.20		96.1	53.3	5,118		0.117	35,993	0.826
	8.30		96.1	53.3	5,118		0.117	36,505	0.838
	8.40		96.1	53.3	5,118		0.117	37,016	0.850
	8.50		96.1	53.3	5,118		0.117	37,528	0.862
	8.60		96.1	53.3	5,118		0.117	38,040	0.873
	8.70		96.1	53.3	5,118		0.117	38,552	0.885
	8.80		96.1	53.3	5,118		0.117	39,064	0.897
	8.90		96.1	53.3	5,118		0.117	39,575	0.909
	9.00		96.1	53.3	5,118		0.117	40,087	0.920
	9.10		96.1	53.3	5,118		0.117	40,599	0.932
	9.20		96.1	53.3	5,118		0.117	41,111	0.944
	9.30		96.1	53.3	5,118		0.117	41,622	0.956
	9.40		96.1	53.3	5,118		0.117	42,134	0.967
	9.50		96.1	53.3	5,118		0.117	42,646	0.979
	9.60		96.1	53.3	5,118		0.117	43,158	0.991
	9.70		96.1	53.3	5,118		0.117	43,670	1.003

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



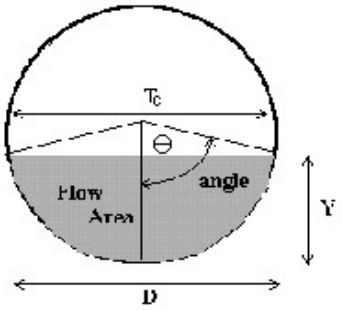


CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Lowell Blvd Apartments

Pipe ID: East Detention Pond Outlet



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	4.84	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	22.68	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.19	radians
Flow area	An =	0.84	sq ft
Top width	Tn =	1.86	ft
Wetted perimeter	Pn =	2.38	ft
Flow depth	Yn =	0.63	ft
Flow velocity	Vn =	5.74	fps
Discharge	Qn =	4.84	cfs
Percent of Full Flow	Flow =	21.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.50	supercritical

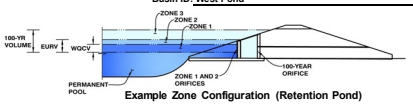
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.34	radians
Critical flow area	Ac =	1.12	sq ft
Critical top width	Tc =	1.95	ft
Critical flow depth	Yc =	0.77	ft
Critical flow velocity	Vc =	4.31	fps
Critical Depth Froude Number	Fr_c =	1.00	

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lowell Boulevard Apartment - Preliminary Pond Sizing

Basin ID: West Pond



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	5.354	acres	Note: L / W Ratio < 1
Watershed Length =	400	ft	L / W Ratio = 0.7
Watershed Slope =	0.010	ft/ft	
Watershed Imperviousness =	70.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	100.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.123	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.364	acre-feet	
2-yr Runoff Volume (P1 = 0.8 in.) =	0.235	acre-feet	0.80 inches
5-yr Runoff Volume (P1 = 1.07 in.) =	0.346	acre-feet	1.07 inches
10-yr Runoff Volume (P1 = 1.32 in.) =	0.446	acre-feet	1.32 inches
25-yr Runoff Volume (P1 = 1.68 in.) =	0.622	acre-feet	1.68 inches
50-yr Runoff Volume (P1 = 1.98 in.) =	0.759	acre-feet	1.98 inches
100-yr Runoff Volume (P1 = 2.31 in.) =	0.928	acre-feet	2.31 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.323	acre-feet	3.14 inches
Approximate 2-yr Detention Volume =	0.220	acre-feet	
Approximate 5-yr Detention Volume =	0.326	acre-feet	
Approximate 10-yr Detention Volume =	0.395	acre-feet	
Approximate 25-yr Detention Volume =	0.468	acre-feet	
Approximate 50-yr Detention Volume =	0.503	acre-feet	
Approximate 100-yr Detention Volume =	0.566	acre-feet	

Stage-Storage Calculation

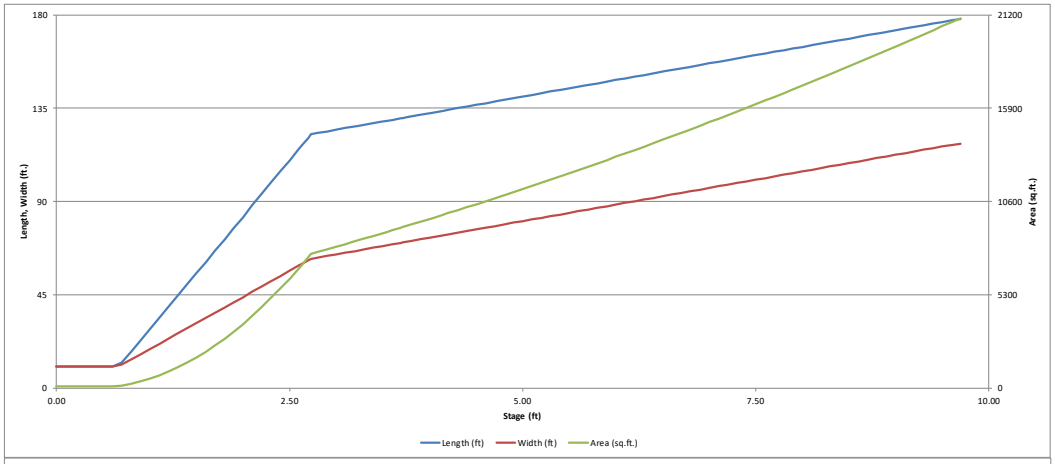
Zone 1 Volume (WQCV) =	0.123	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.203	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.302	acre-feet
Total Detention Basin Volume =	0.628	acre-feet
Initial Surcharge Volume (ISV) =	36	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	5.00	ft
Depth of Trickle Channel (H_{TC}) =	0.33	ft
Slope of Trickle Channel (S_{TC}) =	0.020	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	109	ft^2
Surcharge Volume Length (L_{ISV}) =	10.4	ft
Surcharge Volume Width (W_{ISV}) =	10.4	ft
Depth of Basin Floor (H_{FLOOR}) =	2.07	ft
Length of Basin Floor (L_{FLOOR}) =	122.3	ft
Width of Basin Floor (W_{FLOOR}) =	62.2	ft
Area of Basin Floor (A_{FLOOR}) =	7,615	ft^2
Volume of Basin Floor (V_{FLOOR}) =	5,964	ft^3
Depth of Main Basin (H_{MAIN}) =	2.27	ft
Length of Main Basin (L_{MAIN}) =	140.5	ft
Width of Main Basin (W_{MAIN}) =	80.4	ft
Area of Main Basin (A_{MAIN}) =	11,293	ft^2
Volume of Main Basin (V_{MAIN}) =	21,304	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.628**	acre-feet

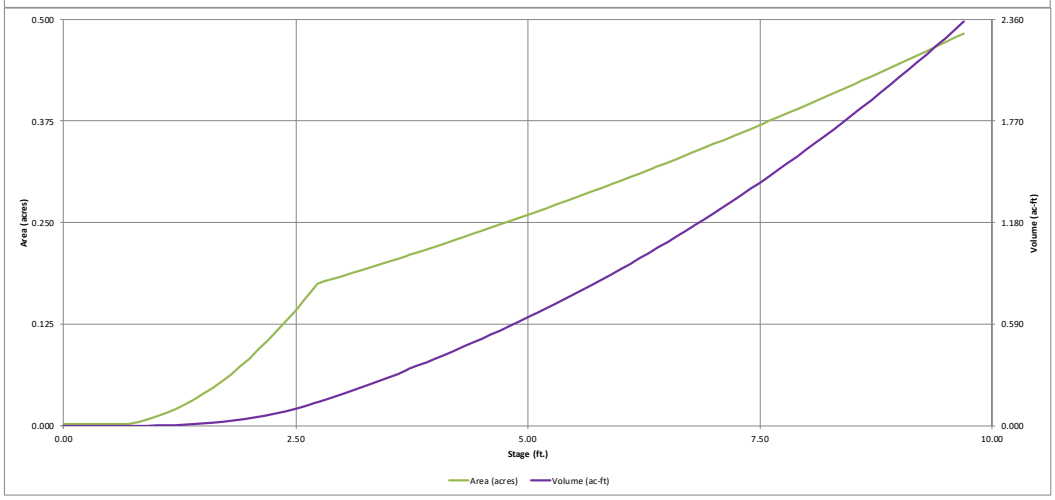
Depth Increment = 0.1 ft

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		10.4	10.4	109		0.003		
ISV	0.33		10.4	10.4	109		0.003	35	0.001
	0.40		10.4	10.4	109		0.003	43	0.001
	0.50		10.4	10.4	109		0.003	53	0.001
	0.60		10.4	10.4	109		0.003	64	0.001
	0.70		12.1	11.2	135		0.003	76	0.002
	0.80		17.5	13.7	239		0.005	94	0.002
	0.90		22.9	16.2	370		0.009	124	0.003
	1.00		28.3	18.7	528		0.012	169	0.004
	1.10		33.7	21.2	714		0.016	231	0.005
	1.20		39.1	23.7	926		0.021	313	0.007
	1.30		44.5	26.2	1,165		0.027	417	0.010
	1.40		49.9	28.7	1,431		0.033	547	0.013
	1.50		55.3	31.2	1,724		0.040	704	0.016
	1.60		60.7	33.7	2,044		0.047	892	0.020
	1.70		66.1	36.2	2,391		0.055	1,114	0.026
	1.80		71.5	38.7	2,765		0.063	1,371	0.031
	1.90		76.9	41.2	3,166		0.073	1,668	0.038
	2.00		82.3	43.7	3,595		0.083	2,006	0.046
	2.10		88.2	46.4	4,097		0.094	2,428	0.056
	2.20		93.6	48.9	4,581		0.105	2,862	0.066
	2.30		99.0	51.4	5,093		0.117	3,345	0.077
	2.40		104.4	53.9	5,632		0.129	3,882	0.089
	2.50		109.8	56.4	6,198		0.142	4,473	0.103
	2.60		115.2	58.9	6,791		0.156	5,122	0.118
Zone 1 (WQCV)	2.64		117.4	59.9	7,035		0.162	5,398	0.124
	2.70		120.6	61.4	7,411		0.170	5,832	0.134
Floor	2.73		122.2	62.2	7,602		0.175	6,057	0.139
	2.80		122.9	62.8	7,715		0.177	6,593	0.151
	2.90		123.7	63.6	7,864		0.181	7,372	0.169
	3.00		124.5	64.4	8,015		0.184	8,166	0.187
	3.10		125.3	65.2	8,167		0.187	8,975	0.206
	3.20		126.1	66.0	8,320		0.191	9,800	0.225
	3.30		126.9	66.8	8,474		0.195	10,639	0.244
	3.40		127.7	67.6	8,629		0.198	11,495	0.264
	3.50		128.5	68.4	8,786		0.202	12,365	0.284
	3.60		129.3	69.2	8,944		0.205	13,252	0.304
	3.70		130.1	70.0	9,104		0.209	14,154	0.325
Zone 2 (5-year)	3.71		130.2	70.1	9,120		0.209	14,245	0.327
	3.80		130.9	70.8	9,265		0.213	15,073	0.346
	3.90		131.7	71.6	9,427		0.216	16,007	0.367
	4.00		132.5	72.4	9,590		0.220	16,958	0.389
	4.10		133.3	73.2	9,754		0.224	17,925	0.412
	4.20		134.1	74.0	9,920		0.228	18,909	0.434
	4.30		134.9	74.8	10,087		0.232	19,909	0.457
	4.40		135.7	75.6	10,256		0.235	20,926	0.480
	4.50		136.5	76.4	10,425		0.239	21,960	0.504
	4.60		137.3	77.2	10,596		0.243	23,011	0.528
	4.70		138.1	78.0	10,768		0.247	24,080	0.553
	4.80		138.9	78.8	10,942		0.251	25,165	0.578
	4.90		139.7	79.6	11,117		0.255	26,268	0.603
Z3 (100+1/2WQCV)	5.00		140.5	80.4	11,293		0.259	27,389	0.629
	5.10		141.3	81.2	11,470		0.263	28,527	0.655
	5.20		142.1	82.0	11,649		0.267	29,683	0.681
	5.30		142.9	82.8	11,829		0.272	30,857	0.708
	5.40		143.7	83.6	12,010		0.276	32,048	0.736
	5.50		144.5	84.4	12,192		0.280	33,258	0.764
	5.60		145.3	85.2	12,376		0.284	34,487	0.792
	5.70		146.1	86.0	12,561		0.288	35,734	0.820
	5.80		146.9	86.8	12,747		0.293	36,999	0.849
	5.90		147.7	87.6	12,935		0.297	38,283	0.879
	6.00		148.5	88.4	13,124		0.301	39,586	0.909
	6.10		149.3	89.2	13,314		0.306	40,908	0.939
	6.20		150.1	90.0	13,505		0.310	42,249	0.970
	6.30		150.9	90.8	13,698		0.314	43,609	1.001
	6.40		151.7	91.6	13,892		0.319	44,989	1.033
	6.50		152.5	92.4	14,087		0.323	46,387	1.065
	6.60		153.3	93.2	14,284		0.328	47,806	1.097
	6.70		154.1	94.0	14,481		0.332	49,244	1.130
	6.80		154.9	94.8	14,681		0.337	50,702	1.164
	6.90		155.7	95.6	14,881		0.342	52,180	1.198
	7.00		156.5	96.4	15,083		0.346	53,679	1.232
	7.10		157.3	97.2	15,286		0.351	55,197	1.267
	7.20		158.1	98.0	15,490		0.356	56,736	1.302
	7.30		158.9	98.8	15,695		0.360	58,295	1.338
	7.40		159.7	99.6	15,902		0.365	59,875	1.375
	7.50		160.5	100.4	16,110		0.370	61,475	1.411
	7.60		161.3	101.2	16,319		0.375	63,097	1.449
	7.70		162.1	102.0	16,530		0.379	64,739	1.486
	7.80		162.9	102.8	16,742		0.384	66,403	1.524
	7.90		163.7	103.6	16,955		0.389	68,088	1.563
	8.00		164.5	104.4	17,169		0.394	69,794	1.602
	8.10		165.3	105.2	17,385		0.399	71,522	1.642
	8.20		166.1	106.0	17,602		0.404	73,271	1.682
	8.30		166.9	106.8	17,821		0.409	75,042	1.723
	8.40		167.7	107.6	18,040		0.414	76,835	1.764
	8.50		168.5	108.4	18,261		0.419	78,650	1.806
	8.60		169.3	109.2	18,483		0.424	80,487	1.848
	8.70		170.1	110.0	18,707		0.429	82,347	1.890
	8.80		170.9	110.8	18,931		0.435	84,229	1.934
	8.90		171.7	111.6	19,157		0.440	86,133	1.977
	9.00		172.5	112.4	19,384		0.445	88,060	2.022
	9.10		173.3	113.2	19,613		0.450	90,010	2.066
	9.20		174.1	114.0	19,843		0.456	91,983	2.112
	9.30		174.9	114.8	20,074		0.461	93,979	2.157
	9.40		175.7	115.6	20,306		0.466	95,998	2.204
	9.50		176.5	116.4	20,540		0.472	98,040	2.251
	9.60		177.3	117.2	20,775		0.477	100,106	2.298
	9.70		178.1	118.0	21,011		0.482	102,195	2.346

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



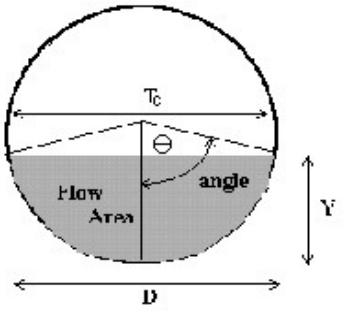


CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Lowell Blvd Apartments

Pipe ID: West Detention Pond Outlet



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	5.35	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	22.68	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.22	radians
Flow area	An =	0.91	sq ft
Top width	Tn =	1.88	ft
Wetted perimeter	Pn =	2.45	ft
Flow depth	Yn =	0.66	ft
Flow velocity	Vn =	5.91	fps
Discharge	Qn =	5.35	cfs
Percent of Full Flow	Flow =	23.6%	of full flow
Normal Depth Froude Number	Fr_n =	1.50	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.39	radians
Critical flow area	Ac =	1.20	sq ft
Critical top width	Tc =	1.97	ft
Critical flow depth	Yc =	0.82	ft
Critical flow velocity	Vc =	4.44	fps
Critical Depth Froude Number	Fr_c =	1.00	

Appendix C

Drainage Plans

LOWELL BLVD APTS - SITE PLAN

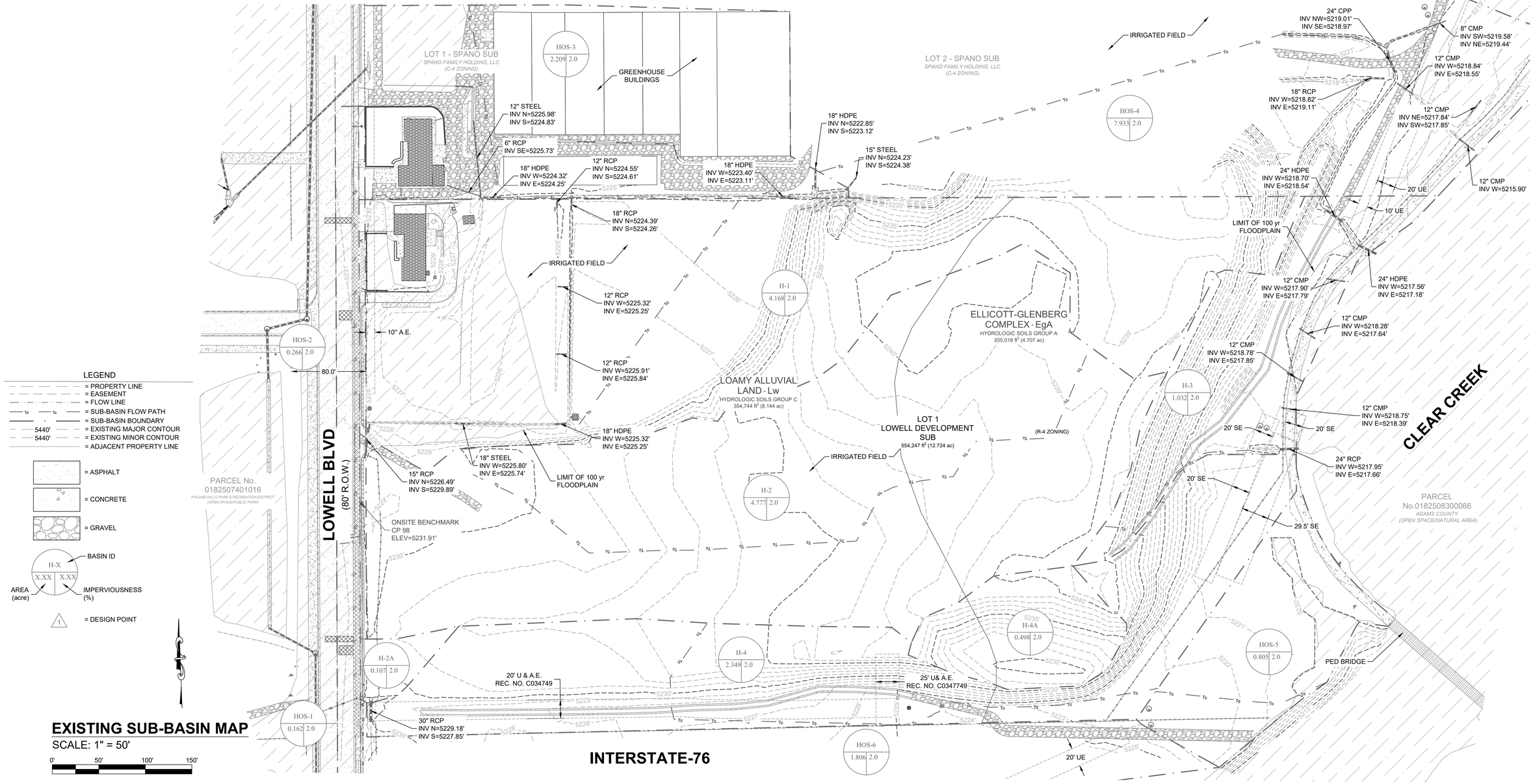
LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

Table 1. Historic Sub-Basin Summary

Basin ID	Basin Parameters						Runoff Coefficients, C			Runoff, Q			Conveyance
	Area (acre)	L (ft)	Δ (ft)	Avg So	I	tuse (min)	C5	C10	C100	Q5 (cfs)	Q10 (cfs)	Q100 (cfs)	
H-1	4.168	561.3	1.8	0.3%	2%	35	0.04	0.12	0.41	0.27	1.00	5.98	Sheet Flow/Channelization
H-2	5.275	800.7	9.5	1.2%	2%	31	0.04	0.10	0.37	0.36	1.11	7.20	Sheet Flow
H-3	1.032	194.3	20.6	10.6%	2%	5	0.01	0.01	0.13	0.04	0.05	1.21	Sheet Flow/Channelization
H-4	2.847	650.6	10.8	1.7%	2%	31	0.04	0.10	0.36	0.20	0.60	3.78	Sheet Flow/Channelization
HOS-1	0.162	184.9	1.0	0.5%	2%	10	0.05	0.15	0.49	0.02	0.09	0.52	Sheet Flow/Curb & Gutter
HOS-2	0.266	416.8	1.6	0.4%	2%	24	0.05	0.15	0.49	0.03	0.10	0.57	Sheet Flow/Curb & Gutter
HOS-3	2.209	505.6	3.5	0.7%	2%	35	0.05	0.15	0.49	0.18	0.66	3.79	Sheet Flow/Channelization
HOS-4	7.933	634.1	6.1	1.0%	2%	29	0.04	0.11	0.39	0.57	1.91	11.91	Sheet Flow/Channelization
HOS-5	0.805	188.4	3.4	1.8%	2%	22	0.01	0.01	0.13	0.02	0.02	0.48	Sheet Flow
HOS-6	1.806				2%	31	0.04	0.12	0.42	0.12	0.46	2.80	Sheet Flow/Channelization
Hist. Site	13.323	Total Historic On-Site Generated Runoff								0.87	2.76	18.18	
Hist. Off-Site	1.806	Total Historic Off-Site Runoff Coming On-site								0.12	0.46	2.80	

NOTES:

1. EXISTING BOUNDARY, UTILITY, IMPROVEMENT LOCATIONS, AND TOPOGRAPHY INFORMATION BASED ON FIELD SURVEY CONDUCTED BY EHRHART LAND SURVEYING IN OCTOBER OF 2022.
   - 1.1. HORIZONTAL DATUM: US STATE PLANE COORDINATES, NAD 1983, MODIFIED STATE PLANE NORTH ZONE, GEOID MODEL GEOID 18. GROUND COORDINATES DERIVED USING A COMBINED SCALE FACTOR OF 0.99973994 AND BEING SCALED ABOUT CONTROL POINT No. 98 (N 1170542.63, E 3130753.89) AN X CHISELED INTO THE CONCRETE ON TOP OF THE RETAINING WALL ALONG THE EAST SIDE OF LOWELL BOULEVARD.
   - 1.2. VERTICAL DATUM: VERTICAL DATUM ESTABLISHED USING NGS CONTROL POINT "HIDDEN" (PID AB3302 - 3.25" BRASS DISK) HAVING A NAVD88 ELEVATION OF 5285.30 ft. THE ELEVATION WAS VERIFIED USING AN NGS OPUS SOLUTION WITH GEOID 18.
   - 1.3. ON-SITE CONTROL POINT No. 98 IS AN X CHISELED INTO THE CONCRETE ON TOP OF THE RETAINING WALL ALONG THE EAST SIDE OF LOWELL BOULEVARD WITH AN ELEVATION OF 5231.91'.



LEGEND

- = PROPERTY LINE
- = EASEMENT
- = FLOW LINE
- Tc Tc = SUB-BASIN FLOW PATH
- = SUB-BASIN BOUNDARY
- 5440' = EXISTING MAJOR CONTOUR
- 5440' = EXISTING MINOR CONTOUR
- = ADJACENT PROPERTY LINE
- = ASPHALT
- = CONCRETE
- = GRAVEL
- H-X = BASIN ID
- X.XX = AREA (acre)
- X.XX = IMPERVIOUSNESS (%)
- 1 = DESIGN POINT

EXISTING SUB-BASIN MAP

SCALE: 1" = 50'

0' 50' 100' 150'

ENTITLEMENTS REVIEW ONLY NOT FOR CONSTRUCTION

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LOWELL DEVELOPMENT, LLC
5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

PROJECT NUMBER 22-C14
DOCUMENT DATE:
1/12/2024 11:34 AM
DOCUMENT PHASE:
FOR REVIEW - INTERNAL

DRAWN BY:	DATE:	CHECKED BY:	DATE:
TJH	07/06/2023	TJH	07/06/2023

REV.	DATE	DESCRIPTION

EXISTING SUB-BASINS

C-21

SHEET 22 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

Table 2. Proposed Sub-Basin Summary

Basin ID	Basin Parameters						Runoff Coefficients, C			Runoff, Q			Conveyance
	Area (acre)	L (ft)	Δ (ft)	Avg So	I	tuse (min)	C5	C10	C100	Q5 (cfs)	Q10 (cfs)	Q100 (cfs)	
P-1	1.429	319	5.4	1.7%	71.9%	11	0.63	0.66	0.78	2.64	3.40	7.09	Sheet Flow/Curb & Gutter
P-2	0.971	157	3.0	1.9%	25.5%	16	0.24	0.32	0.59	0.56	0.93	3.02	Sheet Flow/Channelization
P-3	0.618	233	2.5	1.1%	91.2%	5	0.78	0.80	0.85	2.00	2.53	4.75	Sheet Flow/Curb & Gutter
P-4	0.596	201	2.3	1.1%	84.1%	5	0.72	0.75	0.83	1.78	2.29	4.47	Sheet Flow/Curb & Gutter
P-5	0.380	137	1.4	1.0%	79.7%	5	0.69	0.72	0.81	1.09	1.40	2.78	Sheet Flow/Channelization
P-6	1.359	295	3.7	1.3%	81.1%	10	0.70	0.73	0.81	2.89	3.72	7.28	Sheet Flow/Curb & Gutter
P-7	1.586	412	6.0	1.5%	83.1%	10	0.70	0.72	0.80	3.38	4.28	8.39	Sheet Flow/Curb & Gutter
P-8	2.338	338	4.1	1.2%	80.8%	10	0.66	0.68	0.75	4.69	5.96	11.59	Sheet Flow/Curb & Gutter
P-9	0.911	269	2.7	1.0%	61.8%	10	0.47	0.48	0.59	1.30	1.64	3.55	Sheet Flow/Curb & Gutter
P-10	1.889	362	21.5	5.9%	11.7%	7	0.11	0.17	0.44	0.77	1.47	6.71	Flood Diversion Channel/Culvert
P-11	0.772	250	21.1	8.4%	17.5%	10	0.29	0.32	0.47	0.68	0.93	2.40	Sheet Flow/Ex Culverts
P-12						0	0.00	0.00	0.00	0.00	0.00	0.00	Sheet Flow
Captured	10.189	On-Site Developed Imp %			77%	Total Captured Runoff				20.33	26.16	52.92	
Un-Captured	2.662					Total Un-captured Runoff				1.45	2.39	9.11	

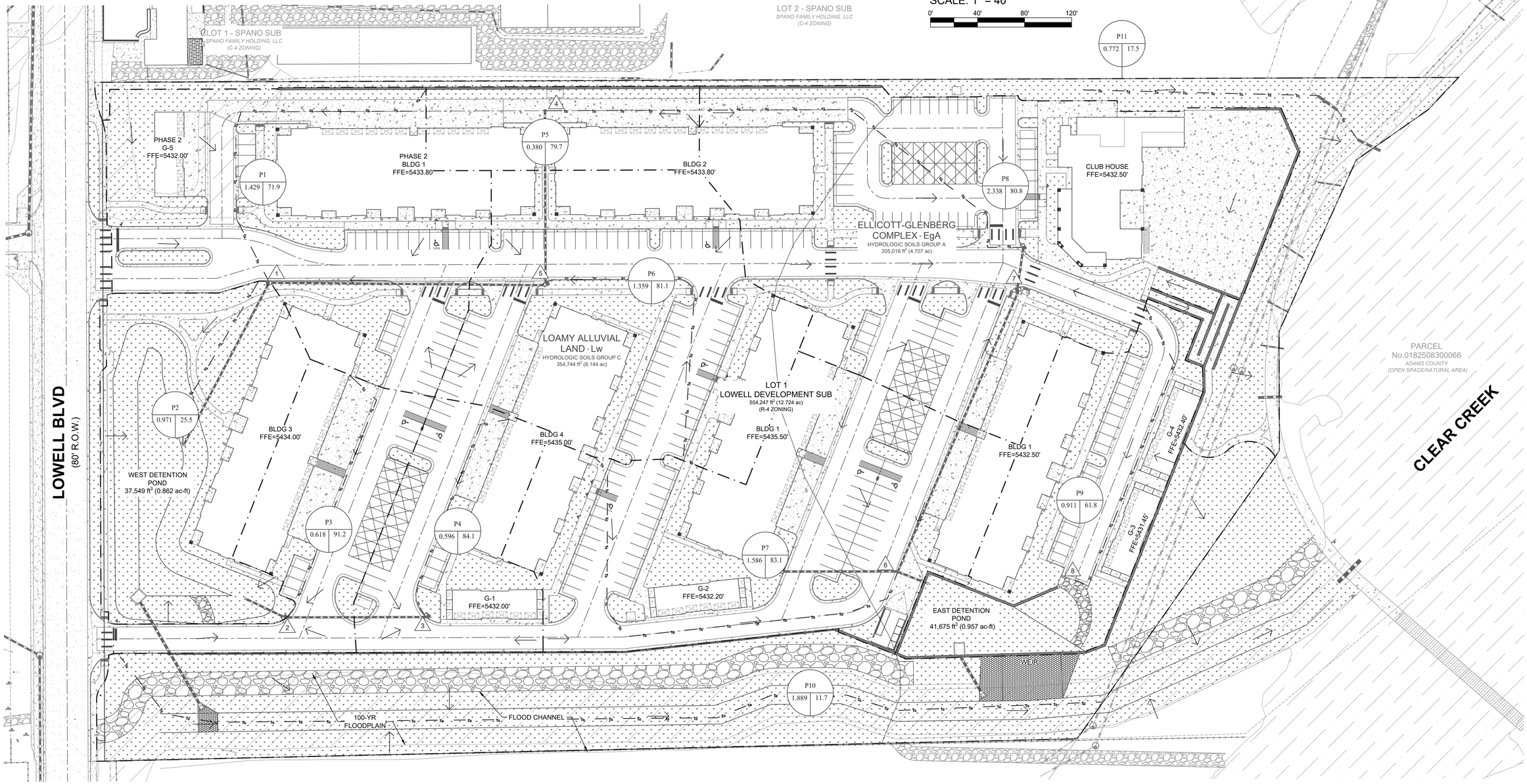
LEGEND

= PROPERTY LINE
= EASEMENT
= FLOW LINE
= SUB-BASIN FLOW PATH
= SUB-BASIN BOUNDARY
= EXISTING MAJOR CONTOUR
= EXISTING MINOR CONTOUR
= ADJACENT PROPERTY LINE
= ASPHALT
= CONCRETE
= GRAVEL
= LANDSCAPE AREA
BASIN ID
IMPERVIOUSNESS (%)
AREA (acre)
= DESIGN POINT

PROPOSED SUB-BASIN MAP

SCALE: 1" = 40'

0' 40' 80' 120'



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LOWELL DEVELOPMENT, LLC
5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

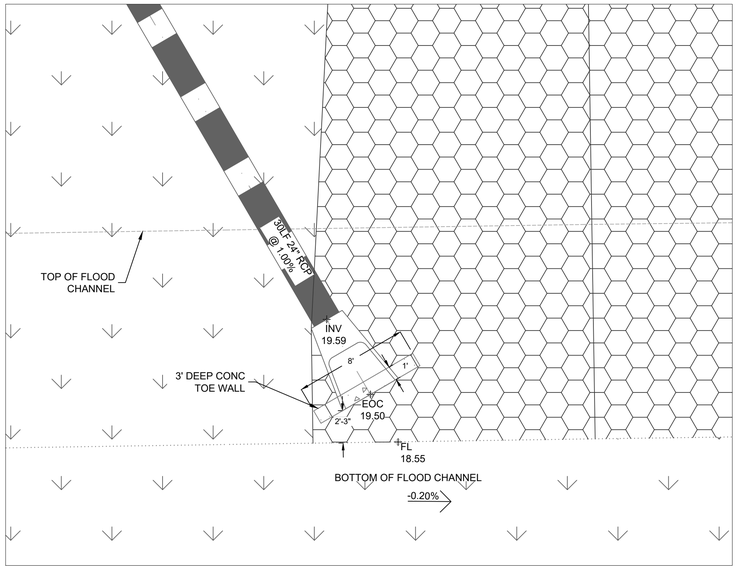
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DOCUMENT DATE:
1/12/2024 11:34 AM
DOCUMENT PHASE:
FOR PERMIT - ROUND 1

REV #	DATE	DESCRIPTION	DRAWN BY:	DATE	CHECKED BY:	DATE
1	00/00/2022	NA	HDS	01/09/2024	TJH	01/09/2024

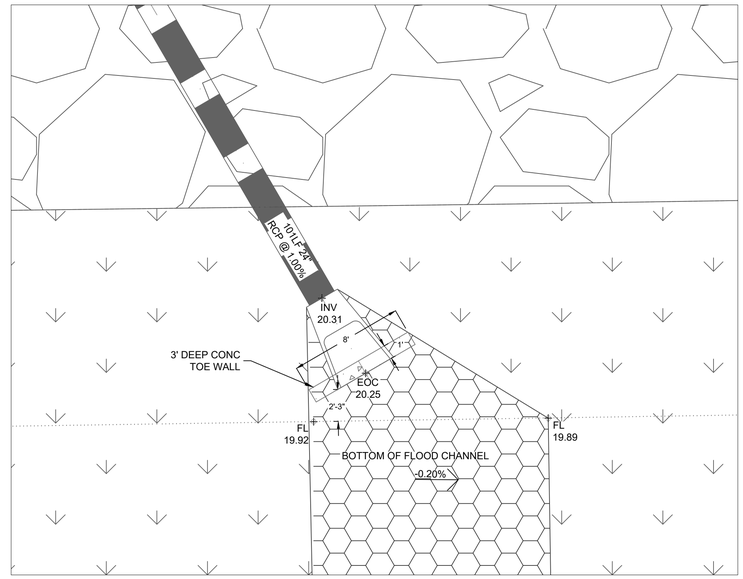
PROPOSED BASIN
C-22
SHEET 21 OF XX

LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO



B C-22 EAST POND OUTLET ELEVATIONS
1" = 5'



C C-22 WEST POND OUTLET ELEVATIONS
NOT TO SCALE

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DOCUMENT DATE:
1/12/2024 11:34 AM
DOCUMENT PHASE:
FOR PERMIT - ROUND 1

REV	DATE	DESCRIPTION

DRAWN BY: TJH/DS DATE 01/09/2024
CHECKED BY: TJH DATE 01/09/2024

POND DETAILS

C-22

SHEET 23 OF XX

Lowell Boulevard Apartments - Sanitary Sewer Design

Lot 1 of Spano-Calabrese Subdivision Amendment No. 1
Located in part of the Southwest Quarter of Section 8, Township 3 South, Range 68 West of the 6th Principal Meridian, County of Adams, Colorado

5602 Lowell Boulevard
Denver, Colorado 80221

Prepared For: Mac Investment Group, LLC

Prepared By: Diana Springett, EI No. 77777

June 06, 2023

Project No. 22-C14

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Engineer's Certification of Sanitary Sewer Report

I hereby certify that this report for the Sanitary Sewer design of the Lowell Boulevard Apartment Project was prepared by me or under my direct supervision in accordance with the provisions of Berkeley Water and Sanitation District Engineering Standards and Sanitary Sewer Design Technical Criteria Manual from City and County of Denver Public Works Department for the owners thereof. I understand that Berkeley Water and Sanitation District does not and will not assume liability for sanitary sewer facilities designed by others.

_____ Date:_____

TJ Heupel, PE
State of Colorado No. 58284
tj@asherarch.com

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General Location and Description

The subject property is Lot 1 of the Calabrese-Spano Subdivision Amendment No. 1, recorded with Adams County Clerk & Recorded at Reception No. (TBD), dated (TBD) (Lot 1, Calabrese-Spano). Lot 1 is ±12.850 acres of agricultural land located on the east side of Lowell Boulevard, just north of Interstate-76 (I-76), and west of Clear Creek. Directly north of the site is another agricultural property made up of two parcels, Lot 1 of the Spano Subdivision, recorded at Adams County Clerk & Recorded at Reception No. 20050202000110370, dated February 2, 2005 (Lot 1, Spano) and Lot 2 the Calabrese-Spano Subdivision Amendment No. 1 (Lot 2, Calabrese-Spano). West of Lowell Boulevard is a large public park on property reclaimed from gravel mining and owned by the Hyland Hills Park & Recreation District. There are several large ponds to the west and north of the site created by past mining activity in the area. Reference the Property Vicinity Map with the property outlined in blue in Figure 1 below.

The property is currently used for agriculture and has a single-family house in the northwest corner of the lot, irrigated fields to the south and east of the house, and a public trail along the eastern property line going through the Clear Creek Natural Area. At some point in the last several decades as much as 20 feet of sandy clay soil was imported and placed on Lot 1 and Lot 2, Calabrese-Spano with the bulk of the fill being placed in the east half of Lot 1. The property naturally slopes from the west to east at a 0-3% slopes, but in the filled area grades slope from the east to the west at 1-5%.

The subject property is within FIRM Panel Number 08001C0591H, effective March 5, 2007, Risk Hazard Zone AE over a majority of the property. However, due to impact from development in the area, and flood mitigation/waterway restoration efforts, the floodplain along this stretch of the Clear Creek has changed considerably. As a result, separate Certified Letters of Map Revision (CLOMR's) have been submitted to FEMA by MAC Investment Group, LLC and the Hyland Hills Park & Recreation District that take into account all of the ponds and the changes in topography across the area between I-76 and the RTD railroad on both sides of Lowell Boulevard since the effective study was conducted. The new limits of the floodplain around the subject property, as determined for the owner by Loewen Engineering Inc and submitted to FEMA on November 18, 2022, FEMA Case No. 23-08-0122R.

Per NRCS Web Soil Survey data the western half of the site is made up of a Loamy Alluvial soil with sand-gravel complex type soil dominant towards Clear Creek to the east. The native soils and fill placed on the site was explored and analyzed by CTL Thompson, Inc. in 2023 for the development project. Their findings are presented in a report for 5602 Lowell Boulevard Apartments dated May 23, 2023, Project No. DN51, 902-125-121, written for MAC Investments, LLC.

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Figure 1. Property Vicinity Map

Existing System

Per Berkeley Water and Sanitation District (Berkeley) utility maps, and confirmed with the survey performed on this property, there are no Berkeley sanitary sewer mains serving this area. Berkeley serves mostly the area south of I-76. The closest possible point of connection to the existing system is located near the intersection of Lowell Boulevard and West 55th Place on the south side of Clear Creek, approximately 1,100 feet south of the site. A portion of Berkeley's service area collects at this point and is pumped north, under Clear Creek, into Metro Water Recovery's (Metro) Clear Creek Interceptor System (Interceptor).

The Interceptor consist of two parallel Reinforced Concrete Pipe (RCP) trunk lines, the western line is 54" in diameter and the eastern line is 39" in diameter, reference orange lines as shown in Figure 2. At the Lowell Boulevard connection with Berkeley's system the Interceptor is south of I-76. Going east from Lowell Boulevard the Interceptor goes under I-76 to the north along the west side of Clear Creek. This portion of the Interceptor passes through the east side of Lot 1, Calabrese-Spano and continues north along Clear Creek, into Lot 2, Calabrese-Spano and beyond.

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The subject site is located on the northern edge of Berkeley's service area where a sanitary sewer collection system does not currently exist. In order for development in this area to connect at the closest point of Berkeley's existing system, a new collection main would have to be installed along Lowell Boulevard going under I-76 and Clear Creek. This would require another lift station to pump flows south under Clear Creek to tie into the existing system. From there sewage is pumped back north, under Clear Creek, to the Interceptor. For this reason, we determined that a new collection system would better serve the area with a new connection point to the Interceptor north of I-76. There are three existing manholes on the western line of the Interceptor, north of I-76, within Lot 1 and Lot 2, Calabrese-Spano that could potentially be connected to for development on these properties. Of these three manholes, the northern most is the deepest relative to the service basin and is the proposed point of connection for this development, reference Figure 2 below.

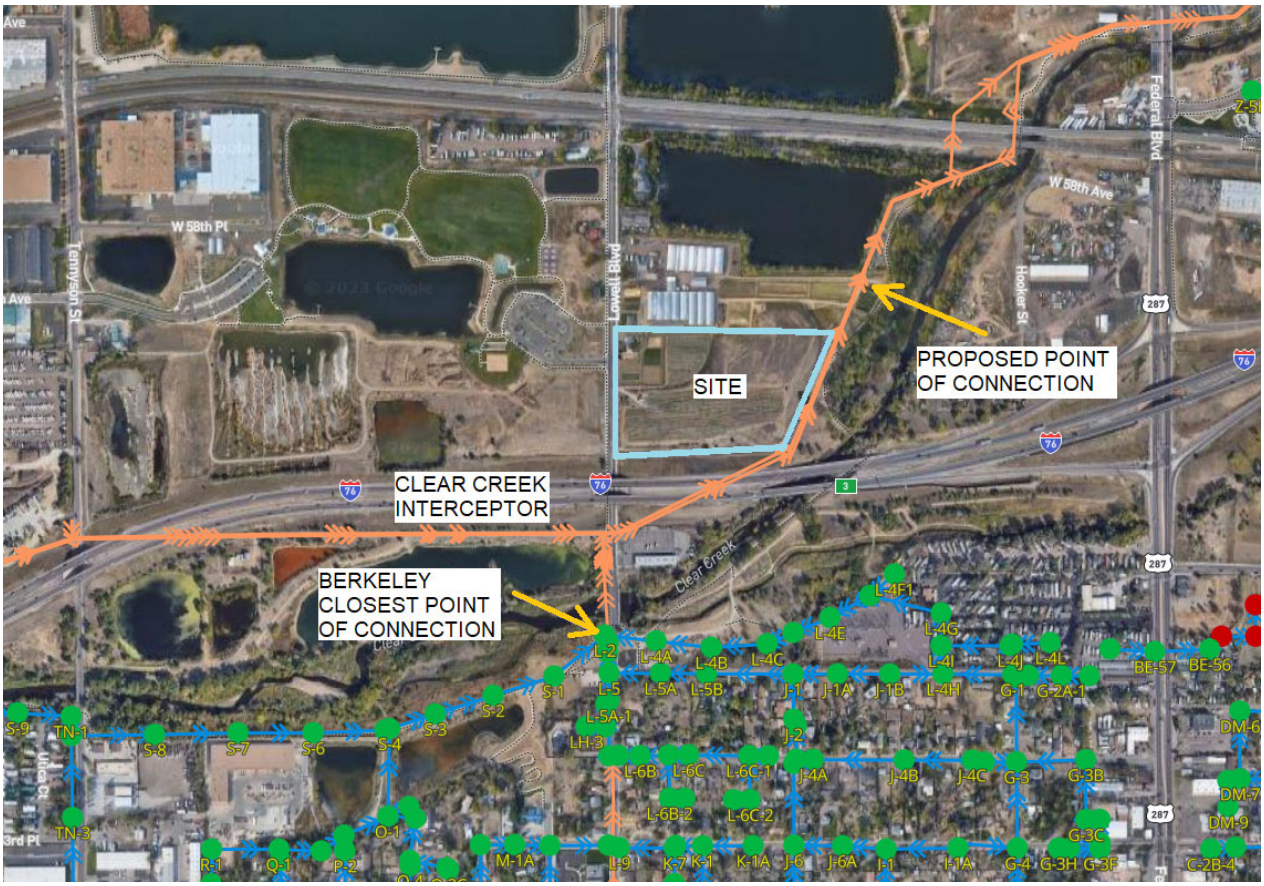


Figure 2, Berkeley Existing System Map

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Proposed Development

The Lowell Boulevard Apartments Project is a 348-unit apartment complex split between six 4-story buildings. The project will include a club house with an outdoor pool, five detached garage buildings, landscape buffers around the perimeter of the buildings and site, and a connection to the existing trail and common open space to the east. Internal drive aisles are planned between buildings with the main drive aisles running east from Lowell Boulevard along the north and south sides of the development. A new water distribution main will be extended east of Lowell Boulevard under the north and south main drive aisles. A sanitary sewer collection system is planned under the north main drive aisle, parallel to the water main, that will extend north of the site into Lot 2, Calabrese-Spano. Reference Appendix A for the proposed utility plan.

The proposed sanitary sewer collection system will connect to the Interceptor, Metro manhole MH CCP43, reference appendix B. From this manhole a 12" Polyvinyl Chloride (PVC) will extend to the west into a proposed 6' diameter manhole, herein referred to as the Terminal manhole (T-1). The pipe connecting between T-1 and MH CCP43 will be sized for all developed future flows within the service basin for this system. The proposed collection system will have a north branch serving Lot 2, Calabrese-Spano and a south branch will serve Lot 1, Calabrese-Spano with both branches connecting to T-1. The north branch will run west from T-1 to serve all future development within the basin, reference Figure 3. The south branch will run south from T-1, paralleling the western Interceptor line, to a manhole at the northern property line of Lot 1, Calabrese-Spano. From there the main runs west through the proposed development to the west side of Lot 1, Calabrese-Spano.

A public restroom for Clear Creek Valley Park is located straight west of subject property. A future connection for this restroom is accounted for in the South branch demand calculation.

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Future Development

Future development of lots in the north half of the service basin, and portions to the west of Lowell Boulevard, are included in the North Branch design, reference Figure 3. The future development area is not currently connected to Berkeley's system or any other district for sanitation purposes. The area includes Lot 2, Calabrese-Spano (10.56 ac), Lot 1, Spano Subdivision (1.05 ac), two parcels north of Lot 2, Calabrese-Spano (1.71 ac), two parcels west of Lowell Boulevard (4.89 ac), and an office for Clear Creek Valley Park. Based on topographic data provided on Adams County online GIS map, it may be possible to extend the North branch even further west. A topographic survey along possible alignments would be required to determine how far west the main could be extended which is beyond the scope of this report. Within Lowell Boulevard there are several existing utilities. Potholes were not excavated within Lowell Boulevard to gather pipe depth data as a part of the analysis presented in this report. The ability to construct the North branch from T-1 going upstream to the east side of Lowell Boulevard within the minimum slopes given in TC-CCD, Section 3, Table 3.07 was evaluated. Assuming a pipe slope of 0.4%, 0.1' drop at each manhole, and no bends the following evaluation information was calculated.

Total pipe length = 1120 ft (T-1 to East Lowell Blvd)
Minimum manhole quantity = 3 (0.3' total drop)
Pipe invert at T-1 = 5211.80 ft (upstream invert)
Pipe depth at T-1 = 8.62 ft
Pipe invert at Lowell Blvd = 5216.58 ft (upstream invert)
Pipe depth at Lowell Blvd = 13.42 ft
Approximate ground elevation at Lowell Blvd = 5230 ft

System Design

Service Basin

A service basin was delineated for the area north of I-76 and south of the RTD railroad, within Berkeley's boundaries, based on existing topographic data from field surveys of the proposed project location, and contours shown on Adams County's online GIS map. A full survey of the service basin was not within the scope of this report. As-built plans were provided by Metro for the Interceptor. The as-builts are from February 1997 with elevations updated to NAVD88 in May 2017.

Lowell Boulevard bisects the service basin into an east and west side. The west side is mainly the park property with a few independent lots to the north near the railroad tracks. East of Lowell Boulevard is

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mainly agricultural land with two industrial properties to the north near the railroad. All of the properties within the basin are developed to some degree at the time of this report.

Two collection main branches will serve the basin via a connection to the interceptor at the northeast corner of the area, within Lot-2, Calabrese-Spano. The North branch will serve the park area and future development within the northern half of the service area, total area 18.21-acre. The southern half will be served by a separate branch and routed into the proposed 12.85-acre residential multi-family development and extended west enough to provide service access for a public restroom within the park.

Population

Future land uses within the service basin were provided by Adams County Advancing Adams Comprehensive Plan (Comp Plan) dated September 27, 2022, with future zoning district layers shown on Adams County's online GIS map, and the preliminary development plans within the proposed development area. Sanitary Sewer Design Technical Criteria from City and County of Denver Public Work Department (TC-DDC) was used to estimate populations within the service basin as shown below.

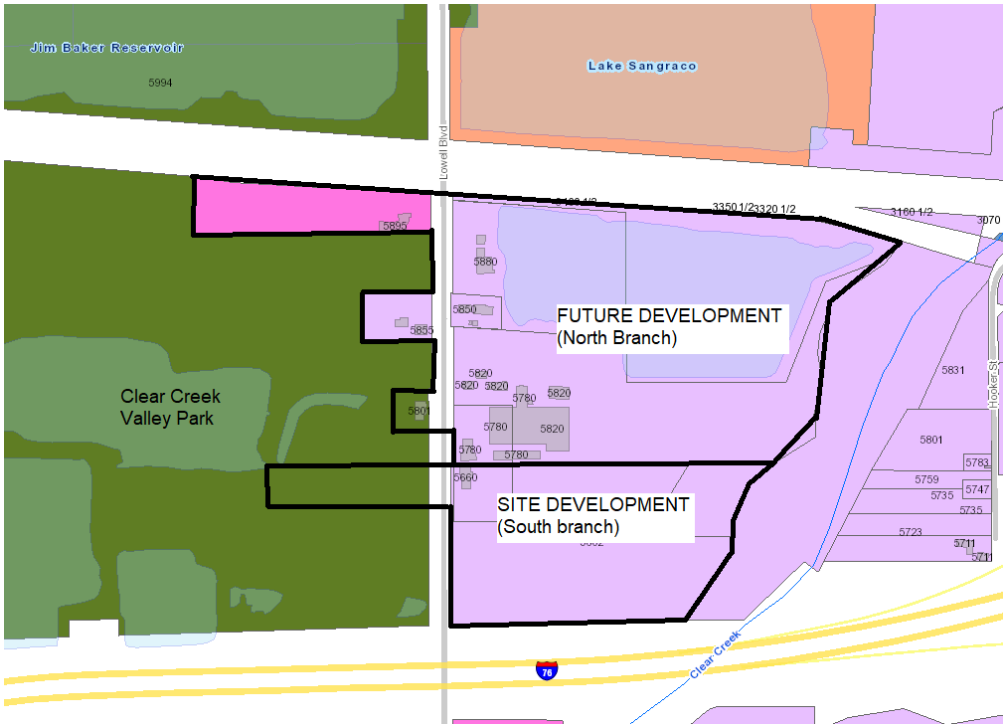


Figure 3. Advancing Adams Future Land Use 2022 (per GIS map researched 05.31.2023) Including future serving area.

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South Branch (Proposed):
Lot 1 Calabrese-Spano, will be developed as high-density residential. Six buildings with 58 units per building will connect to the South branch. A population per dwelling unit for design is provided in table 2.04.1 TC-CCD.

- Multi-family Residential 2.1 per dwelling unit
- Total units = 348 dwellings.
- Total population = 730.8

A Club House with a pool area is being planned as an amenity for the proposed development. The classification for this amenity is similar to a hotel & motel design, flows are provided in table 2.04.3 TC-CCD.

- Club House area = 9437 ft^2
- Pool Area = 10,700 ft^2
- Total Area = 22,200 ft^2

A mechanical room serving the pool will have a separate service line. Discharge to be determined with the pool design.

The public restroom directly west of Lot 1, Calabrese-Spano may also connect to the south branch if the current septic system fails. Fixture units are used to equate each toilet peak demand to 1 gallon per minute. Plumbing fixture units are provided in TC-CCD Table 2.04.4

- Water Closet w/flushometer = 6 units per fixture
- Total = 24 fixture units

North Branch (Future):
The north branch, which serves the future development, is located in a Mix-Use and Mix-Use Commercial zone per Advancing Adams Future Land Use 2022 map. The north Branch basin has 6 parcels for a total area of 18.62 acres. Following the Comp Plan future land use, the three medium sized parcels (2.56 acres) frontine Lowell Boulevard will be considered as commercial use. The other three lots (16.06 acres) will be considered as high-density multi-family residential use.

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Per Adams County Zoning standards, the maximum density in a high-density multi-family residential zone is 32 dwelling units per acre. Population per dwelling unit is provided in TC-CCD Table 2.04.1

- Multi-family Residential 2.1 per dwelling unit
- Residential Use of 16.06 acres, at 32 dwelling per acre = 514 dwelling units
- Total population = 1079.4

For the commercial uses, highest expect zone per the Comp Plan is C-2, with a maximum floor area ratio of 0.75 or 10,000 ft^2 per parcel. A restaurant use has a higher expected sewer flow per TC-CCD Table 2.04.3 and was assumed for the commercial area.

- Commercial use 3 parcels = 30,000 sf, relatively

System Demand

South Branch

Manhole S-7

Starting at the highest point of the South branch manhole S-7, located in the proposed northern access road at the eastern right-of-way line of Lowell Boulevard. This manhole will collect the park's restroom to the west. The calculated fixture units will be converted into an average flow and affected by a peak factor, and infiltration.

- 24 fixture units = 12 gpm
- Average Flow = 0.027 cfs
- Peak Factor = 4 (Table 2.04.5)
- Demand = 0.128 cfs

Manhole S-7 to S-4

This section will collect discharge from all proposed 348 residential units into an 8" main plus flows from upstream of manhole S-7.

- Population = 730.8
- Per Capita Flow Rate = 120 gpm
- Average Flow = 0.136 cfs
- Peak Factor = 3.578 (Table 2.04.5)
- Demand = 0.576 cfs
- Accumulated Demand = 0.704 cfs

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Manhole S-4 to S-1
This section will include the demand of the Club House and Pool area as a Hotel & Motel type of establishment. Plus, flows upstream of S-4.

- Flow factor = 300 gpd/1,000 ft^2
- Total Area = 9437 ft^2
- Demand = 0.099 cfs
- Total South branch demand = 0.804 cfs

Per TC-CCD section 2.04.4, the infiltration rate is 500 gallon per gross acre of tributary

- Total tributary area = 12.85 acre
- I/I = 0.01 cfs

Demand at T-1
At this manhole the South and North branches combine into a 12" pipe connected to Metro's Interceptor manhole MH CCP43. The future development within the basin is calculated below.

- Residential use: Population = 1079.4
- Per Capita Flow Rate: 120 gpm
- Average Flow = 0.201 cfs
- Peak Factor = 3.362 (Table 2.04.5)
- Demand = 0.799 cfs

- Restaurant Flow Factor = 500 gpd/1,000 ft^2 (TC-CCD Table 2.04.3)
- Commercial use area = 30,000 ft^2
- Demand = 0.025 cfs
- Total North branch demand = 0.824 cfs

Per TC-CCD section 2.04.4, the infiltration rate is 500 gallon per gross acre of tributary

- Total tributary area = 18.62 acre
- I/I = 0.01 cfs

Flows from the North and South branch converge at manhole T-1, the total demand for the system is:

- Total system demand = 1.628 cfs

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Hydraulic Calculations

A minimum sewer collection main size of 8" is required per TC-CCD, section 3.06.1. For the purposes of this report, the South branch and Interceptor connection pipes were sized based on the calculated demands. The North branch must be sized with development of the areas in the north half of the service basin.

At manhole T-1, the North and South branch combine into a connecting pipe that conveys flows into the Interceptor. This pipe is sized to handle the proposed demand from the south branch and the estimated future demand from the North branch.

Connector Pipe

- Diameter = 12" SDR 35 PVC
- Length = 10.00'
- Slope = 0.8%
- Capacity = 3.20 cfs
- Total Demand = 1.63 cfs
- d/D = 0.51
- q/Q = 0.51
- v = 4.09 ft/s

The accumulative flows from the proposed development can be conveyed through an 8" main.

South Branch

- Diameter = 8" SDR 35 PVC
- Length = 1409.00'
- Slope = 0.8%
- Quantity of manholes = 7
- Drop at catch manhole = 0.2 ft (TC-CCD, section 3.08)
- Capacity = 1.08 cfs
- Total Demand = 0.80 cfs
- d/D = 0.64
- q/Q = 0.74
- v = 3.40 ft/s

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Easement

Two exclusive utility easements are dedicated to the proposed main system. An exclusive sewer easement is set between station 0+00 to 2+36.5. Due to depth this easement section will contain two widths of 20 ft and 35 ft. A second exclusive sewer easement is set between station 5+00 to 14+20, this section will share the exclusive easement with a main water line from Denver Water, therefore this easement will be a multiple facility easement.

- Sta 0+00 to 2+36.5 Easement (TC-CCD, section 3.04.3.a)
  Easement Width = 8.40" + 2*7.75' + 3' = 18.85 ft
  Easement Width = 20 ft

- Sta 2+36.5 to 5+00 Easement (TC-CCD, section 3.04.3.a)
  Easement Width = 8.40" + 2*14.5' + 3' = 32.70 ft
  Easement Width = 35 ft

- Sta 5+00 to 14+20 Easement (TC-CCD, section 3.04.3.b)
  Easement Width = (0.5*(8.4" + 9.0") + 4.5' + 13.7' + 11.5' + 3' = 33.4 ft
  Easement Width = 35 ft

Variance

Per Berkeley District standards, the sewer hydraulic main's capacity shall not exceed a depth to diameter ratio of 0.50. The proposed collection system does not accept upstream flows from an existing collection system, and does not impact any downstream system since it connects directly to the interceptor trunk line. All services in the proposed system will connect to the collection main with wye fittings, per Berkeley's Standard detail No. 11. Instead of the traditional xxx crown tee fitting typically found in older systems. For these reasons we feel that a depth-to-diameter ratio of 0.80 is appropriate for the proposed system design.

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Conclusion

As outlined in this report, the proposed wastewater collection generally conforms to Berkeley Sanitation District and City of Denver Public Works Sanitary Sewer Design Criteria Manual standards. The proposed system is designed to serve the area along Lowell Boulevard north of I-76, that is not currently servable by Berkeley's existing sanitary sewer system. The proposed system will run two major branches, the North branch will serve future development and the South branch designed to serve the site development. All basin discharge will be conveyed into a manhole from Metro Recovery Water system.

References

- Berkeley Water & Sanitation District Engineering Standard, adopted July, 2019
- City and County of Denver Department of Public Works, Sanitary Sewer Design Technical Criteria Manual, revised March, 2008.
- Clear Creek Interceptor System As-Built, sheet 19
- Advancing Adams Comprehensive Plan, effective September 19, 2022
- Adams County online GIS Map

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Appendix A

Overall Utility Plan

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LOWELL BLVD APTS

LOCATED IN PART OF THE SOUTHWEST ¼ OF SECTION 8, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF THE 6TH P.M., COUNTY OF ADAMS, STATE OF COLORADO

OVERALL UTILITY PLAN

SCALE: 1" = 40'

0' 40' 80' 120'

LEGEND

- = PROPERTY LINE
- = PARKING STRIPING
- = ROAD CENTERLINE
- = EASEMENT
- = FENCE
- = FLOWLINE
- = WATER LINE
- = SANITARY SEWER LINE
- = ELECTRICAL LINE
- = OVERHEAD ELECTRIC LINE
- = COMMUNICATIONS LINE
- = STORM SEWER LINE
- = GAS LINE
- = ASPHALT
- = CONCRETE
- = GRAVEL
- = LANDSCAPE AREA

ENDING PROP BURIED ELEC MAIN

CONNECTION TO PROP UNDERGROUND ELEC MAIN

CONNECTION TO EX GAS MAIN

CONNECTION TO EX H_2O MAIN

CONNECTION TO EX GAS MAIN

CONNECTION TO EX TELE MAIN

CONNECTION TO EX H_2O MAIN

STARTING PROP BURIED ELEC MAIN

LOWELL BLVD (60' R.O.W.)

HYD No. 330139
STATIC=91psi
RESIDUAL=78psi
FLOW=1,500gpm

LOT 1 - SPANO SUB
SPANO FAMILY HOLDING, LLC
(C-4 ZONING)

LOT 2 - SPANO SUB
SPANO FAMILY HOLDING, LLC
(C-4 ZONING)

10' U.E.

10' UE

4-STORY APARTMENT BLDG 1

4-STORY APARTMENT BLDG 2

4-STORY APARTMENT BLDG 3

4-STORY APARTMENT BLDG 4

4-STORY APARTMENT BLDG 5

4-STORY APARTMENT BLDG 6

6" FIRE SRVC
2" H_2O SRVC

6" SS SRVC W/ 2-WAY CO W/ TRAFFIC RATED CO LID

6" SS SRVC

6" 2-WAY CO W/ TRAFFIC RATED CO LID

6" 2-WAY CO

STUB IN PHASE I INSTALL METER IN PHASE II

20' E.W.E.

35' E.W.S.E.

20' E.S.E.

8" PVC H_2O MAIN

8" PVC SS MAIN

MH S-5
MH S-5A
MH S-6
MH S-6A
MH S-7

HYD

11'

10' U.E.

8' U.E.

WEST DETENTION POND

EAST DETENTION POND

RIP-RAP

TRASH ENCLOSURE 640 ft²

MH S-1
MH S-2
MH S-3
MH S-4
MH S-4A

35' E.S.E.

4" SS SRVC

6" FIRE SRVC
1" H_2O SRVC
4" SS SRVC

MAINTENANCE SHOP

2-STORY CLUB HOUSE

MH CCP 43
RIM=5220.63'
INV=5208.00'

MH T-1

CONNECTOR PIPE 12" PVC

METRO MH CC 41
RIM=5220.57'
INV=5209.10'

20' E.S.E.

SOUTH BRANCH 9' PVC SS MAIN

54" RCP @ 0.35%

METRO WATER RECOVERY CLEAR CREEK INTERCEPTOR SEWER TRUNK LINES

39" RCP @ 0.46%

54" RCP @ 0.44%

MH CCP 44
RIM=5222.00'
INV N=5210.70'
INV S=5210.80'

MH CC 42
RIM=5222.00'
INV N=5210.90'
INV S=5211.00'

MH CCP 45
RIM=5222.50'
INV N=5212.60'
INV S=5212.90'

MH CC 43
RIM=5222.90'
INV N=5212.50'
INV S=5212.60'

PARCEL
No.0182508300066
ADAMS COUNTY
(OPEN SPACE/NATURAL AREA)

CLEAR CREEK

ENTITLEMENTS REVIEW ONLY NOT FOR CONSTRUCTION

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LOWELL DEVELOPMENT, LLC
5602 & 5660 LOWELL BLVD
DENVER, CO 80221
LOT 1, SPANO-CALABRESE SUB AMENDMENT No.1

PROJECT NUMBER 22-C14
DOCUMENT DATE:
11/17/2023 1:47 PM
DOCUMENT PHASE:
FOR REVIEW - ROUND 1

REV #	DATE	DESCRIPTION
0	00/00/2022	NA

DRAWN BY: TJ/HDS | DATE: 11/06/2023 | CHECKED BY: TJH | DATE: 11/17/2023

OVERALL UTILITY

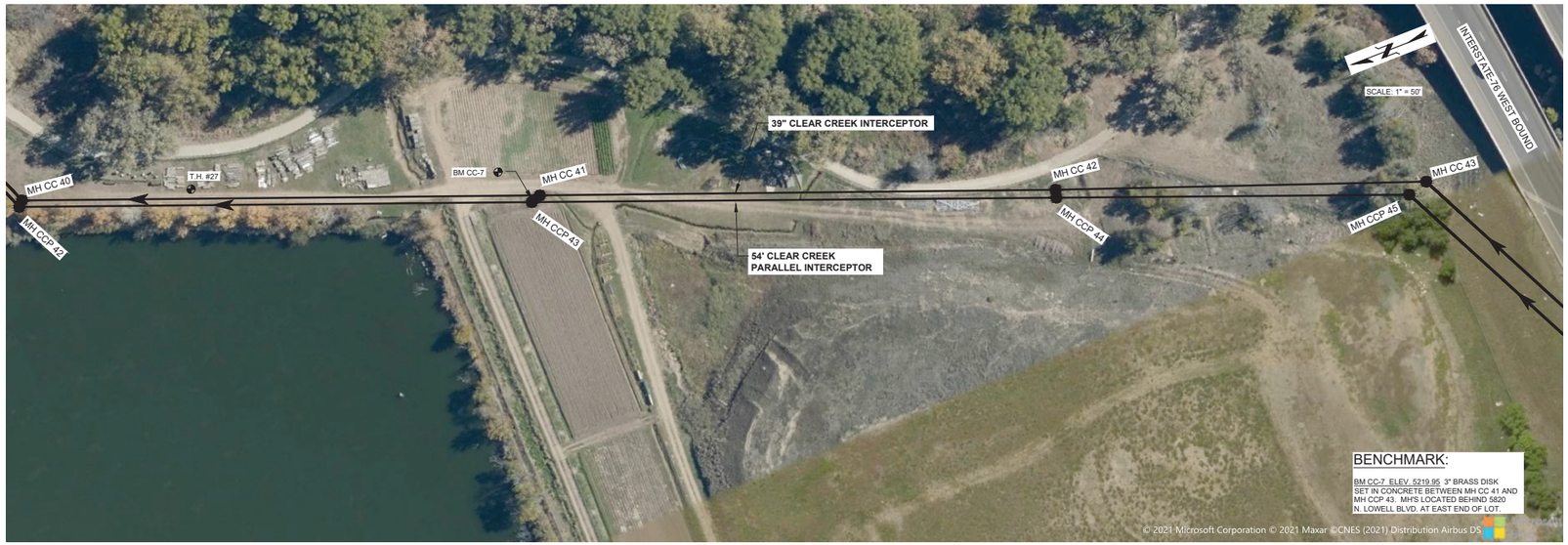
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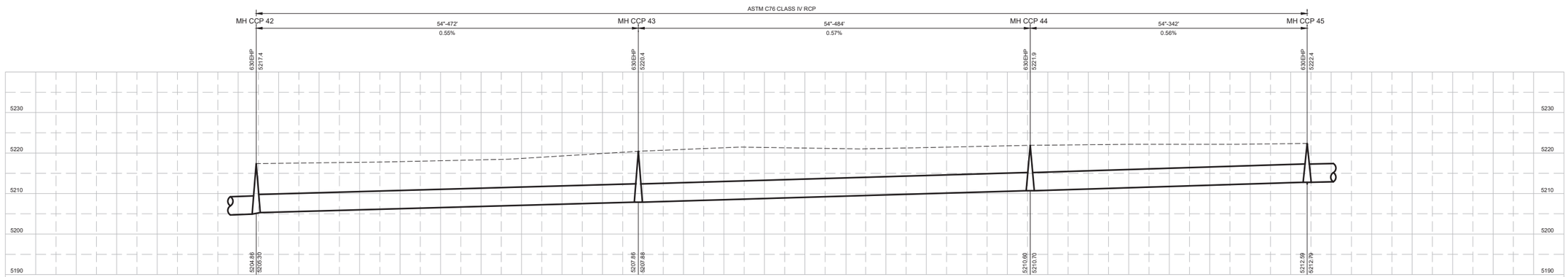
SHEET 11 OF XX

Appendix B

Clear Creek Parallel Interceptor

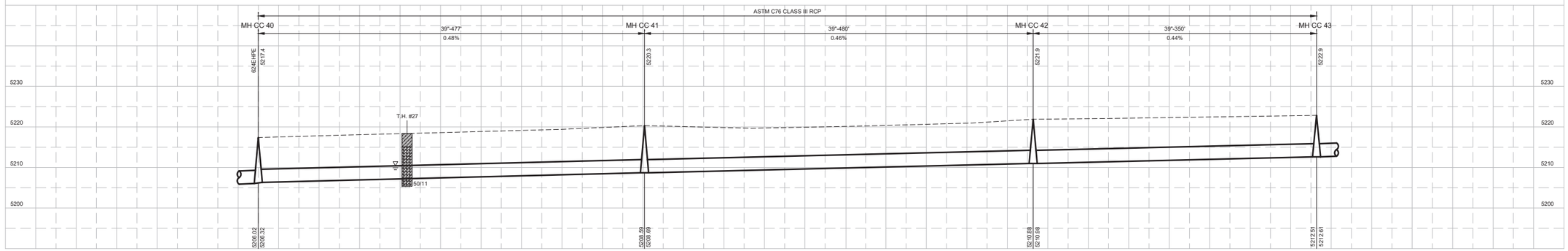
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CLEAR CREEK PARALLEL INTERCEPTOR

SCALE: HORIZ. 1" = 50'
VERT. 1" = 10'



CLEAR CREEK INTERCEPTOR

SCALE: HORIZ. 1" = 50'
VERT. 1" = 10'

5-17	ELEVATIONS CORRECTED TO NAVD88	WK	WK
9-13	PAR 1186	MGS	JW
DATE	REVISION	BY	APP

DESIGNED BY -
DRAWN BY -
CHECKED BY -
APPROVED BY -
DATE 2-97

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CLEAR CREEK INTERCEPTOR SYSTEM

PLAN & PROFILE
MH CCP 42 TO MH CCP 45
MH CC 40 TO MH CC 43

METRO WASTEWATER RECLAMATION DISTRICT

DRAWING NUMBER
CC-C-PP-017

SH 19

Lowell Blvd Apartments

5602 Lowell Blvd., Adams County, Colorado

Traffic Impact Study

KE Job #2022-087

Prepared for:

Mac Investment Group, LLC
4738 Co. Rd. 5
Erie, CO 80516

Prepared by:

KELLAR ENGINEERING

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970.219.1602 phone



April 26, 2023

Sean K. Kellar, PE, PTOE

This document, together with the concepts and recommendations presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization from Kellar Engineering LLC shall be without liability to Kellar Engineering LLC.

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1.0 Introduction

The purpose of this Traffic Impact Study (TIS) is to identify project traffic generation characteristics, to identify potential traffic related impacts on the adjacent street system, and to develop mitigation measures required for identified traffic impacts. This TIS is for the proposed Lowell Blvd. Apartments project located at 5602 Lowell Blvd. in Adams County, Colorado. See Figure 1: Vicinity Map.

Kellar Engineering LLC (KE) has prepared the TIS to document the results of the project's anticipated traffic conditions in accordance with Adams County's requirements and to identify projected impacts to the local and regional traffic system.

2.0 Existing Conditions and Roadway Network

The project site is located at 5602 Lowell Boulevard; on the east side of Lowell Blvd. north of the I-76 bridge in Adams County, CO. Lowell Blvd. is a north-south, two lane minor arterial that provides access into Westminster to the north and Denver to the South. The posted speed of Lowell Blvd. is 40 mph adjacent to the project site and 30 mph south of I-76. Adams County has plans to widen Lowell Blvd. in the future to include a center turn lane south of the railroad tracks to the Clear Creek Trail, just south of I-76 (*Lowell Boulevard Traffic Study, Apex Design. July 2013*). 64th Avenue is an east-west two-lane minor arterial located north of the project site with a posted speed of 30 mph. 54th Avenue is an east-west local street located south of the project site with a posted speed of 25 mph. (See Figure 2: Site Plan and Appendix B.

2.1 Existing Traffic Volumes

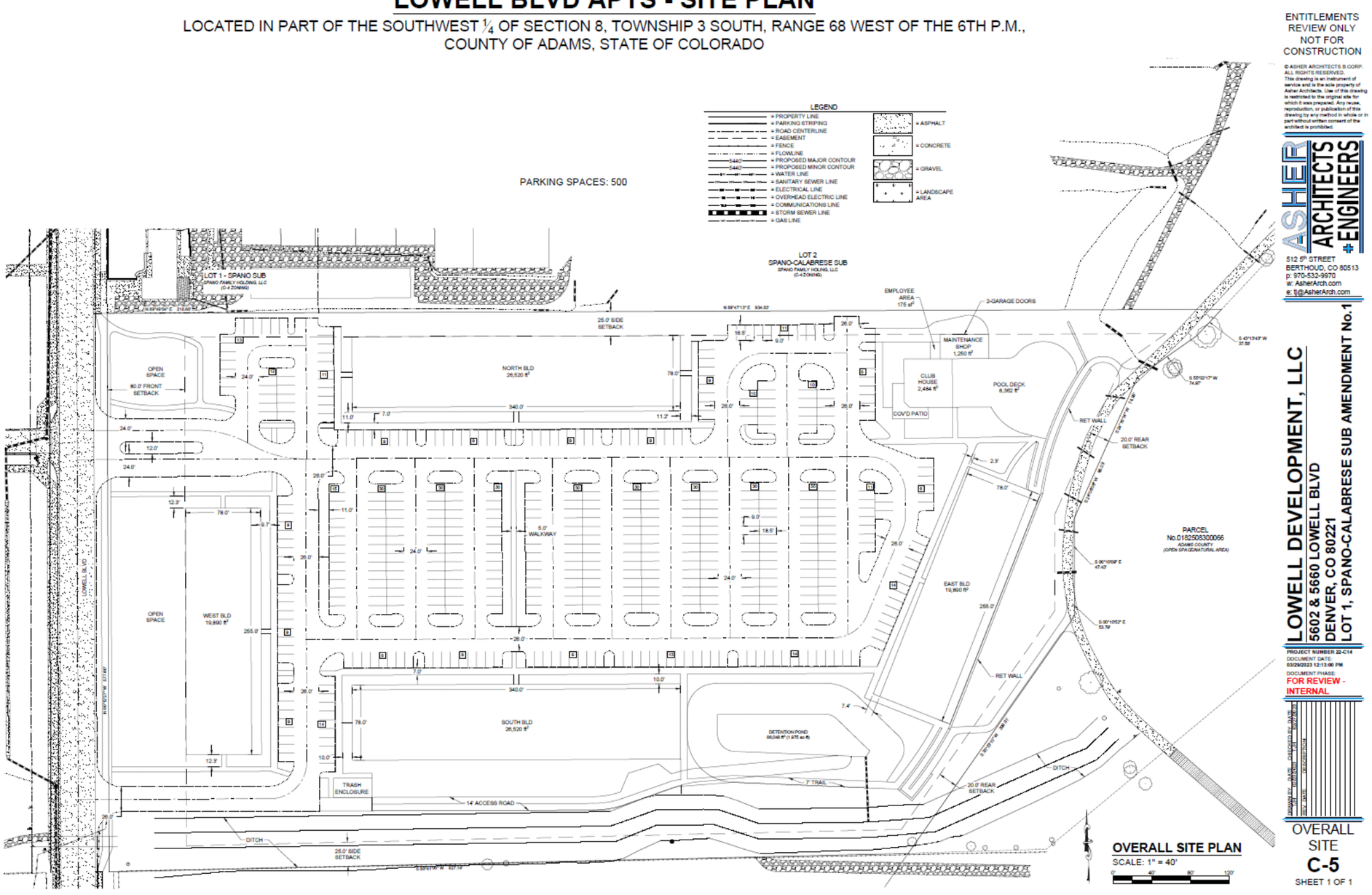
Existing peak hour traffic volume counts were conducted using data collection cameras by All Traffic Data, Inc. on Tuesday, December 20, 2022. The traffic counts were conducted to capture the peak hours of the adjacent street traffic. These traffic counts are shown in Figure 3 with the count sheets provided in Appendix A.

Figure 1: Vicinity Map



Google Earth

Figure 2: Site Plan



3.0 Proposed Development

The proposed project consists of a proposed multifamily apartments project (~360 dwelling units) located at 5602 Lowell Blvd, Adams County, CO. Access to the project site is proposed from one full-movement access and one right-in/right-out (RIRO) access to Lowell Blvd. The full-movement access is aligned with the existing access to the Clear Creek Valley Park on the west side of Lowell Blvd. The proposed RIRO access is located approximately 360' south of the full-movement access (measured to center of intersection). See Figure 1: Vicinity Map and Figure 2: Site Plan.

4.1 Trip Generation

Site generated traffic estimates are determined through a process known as trip generation. Rates and equations are applied to the proposed land use to estimate traffic generated by the development during a specific time interval. The acknowledged source for trip generation rates is the Trip Generation Report published by the Institute of Transportation Engineers (ITE). ITE has established trip generation rates in nationwide studies of similar land uses. Per the ITE, the proposed project is anticipated to generate approximately 2,426 daily trips, 144 AM total peak hour trips, and 184 PM total peak hour trips. See Table 1: Trip Generation.

4.2 Trip Distribution

Distribution of site traffic on the street system was based on the area street system characteristics, existing traffic patterns and volumes, anticipated surrounding development areas, and the proposed access system for the project. The directional distribution of traffic is a means to quantify the percentage of site generated traffic that approaches the site from a given direction and departs the site back to the original source. Figure 6 illustrates the trip distribution used for the project's analysis.

4.3 Traffic Assignment

Traffic assignment was obtained by applying the trip distributions to the estimated trip generation of the development. Figures 7 shows the site generated peak hour traffic assignment.

4.4 Short Range Total Peak Hour Traffic

Site generated peak hour traffic volumes were added to the background traffic volumes to represent the estimated traffic conditions for the short range 2025 horizon. These background (2025) and short range (2025) total traffic volumes are shown in Figures 4 and 8. The short range analysis year 2025 includes the proposed development for this project plus a 2% increase in background traffic per the CDOT Online Transportation Information System (OTIS).

4.5 Long Range Total Peak Hour Traffic

Site generated peak hour traffic volumes were added to the background traffic volumes to represent the estimated traffic conditions for the long range 2045 horizon. These background (2045) and long range (2045) total traffic volumes are shown in Figures 5 and 9. The long range analysis year 2045 includes the proposed development for the project plus project plus a 2% increase in background traffic per the CDOT Online Transportation Information System (OTIS).

5.0 Traffic Operation Analysis

KE's analysis of traffic operations in the site vicinity was conducted to determine the capacity at the identified intersection. The acknowledged source for determining overall capacity is the Highway Capacity Manual.

5.1 Analysis Methodology

Capacity analysis results are listed in terms of level of service (LOS). LOS is a qualitative term describing operating conditions a driver will experience while traveling on a particular street or highway during a specific time interval. LOS ranges from an A (very little delay) to an F (long delays). A description of the level of service (LOS) for signalized and unsignalized intersections from the Highway Capacity Manual are provided in Appendix F.

5.2 Intersection Operational Analysis

Operational analysis was performed for the short range 2025 horizon. The calculations for this analysis are provided in Appendix F. Using the short range total traffic volumes, the project is projected to operate acceptably with all studied intersections and access points meeting Adams County LOS criteria. See Table 4: 2025 Short Range Total Peak Hour Operation.

Table 1: Trip Generation (ITE 11th Edition)

ITE Code	Land Use	Size	Average Daily Trips		AM Peak Hour Trips						PM Peak Hour Trips					
			Rate	Total	Rate	% In	In	% Out	Out	Total	Rate	% In	In	% Out	Out	Total
220	Multifamily Housing	360 DU	6.74	2,426	0.40	24%	35	76%	109	144	0.51	63%	116	37%	68	184
	Total	**360 DU**		**2,426**			**35**		**109**	**144**			**116**		**68**	**184**

DU = Dwelling Units

Figure 3: Recent Peak Hour Traffic

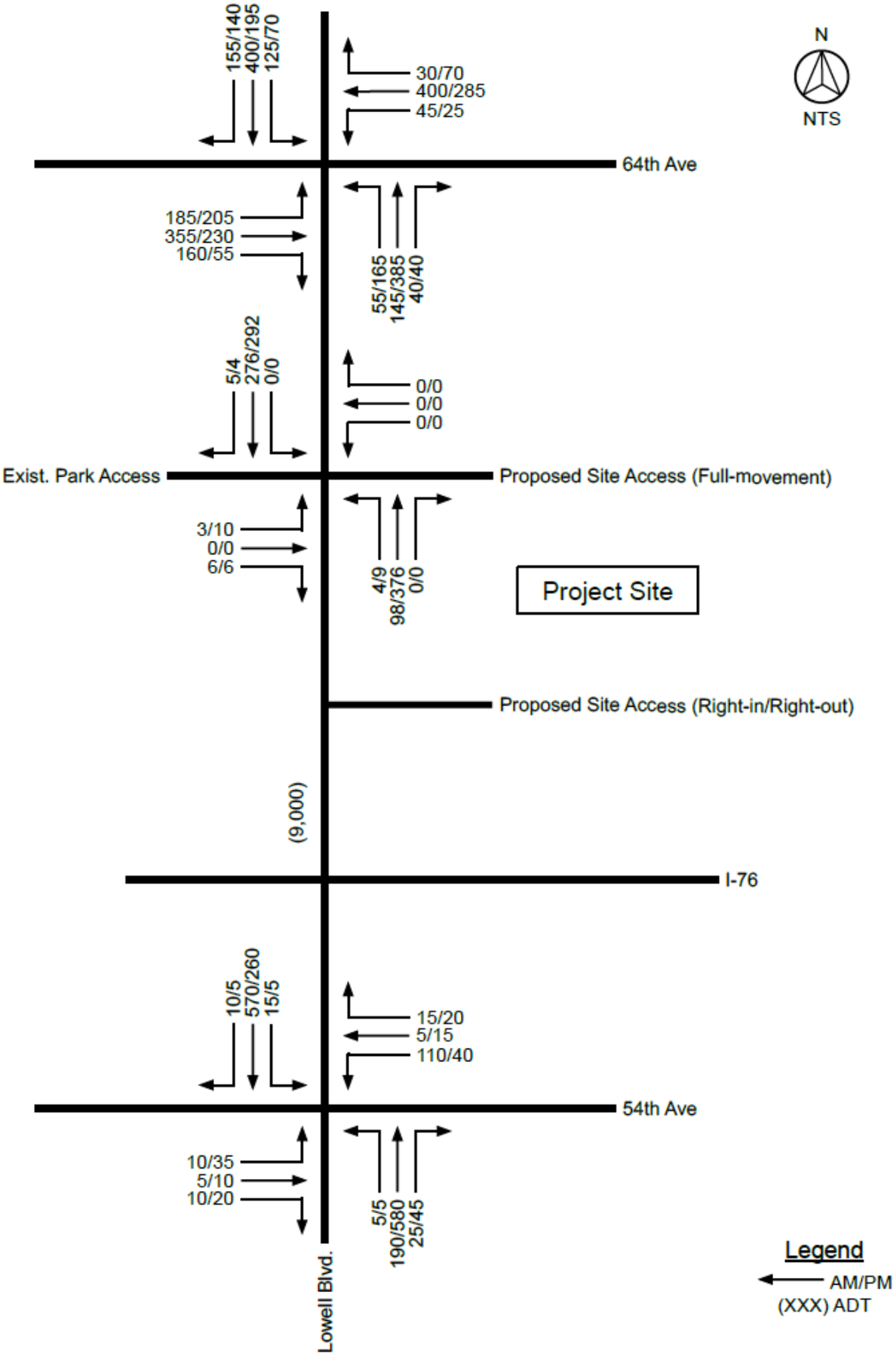


Figure 4: 2025 Background Traffic

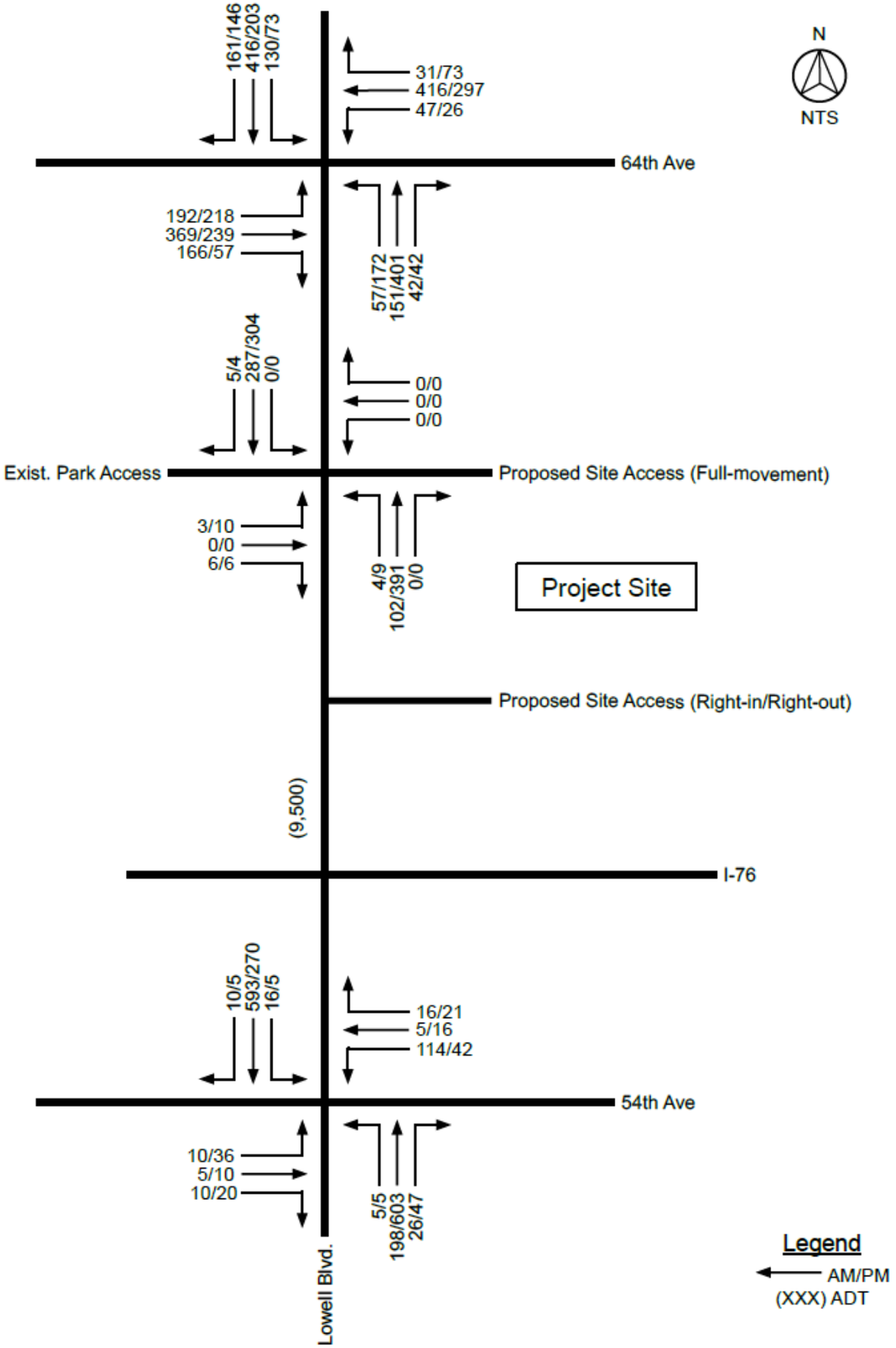


Figure 5: 2045 Background Traffic

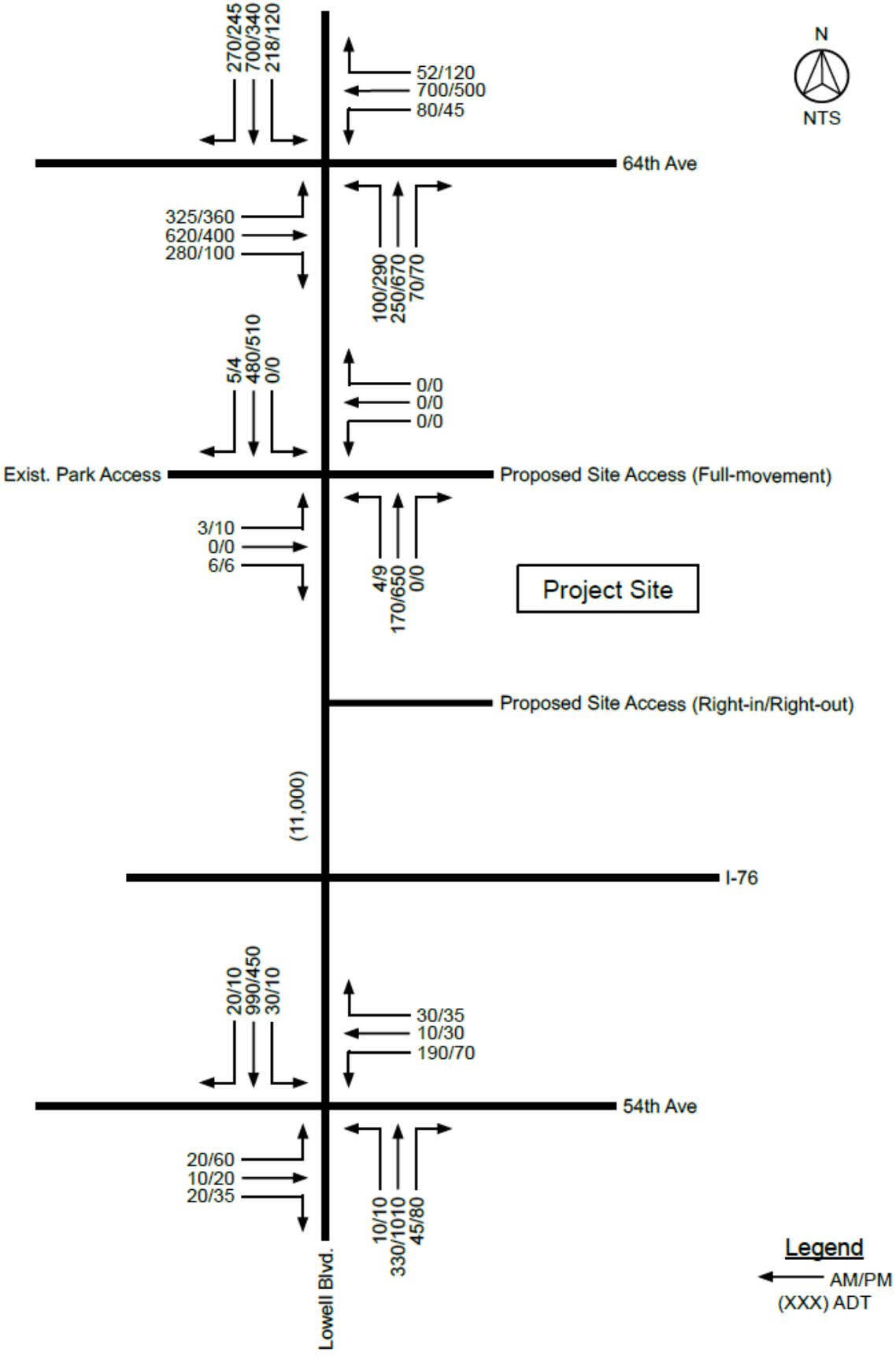


Figure 6: Trip Distribution

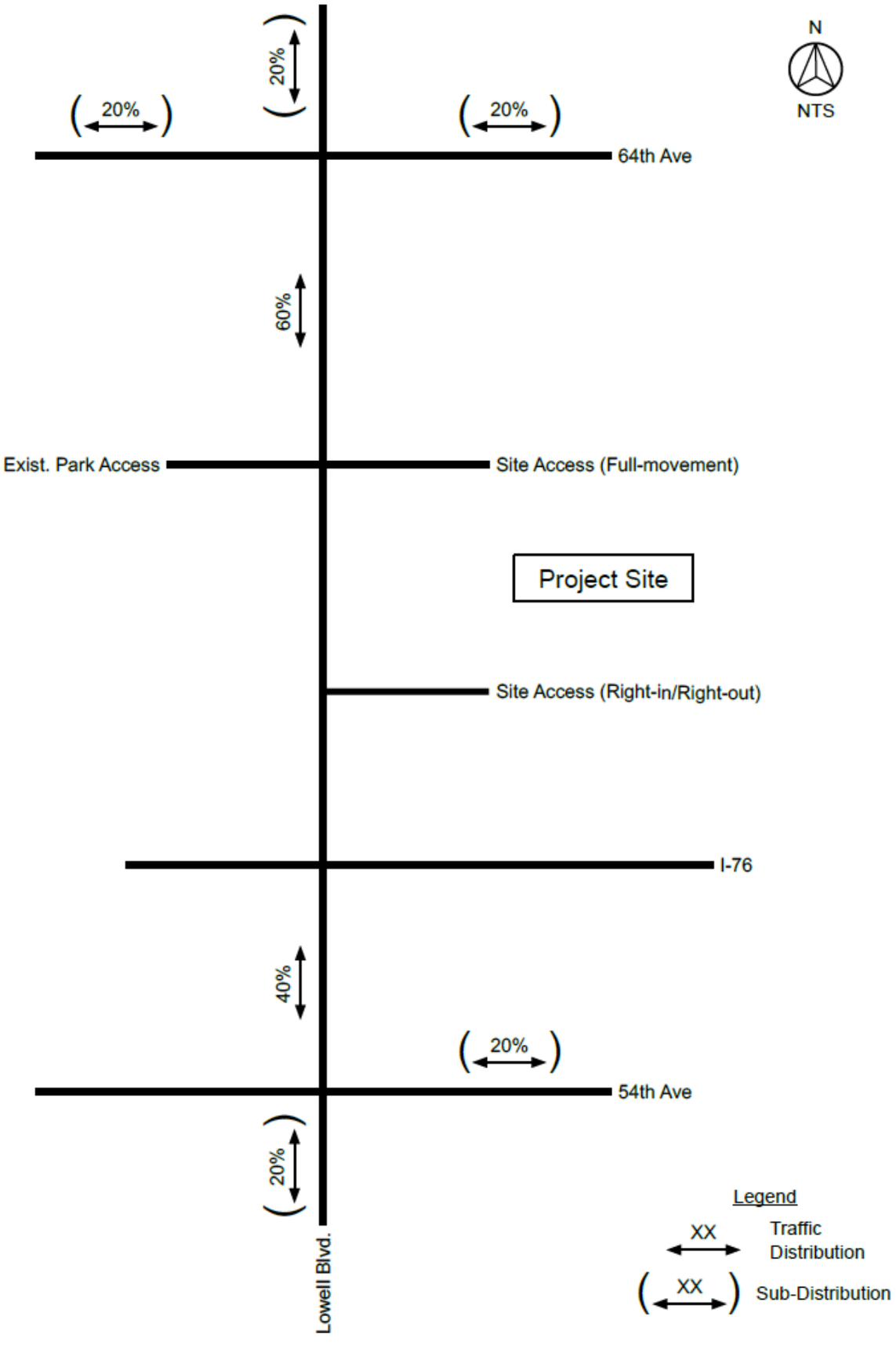


Figure 7: Site Generated Traffic

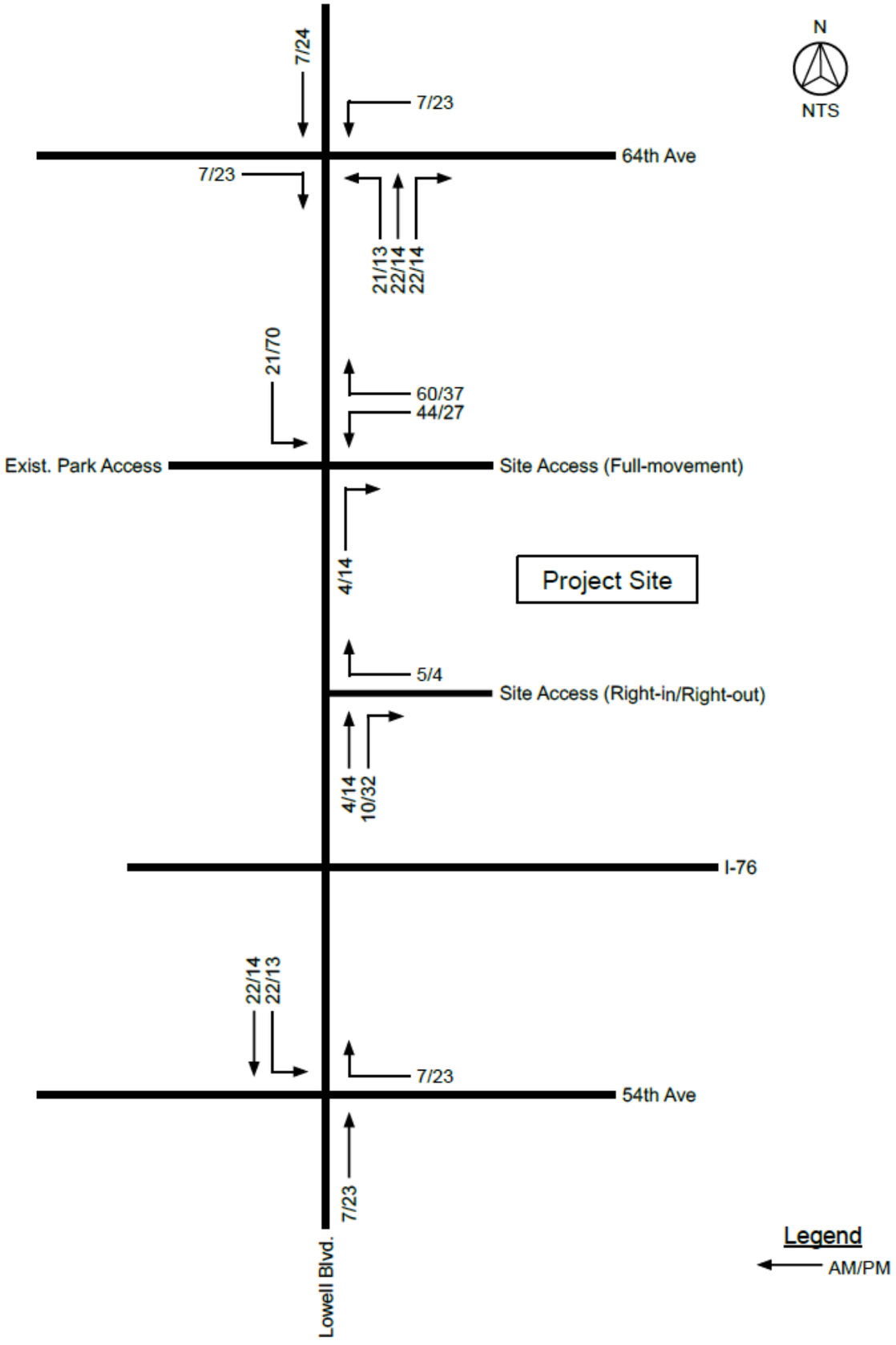


Figure 8: 2025 Short Range Total Traffic

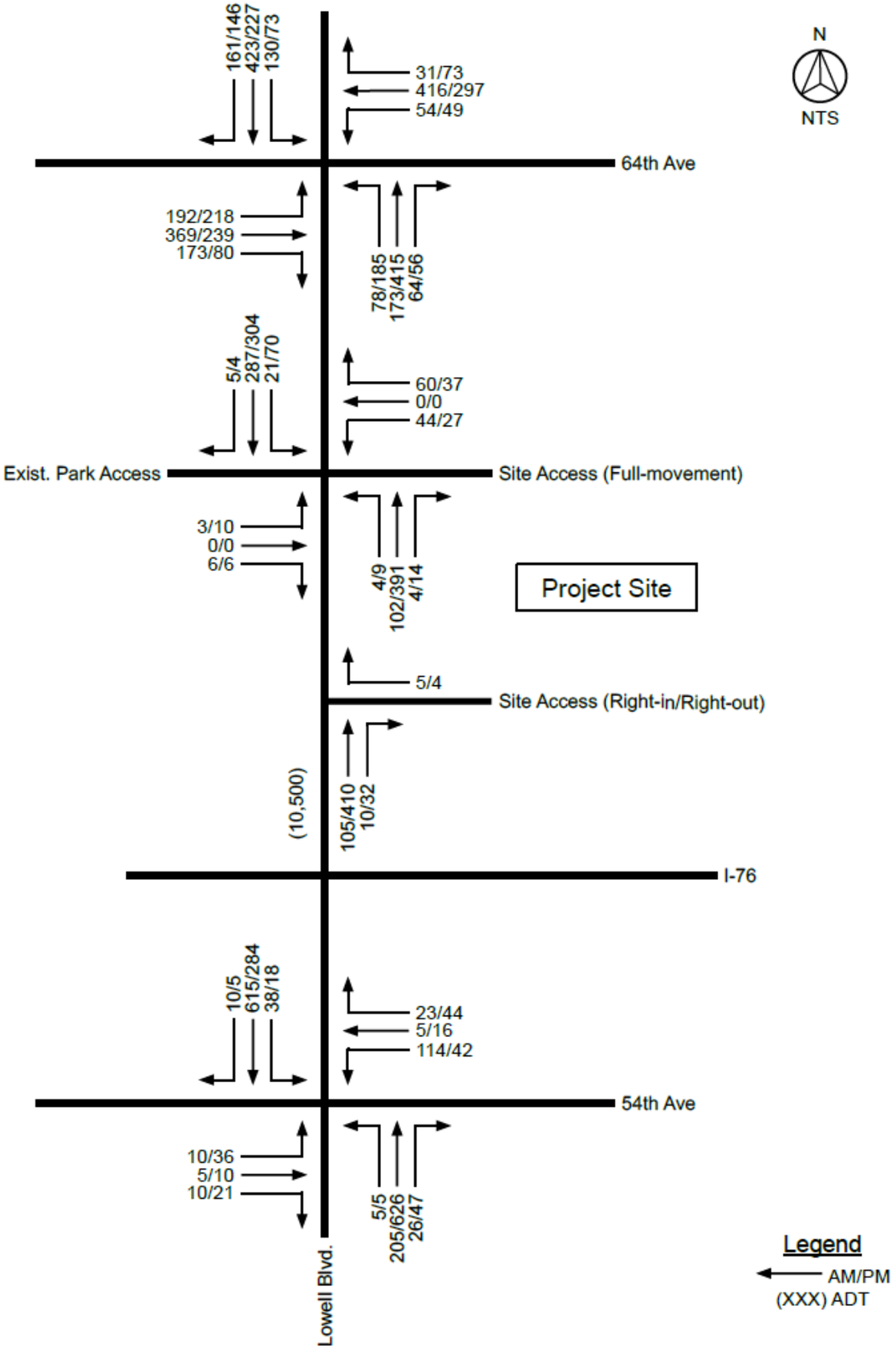


Figure 9: 2045 Long Range Total Traffic

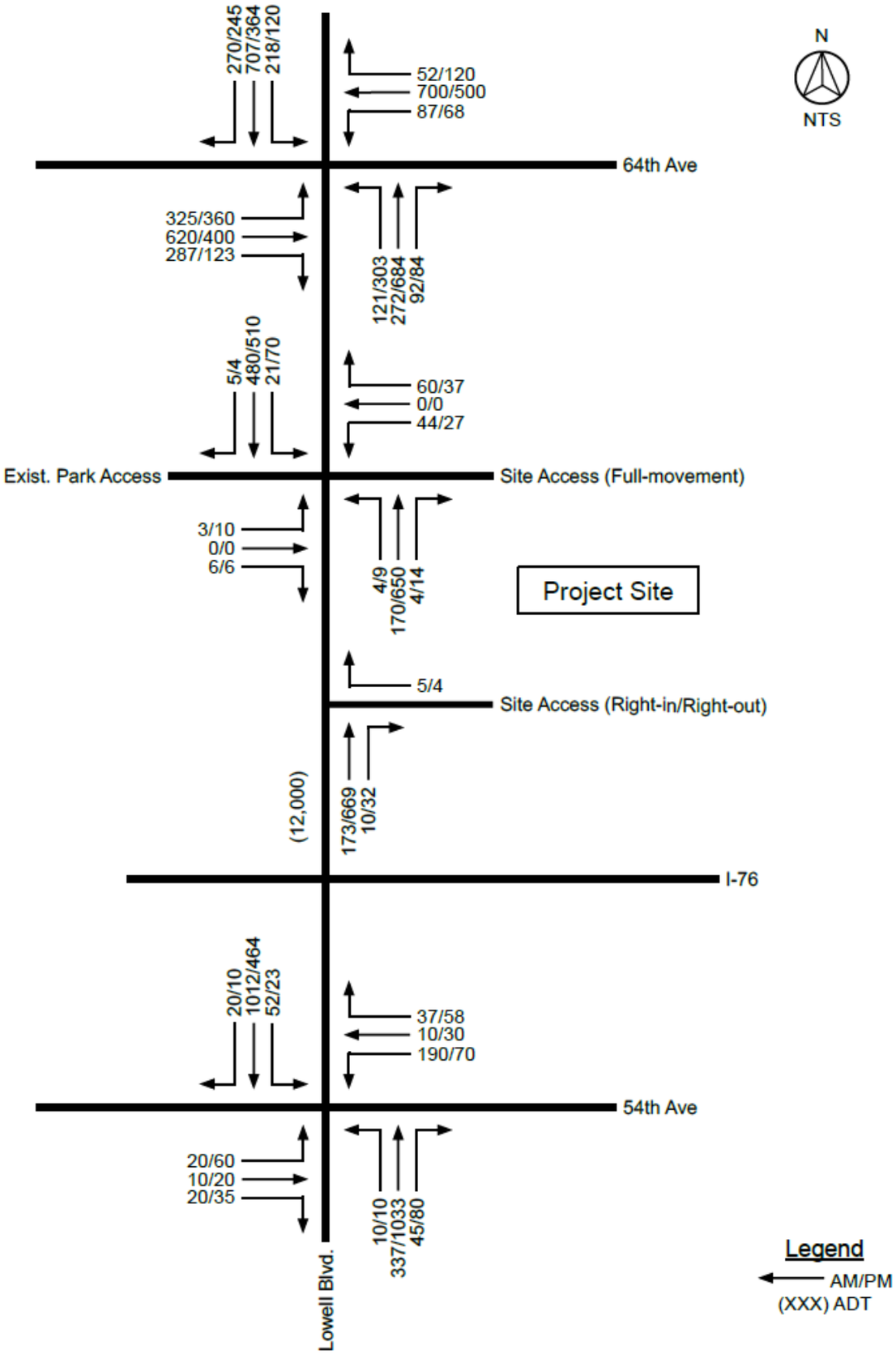


Table 2: Recent Peak Hour Operations

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/64th Ave			
Traffic Signal	EB Left	C	C
	EB Thru	B	B
	EB Right	A	A
	EB Approach	B	C
	WB Left	C	C
	WB Thru/Right	D	E
	WB Approach	D	E
	NB Left	C	C
	NB Thru	C	C
	NB Right	A	A
	NB Approach	C	C
	SB Left	C	B
	SB Thru	C	B
	SB Right	A	A
	SB Approach	C	B
	Overall	C	C

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/54th Ave			
Stop Control	EB Left/Thru/Right	C	C
	EB Approach	C	C
	WB Left/Thru	D	D
	WB Right	A	A
	WB Approach	D	C
	NB Left/Thru/Right	A	A
	NB Approach	A	A
	SB Left/Thru/Right	A	A
	SB Approach	A	A

Table 2: Recent Peak Hour Operations (Continued…)

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/Existing Park Access			
Stop Control	EB Left/Right	B	B
	EB Approach	B	B
	NB Left/Thru	A	A
	NB Approach	A	A
	SB Thru/Right	A	A
	SB Approach	A	A

Table 3: 2025 Background Peak Hour Operations

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/64th Ave			
Traffic Signal	EB Left	C	C
	EB Thru	B	B
	EB Right	A	A
	EB Approach	B	C
	WB Left	C	C
	WB Thru/Right	D	E
	WB Approach	D	E
	NB Left	C	C
	NB Thru	C	D
	NB Right	A	A
	NB Approach	C	C
	SB Left	C	B
	SB Thru	C	B
	SB Right	A	A
	SB Approach	C	B
	Overall	C	C

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/54th Ave			
Stop Control	EB Left/Thru/Right	C	C
	EB Approach	C	C
	WB Left/Thru	E	D
	WB Right	A	B
	WB Approach	D	D
	NB Left/Thru/Right	A	A
	NB Approach	A	A
	SB Left/Thru/Right	A	A
	SB Approach	A	A

Table 3: 2025 Background Peak Hour Operations (Continued…)

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/Existing Park Access			
Stop Control	EB Left/Right	B	B
	EB Approach	B	B
	NB Left/Thru	A	A
	NB Approach	A	A
	SB Thru/Right	A	A
	SB Approach	A	A

Table 4: 2025 Short Range Total Peak Hour Operations

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/64th Ave			
Traffic Signal	EB Left	C	D
	EB Thru	B	B
	EB Right	A	A
	EB Approach	B	C
	WB Left	C	C
	WB Thru/Right	D	E
	WB Approach	D	D
	NB Left	D	C
	NB Thru	C	D
	NB Right	A	A
	NB Approach	C	C
	SB Left	C	B
	SB Thru	C	B
	SB Right	A	A
	SB Approach	C	B
	Overall	C	C

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/54th Ave			
Stop Control	EB Left/Thru/Right	C	D
	EB Approach	C	D
	WB Left/Thru	F (50.5 sec)	D
	WB Right	A	D
	WB Approach	E (43.9 sec)	D
	NB Left/Thru/Right	A	A
	NB Approach	A	A
	SB Left/Thru/Right	A	A
	SB Approach	A	A

Table 4: 2025 Short Range Total Peak Hour Operations (Continued…)

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/Existing Park Access/Site Access (Full-Movement)			
Stop Control	EB Left/Right	B	C
	EB Approach	B	C
	NB Left/Thru	A	A
	NB Approach	A	A
	SB Thru/Right	A	A
	SB Approach	A	A

Intersection	Movement	Level of Service (LOS)	
		AM	PM
		LOS	LOS
Lowell Blvd/ Site Access (Right-in/Right-out)			
Stop Control	WB Right	A	B
	WB Approach	A	B
	NB Thru/Right	A	A
	NB Approach	A	A
	SB Thru	A	A
	SB Approach	A	A

6.0 Findings

Based upon the analysis in this study, the proposed project at 5602 Lowell Blvd., Adams County, CO will be able to meet Adams County's requirements and not create a negative traffic impact upon the local and regional traffic system. Based upon the findings in this TIS, it can be determined that the proposed use is appropriate from a traffic engineering perspective. The access is appropriate and additional auxiliary lanes are not required based upon Section 8-01-08-01 in Chapter 8, Adams County Development Standards and Regulations.

The findings of the TIS are summarized below:

- The proposed project is anticipated to generate approximately 2,426 daily weekday trips, 144 AM total peak hour trips, and 184 PM total peak hour trips.
- The study intersections will operate acceptably during the AM and PM peak hours with the Proposed Development (per Chapter 8 in Adams County Development Standards and Regulations).
- Additional auxiliary lanes are not required at the study intersections per the Auxiliary Lane Requirements (Section 8-01-08-01 in Chapter 8, Adams County Development Standards and Regulations).
- Additional roadway improvements are not required per Adams County Development Standards and Regulations.

APPENDICES:

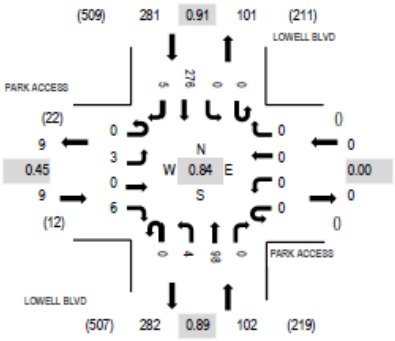
Appendix A: Recent Traffic Counts



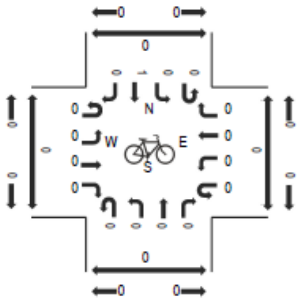
(303) 216-2439
www.alltrafficdata.net

Location: 1 LOWELL BLVD & PARK ACCESS AM
Date: Tuesday, December 20, 2022
Peak Hour: 07:15 AM - 08:15 AM
Peak 15-Minutes: 07:45 AM - 08:00 AM

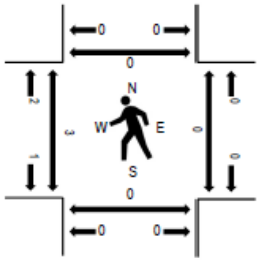
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

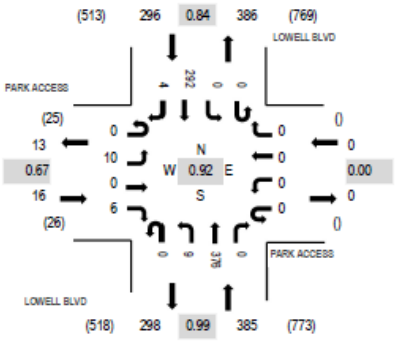
Traffic Counts - Motorized Vehicles

Interval Start Time	PARK ACCESS Eastbound				PARK ACCESS Westbound				LOWELL BLVD Northbound				LOWELL BLVD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	0	0	1	0	0	0	0	0	2	12	0	0	0	63	2	80	389	0	0	0	0
7:15 AM	0	1	0	4	0	0	0	0	0	3	16	0	0	0	69	3	96	392	0	0	0	0
7:30 AM	0	1	0	1	0	0	0	0	0	0	21	0	0	0	72	1	96	391	1	0	0	0
7:45 AM	0	0	0	1	0	0	0	0	0	0	36	0	0	0	79	1	117	377	1	0	0	0
8:00 AM	0	1	0	0	0	0	0	0	0	1	25	0	0	0	56	0	83	351	1	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	1	32	0	0	0	62	0	95		0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	1	36	0	0	0	45	0	82		1	0	0	0
8:45 AM	0	2	0	0	0	0	0	0	0	5	28	0	0	0	54	2	91		0	0	0	0
Count Total	0	5	0	7	0	0	0	0	0	13	206	0	0	0	500	9	740		4	0	0	0
Peak Hour	0	3	0	6	0	0	0	0	0	4	98	0	0	0	276	5	392		3	0	0	0

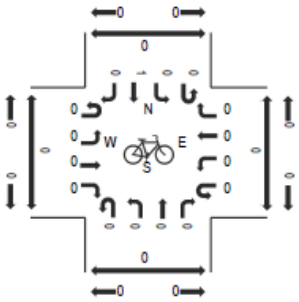
ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

Location: 1 LOWELL BLVD & PARK ACCESS PM
Date: Tuesday, December 20, 2022
Peak Hour: 04:15 PM - 05:15 PM
Peak 15-Minutes: 04:45 PM - 05:00 PM

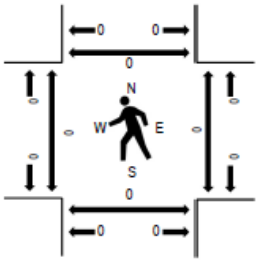
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians

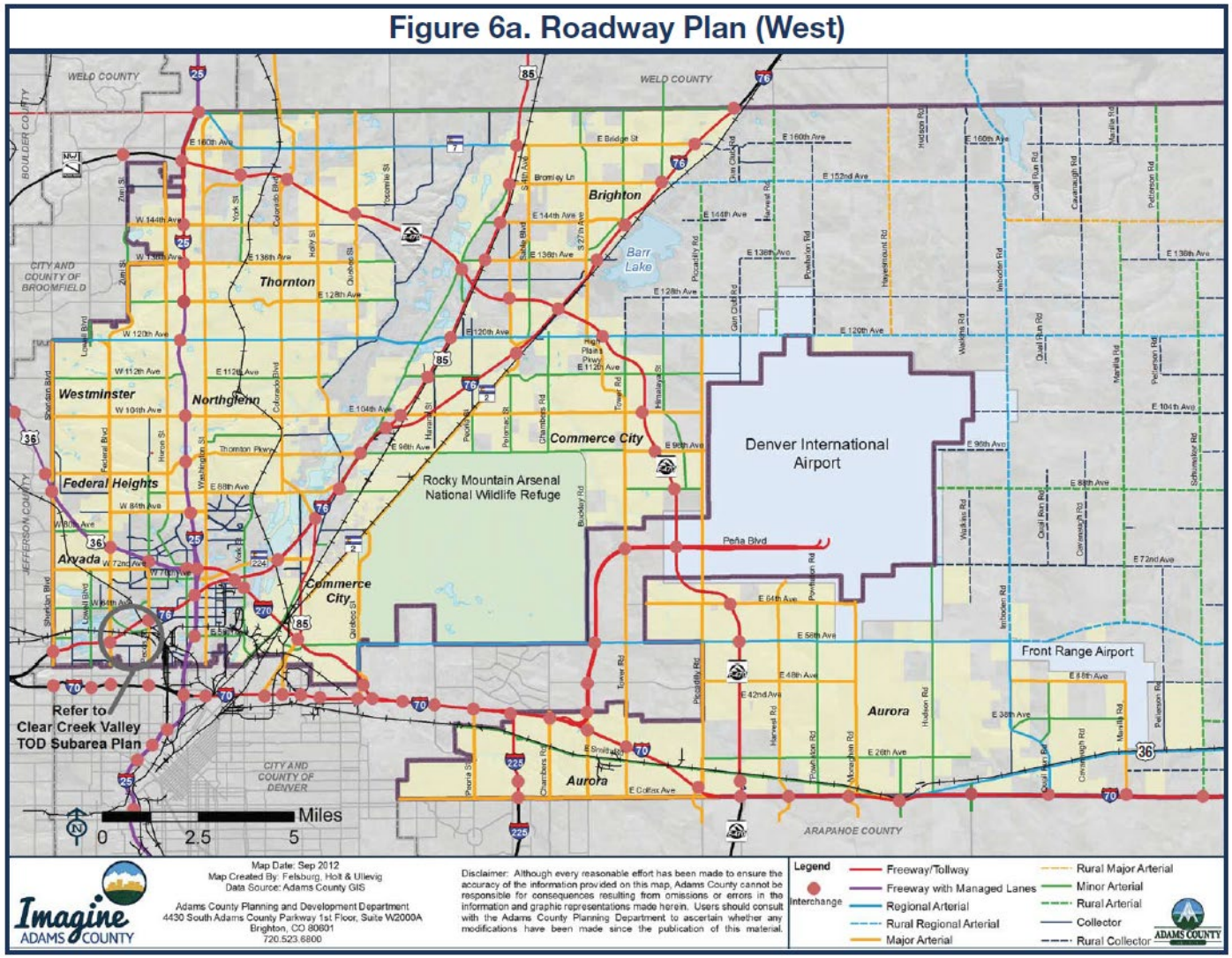


Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	PARK ACCESS Eastbound				PARK ACCESS Westbound				LOWELL BLVD Northbound				LOWELL BLVD Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	0	0	1	0	0	0	0	0	3	84	0	0	0	53	1	142	669	1	0	0	0
4:15 PM	0	2	0	2	0	0	0	0	0	4	87	0	0	0	73	0	168	697	0	0	0	0
4:30 PM	0	2	0	0	0	0	0	0	0	1	92	0	0	0	74	0	169	686	0	0	0	0
4:45 PM	0	1	0	3	0	0	0	0	0	3	95	0	0	0	85	3	190	669	0	0	0	0
5:00 PM	0	5	0	1	0	0	0	0	0	1	102	0	0	0	60	1	170	643	0	0	0	0
5:15 PM	0	0	0	3	0	0	0	0	0	0	103	0	0	0	50	1	157		0	0	0	0
5:30 PM	0	1	0	1	0	0	0	0	0	3	100	0	0	0	46	1	152		0	0	0	0
5:45 PM	0	1	0	3	0	0	0	0	0	1	94	0	0	0	63	2	164		0	0	0	0
Count Total	0	12	0	14	0	0	0	0	0	16	757	0	0	0	504	9	1,312		1	0	0	0
Peak Hour	0	10	0	6	0	0	0	0	0	9	376	0	0	0	292	4	697		0	0	0	0

Appendix B: Adams County Transportation Plan (Figure 6a)



Appendix C: Level of Service (LOS) Table

Level of Service Definitions

Level of Service (LOS)	Signalized Intersection Average Total Delay (sec/veh)	Unsignalized Intersection Average Total Delay (sec/veh)
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

Appendix D: Aerial Image



Google Earth

Appendix E: ITE Code 220

Land Use: 220
Multifamily Housing (Low-Rise)

Description

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have two or three floors (levels). Various configurations fit this description, including walkup apartment, mansion apartment, and stacked townhouse.

- A walkup apartment typically is two or three floors in height with dwelling units that are accessed by a single or multiple entrances with stairways and hallways.
- A mansion apartment is a single structure that contains several apartments within what appears to be a single-family dwelling unit.
- A fourplex is a single two-story structure with two matching dwelling units on the ground and second floors. Access to the individual units is typically internal to the structure and provided through a central entry and stairway.
- A stacked townhouse is designed to match the external appearance of a townhouse. But, unlike a townhouse dwelling unit that only shares walls with an adjoining unit, the stacked townhouse units share both floors and walls. Access to the individual units is typically internal to the structure and provided through a central entry and stairway.

Multifamily housing (mid-rise) (Land Use 221), multifamily housing (high-rise) (Land Use 222), affordable housing (Land Use 223), and off-campus student apartment (low-rise) (Land Use 225) are related land uses.

Land Use Subcategory

Data are presented for two subcategories for this land use: (1) not close to rail transit and (2) close to rail transit. A site is considered close to rail transit if the walking distance between the residential site entrance and the closest rail transit station entrance is ½ mile or less.

Additional Data

For the three sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.72 residents per occupied dwelling unit.

For the two sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 96.2 percent of the total dwelling units were occupied.

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip

generation resource page on the ITE website (https://www.ite.org/technical-resources/topics/trip-and-parking-generation/).

For the three sites for which data were provided for both occupied dwelling units and residents, there was an average of 2.72 residents per occupied dwelling unit.

It is expected that the number of bedrooms and number of residents are likely correlated to the trips generated by a residential site. To assist in future analysis, trip generation studies of all multifamily housing should attempt to obtain information on occupancy rate and on the mix of residential unit sizes (i.e., number of units by number of bedrooms at the site complex).

The sites were surveyed in the 1980s, the 1990s, the 2000s, the 2010s, and the 2020s in British Columbia (CAN), California, Delaware, Florida, Georgia, Illinois, Indiana, Maine, Maryland, Massachusetts, Minnesota, New Jersey, Ontario (CAN), Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, and Washington.

Source Numbers

188, 204, 237, 300, 305, 306, 320, 321, 357, 390, 412, 525, 530, 579, 583, 638, 864, 866, 896, 901, 903, 904, 936, 939, 944, 946, 947, 948, 963, 964, 966, 967, 1012, 1013, 1014, 1036, 1047, 1056, 1071, 1076

Multifamily Housing (Low-Rise)
Not Close to Rail Transit (220)

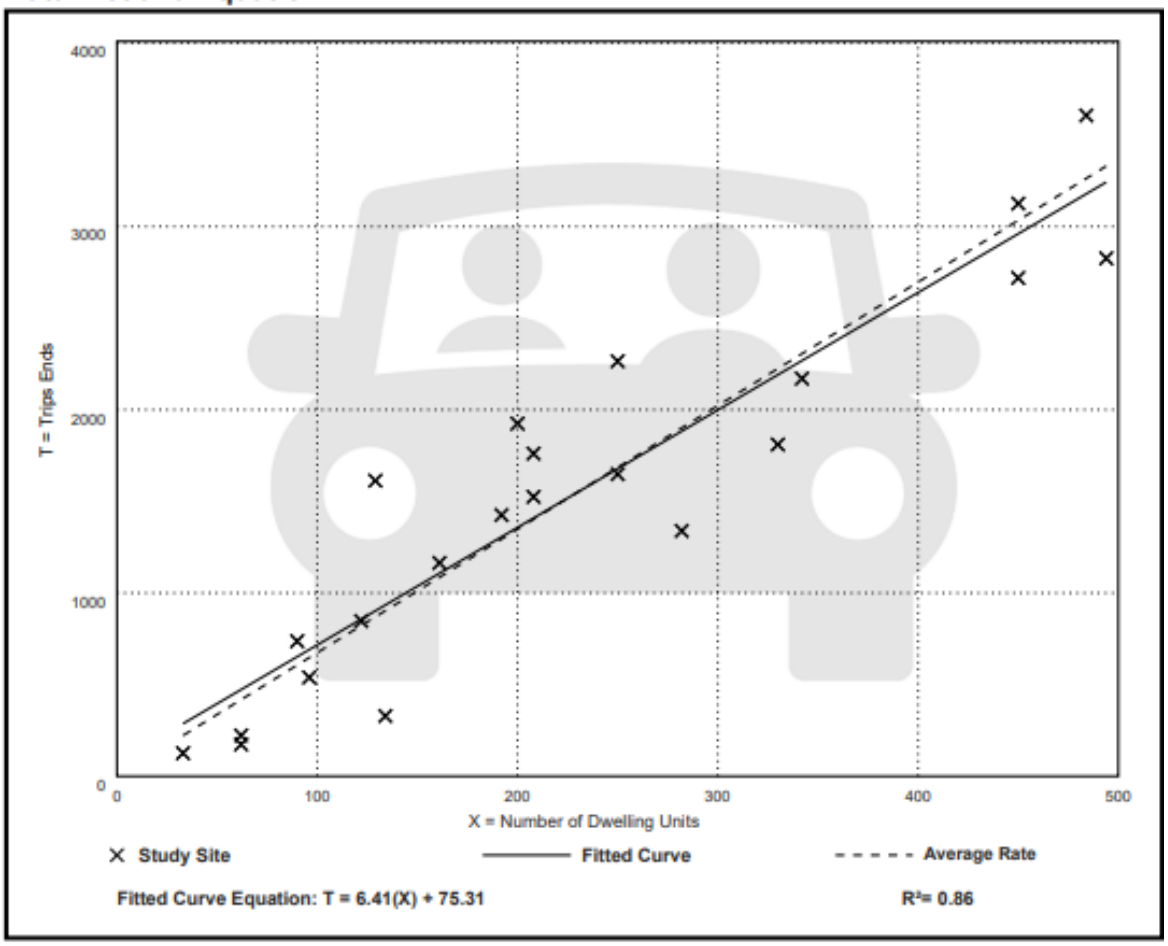
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 22
Avg. Num. of Dwelling Units: 229
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
6.74	2.46 - 12.50	1.79

Data Plot and Equation



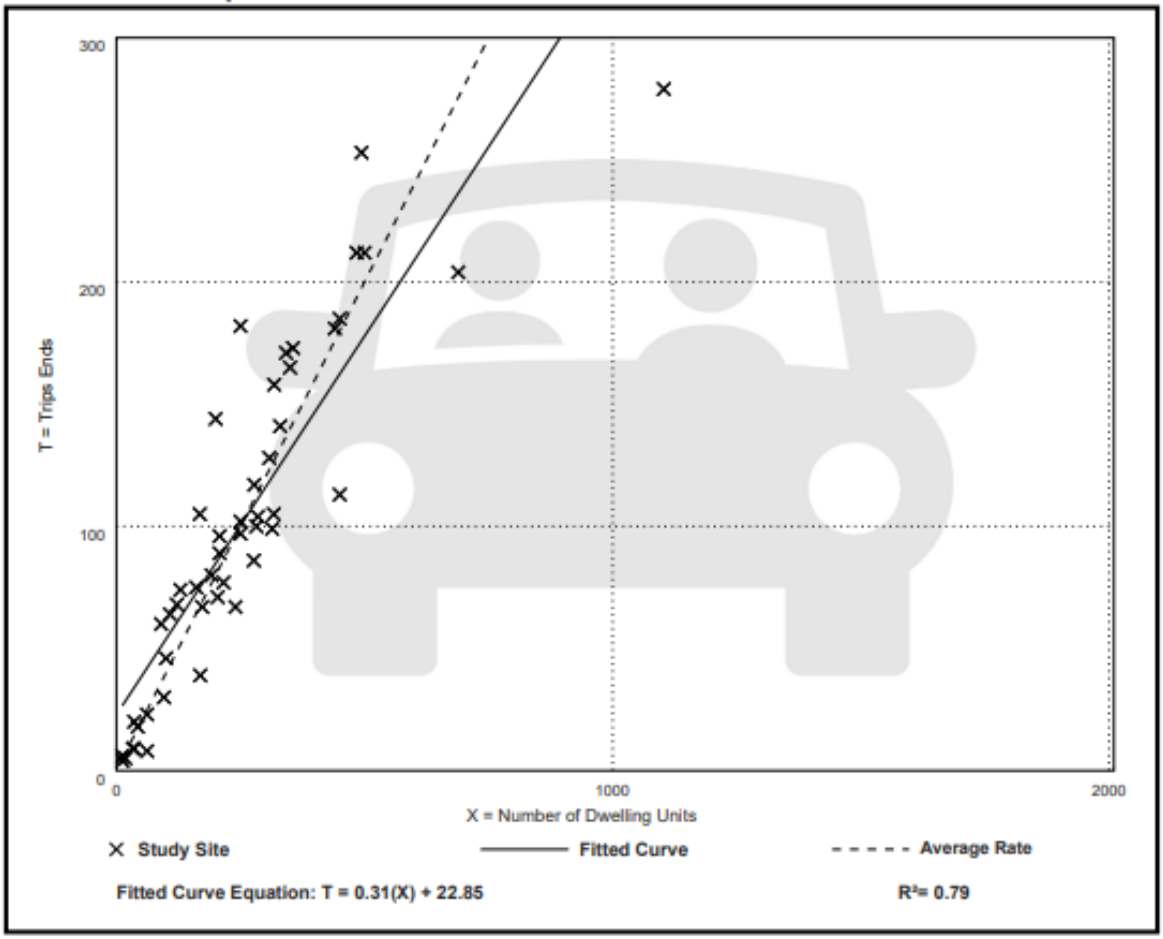
Multifamily Housing (Low-Rise)
Not Close to Rail Transit (220)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
Number of Studies: 49
Avg. Num. of Dwelling Units: 249
Directional Distribution: 24% entering, 76% exiting

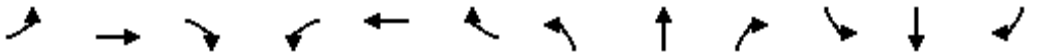
Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.40	0.13 - 0.73	0.12

Data Plot and Equation



Appendix F: HCM Calculations (Synchro)

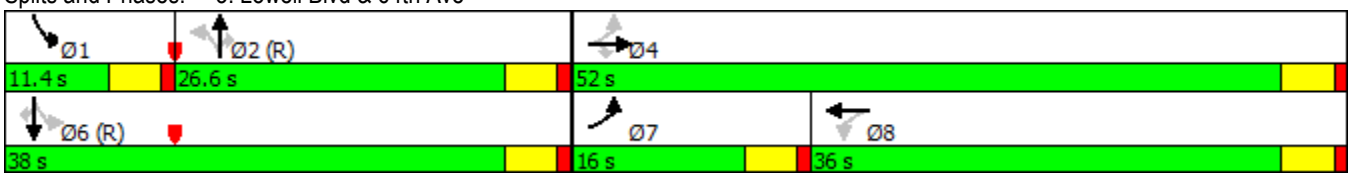


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	185	355	160	45	400	30	55	145	40	125	400	155
Future Volume (vph)	185	355	160	45	400	30	55	145	40	125	400	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.989				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1658	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.175			0.533			0.493			0.517		
Satd. Flow (perm)	293	1676	1425	894	1658	0	827	1676	1425	867	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			174		5				127			168
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	386	174	49	435	33	60	158	43	136	435	168
Shared Lane Traffic (%)												
Lane Group Flow (vph)	201	386	174	49	468	0	60	158	43	136	435	168
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	16.0	52.0	52.0	36.0	36.0		26.6	26.6	26.6	11.4	38.0	38.0
Total Split (%)	17.8%	57.8%	57.8%	40.0%	40.0%		29.6%	29.6%	29.6%	12.7%	42.2%	42.2%
Maximum Green (s)	11.5	47.5	47.5	31.5	31.5		22.1	22.1	22.1	6.9	33.5	33.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	44.4	44.4	44.4	28.7	28.7		24.9	24.9	24.9	36.6	36.6	36.6
Actuated g/C Ratio	0.49	0.49	0.49	0.32	0.32		0.28	0.28	0.28	0.41	0.41	0.41
v/c Ratio	0.66	0.47	0.22	0.17	0.88		0.26	0.34	0.09	0.33	0.64	0.25
Control Delay	24.0	16.6	2.5	22.4	47.5		31.4	30.0	0.3	21.3	27.8	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.0	16.6	2.5	22.4	47.5		31.4	30.0	0.3	21.3	27.8	4.2
LOS	C	B	A	C	D		C	C	A	C	C	A
Approach Delay		15.3			45.1			25.4			21.2	
Approach LOS		B			D			C			C	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 75			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.88			
Intersection Signal Delay: 25.2		Intersection LOS: C	
Intersection Capacity Utilization 79.4%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	5	10	110	5	15	5	190	25	15	570	10
Future Vol, veh/h	10	5	10	110	5	15	5	190	25	15	570	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	5	11	120	5	16	5	207	27	16	620	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	899	902	626	897	894	221	631	0	0	234	0	0
Stage 1	658	658	-	231	231	-	-	-	-	-	-	-
Stage 2	241	244	-	666	663	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	260	277	484	261	280	819	951	-	-	1333	-	-
Stage 1	453	461	-	772	713	-	-	-	-	-	-	-
Stage 2	762	704	-	449	459	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	246	270	484	246	273	819	951	-	-	1333	-	-
Mov Cap-2 Maneuver	246	270	-	246	273	-	-	-	-	-	-	-
Stage 1	450	452	-	767	709	-	-	-	-	-	-	-
Stage 2	737	700	-	425	450	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.6	30.8	0.2	0.2
HCM LOS	C	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	951	-	-	313	247	819	1333	-	-
HCM Lane V/C Ratio	0.006	-	-	0.087	0.506	0.02	0.012	-	-
HCM Control Delay (s)	8.8	0	-	17.6	33.6	9.5	7.7	0	-
HCM Lane LOS	A	A	-	C	D	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	2.6	0.1	0	-	-

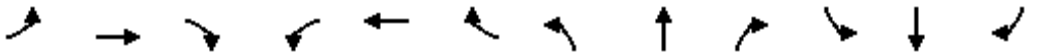
Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	6	4	98	276	5
Future Vol, veh/h	3	6	4	98	276	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	7	4	107	300	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	418	303	305	0	-	0
Stage 1	303	-	-	-	-	-
Stage 2	115	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	591	737	1256	-	-	-
Stage 1	749	-	-	-	-	-
Stage 2	910	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	589	737	1256	-	-	-
Mov Cap-2 Maneuver	634	-	-	-	-	-
Stage 1	747	-	-	-	-	-
Stage 2	910	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.2	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1256	-	699	-	-
HCM Lane V/C Ratio	0.003	-	0.014	-	-
HCM Control Delay (s)	7.9	0	10.2	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

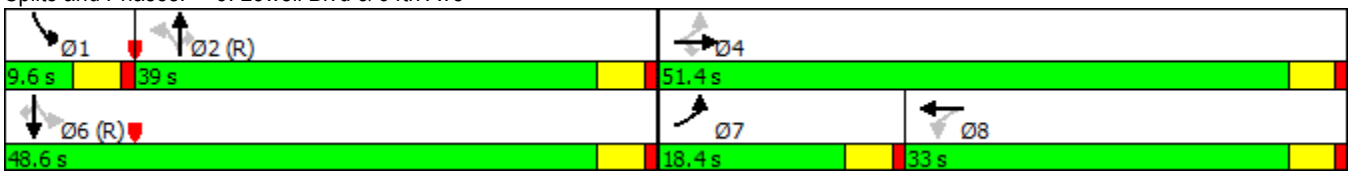


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	205	230	55	25	285	70	165	385	40	70	195	140
Future Volume (vph)	205	230	55	25	285	70	165	385	40	70	195	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.970				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1626	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.183			0.604			0.625			0.288		
Satd. Flow (perm)	307	1676	1425	1013	1626	0	1048	1676	1425	483	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			65		12				115			152
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	250	60	27	310	76	179	418	43	76	212	152
Shared Lane Traffic (%)												
Lane Group Flow (vph)	223	250	60	27	386	0	179	418	43	76	212	152
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	18.4	51.4	51.4	33.0	33.0		39.0	39.0	39.0	9.6	48.6	48.6
Total Split (%)	18.4%	51.4%	51.4%	33.0%	33.0%		39.0%	39.0%	39.0%	9.6%	48.6%	48.6%
Maximum Green (s)	13.9	46.9	46.9	28.5	28.5		34.5	34.5	34.5	5.1	44.1	44.1
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	44.2	44.2	44.2	26.2	26.2		38.7	38.7	38.7	46.8	46.8	46.8
Actuated g/C Ratio	0.44	0.44	0.44	0.26	0.26		0.39	0.39	0.39	0.47	0.47	0.47
v/c Ratio	0.72	0.34	0.09	0.10	0.89		0.44	0.64	0.07	0.26	0.27	0.20
Control Delay	32.3	19.2	3.9	27.8	57.6		29.2	32.5	0.2	18.6	18.3	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.3	19.2	3.9	27.8	57.6		29.2	32.5	0.2	18.6	18.3	3.5
LOS	C	B	A	C	E		C	C	A	B	B	A
Approach Delay		22.9			55.7			29.4			13.2	
Approach LOS		C			E			C			B	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.89			
Intersection Signal Delay: 29.5		Intersection LOS: C	
Intersection Capacity Utilization 75.8%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	35	10	20	40	15	20	5	580	45	5	260	5
Future Vol, veh/h	35	10	20	40	15	20	5	580	45	5	260	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	38	11	22	43	16	22	5	630	49	5	283	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	980	985	286	977	963	655	288	0	0	679	0	0
Stage 1	296	296	-	665	665	-	-	-	-	-	-	-
Stage 2	684	689	-	312	298	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	229	248	753	230	256	466	1274	-	-	913	-	-
Stage 1	712	668	-	449	458	-	-	-	-	-	-	-
Stage 2	439	446	-	699	667	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	206	245	753	214	253	466	1274	-	-	913	-	-
Mov Cap-2 Maneuver	206	245	-	214	253	-	-	-	-	-	-	-
Stage 1	708	663	-	446	455	-	-	-	-	-	-	-
Stage 2	401	443	-	663	662	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22.6	23.3	0.1	0.2
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1274	-	-	274	223	466	913	-	-
HCM Lane V/C Ratio	0.004	-	-	0.258	0.268	0.047	0.006	-	-
HCM Control Delay (s)	7.8	0	-	22.6	27	13.1	9	0	-
HCM Lane LOS	A	A	-	C	D	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	1	1	0.1	0	-	-

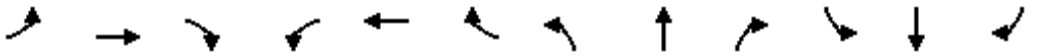
Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	6	9	376	292	4
Future Vol, veh/h	10	6	9	376	292	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	7	10	409	317	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	748	319	321	0	-	0
Stage 1	319	-	-	-	-	-
Stage 2	429	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	380	722	1239	-	-	-
Stage 1	737	-	-	-	-	-
Stage 2	657	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	376	722	1239	-	-	-
Mov Cap-2 Maneuver	486	-	-	-	-	-
Stage 1	730	-	-	-	-	-
Stage 2	657	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.7	0.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1239	-	554	-	-
HCM Lane V/C Ratio	0.008	-	0.031	-	-
HCM Control Delay (s)	7.9	0	11.7	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

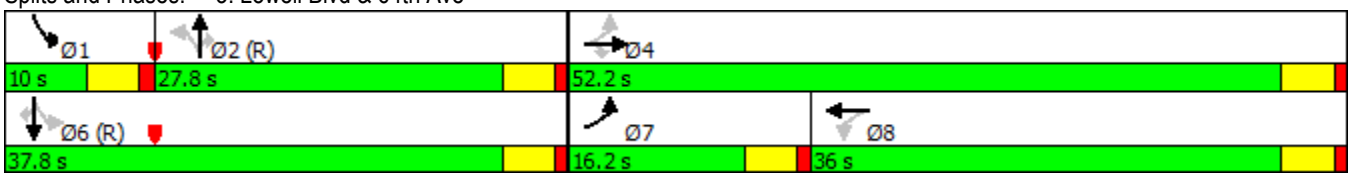


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	192	369	166	47	416	31	57	151	42	130	416	161
Future Volume (vph)	192	369	166	47	416	31	57	151	42	130	416	161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.990				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1660	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.162			0.526			0.447			0.509		
Satd. Flow (perm)	272	1676	1425	882	1660	0	749	1676	1425	853	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			180		5				127			172
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	209	401	180	51	452	34	62	164	46	141	452	175
Shared Lane Traffic (%)												
Lane Group Flow (vph)	209	401	180	51	486	0	62	164	46	141	452	175
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	16.2	52.2	52.2	36.0	36.0		27.8	27.8	27.8	10.0	37.8	37.8
Total Split (%)	18.0%	58.0%	58.0%	40.0%	40.0%		30.9%	30.9%	30.9%	11.1%	42.0%	42.0%
Maximum Green (s)	11.7	47.7	47.7	31.5	31.5		23.3	23.3	23.3	5.5	33.3	33.3
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	45.0	45.0	45.0	29.2	29.2		25.1	25.1	25.1	36.0	36.0	36.0
Actuated g/C Ratio	0.50	0.50	0.50	0.32	0.32		0.28	0.28	0.28	0.40	0.40	0.40
v/c Ratio	0.69	0.48	0.22	0.18	0.90		0.30	0.35	0.09	0.36	0.67	0.26
Control Delay	26.4	16.5	2.5	22.5	49.6		31.9	29.6	0.4	22.2	29.4	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.4	16.5	2.5	22.5	49.6		31.9	29.6	0.4	22.2	29.4	4.5
LOS	C	B	A	C	D		C	C	A	C	C	A
Approach Delay		15.9			47.0			25.2			22.4	
Approach LOS		B			D			C			C	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 75			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.90			
Intersection Signal Delay: 26.2		Intersection LOS: C	
Intersection Capacity Utilization 81.7%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	5.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	5	10	114	5	16	5	198	26	16	593	10
Future Vol, veh/h	10	5	10	114	5	16	5	198	26	16	593	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	5	11	124	5	17	5	215	28	17	645	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	935	938	651	932	929	229	656	0	0	243	0	0
Stage 1	685	685	-	239	239	-	-	-	-	-	-	-
Stage 2	250	253	-	693	690	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	246	264	469	247	268	810	931	-	-	1323	-	-
Stage 1	438	448	-	764	708	-	-	-	-	-	-	-
Stage 2	754	698	-	434	446	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	232	257	469	233	261	810	931	-	-	1323	-	-
Mov Cap-2 Maneuver	232	257	-	233	261	-	-	-	-	-	-	-
Stage 1	435	439	-	759	704	-	-	-	-	-	-	-
Stage 2	728	694	-	410	437	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.3	34.5	0.2	0.2
HCM LOS	C	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	931	-	-	298	234	810	1323	-	-
HCM Lane V/C Ratio	0.006	-	-	0.091	0.553	0.021	0.013	-	-
HCM Control Delay (s)	8.9	0	-	18.3	37.9	9.5	7.8	0	-
HCM Lane LOS	A	A	-	C	E	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	3	0.1	0	-	-

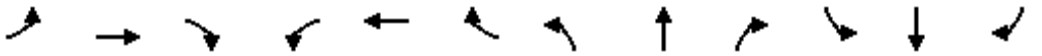
Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	6	4	102	287	5
Future Vol, veh/h	3	6	4	102	287	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	7	4	111	312	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	434	315	317	0	-	0
Stage 1	315	-	-	-	-	-
Stage 2	119	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	579	725	1243	-	-	-
Stage 1	740	-	-	-	-	-
Stage 2	906	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	577	725	1243	-	-	-
Mov Cap-2 Maneuver	625	-	-	-	-	-
Stage 1	738	-	-	-	-	-
Stage 2	906	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.3	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1243	-	688	-	-
HCM Lane V/C Ratio	0.003	-	0.014	-	-
HCM Control Delay (s)	7.9	0	10.3	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

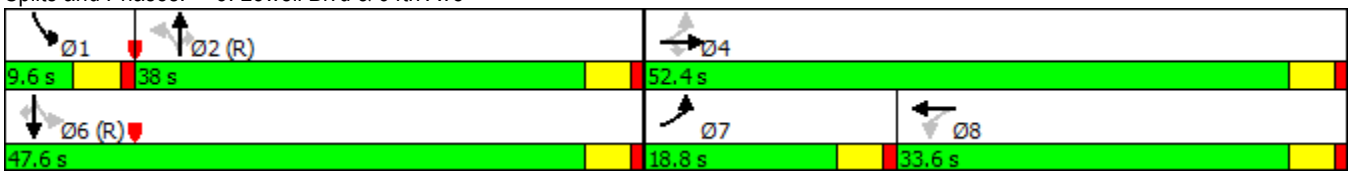


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	218	239	57	26	297	73	172	401	42	73	203	146
Future Volume (vph)	218	239	57	26	297	73	172	401	42	73	203	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.971				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1628	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.175			0.599			0.620			0.257		
Satd. Flow (perm)	293	1676	1425	1004	1628	0	1039	1676	1425	431	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			65		12				115			159
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	237	260	62	28	323	79	187	436	46	79	221	159
Shared Lane Traffic (%)												
Lane Group Flow (vph)	237	260	62	28	402	0	187	436	46	79	221	159
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	18.8	52.4	52.4	33.6	33.6		38.0	38.0	38.0	9.6	47.6	47.6
Total Split (%)	18.8%	52.4%	52.4%	33.6%	33.6%		38.0%	38.0%	38.0%	9.6%	47.6%	47.6%
Maximum Green (s)	14.3	47.9	47.9	29.1	29.1		33.5	33.5	33.5	5.1	43.1	43.1
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	45.5	45.5	45.5	27.0	27.0		37.4	37.4	37.4	45.5	45.5	45.5
Actuated g/C Ratio	0.46	0.46	0.46	0.27	0.27		0.37	0.37	0.37	0.46	0.46	0.46
v/c Ratio	0.75	0.34	0.09	0.10	0.90		0.48	0.70	0.08	0.30	0.29	0.22
Control Delay	34.2	18.5	3.9	27.3	58.1		31.1	35.5	0.2	20.0	19.2	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.2	18.5	3.9	27.3	58.1		31.1	35.5	0.2	20.0	19.2	3.7
LOS	C	B	A	C	E		C	D	A	B	B	A
Approach Delay		23.5			56.1			31.8			14.0	
Approach LOS		C			E			C			B	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.90			
Intersection Signal Delay: 30.7		Intersection LOS: C	
Intersection Capacity Utilization 78.7%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	36	10	20	42	16	21	5	603	47	5	270	5
Future Vol, veh/h	36	10	20	42	16	21	5	603	47	5	270	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	11	22	46	17	23	5	655	51	5	293	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1017	1022	296	1013	999	681	298	0	0	706	0	0
Stage 1	306	306	-	691	691	-	-	-	-	-	-	-
Stage 2	711	716	-	322	308	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	216	236	743	217	243	450	1263	-	-	892	-	-
Stage 1	704	662	-	435	446	-	-	-	-	-	-	-
Stage 2	424	434	-	690	660	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	192	233	743	201	240	450	1263	-	-	892	-	-
Mov Cap-2 Maneuver	192	233	-	201	240	-	-	-	-	-	-	-
Stage 1	699	657	-	432	443	-	-	-	-	-	-	-
Stage 2	384	431	-	654	655	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	24.4	25.1	0.1	0.2
HCM LOS	C	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1263	-	-	256	210	450	892	-	-
HCM Lane V/C Ratio	0.004	-	-	0.28	0.3	0.051	0.006	-	-
HCM Control Delay (s)	7.9	0	-	24.4	29.3	13.4	9.1	0	-
HCM Lane LOS	A	A	-	C	D	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	1.1	1.2	0.2	0	-	-

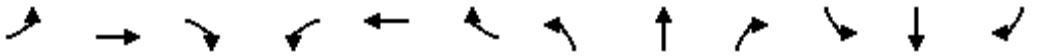
Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	6	9	391	304	4
Future Vol, veh/h	10	6	9	391	304	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	7	10	425	330	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	777	332	334	0	-	0
Stage 1	332	-	-	-	-	-
Stage 2	445	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	365	710	1225	-	-	-
Stage 1	727	-	-	-	-	-
Stage 2	646	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	361	710	1225	-	-	-
Mov Cap-2 Maneuver	474	-	-	-	-	-
Stage 1	719	-	-	-	-	-
Stage 2	646	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.9	0.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1225	-	541	-	-
HCM Lane V/C Ratio	0.008	-	0.032	-	-
HCM Control Delay (s)	8	0	11.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

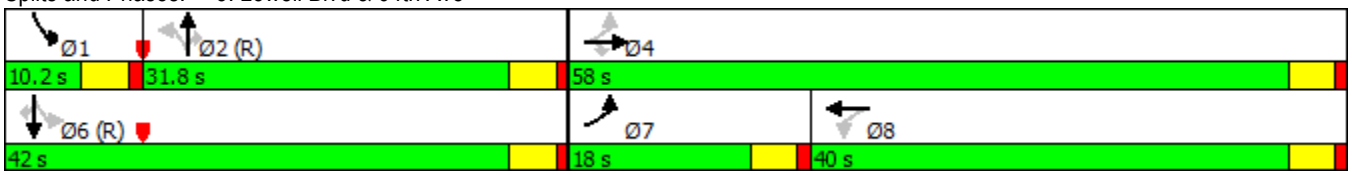


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	192	369	173	54	416	31	78	173	64	130	423	161
Future Volume (vph)	192	369	173	54	416	31	78	173	64	130	423	161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.990				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1660	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.160			0.526			0.423			0.485		
Satd. Flow (perm)	268	1676	1425	882	1660	0	709	1676	1425	813	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			188		4				115			153
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	209	401	188	59	452	34	85	188	70	141	460	175
Shared Lane Traffic (%)												
Lane Group Flow (vph)	209	401	188	59	486	0	85	188	70	141	460	175
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	18.0	58.0	58.0	40.0	40.0		31.8	31.8	31.8	10.2	42.0	42.0
Total Split (%)	18.0%	58.0%	58.0%	40.0%	40.0%		31.8%	31.8%	31.8%	10.2%	42.0%	42.0%
Maximum Green (s)	13.5	53.5	53.5	35.5	35.5		27.3	27.3	27.3	5.7	37.5	37.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	50.1	50.1	50.1	32.6	32.6		29.7	29.7	29.7	40.9	40.9	40.9
Actuated g/C Ratio	0.50	0.50	0.50	0.33	0.33		0.30	0.30	0.30	0.41	0.41	0.41
v/c Ratio	0.68	0.48	0.23	0.21	0.90		0.40	0.38	0.14	0.37	0.67	0.26
Control Delay	27.1	18.0	2.5	25.1	52.0		36.9	31.8	2.0	24.0	31.2	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.1	18.0	2.5	25.1	52.0		36.9	31.8	2.0	24.0	31.2	6.0
LOS	C	B	A	C	D		D	C	A	C	C	A
Approach Delay		16.7			49.1			27.0			24.2	
Approach LOS		B			D			C			C	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 75			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.90			
Intersection Signal Delay: 27.7		Intersection LOS: C	
Intersection Capacity Utilization 82.8%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	6.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	5	10	114	5	23	5	205	26	38	615	10
Future Vol, veh/h	10	5	10	114	5	23	5	205	26	38	615	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	5	11	124	5	25	5	223	28	41	668	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1018	1017	674	1011	1008	237	679	0	0	251	0	0
Stage 1	756	756	-	247	247	-	-	-	-	-	-	-
Stage 2	262	261	-	764	761	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	216	238	455	218	240	802	913	-	-	1314	-	-
Stage 1	400	416	-	757	702	-	-	-	-	-	-	-
Stage 2	743	692	-	396	414	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	197	225	455	200	227	802	913	-	-	1314	-	-
Mov Cap-2 Maneuver	197	225	-	200	227	-	-	-	-	-	-	-
Stage 1	398	395	-	752	698	-	-	-	-	-	-	-
Stage 2	710	688	-	362	393	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	20.3	43.9	0.2	0.4
HCM LOS	C	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	913	-	-	263	201	802	1314	-	-
HCM Lane V/C Ratio	0.006	-	-	0.103	0.644	0.031	0.031	-	-
HCM Control Delay (s)	9	0	-	20.3	50.5	9.6	7.8	0	-
HCM Lane LOS	A	A	-	C	F	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	3.8	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	0	6	44	0	60	4	102	4	21	287	5
Future Vol, veh/h	3	0	6	44	0	60	4	102	4	21	287	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	75	-	-	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	0	7	48	0	65	4	111	4	23	312	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	515	484	315	485	484	113	317	0	0	115	0	0
Stage 1	361	361	-	121	121	-	-	-	-	-	-	-
Stage 2	154	123	-	364	363	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	470	483	725	492	483	940	1243	-	-	1474	-	-
Stage 1	657	626	-	883	796	-	-	-	-	-	-	-
Stage 2	848	794	-	655	625	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	431	474	725	481	474	940	1243	-	-	1474	-	-
Mov Cap-2 Maneuver	431	474	-	481	474	-	-	-	-	-	-	-
Stage 1	655	616	-	880	794	-	-	-	-	-	-	-
Stage 2	787	792	-	639	615	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.2	10.9	0.3	0.5
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1243	-	-	591	481	940	1474	-	-
HCM Lane V/C Ratio	0.003	-	-	0.017	0.099	0.069	0.015	-	-
HCM Control Delay (s)	7.9	0	-	11.2	13.3	9.1	7.5	-	-
HCM Lane LOS	A	A	-	B	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.3	0.2	0	-	-

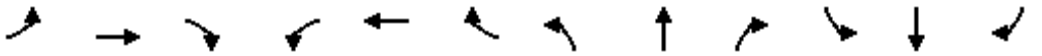
Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	5	105	10	0	337
Future Vol, veh/h	0	5	105	10	0	337
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	5	114	11	0	366

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	120	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	931	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	931	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	931	-
HCM Lane V/C Ratio	-	-	0.006	-
HCM Control Delay (s)	-	-	8.9	-
HCM Lane LOS	-	-	A	-
HCM 95th %tile Q(veh)	-	-	0	-

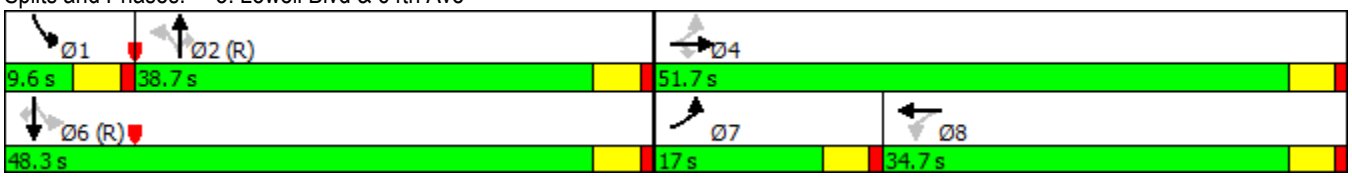


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	218	239	80	49	297	73	185	415	56	73	227	146
Future Volume (vph)	218	239	80	49	297	73	185	415	56	73	227	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.971				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1628	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.182			0.599			0.606			0.252		
Satd. Flow (perm)	305	1676	1425	1004	1628	0	1016	1676	1425	422	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			87		13				115			159
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	237	260	87	53	323	79	201	451	61	79	247	159
Shared Lane Traffic (%)												
Lane Group Flow (vph)	237	260	87	53	402	0	201	451	61	79	247	159
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	17.0	51.7	51.7	34.7	34.7		38.7	38.7	38.7	9.6	48.3	48.3
Total Split (%)	17.0%	51.7%	51.7%	34.7%	34.7%		38.7%	38.7%	38.7%	9.6%	48.3%	48.3%
Maximum Green (s)	12.5	47.2	47.2	30.2	30.2		34.2	34.2	34.2	5.1	43.8	43.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	44.4	44.4	44.4	27.4	27.4		38.4	38.4	38.4	46.6	46.6	46.6
Actuated g/C Ratio	0.44	0.44	0.44	0.27	0.27		0.38	0.38	0.38	0.47	0.47	0.47
v/c Ratio	0.80	0.35	0.13	0.19	0.88		0.52	0.70	0.10	0.30	0.32	0.21
Control Delay	39.5	19.2	3.8	28.4	55.1		31.6	35.0	0.8	19.4	19.0	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.5	19.2	3.8	28.4	55.1		31.6	35.0	0.8	19.4	19.0	3.6
LOS	D	B	A	C	E		C	D	A	B	B	A
Approach Delay		25.2			52.0			31.1			14.0	
Approach LOS		C			D			C			B	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.88			
Intersection Signal Delay: 30.1		Intersection LOS: C	
Intersection Capacity Utilization 79.5%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			↰	↗		⇕			⇕	
Traffic Vol, veh/h	36	10	21	42	16	44	5	626	47	18	284	5
Future Vol, veh/h	36	10	21	42	16	44	5	626	47	18	284	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	11	23	46	17	48	5	680	51	20	309	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1100	1093	312	1085	1070	706	314	0	0	731	0	0
Stage 1	352	352	-	716	716	-	-	-	-	-	-	-
Stage 2	748	741	-	369	354	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	190	214	728	194	221	436	1246	-	-	873	-	-
Stage 1	665	632	-	421	434	-	-	-	-	-	-	-
Stage 2	404	423	-	651	630	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	154	207	728	176	213	436	1246	-	-	873	-	-
Mov Cap-2 Maneuver	154	207	-	176	213	-	-	-	-	-	-	-
Stage 1	660	614	-	418	431	-	-	-	-	-	-	-
Stage 2	343	420	-	602	612	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	30.1	25.6	0.1	0.5
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1246	-	-	215	185	436	873	-	-
HCM Lane V/C Ratio	0.004	-	-	0.339	0.341	0.11	0.022	-	-
HCM Control Delay (s)	7.9	0	-	30.1	34.2	14.3	9.2	0	-
HCM Lane LOS	A	A	-	D	D	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	1.4	1.4	0.4	0.1	-	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	0	6	27	0	37	9	391	14	70	304	4
Future Vol, veh/h	10	0	6	27	0	37	9	391	14	70	304	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	75	-	-	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	0	7	29	0	40	10	425	15	76	330	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	957	944	332	941	939	433	334	0	0	440	0	0
Stage 1	484	484	-	453	453	-	-	-	-	-	-	-
Stage 2	473	460	-	488	486	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	237	262	710	243	264	623	1225	-	-	1120	-	-
Stage 1	564	552	-	586	570	-	-	-	-	-	-	-
Stage 2	572	566	-	561	551	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	209	242	710	226	243	623	1225	-	-	1120	-	-
Mov Cap-2 Maneuver	209	242	-	226	243	-	-	-	-	-	-	-
Stage 1	558	514	-	580	564	-	-	-	-	-	-	-
Stage 2	529	560	-	518	514	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.5	16.3	0.2	1.6
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1225	-	-	284	226	623	1120	-	-
HCM Lane V/C Ratio	0.008	-	-	0.061	0.13	0.065	0.068	-	-
HCM Control Delay (s)	8	0	-	18.5	23.3	11.2	8.4	-	-
HCM Lane LOS	A	A	-	C	C	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.4	0.2	0.2	-	-

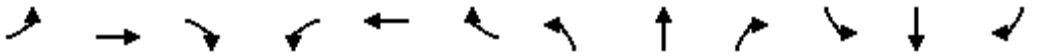
Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	4	410	32	0	337
Future Vol, veh/h	0	4	410	32	0	337
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	4	446	35	0	366

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	464	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	598	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	598	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	598	-
HCM Lane V/C Ratio	-	-	0.007	-
HCM Control Delay (s)	-	-	11.1	-
HCM Lane LOS	-	-	B	-
HCM 95th %tile Q(veh)	-	-	0	-

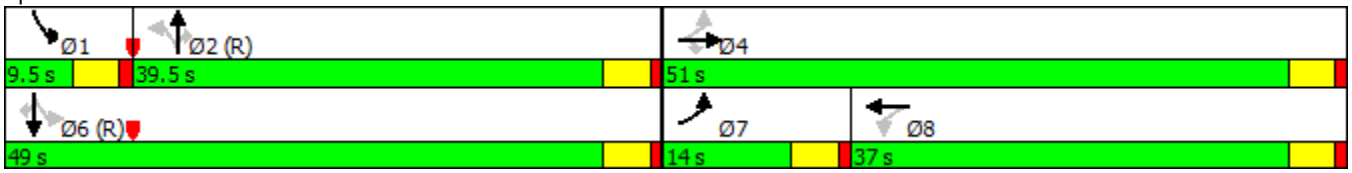


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	325	620	280	80	700	52	100	250	70	218	700	270
Future Volume (vph)	325	620	280	80	700	52	100	250	70	218	700	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.990				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1660	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.108			0.263			0.116			0.429		
Satd. Flow (perm)	181	1676	1425	441	1660	0	194	1676	1425	719	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			122		4				115			175
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	342	653	295	84	737	55	105	263	74	229	737	284
Shared Lane Traffic (%)												
Lane Group Flow (vph)	342	653	295	84	792	0	105	263	74	229	737	284
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	14.0	51.0	51.0	37.0	37.0		39.5	39.5	39.5	9.5	49.0	49.0
Total Split (%)	14.0%	51.0%	51.0%	37.0%	37.0%		39.5%	39.5%	39.5%	9.5%	49.0%	49.0%
Maximum Green (s)	9.5	46.5	46.5	32.5	32.5		35.0	35.0	35.0	5.0	44.5	44.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	46.5	46.5	46.5	32.5	32.5		35.0	35.0	35.0	44.5	44.5	44.5
Actuated g/C Ratio	0.46	0.46	0.46	0.32	0.32		0.35	0.35	0.35	0.44	0.44	0.44
v/c Ratio	1.57	0.84	0.41	0.59	1.46		1.57	0.45	0.13	0.63	0.99	0.39
Control Delay	299.7	35.1	11.8	47.5	246.2		343.4	28.1	1.9	28.6	59.4	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	299.7	35.1	11.8	47.5	246.2		343.4	28.1	1.9	28.6	59.4	8.7
LOS	F	D	B	D	F		F	C	A	C	E	A
Approach Delay		99.9			227.2			98.6			42.2	
Approach LOS		F			F			F			D	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.57			
Intersection Signal Delay: 110.0		Intersection LOS: F	
Intersection Capacity Utilization 126.5%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	105.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	20	10	20	190	10	30	10	330	45	30	990	20
Future Vol, veh/h	20	10	20	190	10	30	10	330	45	30	990	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	11	21	200	11	32	11	347	47	32	1042	21

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1531	1533	1053	1526	1520	371	1063	0	0	394	0	0
Stage 1	1117	1117	-	393	393	-	-	-	-	-	-	-
Stage 2	414	416	-	1133	1127	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	96	116	275	~ 96	119	675	655	-	-	1165	-	-
Stage 1	252	283	-	632	606	-	-	-	-	-	-	-
Stage 2	616	592	-	247	280	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	79	106	275	~ 77	109	675	655	-	-	1165	-	-
Mov Cap-2 Maneuver	79	106	-	~ 77	109	-	-	-	-	-	-	-
Stage 1	246	264	-	618	593	-	-	-	-	-	-	-
Stage 2	564	579	-	204	261	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	57.3	$ 769.3	0.3	0.2
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	655	-	-	119	78	675	1165	-	-
HCM Lane V/C Ratio	0.016	-	-	0.442	2.699	0.047	0.027	-	-
HCM Control Delay (s)	10.6	0	-	57.3	$ 883.1	10.6	8.2	0	-
HCM Lane LOS	B	A	-	F	F	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	1.9	20.4	0.1	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

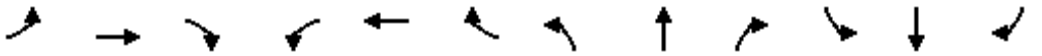
Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	6	4	170	480	5
Future Vol, veh/h	3	6	4	170	480	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	6	4	179	505	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	695	508	510	0	-	0
Stage 1	508	-	-	-	-	-
Stage 2	187	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	408	565	1055	-	-	-
Stage 1	604	-	-	-	-	-
Stage 2	845	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	406	565	1055	-	-	-
Mov Cap-2 Maneuver	494	-	-	-	-	-
Stage 1	602	-	-	-	-	-
Stage 2	845	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.8	0.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1055	-	539	-	-
HCM Lane V/C Ratio	0.004	-	0.018	-	-
HCM Control Delay (s)	8.4	0	11.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

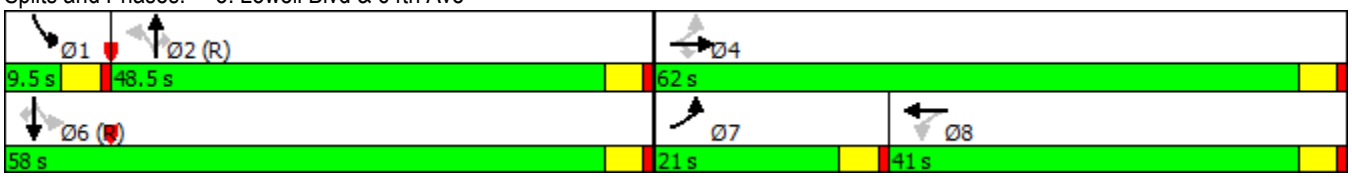


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	360	400	100	45	500	120	290	670	70	120	340	245
Future Volume (vph)	360	400	100	45	500	120	290	670	70	120	340	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.971				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1628	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.098			0.516			0.516			0.082		
Satd. Flow (perm)	164	1676	1425	865	1628	0	865	1676	1425	137	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			78		10				95			258
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	379	421	105	47	526	126	305	705	74	126	358	258
Shared Lane Traffic (%)												
Lane Group Flow (vph)	379	421	105	47	652	0	305	705	74	126	358	258
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	21.0	62.0	62.0	41.0	41.0		48.5	48.5	48.5	9.5	58.0	58.0
Total Split (%)	17.5%	51.7%	51.7%	34.2%	34.2%		40.4%	40.4%	40.4%	7.9%	48.3%	48.3%
Maximum Green (s)	16.5	57.5	57.5	36.5	36.5		44.0	44.0	44.0	5.0	53.5	53.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	57.5	57.5	57.5	36.5	36.5		44.0	44.0	44.0	53.5	53.5	53.5
Actuated g/C Ratio	0.48	0.48	0.48	0.30	0.30		0.37	0.37	0.37	0.45	0.45	0.45
v/c Ratio	1.38	0.52	0.15	0.18	1.30		0.96	1.15	0.13	1.04	0.48	0.33
Control Delay	220.8	24.7	6.4	33.1	183.4		80.2	120.3	3.3	120.6	26.1	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	220.8	24.7	6.4	33.1	183.4		80.2	120.3	3.3	120.6	26.1	3.6
LOS	F	C	A	C	F		F	F	A	F	C	A
Approach Delay		104.7			173.3			101.0			34.3	
Approach LOS		F			F			F			C	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 130			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.38			
Intersection Signal Delay: 102.3		Intersection LOS: F	
Intersection Capacity Utilization 121.1%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	51.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇂	↱		⇕			⇕	
Traffic Vol, veh/h	60	20	35	70	30	35	10	1010	80	10	450	10
Future Vol, veh/h	60	20	35	70	30	35	10	1010	80	10	450	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	63	21	37	74	32	37	11	1063	84	11	474	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1664	1671	480	1658	1634	1105	485	0	0	1147	0	0
Stage 1	502	502	-	1127	1127	-	-	-	-	-	-	-
Stage 2	1162	1169	-	531	507	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	77	96	586	78	101	256	1078	-	-	609	-	-
Stage 1	552	542	-	249	280	-	-	-	-	-	-	-
Stage 2	237	267	-	532	539	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 47	91	586	~ 58	96	256	1078	-	-	609	-	-
Mov Cap-2 Maneuver	~ 47	91	-	~ 58	96	-	-	-	-	-	-	-
Stage 1	536	528	-	242	272	-	-	-	-	-	-	-
Stage 2	174	259	-	467	526	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 433.9	$ 325.8	0.1	0.2
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1078	-	-	74	66	256	609	-	-
HCM Lane V/C Ratio	0.01	-	-	1.636	1.595	0.144	0.017	-	-
HCM Control Delay (s)	8.4	0	-	$ 433.9	$ 432.3	21.4	11	0	-
HCM Lane LOS	A	A	-	F	F	C	B	A	-
HCM 95th %tile Q(veh)	0	-	-	10.3	9.2	0.5	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	6	9	650	510	4
Future Vol, veh/h	10	6	9	650	510	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	6	9	684	537	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1241	539	541	0	-	0
Stage 1	539	-	-	-	-	-
Stage 2	702	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	193	542	1028	-	-	-
Stage 1	585	-	-	-	-	-
Stage 2	491	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	190	542	1028	-	-	-
Mov Cap-2 Maneuver	328	-	-	-	-	-
Stage 1	577	-	-	-	-	-
Stage 2	491	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	14.8	0.1	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1028	-	385	-	-
HCM Lane V/C Ratio	0.009	-	0.044	-	-
HCM Control Delay (s)	8.5	0	14.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	51.7

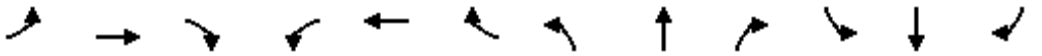
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇂	↱		⇕			⇕	
Traffic Vol, veh/h	60	20	35	70	30	35	10	1010	80	10	450	10
Future Vol, veh/h	60	20	35	70	30	35	10	1010	80	10	450	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	63	21	37	74	32	37	11	1063	84	11	474	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1664	1671	480	1658	1634	1105	485	0	0	1147	0	0
Stage 1	502	502	-	1127	1127	-	-	-	-	-	-	-
Stage 2	1162	1169	-	531	507	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	77	96	586	78	101	256	1078	-	-	609	-	-
Stage 1	552	542	-	249	280	-	-	-	-	-	-	-
Stage 2	237	267	-	532	539	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 47	91	586	~ 58	96	256	1078	-	-	609	-	-
Mov Cap-2 Maneuver	~ 47	91	-	~ 58	96	-	-	-	-	-	-	-
Stage 1	536	528	-	242	272	-	-	-	-	-	-	-
Stage 2	174	259	-	467	526	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 433.9	$ 325.8	0.1	0.2
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1078	-	-	74	66	256	609	-	-
HCM Lane V/C Ratio	0.01	-	-	1.636	1.595	0.144	0.017	-	-
HCM Control Delay (s)	8.4	0	-	$ 433.9	$ 432.3	21.4	11	0	-
HCM Lane LOS	A	A	-	F	F	C	B	A	-
HCM 95th %tile Q(veh)	0	-	-	10.3	9.2	0.5	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

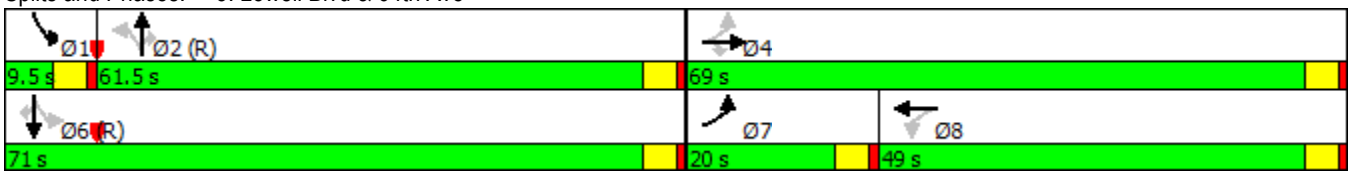


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	325	620	287	87	700	52	121	272	92	218	707	270
Future Volume (vph)	325	620	287	87	700	52	121	272	92	218	707	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.990				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1660	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.082			0.244			0.129			0.435		
Satd. Flow (perm)	137	1676	1425	409	1660	0	216	1676	1425	729	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			119		3				97			131
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	342	653	302	92	737	55	127	286	97	229	744	284
Shared Lane Traffic (%)												
Lane Group Flow (vph)	342	653	302	92	792	0	127	286	97	229	744	284
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	20.0	69.0	69.0	49.0	49.0		61.5	61.5	61.5	9.5	71.0	71.0
Total Split (%)	14.3%	49.3%	49.3%	35.0%	35.0%		43.9%	43.9%	43.9%	6.8%	50.7%	50.7%
Maximum Green (s)	15.5	64.5	64.5	44.5	44.5		57.0	57.0	57.0	5.0	66.5	66.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	64.5	64.5	64.5	44.5	44.5		57.0	57.0	57.0	66.5	66.5	66.5
Actuated g/C Ratio	0.46	0.46	0.46	0.32	0.32		0.41	0.41	0.41	0.48	0.48	0.48
v/c Ratio	1.53	0.85	0.42	0.71	1.50		1.46	0.42	0.15	0.61	0.93	0.38
Control Delay	288.8	45.3	16.6	72.3	268.0		291.8	32.1	5.3	33.0	54.7	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	288.8	45.3	16.6	72.3	268.0		291.8	32.1	5.3	33.0	54.7	13.7
LOS	F	D	B	E	F		F	C	A	C	D	B
Approach Delay		102.8			247.6			91.6			41.5	
Approach LOS		F			F			F			D	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 140			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.53			
Intersection Signal Delay: 114.3		Intersection LOS: F	
Intersection Capacity Utilization 128.2%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	160

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	10	20	190	10	37	10	337	45	52	1012	20
Future Vol, veh/h	20	10	20	190	10	37	10	337	45	52	1012	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	11	22	207	11	40	11	366	49	57	1100	22

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1663	1662	1111	1655	1649	391	1122	0	0	415	0	0
Stage 1	1225	1225	-	413	413	-	-	-	-	-	-	-
Stage 2	438	437	-	1242	1236	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	77	97	254	~ 78	99	658	623	-	-	1144	-	-
Stage 1	219	251	-	616	594	-	-	-	-	-	-	-
Stage 2	597	579	-	214	248	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	58	82	254	~ 57	84	658	623	-	-	1144	-	-
Mov Cap-2 Maneuver	58	82	-	~ 57	84	-	-	-	-	-	-	-
Stage 1	214	218	-	602	580	-	-	-	-	-	-	-
Stage 2	537	566	-	~ 161	215	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	89.5	$ 1169	0.3	0.4
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	623	-	-	92	58	658	1144	-	-
HCM Lane V/C Ratio	0.017	-	-	0.591	3.748	0.061	0.049	-	-
HCM Control Delay (s)	10.9	0	-	89.5	$ 1383.3	10.8	8.3	0	-
HCM Lane LOS	B	A	-	F	F	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	2.7	23.4	0.2	0.2	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	0	6	44	0	60	4	170	4	21	480	5
Future Vol, veh/h	3	0	6	44	0	60	4	170	4	21	480	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	75	-	-	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	0	6	46	0	63	4	179	4	22	505	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	773	743	508	744	743	181	510	0	0	183	0	0
Stage 1	552	552	-	189	189	-	-	-	-	-	-	-
Stage 2	221	191	-	555	554	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	316	343	565	331	343	862	1055	-	-	1392	-	-
Stage 1	518	515	-	813	744	-	-	-	-	-	-	-
Stage 2	781	742	-	516	514	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	289	336	565	322	336	862	1055	-	-	1392	-	-
Mov Cap-2 Maneuver	289	336	-	322	336	-	-	-	-	-	-	-
Stage 1	516	507	-	810	741	-	-	-	-	-	-	-
Stage 2	721	739	-	502	506	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.6	13.1	0.2	0.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1055	-	-	429	322	862	1392	-	-
HCM Lane V/C Ratio	0.004	-	-	0.022	0.144	0.073	0.016	-	-
HCM Control Delay (s)	8.4	0	-	13.6	18	9.5	7.6	-	-
HCM Lane LOS	A	A	-	B	C	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.5	0.2	0	-	-

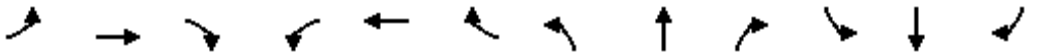
Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	5	173	10	0	530
Future Vol, veh/h	0	5	173	10	0	530
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	5	188	11	0	576

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	194	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	847	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	847	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	847	-
HCM Lane V/C Ratio	-	-	0.006	-
HCM Control Delay (s)	-	-	9.3	-
HCM Lane LOS	-	-	A	-
HCM 95th %tile Q(veh)	-	-	0	-

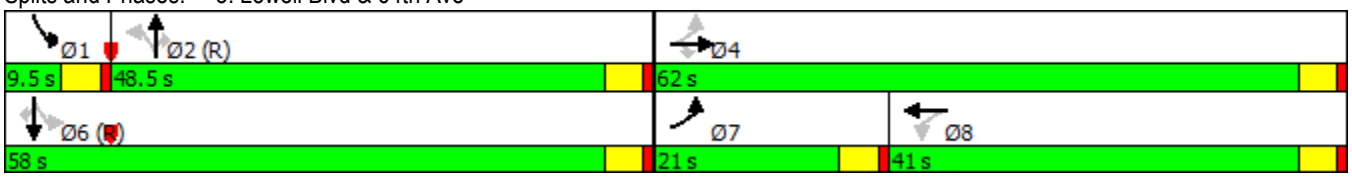


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	360	400	123	68	500	120	303	684	84	120	364	245
Future Volume (vph)	360	400	123	68	500	120	303	684	84	120	364	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		110	150		80	190		140	150		150
Storage Lanes	1		1	1		0	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.971				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1593	1676	1425	1593	1628	0	1593	1676	1425	1593	1676	1425
Flt Permitted	0.098			0.516			0.486			0.082		
Satd. Flow (perm)	164	1676	1425	865	1628	0	815	1676	1425	137	1676	1425
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			95		10				95			255
Link Speed (mph)		30			30			40			40	
Link Distance (ft)		713			780			4265			591	
Travel Time (s)		16.2			17.7			72.7			10.1	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	379	421	129	72	526	126	319	720	88	126	383	258
Shared Lane Traffic (%)												
Lane Group Flow (vph)	379	421	129	72	652	0	319	720	88	126	383	258
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2		2	6		6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	8	8		2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	21.0	62.0	62.0	41.0	41.0		48.5	48.5	48.5	9.5	58.0	58.0
Total Split (%)	17.5%	51.7%	51.7%	34.2%	34.2%		40.4%	40.4%	40.4%	7.9%	48.3%	48.3%
Maximum Green (s)	16.5	57.5	57.5	36.5	36.5		44.0	44.0	44.0	5.0	53.5	53.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lead			Lag	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0		7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0		11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0		0	0	0		0	0
Act Effct Green (s)	57.5	57.5	57.5	36.5	36.5		44.0	44.0	44.0	53.5	53.5	53.5
Actuated g/C Ratio	0.48	0.48	0.48	0.30	0.30		0.37	0.37	0.37	0.45	0.45	0.45
v/c Ratio	1.38	0.52	0.18	0.27	1.30		1.07	1.17	0.15	1.04	0.51	0.33
Control Delay	220.8	24.7	6.4	35.2	183.4		109.6	129.4	5.0	120.6	26.9	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	220.8	24.7	6.4	35.2	183.4		109.6	129.4	5.0	120.6	26.9	3.8
LOS	F	C	A	D	F		F	F	A	F	C	A
Approach Delay		102.2			168.7			114.0			34.5	
Approach LOS		F			F			F			C	

Intersection Summary			
Area Type:	CBD		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 120			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.38			
Intersection Signal Delay: 104.9		Intersection LOS: F	
Intersection Capacity Utilization 121.9%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 3: Lowell Blvd & 64th Ave



Intersection	
Int Delay, s/veh	97.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	60	20	35	70	30	58	10	1033	80	23	464	10
Future Vol, veh/h	60	20	35	70	30	58	10	1033	80	23	464	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	65	22	38	76	33	63	11	1123	87	25	504	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1797	1792	510	1779	1754	1167	515	0	0	1210	0	0
Stage 1	560	560	-	1189	1189	-	-	-	-	-	-	-
Stage 2	1237	1232	-	590	565	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 62	81	563	~ 64	85	236	1051	-	-	577	-	-
Stage 1	513	511	-	229	261	-	-	-	-	-	-	-
Stage 2	215	249	-	494	508	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 28	74	563	~ 43	77	236	1051	-	-	577	-	-
Mov Cap-2 Maneuver	~ 28	74	-	~ 43	77	-	-	-	-	-	-	-
Stage 1	496	480	-	221	252	-	-	-	-	-	-	-
Stage 2	133	241	-	413	477	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 964.7	$ 462.3	0.1	0.5
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1051	-	-	46	50	236	577	-	-
HCM Lane V/C Ratio	0.01	-	-	2.717	2.174	0.267	0.043	-	-
HCM Control Delay (s)	8.5	0	-	$ 964.7	$ 715.6	25.7	11.5	0	-
HCM Lane LOS	A	A	-	F	F	D	B	A	-
HCM 95th %tile Q(veh)	0	-	-	13.4	11	1	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↰	↱			↕		↰	↱	
Traffic Vol, veh/h	10	0	6	27	0	37	9	650	14	70	510	4
Future Vol, veh/h	10	0	6	27	0	37	9	650	14	70	510	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	75	-	-	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	0	6	28	0	39	9	684	15	74	537	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1416	1404	539	1400	1399	692	541	0	0	699	0	0
Stage 1	687	687	-	710	710	-	-	-	-	-	-	-
Stage 2	729	717	-	690	689	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	115	140	542	118	141	444	1028	-	-	898	-	-
Stage 1	437	447	-	424	437	-	-	-	-	-	-	-
Stage 2	414	434	-	435	446	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	97	127	542	108	128	444	1028	-	-	898	-	-
Mov Cap-2 Maneuver	97	127	-	108	128	-	-	-	-	-	-	-
Stage 1	431	410	-	418	431	-	-	-	-	-	-	-
Stage 2	372	428	-	395	409	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	34.2	29	0.1	1.1
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1028	-	-	140	108	444	898	-	-
HCM Lane V/C Ratio	0.009	-	-	0.12	0.263	0.088	0.082	-	-
HCM Control Delay (s)	8.5	0	-	34.2	49.8	13.9	9.4	-	-
HCM Lane LOS	A	A	-	D	E	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	1	0.3	0.3	-	-

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	4	669	32	0	543
Future Vol, veh/h	0	4	669	32	0	543
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	4	727	35	0	590

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	745	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	414	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	414	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.8	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	414	-
HCM Lane V/C Ratio	-	-	0.011	-
HCM Control Delay (s)	-	-	13.8	-
HCM Lane LOS	-	-	B	-
HCM 95th %tile Q(veh)	-	-	0	-

KELLAR ENGINEERING



Sean Kellar, PE, PTOE

Principal Engineer

Education
B.S., Civil Engineering, Arizona State University – Tempe, AZ

Registration
Colorado, Professional Engineer (PE)
Wyoming, Professional Engineer (PE)
Idaho, Professional Engineer (PE)
Arizona, Professional Engineer (PE)
Kansas, Professional Engineer (PE)
Missouri, Professional Engineer (PE)
Professional Traffic Operations Engineer (PTOE)

Professional Memberships
Institute of Transportation Engineers (ITE)

Industry Tenure
23 Years

Sean's wide range of expertise includes: transportation planning, traffic modeling roadway design, bike and pedestrian facilities, traffic impact studies, traffic signal warrant analysis, parking studies, corridor planning and access management. Sean's experience in both the private and public sectors; passion for safety and excellence; and strong communication and collaboration skills can bring great value to any project. Prior to starting Kellar Engineering, Sean was employed at the Missouri Department of Transportation (MoDOT) as the District Traffic Engineer for the Kansas City District. Sean also worked for the City of Loveland, CO for over 10 years as a Senior Civil Engineer supervising a division of transportation/traffic engineers. While at the City of Loveland, Sean managed several capital improvement projects, presented several projects to the City Council and Planning Commission in public hearings, and managed the revisions to the City's Street Standards. Sean is also proficient in Highway Capacity Software, Synchro, PT Vissim, Rodel, GIS, and AutoCAD.

WORK EXPERIENCE:

Kellar Engineering, Principal Engineer/President – January 2016 – Present

Missouri Department of Transportation, District Traffic Engineer, Kansas City District – June 2015 – January 2016

City of Loveland, Colorado, Senior Civil Engineer, Public Works Department – February 2005 – June 2015

Kirkham Michael Consulting Engineers, Project Manager - February 2004 – February 2005

Dibble and Associates Consulting Engineers, Project Engineer – August 1999 – February 2004

Fidelity National Title
NATIONAL COMMERCIAL SERVICES

8055 E Tufts Ave, Suite 900
Denver, CO 80237
Phone:

DATE: November 15, 2023
FILE NUMBER: 100-N0035233-010-TO2, Amendment No. 4
PROPERTY ADDRESS: 5660 Lowell Blvd, 5602 Lowell Blvd, Denver, CO 80221
BUYER/BORROWER: Purchaser with contractual rights under a purchase agreement with the vested Owner identified at Item 4 below
OWNER(S): 5602 Lowell, LLC, a Colorado limited liability company
YOUR REFERENCE NUMBER:
ASSESSOR PARCEL NUMBER: R0178385 R0178384

PLEASE TAKE NOTE OF THE FOLLOWING REVISED TERMS CONTAINED HEREIN:

None.

WIRED FUNDS ARE REQUIRED ON ALL CASH PURCHASE TRANSACTIONS. FOR WIRING INSTRUCTIONS, PLEASE CONTACT YOUR ESCROW OFFICE AS NOTED ON THE TRANSMITTAL PAGE OF THIS COMMITMENT.

TO:	**Escrow Officer**	**ATTN:**	Title Only 10
		PHONE:	
		FAX:	**(303) 633-7720**
		E-MAIL:	
	Escrow Assistant	**ATTN:**	
		PHONE:	
		E-MAIL:	
	Title Officer	**ATTN:**	Eric Stearns
		PHONE:	(303) 692-6778
		E-MAIL:	estearns@fnf.com
	Sales Executive	**ATTN:**	Geoff Sanders
		E-MAIL:	Geoff.Sanders@fnf.com
TO:	**Mac Investments Group, LLC** **5895 W. 56th Ave.** **Arvada, CO 80001**	**ATTN:**	**Marko Mackovic**
		PHONE:	**(303) 888-8802**
		FAX:	
		E-MAIL:	**marko@macinvestmentgroup.com**
TO:	**National Commercial Services Title Only** **8055 E Tufts Ave** **Suite 900** **Denver, CO 80237**	**ATTN:**	**Title Only 10**
		PHONE:	
		FAX:	**(303) 633-7720**
		E-MAIL:	

END OF TRANSMITTAL

COMMITMENT FOR TITLE INSURANCE

Issued by

Fidelity National Title Insurance Company

NOTICE

IMPORTANT—READ CAREFULLY: THIS COMMITMENT IS AN OFFER TO ISSUE ONE OR MORE TITLE INSURANCE POLICIES. ALL CLAIMS OR REMEDIES SOUGHT AGAINST THE COMPANY INVOLVING THE CONTENT OF THIS COMMITMENT OR THE POLICY MUST BE BASED SOLELY IN CONTRACT.

THIS COMMITMENT IS NOT AN ABSTRACT OF TITLE, REPORT OF THE CONDITION OF TITLE, LEGAL OPINION, OPINION OF TITLE, OR OTHER REPRESENTATION OF THE STATUS OF TITLE. THE PROCEDURES USED BY THE COMPANY TO DETERMINE INSURABILITY OF THE TITLE, INCLUDING ANY SEARCH AND EXAMINATION, ARE PROPRIETARY TO THE COMPANY, WERE PERFORMED SOLELY FOR THE BENEFIT OF THE COMPANY, AND CREATE NO EXTRA CONTRACTUAL LIABILITY TO ANY PERSON, INCLUDING A PROPOSED INSURED.

THE COMPANY'S OBLIGATION UNDER THIS COMMITMENT IS TO ISSUE A POLICY TO A PROPOSED INSURED IDENTIFIED IN SCHEDULE A IN ACCORDANCE WITH THE TERMS AND PROVISIONS OF THIS COMMITMENT. THE COMPANY HAS NO LIABILITY OR OBLIGATION INVOLVING THE CONTENT OF THIS COMMITMENT TO ANY OTHER PERSON.

COMMITMENT TO ISSUE POLICY

Subject to the Notice; Schedule B, Part I—Requirements; Schedule B, Part II—Exceptions; and the Commitment Conditions, **Fidelity National Title Insurance Company**, a Florida Corporation (the "Company"), commits to issue the Policy according to the terms and provisions of this Commitment. This Commitment is effective as of the Commitment Date shown in Schedule A for each Policy described in Schedule A, only when the Company has entered in Schedule A both the specified dollar amount as the Proposed Policy Amount and the name of the Proposed Insured.

If all of the Schedule B, Part I—Requirements have not been met within 180 Days after the Commitment Date, this Commitment terminates and the Company's liability and obligation end.

Countersigned

By:
John Miller
Authorized Signature

Fidelity National Title Insurance Company

By:
Michael J. Nolan
President

ATTEST:
Marjorie Nemzura
Secretary

This page is only a part of a 2016 ALTA® Commitment for Title Insurance issued by Fidelity National Title Insurance Company. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I—Requirements; and Schedule B, Part II—Exceptions; and a counter-signature by the Company or its issuing agent that may be in electronic form.

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AMERICAN LAND TITLE ASSOCIATION

COMMITMENT CONDITIONS

1. DEFINITIONS

(a) "Knowledge" or "Known": Actual or imputed knowledge, but not constructive notice imparted by the Public Records.

(b) "Land": The land described in Schedule A and affixed improvements that by law constitute real property. The term "Land" does not include any property beyond the lines of the area described in Schedule A, nor any right, title, interest, estate, or easement in abutting streets, roads, avenues, alleys, lanes, ways, or waterways, but this does not modify or limit the extent that a right of access to and from the Land is to be insured by the Policy.

(c) "Mortgage": A mortgage, deed of trust, or other security instrument, including one evidenced by electronic means authorized by law.

(d) "Policy": Each contract of title insurance, in a form adopted by the American Land Title Association, issued or to be issued by the Company pursuant to this Commitment.

(e) "Proposed Insured": Each person identified in Schedule A as the Proposed Insured of each Policy to be issued pursuant to this Commitment.

(f) "Proposed Policy Amount": Each dollar amount specified in Schedule A as the Proposed Policy Amount of each Policy to be issued pursuant to this Commitment.

(g) "Public Records": Records established under state statutes at the Commitment Date for the purpose of imparting constructive notice of matters relating to real property to purchasers for value and without Knowledge.

(h) "Title": The estate or interest described in Schedule A.

2. If all of the Schedule B, Part I—Requirements have not been met within the time period specified in the Commitment to Issue Policy, this Commitment terminates and the Company's liability and obligation end.

3. The Company's liability and obligation is limited by and this Commitment is not valid without:

(a) the Notice;
(b) the Commitment to Issue Policy;
(c) the Commitment Conditions;
(d) Schedule A;
(e) Schedule B, Part I—Requirements;
(f) Schedule B, Part II—Exceptions; and
(g) a counter-signature by the Company or its issuing agent that may be in electronic form.

4. COMPANY'S RIGHT TO AMEND

The Company may amend this Commitment at any time. If the Company amends this Commitment to add a defect, lien, encumbrance, adverse claim, or other matter recorded in the Public Records prior to the Commitment Date, any liability of the Company is limited by Commitment Condition 5. The Company shall not be liable for any other amendment to this Commitment.

5. LIMITATIONS OF LIABILITY

(a) The Company's liability under Commitment Condition 4 is limited to the Proposed Insured's actual expense incurred in the interval between the Company's delivery to the Proposed Insured of the Commitment and the delivery of the amended Commitment, resulting from the Proposed Insured's good faith reliance to:

(i) comply with the Schedule B, Part I—Requirements;
(ii) eliminate, with the Company's written consent, any Schedule B, Part II—Exceptions; or
(iii) acquire the Title or create the Mortgage covered by this Commitment.

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AMERICAN LAND TITLE ASSOCIATION

(b) The Company shall not be liable under Commitment Condition 5(a) if the Proposed Insured requested the amendment or had Knowledge of the matter and did not notify the Company about it in writing.
(c) The Company will only have liability under Commitment Condition 4 if the Proposed Insured would not have incurred the expense had the Commitment included the added matter when the Commitment was first delivered to the Proposed Insured.
(d) The Company's liability shall not exceed the lesser of the Proposed Insured's actual expense incurred in good faith and described in Commitment Conditions 5(a)(i) through 5(a)(iii) or the Proposed Policy Amount.
(e) The Company shall not be liable for the content of the Transaction Identification Data, if any.
(f) In no event shall the Company be obligated to issue the Policy referred to in this Commitment unless all of the Schedule B, Part I—Requirements have been met to the satisfaction of the Company.
(g) In any event, the Company's liability is limited by the terms and provisions of the Policy.

6. LIABILITY OF THE COMPANY MUST BE BASED ON THIS COMMITMENT

(a) Only a Proposed Insured identified in Schedule A, and no other person, may make a claim under this Commitment.
(b) Any claim must be based in contract and must be restricted solely to the terms and provisions of this Commitment.
(c) Until the Policy is issued, this Commitment, as last revised, is the exclusive and entire agreement between the parties with respect to the subject matter of this Commitment and supersedes all prior commitment negotiations, representations, and proposals of any kind, whether written or oral, express or implied, relating to the subject matter of this Commitment.
(d) The deletion or modification of any Schedule B, Part II—Exception does not constitute an agreement or obligation to provide coverage beyond the terms and provisions of this Commitment or the Policy.
(e) Any amendment or endorsement to this Commitment must be in writing and authenticated by a person authorized by the Company.
(f) When the Policy is issued, all liability and obligation under this Commitment will end and the Company's only liability will be under the Policy.

7. IF THIS COMMITMENT HAS BEEN ISSUED BY AN ISSUING AGENT

The issuing agent is the Company's agent only for the limited purpose of issuing title insurance commitments and policies. The issuing agent is not the Company's agent for the purpose of providing closing or settlement services.

8. PRO-FORMA POLICY

The Company may provide, at the request of a Proposed Insured, a pro-forma policy illustrating the coverage that the Company may provide. A pro-forma policy neither reflects the status of Title at the time that the pro-forma policy is delivered to a Proposed Insured, nor is it a commitment to insure.

9. ARBITRATION

The Policy contains an arbitration clause. All arbitrable matters when the Proposed Policy Amount is $2,000,000 or less shall be arbitrated at the option of either the Company or the Proposed Insured as the exclusive remedy of the parties. A Proposed Insured may review a copy of the arbitration rules at <http://www.alta.org/arbitration>.

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AMERICAN LAND TITLE ASSOCIATION

Transaction Identification Data for reference only:

Issuing Agent:	Fidelity National Title, National Commercial Services
Issuing Office:	8055 E Tufts Ave, Suite 900, Denver, CO 80237
Loan ID Number:	
Issuing Office File Number:	100-N0035233-010-TO2, Amendment No. 4
Property Address:	5660 Lowell Blvd, 5602 Lowell Blvd, Denver, CO 80221
Revision Number:	Amendment No. 4, Amendment Date: November 15, 2023

SCHEDULE A

AMERICAN LAND TITLE ASSOCIATION COMMITMENT

1. Commitment Date: **November 7, 2023**
2. Policy to be issued:
   (a) ALTA Owners Policy 6-17-06

   Proposed Insured: Purchaser with contractual rights under a purchase agreement with the vested Owner identified at Item 4 below

   Proposed Policy Amount: **$**100,000.00

   (b) None

   Proposed Insured:

   Proposed Policy Amount: **$**0.00

   (c) None

   Proposed Insured:

   Proposed Policy Amount: **$**0.00
3. The estate or interest in the Land described or referred to in this Commitment is:

   FEE SIMPLE
4. The Title is, at the Commitment Date, vested in:

   5602 Lowell, LLC, a Colorado limited liability company
5. The Land is described as follows:

   See Exhibit A attached hereto and made a part hereof.

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SCHEDULE A
(Continued)

PREMIUMS:

Owners Policy	579.00
Deletion of 1 - 4 upon requirements met and provided there is no recent, ongoing or anticipated construction on the land	75.00
ALTA 39-06 - Policy Authentication	0.00
Tax Certificate	18.00

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EXHIBIT A
LEGAL DESCRIPTION

Lots 1 and 2, Calabrese Subdivision, County of Adams, State of Colorado.

FOR INFORMATIONAL PURPOSES
TAX ID NO. 0182508302003 and 0182508302004

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AMERICAN LAND TITLE ASSOCIATION

SCHEDULE B

PART I – REQUIREMENTS

All of the following Requirements must be met:

a. Pay the agreed amounts for the interest in the land and/or for the mortgage to be insured.

b. Pay us the premiums, fees and charges for the policy.

c. Obtain a certificate of taxes due from the county treasurer or the county treasurer's authorized agent.

Note: Any documents being executed in conjunction with this transaction must be signed in the presence of an authorized Company employee, an authorized employee of an agent, an authorized employee of the insured lender, or by using Bancserv or other approved third-party service. If the above requirement cannot be met, please call the Company at the number provided in this report.

d. Furnish for recordation a full release of deed of trust:

Amount:	$1,000,000.00
Dated:	September 2, 2021
Trustor/Grantor:	5602 Lowell, LLC, a Colorado limited liability company
Trustee:	Public Trustee of Adams County
Beneficiary:	Stockmens Bank
Recording Date:	September 2, 2021
Recording No:	Reception No. 2021000105049

e. Deed sufficient to convey the fee simple estate or interest in the Land described or referred to herein, to the Proposed Insured Purchaser.

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AMERICAN LAND TITLE ASSOCIATION

SCHEDULE B
PART I – Requirements
(Continued)

f. The Company will require the following documents for review prior to the issuance of any title insurance predicated upon a conveyance or encumbrance from the entity named below:

Limited Liability Company: 5602 Lowell, LLC, a Colorado limited liability company

a) A copy of its operating agreement, if any, and any and all amendments, supplements and/or modifications thereto, certified by the appropriate manager or member

b) If a domestic Limited Liability Company, a copy of its Articles of Organization and all amendments thereto with the appropriate filing stamps

c) If the Limited Liability Company is member-managed, a full and complete current list of members certified by the appropriate manager or member

d) A current dated certificate of good standing from the proper governmental authority of the state in which the entity was created

e) If less than all members, or managers, as appropriate, will be executing the closing documents, furnish evidence of the authority of those signing.

The Company reserves the right to add additional items or make further requirements after review of the requested documentation.

g. Recordation of Statement of Authority for 5602 Lowell, LLC, a Colorado limited liability company pursuant to Colorado Revised Statutes evidencing the existence of the entity and authority of the person(s) authorized to execute and deliver instruments affecting title to real property on behalf of the entity and containing other information required by Colorado Revised Statutes.

h. The Company will require a survey of the subject Land, which is in compliance with minimum technical standards, prepared by a duly registered and licensed surveyor. If the owner of the Land the subject of this transaction is in possession of a survey, the Company will require that said survey be submitted for review and approval; otherwise, a new survey, satisfactory to the Company, must be submitted to the Company for examination. In order to prevent delays, please furnish the survey at least 10 days prior to the close of this transaction.

If an existing survey is to be relied upon, an affidavit from the seller(s)/mortgagor(s) must be furnished to the Company stating that no improvements have been made on the Land the subject of this transaction or adjacent thereto subsequent to the survey presented to the Company.

The Company reserves the right to add additional items or make further requirements after review of the requested documentation.

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AMERICAN LAND TITLE ASSOCIATION

SCHEDULE B
PART I – Requirements
(Continued)

i. The Company will require that an Owner's Affidavit be completed by the party(s) named below before the issuance of any policy of title insurance.

Party(s): 5602 Lowell, LLC, a Colorado limited liability company

The Company reserves the right to add additional items or make further requirements after review of the requested Affidavit.

Please be advised that our search did not disclose any open Deeds of Trust of record. If you should have knowledge of any outstanding obligation, please contact the Title Department immediately for further review prior to closing.

Note: Please be aware that due to the conflict between federal and state laws concerning the cultivation, distribution, manufacture or sale of marijuana, the Company is not able to close or insure any transaction involving Land that is associated with these activities.

END OF REQUIREMENTS

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AMERICAN LAND TITLE ASSOCIATION

SCHEDULE B

PART II – EXCEPTIONS

THIS COMMITMENT DOES NOT REPUBLISH ANY COVENANT, CONDITION, RESTRICTION, OR LIMITATION CONTAINED IN ANY DOCUMENT REFERRED TO IN THIS COMMITMENT TO THE EXTENT THAT THE SPECIFIC COVENANT, CONDITION, RESTRICTION, OR LIMITATION VIOLATES STATE OR FEDERAL LAW BASED ON RACE, COLOR, RELIGION, SEX, SEXUAL ORIENTATION, GENDER IDENTITY, HANDICAP, FAMILIAL STATUS, OR NATIONAL ORIGIN.

The Policy will not insure against loss or damage resulting from the terms and provisions of any lease or easement identified in Schedule A, and will include the following Exceptions unless cleared to the satisfaction of the Company:

1. Any facts, rights, interests or claims that are not shown by the Public Records but which could be ascertained by an inspection of the Land or that may be asserted by persons in possession of the Land.

2. Easements, liens or encumbrances, or claims thereof, not shown by the Public Records.

3. Any encroachments, encumbrances, violation, variation, or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the Land and not shown by Public Records.

4. Any lien or right to a lien, for services, labor or material heretofore or hereafter furnished, imposed by law and not shown by the Public Records.

5. Defects, liens, encumbrances, adverse claims or other matters, if any, created, first appearing in the Public Records or attaching subsequent to the effective date hereof but prior to the date the proposed Insured acquires of record for the value the estate or interest or mortgage thereon covered by this Commitment.

   NOTE: The above exception will not appear on policies where closing and settlement has been performed by the Company.

6. Water rights, claims of title to water, whether or not these matters are shown by the Public Records.

7. All taxes and assessments, now or heretofore assessed, due or payable.

   NOTE: This tax exception will be amended at policy upon satisfaction and evidence of payment of taxes.

8. Any existing leases or tenancies, and any and all parties claiming by, through or under said lessees.

9. Right of way for Clear Creek Bike Path/Recreation Trail.

10. Reservations as contained in Deed recorded March 4, 1938 in Book 245 at Page 361 and in Deed recorded April 4, 1938 in Book 246 at Page 283.

11. Reservations, conditions, and restrictions as contained in Deed recorded December 4, 1939 in Book 259 at Page 577.

This page is only a part of a 2016 ALTA® Commitment for Title Insurance issued by Fidelity National Title Insurance Company. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I—Requirements; and Schedule B, Part II—Exceptions; and a counter-signature by the Company or its issuing agent that may be in electronic form.

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AMERICAN LAND TITLE ASSOCIATION

SCHEDULE B
PART II – Exceptions
(Continued)

12. Terms, conditions, provisions, agreements and obligations contained in the Easements for Construction and Maintenance of Sewer Lines as set forth below:

    Recording Date: September 25, 1963
    Recording No.: Book 1099 at Page 232

13. Terms, conditions, provisions, agreements and obligations contained in the Easements for Construction and Maintenance of Sewer Lines as set forth below:

    Recording Date: September 25, 1963
    Recording No.: Book 1099 at Page 248

14. Terms, conditions, provisions, agreements and obligations contained in the Easement for Construction and Maintenance of Sewer Lines as set forth below:

    Recording Date: February 21, 1984
    Recording No.: Book 2842 at Page 42

15. Terms, conditions, provisions, agreements and obligations contained in the Rule and Order as set forth below:

    Recording Date: July 31, 1985
    Recording No.: Book 3030 at Page 1

16. Terms, conditions, provisions, agreements and obligations contained in the Rule and Order as set forth below:

    Recording Date: June 12, 1987
    Recording No.: Book 3329 at Page 801

17. Any tax, lien, fee, or assessment by reason of inclusion of the Land in the Hyland Hills Park and Recreation District, as evidenced by instrument(s) recorded August 23, 1990 in Book 3712 at Page 402.

18. Terms, conditions, provisions, agreements and obligations contained in the Grant of Permanent Easement as set forth below:

    Recording Date: November 14, 1997
    Recording No.: Book 5157 at Page 652

19. Terms, conditions, provisions, agreements and obligations contained in the Grant of Easement as set forth below:

    Recording Date: November 14, 1997
    Recording No.: Book 5157 at Page 658

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AMERICAN LAND TITLE ASSOCIATION

SCHEDULE B
PART II – Exceptions
(Continued)

20. Terms, conditions, provisions, agreements and obligations contained in the Grant of Permanent Easement as set forth below:

    Recording Date: December 22, 1997
    Recording No.: Book 5188 at Page 706

21. Terms, conditions, provisions, agreements and obligations contained in the Zoning Hearing Decision as set forth below:

    Recording Date: November 30, 2004
    Recording No.: Reception No. 20041130001205310

22. Easements, notes, terms, conditions, provisions, agreements and obligations as shown on the plat of Calabrese Subdivision recorded February 2, 2005 at Reception No. 20050202000110270.

23. Terms, conditions, provisions, agreements and obligations contained in the Planned Unit Development as set forth below:

    Recording Date: July 21, 2005
    Recording No.: Reception No. 20050772130

24. Terms, conditions, provisions, agreements and obligations contained in the Zoning Hearing Decision as set forth below:

    Recording Date: May 10, 2005
    Recording No.: Reception No. 20050510000498800

END OF EXCEPTIONS

This page is only a part of a 2016 ALTA® Commitment for Title Insurance issued by Fidelity National Title Insurance Company. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I—Requirements; and Schedule B, Part II—Exceptions; and a counter-signature by the Company or its issuing agent that may be in electronic form.

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DISCLOSURE STATEMENT

- Pursuant to Section 38-35-125 of Colorado Revised Statutes and Colorado Division of Insurance Regulation 8-1-2 (Section 5), if the parties to the subject transaction request us to provide escrow-settlement and disbursement services to facilitate the closing of the transaction, then all funds submitted for disbursement must be available for immediate withdrawal.
- Colorado Division of Insurance Regulation 8-1-2, Section 5, Paragraph H, requires that "Every title insurance company shall be responsible to the proposed insured(s) subject to the terms and conditions of the title insurance commitment, other than the effective date of the title insurance commitment, for all matters which appear of record prior to the time of recording whenever the title insurance company, or its agent, conducts the closing and settlement service that is in conjunction with its issuance of an owners policy of title insurance and is responsible for the recording and filing of legal documents resulting from the transaction which was closed". Provided that Fidelity National Title, National Commercial Services conducts the closing of the insured transaction and is responsible for recording the legal documents from the transaction, exception No. 5 in Schedule B-2 will not appear in the Owner's Title Policy and Lender's Title Policy when issued.
- Colorado Division of Insurance Regulation 8-1-2, Paragraph M of Section 5, requires that prospective insured(s) of a single family residence be notified in writing that the standard exception from coverage for unfiled Mechanics or Materialmans Liens may or may not be deleted upon the satisfaction of the requirement(s) pertinent to the transaction. These requirements will be addressed upon receipt of a written request to provide said coverage, or if the Purchase and Sale Agreement/Contract is provided to the Company then the necessary requirements will be reflected on the commitment.
- Colorado Division of Insurance Regulation 8-1-3, Paragraph C. 11.f. of Section 5 - requires a title insurance company to make the following notice to the consumer: “A closing protection letter is available to be issued to lenders, buyers and sellers.”
- If the sales price of the subject property exceeds $100,000.00 the seller shall be required to comply with the Disclosure of Withholding Provisions of C.R.S. 39-22-604.5 (Nonresident Withholding).
- Section 39-14-102 of Colorado Revised Statutes requires that a Real Property Transfer Declaration accompany any conveyance document presented for recordation in the State of Colorado. Said Declaration shall be completed and signed by either the grantor or grantee.
- Recording statutes contained in Section 30-10-406(3)(a) of the Colorado Revised Statutes require that all documents received for recording or filing in the clerk and recorder's office shall contain a top margin of at least one inch and a left, right, and bottom margin of at least one-half of an inch. The clerk and recorder may refuse to record or file a document that does not conform to requirements of this paragraph.
- Section 38-35-109 (2) of the Colorado Revised Statutes, requires that a notation of the purchasers legal address, (not necessarily the same as the property address) be included on the face of the deed to be recorded.
- Regulations of County Clerk and Recorder's offices require that all documents submitted for recording must contain a return address on the front page of every document being recorded.
- Pursuant to Section 10-11-122 of the Colorado Revised Statutes, the Company is required to disclose the following information:
    - The subject property may be located in a special taxing district.
    - A Certificate of Taxes Due listing each taxing jurisdiction shall be obtained from the County Treasurer or the County Treasurer's authorized agent.
    - Information regarding special districts and the boundaries of such districts may be obtained from the Board of County Commissioners, the County Clerk and Recorder or the County Assessor.
- Pursuant to Section 10-11-123 of the Colorado Revised Statutes, when it is determined that a mineral estate has been severed from the surface estate, the Company is required to disclose the following information: that there is recorded evidence that a mineral estate has been severed, leased, or otherwise conveyed from the surface estate and that there is a substantial likelihood that a third party holds some or all interest in oil, gas, other minerals, or geothermal energy in the property; and that such mineral estate may include the right to enter and use the property without the surface owner's permission.

Note: Notwithstanding anything to the contrary in this Commitment, if the policy to be issued is other than an ALTA Owner's Policy (6/17/06), the policy may not contain an arbitration clause, or the terms of the arbitration clause may be different from those set forth in this Commitment. If the policy does contain an arbitration clause, and the Amount of Insurance is less than the amount, if any, set forth in the arbitration clause, all arbitrable matters shall be arbitrated at the option of either the Company or the Insured as the exclusive remedy of the parties.

Wire Fraud Alert

This Notice is not intended to provide legal or professional advice. If you have any questions, please consult with a lawyer.

All parties to a real estate transaction are targets for wire fraud and many have lost hundreds of thousands of dollars because they simply relied on the wire instructions received via email, without further verification. **If funds are to be wired in conjunction with this real estate transaction, we strongly recommend verbal verification of wire instructions through a known, trusted phone number prior to sending funds.**

In addition, the following non-exclusive self-protection strategies are recommended to minimize exposure to possible wire fraud.

- **NEVER RELY** on emails purporting to change wire instructions. Parties to a transaction rarely change wire instructions in the course of a transaction.
- **ALWAYS VERIFY** wire instructions, specifically the ABA routing number and account number, by calling the party who sent the instructions to you. DO NOT use the phone number provided in the email containing the instructions, use phone numbers you have called before or can otherwise verify. **Obtain the phone number of relevant parties to the transaction as soon as an escrow account is opened**. DO NOT send an email to verify as the email address may be incorrect or the email may be intercepted by the fraudster.
- **USE COMPLEX EMAIL PASSWORDS** that employ a combination of mixed case, numbers, and symbols. Make your passwords greater than eight (8) characters. Also, change your password often and do NOT reuse the same password for other online accounts.
- **USE MULTI-FACTOR AUTHENTICATION** for email accounts. Your email provider or IT staff may have specific instructions on how to implement this feature.

For more information on wire-fraud scams or to report an incident, please refer to the following links:

Federal Bureau of Investigation:
http://www.fbi.gov

Internet Crime Complaint Center:
http://www.ic3.gov

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FIDELITY NATIONAL FINANCIAL, INC.
PRIVACY NOTICE

Effective August 1, 2021

Fidelity National Financial, Inc. and its majority-owned subsidiary companies (collectively, "FNF," "our," or "we") respect and are committed to protecting your privacy. This Privacy Notice explains how we collect, use, and protect personal information, when and to whom we disclose such information, and the choices you have about the use and disclosure of that information.

A limited number of FNF subsidiaries have their own privacy notices. If a subsidiary has its own privacy notice, the privacy notice will be available on the subsidiary's website and this Privacy Notice does not apply.

Collection of Personal Information

FNF may collect the following categories of Personal Information:

- contact information (*e.g.*, name, address, phone number, email address);
- demographic information (*e.g.*, date of birth, gender, marital status);
- identity information (*e.g.* Social Security Number, driver's license, passport, or other government ID number);
- financial account information (*e.g.* loan or bank account information); and
- other personal information necessary to provide products or services to you.

We may collect Personal Information about you from:

- information we receive from you or your agent;
- information about your transactions with FNF, our affiliates, or others; and
- information we receive from consumer reporting agencies and/or governmental entities, either directly from these entities or through others.

Collection of Browsing Information

FNF automatically collects the following types of Browsing Information when you access an FNF website, online service, or application (each an "FNF Website") from your Internet browser, computer, and/or device:

- Internet Protocol (IP) address and operating system;
- browser version, language, and type;
- domain name system requests; and
- browsing history on the FNF Website, such as date and time of your visit to the FNF Website and visits to the pages within the FNF Website.

Like most websites, our servers automatically log each visitor to the FNF Website and may collect the Browsing Information described above. We use Browsing Information for system administration, troubleshooting, fraud investigation, and to improve our websites. Browsing Information generally does not reveal anything personal about you, though if you have created a user account for an FNF Website and are logged into that account, the FNF Website may be able to link certain browsing activity to your user account.

Other Online Specifics

Cookies. When you visit an FNF Website, a "cookie" may be sent to your computer. A cookie is a small piece of data that is sent to your Internet browser from a web server and stored on your computer's hard drive. Information gathered using cookies helps us improve your user experience. For example, a cookie can help the website load properly or can customize the display page based on your browser type and user preferences. You can choose whether or not to accept cookies by changing your Internet browser settings. Be aware that doing so may impair or limit some functionality of the FNF Website.

Web Beacons. We use web beacons to determine when and how many times a page has been viewed. This information is used to improve our websites.

Do Not Track. Currently our FNF Websites do not respond to "Do Not Track" features enabled through your browser.

Links to Other Sites. FNF Websites may contain links to unaffiliated third-party websites. FNF is not responsible for the privacy practices or content of those websites. We recommend that you read the privacy policy of every website you visit.

Use of Personal Information

FNF uses Personal Information for three main purposes:

- To provide products and services to you or in connection with a transaction involving you.
- To improve our products and services.
- To communicate with you about our, our affiliates', and others' products and services, jointly or independently.

When Information Is Disclosed

We may disclose your Personal Information and Browsing Information in the following circumstances:

- to enable us to detect or prevent criminal activity, fraud, material misrepresentation, or nondisclosure;
- to nonaffiliated service providers who provide or perform services or functions on our behalf and who agree to use the information only to provide such services or functions;

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- to nonaffiliated third party service providers with whom we perform joint marketing, pursuant to an agreement with them to jointly market financial products or services to you;
- to law enforcement or authorities in connection with an investigation, or in response to a subpoena or court order; or
- in the good-faith belief that such disclosure is necessary to comply with legal process or applicable laws, or to protect the rights, property, or safety of FNF, its customers, or the public.

The law does not require your prior authorization and does not allow you to restrict the disclosures described above. Additionally, we may disclose your information to third parties for whom you have given us authorization or consent to make such disclosure. We do not otherwise share your Personal Information or Browsing Information with nonaffiliated third parties, except as required or permitted by law. We may share your Personal Information with affiliates (other companies owned by FNF) to directly market to you. Please see "Choices with Your Information" to learn how to restrict that sharing.

We reserve the right to transfer your Personal Information, Browsing Information, and any other information, in connection with the sale or other disposition of all or part of the FNF business and/or assets, or in the event of bankruptcy, reorganization, insolvency, receivership, or an assignment for the benefit of creditors. By submitting Personal Information and/or Browsing Information to FNF, you expressly agree and consent to the use and/or transfer of the foregoing information in connection with any of the above described proceedings.

Security of Your Information
We maintain physical, electronic, and procedural safeguards to protect your Personal Information.

Choices With Your Information
If you do not want FNF to share your information among our affiliates to directly market to you, you may send an "opt out" request as directed at the end of this Privacy Notice. We do not share your Personal Information with nonaffiliates for their use to direct market to you without your consent.

Whether you submit Personal Information or Browsing Information to FNF is entirely up to you. If you decide not to submit Personal Information or Browsing Information, FNF may not be able to provide certain services or products to you.

For California Residents: We will not share your Personal Information or Browsing Information with nonaffiliated third parties, except as permitted by California law. For additional information about your California privacy rights, please visit the "California Privacy" link on our website (https://fnf.com/pages/californiaprivacy.aspx) or call (888) 413-1748.

For Nevada Residents: You may be placed on our internal Do Not Call List by calling (888) 714-2710 or by contacting us via the information set forth at the end of this Privacy Notice. Nevada law requires that we also provide you with the following contact information: Bureau of Consumer Protection, Office of the Nevada Attorney General, 555 E. Washington St., Suite 3900, Las Vegas, NV 89101; Phone number: (702) 486-3132; email: BCPINFO@ag.state.nv.us.
For Oregon Residents: We will not share your Personal Information or Browsing Information with nonaffiliated third parties for marketing purposes, except after you have been informed by us of such sharing and had an opportunity to indicate that you do not want a disclosure made for marketing purposes.

For Vermont Residents: We will not disclose information about your creditworthiness to our affiliates and will not disclose your personal information, financial information, credit report, or health information to nonaffiliated third parties to market to you, other than as permitted by Vermont law, unless you authorize us to make those disclosures.

Information From Children
The FNF Websites are not intended or designed to attract persons under the age of eighteen (18).We do not collect Personal Information from any person that we know to be under the age of thirteen (13) without permission from a parent or guardian.

International Users
FNF's headquarters is located within the United States. If you reside outside the United States and choose to provide Personal Information or Browsing Information to us, please note that we may transfer that information outside of your country of residence. By providing FNF with your Personal Information and/or Browsing Information, you consent to our collection, transfer, and use of such information in accordance with this Privacy Notice.

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Certain FNF companies provide services to mortgage loan servicers, including hosting websites that collect customer information on behalf of mortgage loan servicers (the "Service Websites"). The Service Websites may contain links to both this Privacy Notice and the mortgage loan servicer or lender's privacy notice. The sections of this Privacy Notice titled When Information is Disclosed, Choices with Your Information, and Accessing and Correcting Information do not apply to the Service Websites. The mortgage loan servicer or lender's privacy notice governs use, disclosure, and access to your Personal Information. FNF does not share Personal Information collected through the Service Websites, except as required or authorized by contract with the mortgage loan servicer or lender, or as required by law or in the good-faith belief that such disclosure is necessary: to comply with a legal process or applicable law, to enforce this Privacy Notice, or to protect the rights, property, or safety of FNF or the public.

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Your Consent To This Privacy Notice; Notice Changes

By submitting Personal Information and/or Browsing Information to FNF, you consent to the collection and use of the information in accordance with this Privacy Notice. We may change this Privacy Notice at any time. The Privacy Notice's effective date will show the last date changes were made. If you provide information to us following any change of the Privacy Notice, that signifies your assent to and acceptance of the changes to the Privacy Notice.

Accessing and Correcting Information; Contact Us

If you have questions, would like to correct your Personal Information, or want to opt-out of information sharing for affiliate marketing, visit FNF's Opt Out Page or contact us by phone at (888) 714-2710 or by mail to:

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Jacksonville, Florida 32204
Attn: Chief Privacy Officer

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